home+

Project Manual - Deliverable #7 Team HFT Stuttgart



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2. Summary of Changes

- 1. 22.09.2010 Deliverable 7
- 2. 03.05.2010 Deliverable 6
- 3. 05.02.2010 Deliverable 5
- 4. 11.09.2009 Deliverable 4
- 5. 04.05.2009 Deliverable 3
- 6. 30.01.2009 Deliverable 2

Summary of Changes

22.09.2010 Deliverable 8

1.Projekt Manual

COVER SHEET:	-
TABLE OF CONTENTS:	observed
RULES AND BUILDING CODE COMPLIANCE CHECKLIST:	-
CONSTRUCTION SPECIFICATIONS:	-
STRUCTURAL CALCULATIONS:	-
DETAILED WATER BUDGET:	-
SUMMARY OF UNLISTED ELECTRICAL COMPONENTS:	-
SUMMARY OF RECONFIGURABLE FEATURES:	-

ELECTRICAL AND PHOTOVOLIAIC CHART.	-
COMPREHENSIVE ENERGY ANALYSIS	
AND DISCUSSION REPORT:	-
CONTEST SUPPORT DOCUMENTS	
Architecture Design Narrative:	advanced
Accoustic Report:	-
Lighting Design Narrative:	-
Engineering Design Narrative:	-
Solar Thermal System:	-
Photovoltaic System:	advanced
List of Appliances:	-
Communication Plan:	advanced
Industrialization and	
Market Viability Report:	-
Sustainability Report:	-
Public tour Plan:	advanced
CONSTRUCTION COST ESTIMATE	
AND PROJECT FINANCIAL SUMMARY:	advanced
DINNER PARTY MENU:	-
SITE OPERATIONS PLAN:	advanced
HEALTH AND SAFETY PLAN:	-

2.Construction Drawings

As stated in Rule 26.2, the Construction Drawings are consistent with the SDEConstruction Drawings formatting template and guidelines.

GENERAL (GE)

GE-001	COVER SHEET	-
GE-101	SHEET LIST 1	adapted
GE-102	SHEET LIST 2	apapted in addition to GE-101
GE-201	GENERAL SYMBOLS	-
GE-301	GENERAL ABBREVIATIONS	-
GE-401	EXTERIOR RENDERING 1	-
GE-402	EXTERIOR RENDERING 2	-
GE-403	EXTERIOR RENDERING 3	-
GE-404	EXTERIOR RENDERING 4	-

ARCHITECTURAL (AR)

AR-001a	VILLA SOLAR	-
AR-011f	SITE DESIGN	-
AR-012f	SITE TECHNICAL	-
AR-021f	FLOOR	-
AR-031b	ROOF DESIGN	-
AR-032d	ROOF TECHNICAL	-
AR-041b	MOVEABLE COMPONENTS	-
AR-051b	CONDITIONED SPACE	-
AR-052b	CONDITIONED VOLUME	-
AR-061	SHADING STUDIES 1	-
AR-062	SHADING STUDIES 2	-

AR-063	SHADING STUDIES 3	-
AR-102f	ELEVATION SITE NORTH	_
AR-103f	ELEVATION SITE EAST	-
AR-104f	ELEVATION SITE SOUTH	_
AR-105f	ELEVATION SITE WEST	-
AR-112b	ELEVATION BUILDING	
	NORTH	-
AR-113b	ELEVATION BUILDING	
	EAST	-
AR-114b	ELEVATION BUILDING	
	SOUTH	-
AR-115b	ELEVATION BUILDING	
	WEST	-
AR-201g	SECTION LONGITUDINAL	
	SOLAR CHIMNEY	-
AR-202 e	SECTION LONGITUDINAL	
	VENTILATION TOWER	-
AR-211e	SECTION TRANSVERSAL	
	MODULE	_
AR-212b	SECTION TRANSVERSAL	
AR-212b	SECTION TRANSVERSAL CLIMATE GAP	-
AR-212b AR-213b		-
	CLIMATE GAP	-
	CLIMATE GAP SECTION TRANSVERSAL	-
AR-213b	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER	-
AR-213b AR-301a	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1	
AR-213b AR-301a AR-302a	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2	
AR-213b AR-301a AR-302a AR-303a	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3	-
AR-213b AR-301a AR-302a AR-303a AR-304a	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2	-
AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1	
AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1	
AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306 AR-307	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1 TERRACE DOOR 1	
AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306 AR-307 AR-308	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1 TERRACE DOOR 1 FIXED GLAZING 2	
AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306 AR-307 AR-308 AR-309	CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1 TERRACE DOOR 1 FIXED GLAZING 2 TERRACE DOOR 2	

AR-313	WINDOW NORTH WALL 3	-
AR-322b	FLOOR NORMED	_
AR-332b	ROOF NORMED	_
AR-342b	WALL NORMED	_
AR-351	GAP 2+3	-
AR-352	PLANTER 1 GAP 2+3	-
AR-353	GAP 2	-
AR-354	FLOOR GAP 2+3	-
AR-355c	OVERHEADGLAZING	
	GAP 2	-
AR-356	PLANTER 2 GAP 2+3	-
AR-359	VENTILATION TOWER 1	-
AR-360	SOLAR CHIMNEY 1	-
AR-361a	SOLAR CHIMNEY 2	-
AR-362a	VENTILATION TOWER 2	-
AR-363a	VENTILATION TOWER 3	-
AR-364a	SOLAR CHIMNEY 3	-
AR-365	SOLAR CHIMNEY 4	-
AR-366	VENTILATION TOWER 4	-
AR-367	VENTILATION TOWER 5	-
AR-368	VENTILATION TOWER 6	-
AR-371	INSULATION ROOF	_
AR-373b	SUBSTRUCTURE PV	
	OVERVIEW	-
AR-374b_1	SUBSTRUCTURE PV	
	DETAILS	-
AR-374a_2	SUBSTRUCTURE SECTIONS	-
AR-375c	VIP ROOF	-
AR-376b	VIP WALL EAST-WEST	-
AR-377b	VIP WALL NORTH-SOUTH	-
AR-378b	FLOOR	-
AR-379c	DETAILS	-
AR-380b	PVT	-
AR-395 HAND	RAIL DETAILS	-
AR-396 HAND	RAIL SECTIONS	-

BIOCLIMATIC ANALYSIS (BA)

BA-001	EAST SUN	-
BA-002	SUN SUMMER	-
BA-003	SUN WINTER	-
BA-004	CROSS VENTILATION	-
BA-005	AIR PREHEATING	-
BA-006	VENTILATION TOWER 1	-
BA-007	VENTILATION TOWER 2	-
BA-008	WATER USE NIGHT	-
BA-009	WATER USE DAY	-

INTERIORS (IN)

IN-001a	FLOOR 1	-
IN-002a	FLOOR 2	-
IN-003a	FLOOR 3	-
IN-010a	FLOOR - FURNISHING 1	-
IN-020b	FLOOR - FURNISHING 2	-
IN-030a	FLOOR - FURNISHING 3	-
IN-100a	REFLECTED CEILING	advanced
IN-101	REFLECTED CEILING PCM	aavanoca
114 101	BOARD + GYPSUM	
	PLASTER BOARD	-
IN-102a	REFLECTED CEILING	
	PCM + GPB	advanced
IN-103	REFLECTED CEILING	
	DETAILS	added
IN-201_202c	ELEVATIONS 1	_
	ELEVATIONS 2	-
IN-301a	FURNISHING LOGGIA 1	-
IN-302a	FURNISHING LOGGIA 2	-
IN-303a	FURNISHING LOGGIA 3	-
IN-401c	FURNISHING LIVING	
-	_FACILITIES 1	-

IN-402d	FURNISHING LIVING FACILITIES 2	_
IN-403c	FURNISHING LIVING	
HV 4000	FACILITIES 3	_
	/	
IN-500a	KITCHEN PLAN	-
IN-501b	FURNISHING DINING	
	_KITCHEN 1	-
IN-502c	FURNISHING DINING	
	_KITCHEN 2	-
IN-503b	FURNISHING DINING	
	_KITCHEN 3	-
IN-600a	BATHPLAN	-
IN-601c	FURNISHING BEDROOM BATH 1	
IN-602c	FURNISHING BEDROOM	-
114-0020	BATH 2	_
IN-603b	FURNISHING BEDROOM	
114-0030	BATH 3	_
	_DAIII 3	
IN-701	INTERIOR RENDERING	-
IN-1001	DETAIL	
	FURNISHING FITTINGS	-
IN-1003a	DETAIL LOGGIA WEST 1	-
IN-1004a	DETAIL LOGGIA WEST 2	-
IN-1005a	DETAIL LOGGIA WEST 3	-
IN-1008a	DETAIL	
	SWITACHABLE GLAZING 1	-
IN-1009a	DETAIL	
	SWITACHABLE GLAZING 2	-
IN-1010	COLLECTOR PAN	-

STRUCTURAL (ST)

ST-001a-002a SUBSTRUCTURE ST-011f BOTTOM VIEW OF FLOOR

ST-012I	AND ROOF SUBCARRIER IN THE	-
	FLOOR	-
ST-101g	SECTIONS B-B, E-E, J-J	-
ST-112i	SECTIONS H-H, I-I	-
ST-113h	SECTIONS F-F, G-G	-
ST-114e	SECTIONS C-C, D-D	-
ST-301d	DETAIL 1	-
ST-302	DETAIL 2	-
ST-303	DETAIL 3, 4	-
ST-304i	DETAIL 5,11, 12	-
ST-305	DETAIL 6, 7	-
ST-306f	DETAIL 8, 9, 10	-
ST-307	PICTURE OF OUR HOUSE	-
ST-311a-313a	DETAIL 15 FOUNDATION	-
01	ASSEMBLYPLAN	
	FOUNDATION 1	-
02	ASSEMBLYPLAN	
	FOUNDATION 2	-
03	DETAILS FOUNDATION	
	ELEMENTS 1	-
04	DETAILS FOUNDATION	
	ELEMENTS 2	-
05	TERRACE OVERVIEW	-
06	ASSEMBLYPLAN	
	TERRACE	-
07	RAMPPLAN	-

FIRE PROTECTION (FP)

FP-001b FIRE PROTECTION

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FP	-002c	DURING ASSEMBLY	-
FP	-003	CEILING	-
PLUMBING	9 (PL)		
PL-	-001	SUPPLY AND REMOVAL	-
PL-	-011	GREY WATER	-
PL-	-021	WATER SUPPLY	-
PL-	-022	WATERTANKS	-
PL-	-023	SUMMARY GUIDANCE	-
PL-	-032b	COOLING WATER TANK	-
PL-	-033c	FRESHWATER TANKS	-
PL-	-034b	GREYWATER TANK	-

SOLAR WATER HEATING (SW)

SW-002	SCHEMATIC DIAGRAM	-
SW-003	SCHEMATIC DIAGRAM	
	_HEAT SINK TANK	-

ME-011 HVAC EQUIPMENT

MECHANICAL (ME)

ME-021	HEATING	-
ME-031	COOLING	-
ME-041	VENTILATION	-
ME-100	ROOM ELEVATION	-
ME-101	TECHNOLOGY BOX	-
ME-102	MANAGEMENT GUIDANCE	
	_ELEVATION	-
ME-205	HEATPUMP - HEATING	
	MODE	-
ME-206	HEATPUMP - COOLING MOD)E -
ME-211a	HEATING MODE CASE 6	-
ME-212a	HEATING MODE CASE 7	-
ME-214a	HEATING MODE CASE 8	-
ME-221a	COOLING MODE CASE 1	-
ME-222a	COOLING MODE CASE 2	-
ME-223a	COOLING MODE CASE 3	-
ME-224a	COOLING MODE CASE 4a	-
ME-225a	COOLING MODE CASE 4b	-

ME-226a COOLING MODE CASE 5

ELECTRICAL (EL)

EL-301 POWER PLAN -

EL-401g LIGHTING PLAN -

EL-403 PRELIMINARY LIGHTING

PLAN -

EL-501 ONE_LINE DIAGRAMM

EL-601 AC CIRCUIT LAYOUT

SOLAR SYSTEMS (SS) PHOTOVOLTAIC SYSTEM

SS-001 PV SYSTEM: GENERAL

Page 1-4 -

SS-011a PHOTOVOLTAIC SYSTEM:

DC ROOF

SS-012a PHOTOVOLTAIC SYSTEM:

DC EAST

SS-013a PHOTOVOLTAIC SYSTEM:

DC WEST

SS-031 PHOTOVOLTAIC SYSTEM:

GROUNDING

SS-041 PHOTOVOLAIC SYSTEM:

EQUIPMENT -

TELECOMMUNICATIONS AND BUILDING AUTOMATIZATION SYSTEM (BAS)

BAS-001a WIRING PLAN BUILDING

AUTOMATIZATION -

BAS-101 SCHEMATIC DIAGRAM

BUILDING AUTOMATIZATION

_cover

BAS-101 SCHEMATIC DIAGRAM

BUILDING AUTOMATIZATION

SIGGI added only german possible

SITE OPERATIONS (SO)

SO-001c	OUTSIDE LOGISTIC	-
SO-101d	INSIDE LOGISTIC	-
SO-201e	UNLOAD + ASSEMBLY 1	-
SO-202e	UNLOAD + ASSEMBLY 2	-
SO-203e	UNLOAD + ASSEMBLY 3	-
SO-204e	ASSEMBLY 4	-
SO-205e	ASSEMBLY 5	-
SO-206e	ASSEMBLY 6	-
SO-207e	ASSEMBLY 7	-
SO-208e	ASSEMBLY 8	-
SO-211b	UNLOAD + DISASSEMBLY 1	-
SO-212b	LOAD + DISASSEMBLY 2	-
SO-213b	LOAD + DISASSEMBLY 3	-
SO-214b	LOAD + DISASSEMBLY 4	-
SO-300	STEP 1 OVERVIEW	-
SO-301	STEP 1 FOUNDATION	-
SO-302	STEP 1a-c FOUNDATION	-
SO-303	STEP 1d-f FOUNDATION	-
SO-304	STEP 1g-i FOUNDATION	-
SO-305	STEP 1j-I FOUNDATION	-
SO-306	STEP 1m-o FOUNDATION	-
SO-307	STEP 1p-r FOUNDATION	-
SO-310	STEP 2 OVERVIEW	-
SO-311	STEP 2a-d MODULES	-
SO-312	STEP 2 DETAILED	-
SO-320	STEP 3 OVERVIEW	-
SO-321	STEP 3a-d GAPS	-
SO-330	STEP 4 OVERVIEW	-
SO-331	STEP 4 TERRACE	-
SO-340	STEP 5 PV	-
SO-401b	OPERATIONS CHART	advanced
SO-402b	LOGISTIC PLANNING	advanced

HEALTH AND SAFETY (HS)

HS-001c	LOT - SURROUNDING	-
HS- 101	ASSEMBLY 01	-
HS- 102	ASSEMBLY 02	-
HS- 103	ASSEMBLY 03	-
HS- 104	ASSEMBLY 04	-
HS- 105	ASSEMBLY 05	-
HS- 106	ASSEMBLY 06	-
HS- 107	ASSEMBLY 07	-
HS- 107	ASSEMBLY 08	-

PUBLIC TOUR (PT)

PT-001b SITE ACCESIBILITY
PT-101d PUBLIC EXHIBITION PLAN
PT-201b EXIHIBITON ELEVATIONS 1
PT-202b EXHIBITIONS ELEVATIONS 2 -

INSTRUMENTATION (PI)

PI-001a WIRERING ROUTE_SITE
PI-101b INSTRUMENTATION
 FLOOR PLAN
PI-102 MONITORING HFT
PI-103a WIRING ROUTE_FLOOR
PI-201a INSTRUMENTATION
 SECTION LONGITUDINAL -

3. Simulation Input Report: added

4. Project Summary # 4 advanced

5. Compilation of communications added documents

Summary of Changes

03.05.2010 Deliverable 7

1.Projekt Manual

COVER SHEET: new designed

TABLE OF CONTENTS: observed

RULES AND BUILDING CODE

COMPLIANCE CHECKLIST: advanced

CONSTRUCTION SPECIFICATIONS: advanced

STRUCTURAL CALCULATIONS: advanced

DETAILED WATER BUDGET: note added

SUMMARY OF UNLISTED ELECTRICAL

COMPONENTS: advanced

SUMMARY OF RECONFIGURABLE FEATURES: advanced

ELECTRICAL AND PHOTOVOLTAIC CHART: advanced **COMPREHENSIVE ENERGY ANALYSIS** AND DISCUSSION REPORT: advanced **CONTEST SUPPORT DOCUMENTS: Architecture Design Narrative:** advanced **Accoustic Report:** advanced **Lighting Design Narrative:** advanced **Engineering Design Narrative:** advanced **Solar Thermal System:** advanced **Photovoltaic System:** advanced **List of Appliances:** advanced **Communication Plan:** advanced Industrialization and **Market Viability Report:** advanced **Sustainability Report:** advanced **Public tour Plan:** advanced **CONSTRUCTION COST ESTIMATE** AND PROJECT FINANCIAL SUMMARY: **DINNER PARTY MENU:** advanced

advanced

advanced

SITE OPERATIONS PLAN:

HEALTH AND SAFETY PLAN:

Summary of Changes

2.Construction Drawings

As stated in Rule 26.2, the Construction Drawings are consistent with the SDEConstruction Drawings formatting template and guidelines.

GENERAL (GE)

GE-001	COVER SHEET	new designed
GE-101	SHEET LIST 1	advanced
GE-102	SHEET LIST 2	added in addition to GE-101
GE-201	GENERAL SYMBOLS	adapted
GE-301	GENERAL ABBREVIATIONS	-
GE-401	EXTERIOR RENDERING 1	new designed
GE-402	EXTERIOR RENDERING 2	new designed
GE-403	EXTERIOR RENDERING 3	new designed
GE-404	EXTERIOR RENDERING 4	new designed

ARCHITECTURAL (AR)

AR-001a	VILLA SOLAR	-
AR-011f	SITE DESIGN	advanced
AR-012f	SITE TECHNICAL	advanced
AR-021f	FLOOR	advanced
AR-031b	ROOF DESIGN	advanced
AR-032d	ROOF TECHNICAL	advanced
AR-041b	MOVEABLE COMPONENTS	adapted
AR-051b	CONDITIONED SPACE	adapted
AR-052b	CONDITIONED VOLUME	adapted
AR-061	SHADING STUDIES 1	-
AR-062	SHADING STUDIES 2	-
AR-031b AR-032d AR-041b AR-051b AR-052b AR-061	ROOF DESIGN ROOF TECHNICAL MOVEABLE COMPONENTS CONDITIONED SPACE CONDITIONED VOLUME SHADING STUDIES 1	advanced advanced adapted adapted

AR-063	SHADING STUDIES 3	-
AR-102f	ELEVATION SITE NORTH	advanced
AR-103f	ELEVATION SITE EAST	advanced
AR-104f	ELEVATION SITE SOUTH	advanced
AR-105f	ELEVATION SITE WEST	advanced
AR-112b	ELEVATION BUILDING	
	NORTH	adapted
AR-113b	ELEVATION BUILDING	
	EAST	adapted
AR-114b	ELEVATION BUILDING	
	SOUTH	adapted
AR-115b	ELEVATION BUILDING	
	WEST	adapted
AR-201g	SECTION LONGITUDINAL	
	SOLAR CHIMNEY	advanced
AR-202 e	SECTION LONGITUDINAL	
	VENTILATION TOWER	advanced
AR-211e	SECTION TRANSVERSAL	
AR-211e	SECTION TRANSVERSAL MODULE	advanced
AR-211e AR-212b		advanced
	MODULE	advanced
	MODULE SECTION TRANSVERSAL	
AR-212b	MODULE SECTION TRANSVERSAL CLIMATE GAP	
AR-212b	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL	advanced
AR-212b AR-213b	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER	advanced advanced
AR-212b AR-213b AR-301a	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1	advanced advanced
AR-212b AR-213b AR-301a AR-302a	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2	advanced advanced advanced
AR-212b AR-213b AR-301a AR-302a AR-303a	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3	advanced advanced advanced
AR-212b AR-213b AR-301a AR-302a AR-303a AR-304a	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2	advanced advanced advanced
AR-212b AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1	advanced advanced advanced
AR-212b AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1	advanced advanced advanced
AR-212b AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306 AR-307	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1 TERRACE DOOR 1	advanced advanced advanced
AR-212b AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306 AR-307 AR-308	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1 TERRACE DOOR 1 FIXED GLAZING 2	advanced advanced advanced
AR-212b AR-213b AR-301a AR-302a AR-303a AR-304a AR-305a AR-306 AR-307 AR-308 AR-309	MODULE SECTION TRANSVERSAL CLIMATE GAP SECTION TRANSVERSAL VENTILATION TOWER WINDOW SOUTH WALL 1 WINDOW SOUTH WALL 2 WINDOW SOUTH WALL 3 ENTRANCE DOOR 2 ENTRANCE DOOR 1 FIXED GLAZING 1 TERRACE DOOR 1 FIXED GLAZING 2 TERRACE DOOR 2	advanced advanced advanced - advanced

AR-313	WINDOW NORTH WALL 3	advanced
AR-322b	FLOOR NORMED	advanced
AR-332b	ROOF NORMED	advanced
AR-342b	WALL NORMED	advanced
AR-351	GAP 2+3	advanced
AR-352	PLANTER 1 GAP 2+3	-
AR-353	GAP 2	-
AR-354	FLOOR GAP 2+3	-
AR-355c	OVERHEADGLAZING	
	GAP 2	advanced
AR-356	PLANTER 2 GAP 2+3	-
AR-359	VENTILATION TOWER 1	advanced
AR-360	SOLAR CHIMNEY 1	advanced
AR-361a	SOLAR CHIMNEY 2	advanced
AR-362a	VENTILATION TOWER 2	advanced
AR-363a	VENTILATION TOWER 3	advanced
AR-364a	SOLAR CHIMNEY 3	advanced
AR-365	SOLAR CHIMNEY 4	advanced
AR-366	VENTILATION TOWER 4	advanced
AR-367	VENTILATION TOWER 5	advanced
AR-368	VENTILATION TOWER 6	advanced
AR-371	INSULATION ROOF	added
AR-373b	SUBSTRUCTURE PV	
	OVERVIEW	advanced
AR-374b_1	SUBSTRUCTURE PV	
	DETAILS	advanced
AR-374a_2	SUBSTRUCTURE SECTIONS	added
AR-375c	VIP ROOF	advanced
AR-376b	VIP WALL EAST-WEST	-
AR-377b	VIP WALL NORTH-SOUTH	-
AR-378b	FLOOR	advanced
AR-379c	DETAILS	-
AR-380b	PVT	added
AR-395 HAND	RAIL DETAILS	added
AR-396 HAND	RAIL SECTIONS	added

BIOCLIMATIC ANALYSIS (BA)

BA-001	EAST SUN	-
BA-002	SUN SUMMER	-
BA-003	SUN WINTER	-
BA-004	CROSS VENTILATION	-
BA-005	AIR PREHEATING	-
BA-006	VENTILATION TOWER 1	-
BA-007	VENTILATION TOWER 2	-
BA-008	WATER USE NIGHT	-
BA-009	WATER USE DAY	-

INTERIORS (IN)

IN-001a	FLOOR 1	-
IN-002a	FLOOR 2	-
IN-003a	FLOOR 3	-
IN-010a	FLOOR - FURNISHING 1	-
IN-020b	FLOOR - FURNISHING 2	advanced
IN-030a	FLOOR - FURNISHING 3	-
IN-100	REFLECTED CEILING	-
IN-101	REFLECTED CEILING PCM	
	BOARD + GYPSUM	
	PLASTER BOARD	-
IN-102	REFLECTED CEILING	
	PCM + GPB	added
IN-201_202c	ELEVATIONS 1	advanced
IN-201_202c IN-203_204e	ELEVATIONS 1 ELEVATIONS 2	advanced advanced
IN-203_204e	ELEVATIONS 2	
_		
IN-203_204e	ELEVATIONS 2	advanced
IN-203_204e	ELEVATIONS 2 FURNISHING LOGGIA 1	advanced
IN-203_204e IN-301a IN-302a IN-303a	FURNISHING LOGGIA 1 FURNISHING LOGGIA 2 FURNISHING LOGGIA 3	advanced advanced
IN-203_204e IN-301a IN-302a	FURNISHING LOGGIA 1 FURNISHING LOGGIA 2 FURNISHING LOGGIA 3 FURNISHING LIVING	advanced advanced advanced advanced
IN-203_204e IN-301a IN-302a IN-303a	FURNISHING LOGGIA 1 FURNISHING LOGGIA 2 FURNISHING LOGGIA 3	advanced advanced
IN-203_204e IN-301a IN-302a IN-303a	FURNISHING LOGGIA 1 FURNISHING LOGGIA 2 FURNISHING LOGGIA 3 FURNISHING LIVING _FACILITIES 1 FURNISHING LIVING	advanced advanced advanced advanced
IN-203_204e IN-301a IN-302a IN-303a IN-401c	FURNISHING LOGGIA 1 FURNISHING LOGGIA 2 FURNISHING LOGGIA 3 FURNISHING LIVING _FACILITIES 1	advanced advanced advanced advanced

	IN-403c	FURNISHING LIVING	
		_FACILITIES 3	advanced
	IN-500a	KITCHEN PLAN	advanced
	IN-501b	FURNISHING DINING	
		_KITCHEN 1	adnanced
	IN-502c	FURNISHING DINING	
		_KITCHEN 2	advanced
	IN-503b	FURNISHING DINING	
		_KITCHEN 3	advanced
	IN-600a	BATHPLAN	advanced
	IN-601c	FURNISHING BEDROOM	
		_BATH 1	advanced
	IN-602c	FURNISHING BEDROOM	
		_BATH 2	advanced
	IN-603b	FURNISHING BEDROOM	
		_BATH 3	advanced
	IN-701	INTERIOR RENDERING	new designed
	IN-1001	DETAIL	
		FURNISHING FITTINGS	added
	IN-1003a	DETAIL LOGGIA WEST 1	added
	IN-1004a	DETAIL LOGGIA WEST 2	added
	IN-1005a	DETAIL LOGGIA WEST 3	added
	IN-1008a	DETAIL	
		SWITACHABLE GLAZING 1	added
	IN-1009a	DETAIL	
		SWITACHABLE GLAZING 2	added
	IN-1010	COLLECTOR PAN	added
STRU	CTURAL (ST)		
	ST-001a-002a	SUBSTRUCTURE	-

ST-011f

ST-012I

BOTTOM VIEW OF FLOOR

SUBCARRIER IN THE

AND ROOF

	FLOOR	advanced
ST-101g	SECTIONS B-B, E-E, J-J	-
ST-112i	SECTIONS H-H, I-I	advanced
ST-113h	SECTIONS F-F, G-G	added
ST-114e	SECTIONS C-C, D-D	-
ST-301d	DETAIL 1	-
ST-302	DETAIL 2	-
ST-303	DETAIL 3, 4	-
ST-304i	DETAIL 5,11, 12	-
ST-305	DETAIL 6, 7	-
ST-306f	DETAIL 8, 9, 10	-
ST-307	PICTURE OF OUR HOUSE	-
ST-311a-313a	DETAIL 15 FOUNDATION	-
ST-311a-313a	DETAIL 15 FOUNDATION ASSEMBLYPLAN	-
		- added
	ASSEMBLYPLAN	- added
01	ASSEMBLYPLAN FOUNDATION 1	- added added
01	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN	
01 02	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2	
01 02	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2 DETAILS FOUNDATION	added
01 02 03	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2 DETAILS FOUNDATION ELEMENTS 1	added
01 02 03	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2 DETAILS FOUNDATION ELEMENTS 1 DETAILS FOUNDATION	added added
01020304	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2 DETAILS FOUNDATION ELEMENTS 1 DETAILS FOUNDATION ELEMENTS 2	added added added
0102030405	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2 DETAILS FOUNDATION ELEMENTS 1 DETAILS FOUNDATION ELEMENTS 2 TERRACE OVERVIEW	added added added
0102030405	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2 DETAILS FOUNDATION ELEMENTS 1 DETAILS FOUNDATION ELEMENTS 2 TERRACE OVERVIEW ASSEMBLYPLAN	added added added added
01 02 03 04 05 06	ASSEMBLYPLAN FOUNDATION 1 ASSEMBLYPLAN FOUNDATION 2 DETAILS FOUNDATION ELEMENTS 1 DETAILS FOUNDATION ELEMENTS 2 TERRACE OVERVIEW ASSEMBLYPLAN TERRACE	added added added added

FIRE PROTECTION (FP)

FP-001b	FIRE PROTECTION	advanced
FP-002c	DURING ASSEMBLY	added

FP-003	CEILING	added
UMBING (PL)		
PL-001	SUPPLY AND REMOVAL	added
PL-011	GREY WATER	added
PL-021	WATER SUPPLY	added
PL-022	WATERTANKS	added
PL-023	SUMMARY GUIDANCE	added
PL-031	ME 001-041 CONDUIT	added
PL-032b	COOLING WATER TANK	advanced
PL-033c	FRESHWATER TANKS	advanced
PL-034b	GREYWATER TANK	advanced
named:		
PL-101	SCHEMATIC DIAGRAMM	
	CASE 1	added (see ME-211)
PL-102	SCHEMATIC DIAGRAMM	
	CASE 2	added (see ME-212)
PL-104	SCHEMATIC DIAGRAMM	
	CASE 4	added (see ME-213)
PL-105	SCHEMATIC DIAGRAMM	
	CASE 5	added (see ME-221)
PL-106	SCHEMATIC DIAGRAMM	
	CASE 6	added (see ME-222)
PL-107	SCHEMATIC DIAGRAMM	
	CASE 7	added (see ME-223)
PL-108	SCHEMATIC DIAGRAMM	
	CASE 8	added (see ME-224)
PL-109	SCHEMATIC DIAGRAMM	
	CASE 9	added (see ME-225)
LAR WATER HE	ATING (SW)	
SW-001	SOLAR WATER HEATING	advanced
SW-002	SCHEMATIC DIAGRAM	added
SW-003	SCHEMATIC DIAGRAM	

added

HVAC EQUIPMENT

ME-011

ME-021	HEATING	added
ME-031	COOLING	added
ME-041	VENTILATION	added
ME-100	ROOM ELEVATION	added
ME-101	TECHNOLOGY BOX	added
ME-102	MANAGEMENT GUIDANCE	
	_ELEVATION	added
ME-205	HEATPUMP - HEATING	
	MODE	added
ME-206	HEATPUMP - COOLING MODE	added
ME-211a	HEATING MODE CASE 6	added
ME-212a	HEATING MODE CASE 7	added
ME-214a	HEATING MODE CASE 8	added
ME-221a	COOLING MODE CASE 1	added
ME-222a	COOLING MODE CASE 2	added
ME-223a	COOLING MODE CASE 3	added
ME-224a	COOLING MODE CASE 4a	added
ME-225a	COOLING MODE CASE 4b	added
ME-226a	COOLING MODE CASE 5	added

ELECTRICAL (EL)

Renamed, see SOLAR SYSTEMS drawings

 EL-101a	PV WIRING ROOF	advanced
 EL-102a	PV WIRING EAST FACADE	advanced
EL-103a	PV WIRING WEST FACADE	advanced
EL-104	PV MODULE_PLÄNE	added
EL-104	PV MODULES	added
 EL-105	PV SYSTEM	added
 EL-106	SCHEMATIC DIAGRAM PV	added
 EL-106	SCHEMATIC DIAGRAM PV	
	SIGGI	added
EL-301	POWER PLAN	-
EL-401g	LIGHTING PLAN	advanced
EL-403	PRELIMINARY LIGHTING	
	PLAN	added

EL-501 ONE_LINE DIAGRAMM -

EL-601 AC CIRCUIT LAYOUT -

SOLAR SYSTEMS (SS) PHOTOVOLTAIC SYSTEM

SS-001 PV SYSTEM: GENERAL

Page 1-4 added

SS-011a PHOTOVOLTAIC SYSTEM:

DC ROOF added

SS-012a PHOTOVOLTAIC SYSTEM:

DC EAST added

SS-013a PHOTOVOLTAIC SYSTEM:

DC WEST added

SS-021 PHOTOVOLTAIC SYSTEM:

AC see SS-001 and EL-501

SS-031 PHOTOVOLTAIC SYSTEM:

GROUNDING added

SS-041 PHOTOVOLAIC SYSTEM:

EQUIPMENT added

SS-101 THERMAL SYSTEM see Plumbing plans for PV/T circulation

TELECOMMUNICATIONS AND BUILDING AUTOMATIZATION SYSTEM (BAS)

BAS-001a WIRING PLAN BUILDING

AUTOMATIZATION advanced

BAS-101 SCHEMATIC DIAGRAM

BUILDING AUTOMATIZATION

_cover added

BAS-101 SCHEMATIC DIAGRAM

BUILDING AUTOMATIZATION

SIGGI added only german possible

SITE OPERATIONS (SO)

SO-001c	OUTSIDE LOGISTIC	advanced
SO-101d	INSIDE LOGISTIC	advanced
SO-201e	UNLOAD + ASSEMBLY 1	advanced
SO-202e	UNLOAD + ASSEMBLY 2	advanced
SO-203e	UNLOAD + ASSEMBLY 3	advanced
SO-204e	ASSEMBLY 4	advanced
SO-205e	ASSEMBLY 5	advanced
SO-206e	ASSEMBLY 6	advanced
SO-207e	ASSEMBLY 7	advanced
SO-208e	ASSEMBLY 8	advanced
SO-211b	UNLOAD + DISASSEMBLY 1	added
SO-212b	LOAD + DISASSEMBLY 2	added
SO-213b	LOAD + DISASSEMBLY 3	added
SO-214b	LOAD + DISASSEMBLY 4	added
00.000	OTED 4 OVERVIEW	- 1.11
SO-300	STEP 1 OVERVIEW	added
SO-301	STEP 1 FOUNDATION	added
SO-302	STEP 1a-c FOUNDATION STEP 1d-f FOUNDATION	added
SO-303		added
SO-304	STEP 1g-i FOUNDATION	added
SO-305 SO-306	STEP 1j-I FOUNDATION STEP 1m-o FOUNDATION	added added
SO-300	STEP 1p-r FOUNDATION	added
30-307	STEP IP-11 CONDATION	auueu
SO-310	STEP 2 OVERVIEW	added
SO-311	STEP 2a-d MODULES	added
SO-312	STEP 2 DETAILED	added
SO-320	STEP 3 OVERVIEW	added
SO-321	STEP 3a-d GAPS	added
SO-330	STEP 4 OVERVIEW	added
SO-331	STEP 4 TERRACE	added
SO-340	STEP 5 PV	added
SO-401	OPERATIONS CHART	advanced
SO-402	LOGISTIC PLANNING	advanced

HEALTH AND SAFETY (HS)

HS-001c	LOT - SURROUNDING	advanced	
HS-201a	INSIDE LOGISTIC	renamed	(see FP - 002c DURING ASSEMBLY)
HS- 101	ASSEMBLY 01	added	
HS- 102	ASSEMBLY 02	added	
HS- 103	ASSEMBLY 03	added	
HS- 104	ASSEMBLY 04	added	
HS- 105	ASSEMBLY 05	added	
HS- 106	ASSEMBLY 06	added	
HS- 107	ASSEMBLY 07	added	
HS- 107	ASSEMBLY 08	added	

PUBLIC TOUR (PT)

PT-001b	SITE ACCESIBILITY	advanced
PT-101d	PUBLIC EXHIBITION PLAN	advanced
PT-201b	EXIHIBITON ELEVATIONS 1	advanced
PT-202b	EXHIBITIONS ELEVATIONS 2	advanced

INSTRUMENTATION (PI)

PI-001a	WIRERING ROUTE_SITE	advanced
PI-101b	INSTRUMENTATION	
	FLOOR PLAN	-
PI-102	MONITORING HFT	added
PI-103a	WIRING ROUTE_FLOOR	added
PI-201a	INSTRUMENTATION	
	SECTION LONGITUDINAL	advanced

3. Electric and Photovoltaic chart: added in Project Manual

4. Project Summary # 3 advanced

Summary of Changes

05.02.2010 Deliverable 5

1.Projekt Manual

COVER SHEET:	
TABLE OF CONTENTS:	new designed
TABLE OF CONTENTS.	observed
RULES AND BUILDING CODE	
COMPLIANCE CHECKLIST:	
	added
CONSTRUCTION SPECIFICATIONS:	
	advanced
STRUCTURAL CALCULATIONS:	
STRUCTURAL GALGGEATIONS.	advanced
DETAILED WATER BUDGET:	
	advanced
SUMMARY OF UNLISTED ELECTRICAL	
COMPONENTS:	

added

SUMMARY OF RECONFIGURABLE FEATURES:	advanced
ELECTRICAL AND PHOTOVOLTAIC CHART:	added
COMPREHENSIVE ENERGY ANALYSIS AND DISCUSSION REPORT:	advanced
CONTEST SUPPORT DOCUMENTS:	
Architecture Design Narrative:	advanced
Accoustic Report:	advanced
Lighting Design Narrative:	advanced
Engineering Design Narrative:	advanced
Solar Thermal System:	advanced
Photovoltaic System:	advanced
List of Appliances and	
Equipment Specifications:	advanced
Communication Plan:	advanced
Industrialization and	
Market Viability Report:	advanced
Sustainability Report:	advanced
Public tour Plan:	advanced
CONSTRUCTION COST ESTIMATE AND PROJECT FINANCIAL SUMMARY:	
	not required for this deliverable

SITE OPERATIONS PLAN:

DINNER PARTY MENU:

This part is actually in process and will be handed in later (till Monday 15.02.2010). Please just work the later handed informations in the General Site Operations Plan. Kindly excuse this retardation, we have to include all new informations of the competition calendar in our planning of the Site Operations.

HEALTH AND SAFETY PLAN:

advanced

advanced

2.Construction Drawings

As stated in Rule 26.2, the Construction Drawings are consistent with the SDEConstruction Drawings formatting template and guidelines.

This is a general update compared with Deliverable #4.

All drawings are renamed by this code.

The layout contains a new header.

GENERAL (GE)

GE-001 COVER SHEET	new designed
GE-101 SHEET LIST	advanced
GE-201 GENERAL SYMBOLS	advanced
GE-301 GENERAL ABBREVIATIONS	advanced
GE-401 EXTERIOR RENDERING 1	added
GE-402 EXTERIOR RENDERING 2	added

ARCHITECTURAL (AR)

AR-001a	VILLA SOLAR	added
AR-011e	SITE DESIGN	advanced
AR-012e	SITE TECHNICAL	advanced
AR-021e	FLOOR	advanced
AR-031b	ROOF DESIGN	advanced
AR-032	ROOF TECHNICAL	added
AR-041a	MOVEABLE COMPONENTS	advanced
AR-051a	CONDITIONED SPACE	advanced
AR-052a	CONDITIONED VOLUME	advanced
AR-061	SHADING STUDIES 1	added
AR-062	SHADING STUDIES 2	added
AR-063	SHADING STUDIES 3	added

AR-102e	ELEVATION SITE NORTH	advanced
AR-103e	ELEVATION SITE EAST	advanced
AR-104e	ELEVATION SITE SOUTH	advanced
AR-105e	ELEVATION SITE WEST	advanced
AR-112a	ELEVATION BUILDING	
	NORTH	advanced
AR-113a	ELEVATION BUILDING	
	EAST	advanced
AR-114a	ELEVATION BUILDING	
	SOUTH	advanced
AR-115a	ELEVATION BUILDING	
	WEST	advanced
AR-201d	SECTION LONGITUDINAL	
AK-2010	SOLAR CHIMNEY	advanced
AR-202 d	SECTION LONGITUDINAL	auvanceu
AR-202 0		الم مراد مراد م
	VENTILATION TOWER	advanced
AR-211d	SECTION TRANSVERSAL	
	MODULE	advanced
AR-212a	SECTION TRANSVERSAL	
	CLIMATE GAP	advanced
AR-213a	SECTION TRANSVERSAL	
	VENTILATION TOWER	advanced
AD 204-	WINDOW COUTH WALL 4	
AR-301a	WINDOW SOUTH WALL 1	advanced
AR-302a	WINDOW SOUTH WALL 2	advanced
AR-303a	WINDOW SOUTH WALL 3	advanced
AR-304a	ENTRANCE DOOR 2	added
AR-305a	ENTRANCE DOOR 1	added
AR-306	FIXED GLAZING 1	added
AR-307	TERRACE DOOR 1	added
AR-308	FIXED GLAZING 2	added
AR-309	TERRACE DOOR 2	added
AR-311	WINDOW NORTH WALL 1	added
AR-312	WINDOW NORTH WALL 2	added
AR-313	WINDOW NORTH WALL 3	added
-	- ··· · ·	

AR-322a	FLOOR NORMED	advanced
AR-332a	ROOF NORMED	advanced
AR-342a	WALL NORMED	advanced
AR-351	GAP 2+3	added
AR-352	PLANTER 1 GAP 2+3	added
AR-353	GAP 2	added
AR-354	FLOOR GAP 2+3	added
AR-355	OVERHEADGLAZING	
	GAP 2	added
AR-356	PLANTER 2 GAP 2+3	added
AR-359	VENTILATION TOWER 1	added
AR-360	SOLAR CHIMNEY 1	added
AR-361a	SOLAR CHIMNEY 2	added
AR-362a	VENTILATION TOWER 2	added
AR-363a	VENTILATION TOWER 3	added
AR-364a	SOLAR CHIMNEY 3	added
AR-365	SOLAR CHIMNEY 4	added
AR-366	VENTILATION TOWER 4	added
AR-367	VENTILATION TOWER 5	added
AR-368	VENTILATION TOWER 6	added
AR-373a	SUBSTRUCTURE PV	
	OVERVIEW	added
AR-374a	SUBSTRUCTURE PV	
	DETAILS	added
AR-375b	VIP ROOF	added
AR-376b	VIP WALL EAST-WEST	added
AR-377b	VIP WALL NORTH-SOUTH	added
AR-378a	FLOOR	added
AR-379c	DETAILS	added

BIOCLIMATIC ANALYSIS (BA)

BA-001	FLOOR EAST SUN	added
BA-002	SECTION SUN SUMMER	added
BA-003	SECTION SUN WINTER	added
BA-004	CROSS VENTILATION	added

BA-005	AIR PREHEATING	added
BA-006	VENTILATION TOWER 1	added
BA-007	VENTILATION TOWER 2	added
BA-008	WATER USE NIGHT	added
BA-009	WATER USE DAY	added
INTERIORS (IN)		
IN-001a	FLOOR 1	added
IN-002a	FLOOR 2	added

d FLOOR 3 IN-003a added IN-010a FLOOR - FURNISHING 1 added IN-020a FLOOR - FURNISHING 2 added IN-030a FLOOR - FURNISHING 3 added IN-100 REFLECTED CEILING added IN-101 REFLECTED CEILING PCM BOARD + GYPSUM PLASTER BOARD added IN-201_202a **ELEVATIONS 1** advanced IN-203_204a **ELEVATIONS 2** advanced IN-301 **FURNISHING LOGGIA 1** added IN-302 **FURNISHING LOGGIA 2** added **FURNISHING LOGGIA 3** IN-303 added FURNISHING LIVING IN-401 _FACILITIES 1 added IN-402 FURNISHING LIVING _FACILITIES 2 added IN-403 FURNISHING LIVING _FACILITIES 3 added IN-500 KITCHEN PLAN added IN-501 **FURNISHING DINING** _KITCHEN 1 added IN-502 **FURNISHING DINING** _KITCHEN 2 added

FURNISHING DINING	
_KITCHEN 3	added
BATHPLAN	added
FURNISHING BEDROOM	
_BATH 1	added
FURNISHING BEDROOM	
_BATH 2	added
FURNISHING BEDROOM	
_BATH 3	added
INTERIOR RENDERING	added
	_KITCHEN 3 BATHPLAN FURNISHING BEDROOM _BATH 1 FURNISHING BEDROOM _BATH 2 FURNISHING BEDROOM _BATH 3

STRUCTURAL (ST)

ST-001a-002a	SUBSTRUCTURE	added
ST-011f	BOTTOM VIEW OF FLOOR	
	AND ROOF	advanced
ST-012g	SUBCARRIER IN THE	
	FLOOR	added
ST-101g	SECTIONS B-B, E-E, J-J	advanced
ST-112f	SECTIONS H-H, I-I	advanced
ST-114e	SECTIONS C-C, D-D	added
ST-301d	DETAIL 1	advanced
ST-302	DETAIL 2	added
ST-303	DETAIL 3, 4	added
ST-304i	DETAIL 5,11, 12	added
ST-305	DETAIL 6, 7	added
ST-306f	DETAIL 8, 9, 10	added
ST-307	PICTURE OF OUR HOUSE	added
ST-311a-313a DETAIL 15 FOUNDATION		added

FIRE PROTECTION (FP)

FP-001a fire protection advanced

PLUMBING (PL)

PL-031, ME 001-041 CONDUIT added PL-032a COOLING WATER TANK added PL-033a FRESHWATER TANKS added PL-034a GREYWATER TANK added PL-101 SCHEMATIC DIAGRAMM CASE 1 added PL-102 SCHEMATIC DIAGRAMM CASE 2 added PL-103 SCHEMATIC DIAGRAMM CASE 3 added PL-104 SCHEMATIC DIAGRAMM CASE 4 added PL-105 SCHEMATIC DIAGRAMM CASE 5 added PL-106 SCHEMATIC DIAGRAMM CASE 6 added PL-107 SCHEMATIC DIAGRAMM CASE 7 added PL-108 SCHEMATIC DIAGRAMM CASE 8 added PL-109 SCHEMATIC DIAGRAMM CASE 9 added

SOLAR WATER HEATING (SW)

SW-001 SOLAR WATER HEATING advanced

MECHANICAL (ME)

ME-101 ROOM ELEVATION advanced

ELECTRICAL (EL)

EL-101 PV WIRING ROOF	added
EL-102 PV WIRING EAST FACADE	added
EL-103 PV WIRING WEST FACADE	added
EL-104 PV MODULE_PLÄNE	added
EL-104 PV MODULES	added
EL-105 PV SYSTEM	added
EL-106 SCHEMATIC DIAGRAM PV	added
EL-106 SCHEMATIC DIAGRAM PV_SIGGI	added

EL-301 POWER

EL-401 LIGHTING PLAN advanced EL-401b PRELIMINARY LIGHTING PLAN added

EL-501 ONE_LINE DIAGRAMM added

EL-601 AC added

SOLAR SYSTEMS (SS) PHOTOVOLTAIC SYSTEM TELECOMMUNICATIONS AND BUILDING AUTOMATIZATION SYSTEM (BAS)

BAS-001 WIRING PLAN BUILDING

added **AUTOMATIZATION**

BAS-101 SCHEMATIC DIAGRAM

BUILDING AUTOMATIZATION added

BAS-101 SCHEMATIC DIAGRAM

BUILDING AUTOMATIZATION

SIGGI added

SITE OPERATIONS (SO)

This part is actually in process and will be handed in later (till Monday 15.02.2010). Please just work the later handed informations in the General Site Operations Plan. Kindly excuse this retardation, we have to include all new informations of the competition calendar in our planning of the Site Operations.

SO-001a	OUTSIDE LOGISTIC	added
SO-101b	INSIDE LOGISTIC	advanced
SO-201b	UNLOAD + ASSEMBLY 1	advanced
SO-202b	UNLOAD + ASSEMBLY 2	advanced
SO-203b	UNLOAD + ASSEMBLY 3	advanced
SO-204b	ASSEMBLY 4	advanced
SO-205b	ASSEMBLY 5	advanced
SO-206b	ASSEMBLY 6	advanced
SO-207b	ASSEMBLY 7	advanced
SO-208b	ASSEMBLY 8	advanced

HEALTH AND SAFETY (HS)

HS-001a **SURROUNDINGS** advanced

HS-201a **INSIDE LOGISTIC** advanced

PUBLIC TOUR (PT)

PT-001	SITE ACCESIBILITY	advanced
PT-101a	PUBLIC EXHIBITION PLAN	advanced
PT-201	EXIHIBITON ELEVATIONS 1	advanced
PT-202	EXHIBITIONS ELEVATIONS 2	advanced

INSTRUMENTATION (PI)

PI-001 INSTRUMENTATION SITE PLAN added

PI-101 INSTRUMENTATION FLOOR PLAN added

PI-201 INSTRUMENTATION SECTION

LONGITUDINAL added

3. Operations chart:

This part is actually in process and will be handed in later (till Monday 15.02.2010). Please just work the later handed informations in the General Site Operations Plan. Kindly excuse this retardation, we have to include all new informations of the competition calendar in our planning of the Site Operations.

4. Electric and Photovoltaic chart: added in Project Manual

5. Project Summary # 2 added

11.09.2009	Deliverable 4	
1. Projekt Manual		
COVER SHEET:		new designed
TABLE OF CONTENTS:		adapted
CONSTRUCTION SPECIFICA	TIONS:	added
STRUCTURAL CALCULATION	NS:	added
DETAILED WATER BUDGET:		added
SUMMARY OF RECONFIGUR	ABLE FEATURES:	added
COMPREHENSIVE ENERGY AND DISCUSSION REPORT:	ANALYSIS	added

CONTEST SUPPORT DOCUMENTS:

Architecture Design Narrative: added
Accoustic Report: added
Lighting Design Narrative: added
Engineering Design Narrative: added
Solar Water Heating: added
Photovoltaic System: added

List of Appliances and

Equipment Specifications: added

Communication Plan:

Defining Markeing's Role Sponsoring Communication

Industrialization and

Market Viability Report: added
Sustainability Report: added

CONSTRUCTION COST ESTIMATE

AND PROJECT FINANCIAL SUMMARY: adapted

DINNER PARTY MENU: added

SITE OPERATIONS PLAN: adapted

HEALTH AND SAFETY PLAN: added

2.Construction Drawings

As stated in Rule 26.2, the Construction Drawings are consistent with the SDEConstruction Drawings formatting template and guidelines.

This is a general update compared with Deliverable #3.

All drawings are renamed by this code.

The layout contains a new header.

The energy tower is renamed. It is called ventilation tower.

AR-011 site	adapted
AR-012 site	adapted
AR-021 floor	adapted
AR-031 roof	added
AR-041 Moveable Components	added
AR-051 Conditioned Space	added
AR-052 Conditioned Volume	added
AR-102 site north	added
AR-103 site east	added
AR-104 site south	added
AR-105 site west	added
AR-112 elevation building north	added
AR-113 elevation building east	added
AR-114 elevation building south	added
AR-115 elevation building west	added
AR-201 section longitudinal	added
AR-202 section longitudinal	added
AR-211 section transversal	added
AR-212 section transversal	added
AR-213 section transversal	added
AR-301 window gap	added
AR-301 window sliding glass door	added
AR-302 window sliding glass door	added
AR-303 window sliding glass door	added
AR-322 floor normed	added
AR-332 roof normed	added
AR-342 wall normed	added
AR-365 ventilation tower 1	added
AR-365 ventilation tower 2	added
AR-365 ventilation tower 3	added
AR-365 ventilation tower 4	added

AR-365 ventilation tower 5	added
AR-365 ventilation tower floor	added
AR-366 solar chimney	added
AR-366 solar chimney 2	added
AR-366 solar chimney floor	added
IN-001 floor 1	added
IN-001 floor 2	added
IN-001 floor 3	added
IN-001 floor - furnishing 1	added
IN-001 floor - furnishing 2	added
IN-001 floor - furnishing 3	added
IN-201_202 elevations	added
IN-203_204 elevations	added
IN-601 interior renderings	added
ST-011 first floor	added
ST-021 roof	added
ST-101 longitudinal	added
ST-111 transversal	added
ST-301 rigid edge	added
FP-001 fire protection	added
PL-001 supply and removal	added
PL-021 drain waste vent	added
PL-022 waste	added
PL-211 grey water	added
SW-001 plan	added
ME-011 HVAC equipment	added
ME-021 heating	added
ME-031 cooling	added
ME-041 ventilation	added
ME-101 mecanical room	added
	elevations
EL-401 lighting plan	added
EL-402 lighting plan	added

home+

SO-101 inside logistic	added
SO-201 unload and assembly	added
SO-202 unload and assembly	added
SO-203 unload and assembly	added
SO-204 unload and assembly	added
SO-301 assembly detailed	added
SO-302 assembly detailed	added
SO-303 assembly detailed	added
SO-304 assembly detailed	added
SO-305 assembly detailed	added
HS-001 lot and sorroundings	added
HS-201 inside logistic	added
HS-301 unload and assembly	added
PT-001 site accesibility	added
PT-101 public exhibition plan	added

3. Project Summary #1: added

4. Electric and photovoltaic installation chart:

added

5. Operations chart:

04.05.2009 Deliverable 3

Communication Plan Update: added

Development Drawings Update:

Projekt Manual Text added Solar Envelope Dimensions added added **Building measurements** Site Plan added **Entrance Glazing** added Fassade south/north added Section b-b Climate Gap added Sun shading added PV collector added Watertank added View South added View North added Guided House Tour Plan added

Preliminary Energy Analysis Update:

Weather Data Madrid added
Cooling Load Calculation - Day added
Internal Loads added
Cooling Load Calculation - Week added

Dynamic Building Simulation: added
Annual / Contest added
Energy Consumption: added
Electricity added
Hot Water added
Solar Photovoltaic System added
Schematic Electric Diagramm added

Assembling Description Update:

Preliminary site operation plan added **Building weight** added Module size added Module names added Trailer size added **Trailer Route** added Time for assembling phases added Technical installations added **Preliminary Cost Estimate** added

Market Viability Report Update:

Modul arrangement variabilities added

30.01.2009 Deliverable 2

Table of Contents

2. Summary of Changes	3
4. Rules and Building Code Compliances Checklist	51
5. Construction Specifications	59
6. Structural Calculations	69
7. Water Budget	73
8. Summary of Unlisted Electrical Components	77
9. Summary of reconfigurable Features	91
10. Electric and Photovoltaic Chart	95
11. Comprehensive Energy Analysis and Discussion Report	99
12.1 Architecture Design Narrative	201
12.2 Acoustic Report	211
12.3 Lighting Design Narrative	219
12.4 Engineering Design Narrative	231

12.5 Solar Thermal System	257
12.6 Photovoltaic System	275
12.7 List of Appliances	319
12.8 Communication Plan	325
12.9 Preliminary Industrialization and Market Viability	361
12.10 Sustainability Report	405
12.11 Public Tour	445
13. Cost Estimate and Project Financial Summary	453
14. Dinner Party Menue	463
15. Site Operations	475
16. Health and Safety Report	495

home+			

4. Rules and Building Code Compliances Checklist

Chart

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Rules and Building Code Compliances Checklist

_9	sd eur	rope GOBEANO DE ERMOA	MINISTRIAO DE VYMENDA	
		Rule Description	Content Requirement(s)	Drawing(s)/Report(s)
	3.2	Team Officers and Contact Information	Team officer's contact information completely fulfilled in Table 1 (SDE WAT)	see WAT
	4.2	Construction Equipment	Drawing(s) showing the assembly and disassembly	SO-201e-208e; SO- 211b-214b
	4.2	Construction Equipment	Specs for heavy machinery	Manual_Site Operations
	4.3	Ground Penetration	Drawing(s) showing the locations and depths of all	doesn't exist
	4.4	Impact on the Ground	Drawing(s) showing the location, contact area and soil-bearing pressure of every component resting directly on the turf	ST-001/002a; ST-311a-313a; Sructural Calculations
	4.5	Generators	Specifications for generators	Construction Specifications
	4.6	Spill Containment	Drawing(s) showing the locations of all equipment, tanks and pipes that will contain fluids at any point	PL-032b, -033c,-034b; SO-206e;
	4.6	Spill Containment	Specifications for all equipment, tanks, and pipes that will contain fluids at any point during the event	Construction Specifications
	5.2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site	AR-102e-105e AR-012e
	5.2	Solar Envelope Dimensions	List of solar envelope	AR-102e-105e
	6.1	Structural Design Approval	Structural drawings and calculations signed and	included in Hard copies
	6.1	Electrical Design Approval	Electrical drawings and calculations signed and	observed, exepted calculations
	6.1	Codes Design Compliance	List of the country of origin codes complied, properly signed by the faculty advisor, in order to certify compliance	included in Hard copies
	6.2	Maximum Architectural Footprint	Drawing(s) showing all information needed by the Rules Officials to measure the	AR-041b
	6.2	Maximum Architectural Footprint	Drawing(s) showing all movable components that may increase the footprint if operated during contest	AR-041b

6.2	Maximum Architectural Footprint	Shading calculations and/or diagrams for components that DO NOT shade the	AR-061-63
6.3	Minimum Conditioned Space	Drawing(s) showing space	AR-051b
6.4	Entrance and Exit Routes	Drawing(s) showing the accessible public tour route	PT-001b, -101d
7.1	Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	AR-011f-012f; AR - 212a-213a; AR - 352, AR - 356
7.2	Watering Restrictions	Drawings showing the layout and operation of greywater irrigation systems	doesn't exist
8.1	PV Technology Limitations	Specifications for photovoltaic components	Construction specification and PV- System Report
8.1	PV Technology Limitations	Contractor price quote for photovoltaic components	Construction specification, PV-System Report
8.3	Thermal Energy Storage	Drawing(s) showing the location of thermal energy	PL - 031
8.3	Thermal Energy Storage	Specifications for thermal energy storage components	Construction specification
8.3	Thermal Energy Storage	Shading calculations and/or diagrams for thermal energy storage components (if necessary)	AR-011f-012f;
8.4	Batteries	Drawing(s) showing the location(s) and quantity of	doesn't exist
8.4	Batteries	Specifications for all stand- alone, PV-powered devices	doesn't exist
8.4	Batteries	Drawing(s) showing the location(s) and quantity of	doesn't exist
8.4	Batteries	Specifications for hard-wired battery bank components.	doesn't exist
8.5	Desiccant Systems	Drawing(s) describing the operation of the desiccant	doesn't exist
8.5	Desiccant Systems	Specifications for desiccant	doesn't exist
8.6	Village Grid	Electrical and Photovoltaic	included
8.8	Humidification systems	Specifications for humidification systems and corresponding certifications of the different elements.	Ventilation system in Construction specification / Tower has no datashed

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	9.1	Tank locations	Drawing(s) showing the location of all the water tanks relative to the conditioned	AR-011g-012g; SO-206e
	9.3	Grey water reuse	Specifications for grey water reuse systems.	doesn't exist
	9.4	Rainwater Collection	Drawing(s) showing the layout and operation of	doesn't exist
	9.6	Thermal Mass	Drawing(s) showing the locations of water-based	doesn't exist
	9.6	Thermal Mass	Specifications for components of water-based	doesn't exist
	9.7	Grey Water Heat Recovery	Specifications for grey water	doesn't exist
	9.8	Water Delivery	Drawing(s) showing the fill location(s), quantity of water requested at each fill location, tank dimensions,	Water Budget; PL-032-034a; SO-206b;
	9.9	Water Removal	Drawing(s) showing the quantity of water to be removed from each fill location, tank dimensions,	Water Budget; PL-032b, -033c,-034b; SO-206b;
	10.2	Event Sponsor Recognition	Drawing(s) showing the dimensions, materials,	Communication Plan
	10.3	Team Sponsor Recognition	Drawing(s) showing the dimensions, materials,	Communication Plan
	11.4	Public Exhibit	Drawing(s) showing the dimensions, materials,	PT-101d-201b-202b
	11.5	Team Uniform	Drawing(s) showing the artwork and content of the team uniform	Public Exhibition Tour
	36.2	Lots	Drawing(s) showing the storage and unloading areas	SO-101d
	36.2	Lots	Calculations (Specifications) showing the load of storage element area	to be added in Deliverable 6 (March)
	36.2	Lots	Calculations showing that structural design remains compliant even if 0.45 m of vertical elevation change	to be added in Deliverable 6 (March)
0	36.2	Lots	Drawing(s) showing shimming methods and materials to be used if 0.45 m of vertical elevation change exists on the lot	ST-001/002a; ST-311a-313a; Sructural Calculations
	38.2	Instrumentation	Drawing(s) showing the location of bi-directional	PI-001a site plan/ PI- 101b Floor plan
	40.3	Fire Safety	Specifications for Fire Reaction of Constructive elements	Sructural Calculations

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40.4	Security against falls	Specifications of compliance with the slipperiness degree classes of floors included in House tour	Health and Safety Report, test is in process and results have to be added
40.4	Security against falls	Drawing(s) showing compliance with conditions for uneven flooring and for floor with different level	AR-011g-012g; AR-102f-105f
40.4	Security against falls	Drawing(s) showing compliance with conditions Restricted Areas stairs, Public Areas Staircases,Restricted	AR-011g-012g; AR-102f-105f
40.4	Safety for avoiding trapping and impact risk	Drawing(s) showing compliance with conditions for avoiding trapping and	Construction Specifications
40.4	Safety against the risk of inadequate lighting	Specifications for level of illumination of house tour	Lighting Desgn Narrative
40.5	Accesibility	Interior and exterior plans showing entire accessible	PT-001b
40.6	Structural Safety	Specifications for using dead loads, live loads, safety factors and load combinations in the structural calculations	Engineering Design Narrative and Structural Calculations
40.7	Electrical and PV System	Drawing(s) showing the locations of the photovoltaics, inverter(s),	PI-101b
40.7	Electrical and PV System	Specifications for the photovoltaics, inverter(s), meter housing, service equipment, and grounding	Construction Specifications and PV System Report
40.7	Electrical and PV System	Diagram(s) showing Electricity and Pv system	EL-601+501+401g+301 and EL-101-106
40.7	Electrical and PV System	One-line electrical diagram	EL-501
40.7	Electrical and PV System	Drawing(s) showing the house, decks, ramps, tour paths, metering box, meter	EL-101-103, PI-101, PT- 001b, AR-001a









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5. Construction Specifications - Contents

- 1. Chart
- 2.Data Sheets (Appendix 1 at the end of the project manual)

Construction Specifications



Project Manual, 22 September 2010

No.	Product	Description	Producer	Data sheet
05	Metals curtain rail	3114_ curtain rail	www.helmo.de	yes, just german
06	Wood, plastics and composites Roof			
	OSB (oriented strand board) panel	OSB is an engineered wood product formed by layering strands of wood in specific orientations. In appearance it may have a rough and variegated surface with the individual strips lying unevenly across each other.	www.kronoply.de	yes, just german
	Wood construction	STEICOjoists fulfil the demands from house builders for greater clear spans and better dimensional stability, whilst not increasing the size of the cross section of the construction elements.	www.steico.com	yes, german /english
	Wood construction (FSH)	STEICOultralam is a laminated veneer lumber for the highest demands. Is made of multiple 3 mm layers of graded laminated spruce veneers. This disperses knots and irregular growth, producing a practically homogeneous cross section. This construction means that STEICOultralam is highly rigid and dimensionally stable. Powerful engineered timber product for rectangular cross sections. With STEICOultralamR™ elements all veneer layers are glued together longitudinally. Cross laminated STEICOultralamX™ means that one-fifth of the veneers are glued crosswise – improving the lateral bending strength and stiffness of the board.	www.steico.com	yes, german /english
	Floor Parquet floor	Solid wood planks are milled from one solid piece of wood. This is the main difference between them and all types of engineered flooring. Engineered floors are made of three to seven layers of thin wood that are stacked together and then glued. Solid wood planks are milled with tongue and groove on all four sides. This makes possible a time- and cost-saving continuous installation. Slightly bevelled edges on all four sides rule out variations in board height, often referred to as "overwood", and guarantee an even surface. An exact fitting of the planks is achieved by slightly bevelled and backcut tongues and grooves. Stress grooves on the bottom side of the planks prevent them from cupping or buckling.	www.berthold-holz.de	yes, german /english
	Parquet terrace			yes, just german
07	Thermal and moisture protection Roof			
	Vacuum-Insulation-Panel (perlite filling)	va-Q-vip B is an evacuated thermal insulating panel with a very low thermal conductivity.	www.va-q-tec.de	yes, german /english
	Waterproofing	This Sarnafil plastic liner (TS 77-20) is a high- quality flexible polyolefin alloy membrane containing advanced polymers, stabilizers, fiberglass and polyester reinforcement.	www.sika.de	yes, just german

		Sarnafil_Dunstrohreinfassung	www.sika.de	l was
		Sarriani_Dunstroni ennassung	www.sika.ue	yes, just german
		Sarnafil_Verbundblechtafeln	www.sika.de	yes, just german
	Lamb's wool		www.klimalan.com	yes, just german
	Recycling structural panel	Linirec	www.linzmeier.de	yes, just german
	Wall Vacuum-Insulation-Panel (silica filling)	va-Q-vip B is an evacuated thermal insulating panel with a very low thermal conductivity.	www.va-q-tec.de	yes, german /english
	Waterproofing	This Sarnafil plastic liner (TS 77-20) is a high- quality flexible polyolefin alloy membrane containing advanced polymers, stabilizers, fiberglass and polyester reinforcement.	www.sika.de	yes, just german
	Recycling structural panel	Linirec	www.linzmeier.de	yes, just german
	Floor Vacuum-Insulation-Panel (silica filling)	description see wall	www.va-q-tec.de	yes, german /english
	Recycling structural panel	Linirec	www.linzmeier.de	yes, just german
3	Openings / windows (glass)			
	Wall HAHN lamella (ventilation	HAHN S9 Louvre window is applied for optimal	www.glasbau-hahn.de	yes,
	tower) VSG	adjustable ventilation. It consist of at least two single panes of glass with are joined togehter by a strong, tear-	www.bgt-brette.de	german /english yes, german /english
	Insulated glass	resistant polyvinylbutyral film (PVB).	www.glastroesch.de	yes, just german
	Roof Overhanging window Solar Chimney	chain drive engine	www.dh-partner.com	yes, just german
	Equipment Cooker	Miele KM 5944	www.miele.de	yes,
	Oven	Miele - H5681 BL	www.miele.de	just german yes,
	Cooker Hood	Miele - DA420 V mit Umluftbetrieb	www.miele.de	just german yes,
	Coffee Machine	Miele - CVA3660	www.miele.de	just german yes, just german
	Freezer / Refrigerator	Liebherr ICBP 3166 Premium Plus BioFresh	www.liebherr.com	yes, german /english
	Dishwasher	Miele G1562 SCVI (integrable)	www.miele.de	yes, just german
	Washing machine	Miele Softtronic W 5841 WPS EcoComfort	www.miele.de	yes, just german
	Clothes dryer	Miele Softtronic T 8627 WP EcoComfort	www.miele.de	yes, just german
	LCD-TV	Connect 32 Media Full-HD+100	www.loewe.de	yes, german /english
	Soundboard	Soundboard 300 - 40PW The purSonic Soundboards satisfy all individual desires. Soundboards are available in a wide variety of different lines to suit the different applications and uses. So you can design your building programme just as you please.	www.pursonic.com	yes, just german
	Speaker system	Speaker system for stereo or surround sound. Perfect functionality in combination with Auro audio system.	www.loewe.de	yes, german /english
	Apple	17-inch MacBook Pro	www.apple.de	yes,
	Wireless	Netgear DG834GB Wireless ADSL Firewall Router	www.kmelektronik.de	just german yes, just german
	TV Live Media Player	WD TV Lieve Mediaplayer LAN/HDMI	www.kmelektronik.de	yes, just german

	Network Direct Attached Storage	1000GB IOCELL NetDisk NAS USB	www.kmelektronik.de	yes, just german
	Portable generators	PRAMAC E 5000	www.pramac.com	yes, german /english
	Lights			yes, just german
12	Furnishings Oak (work plate kitchen, table, bed)	Oak wood is hard and heavy, but nonetheless elastic. The heartwood is very resilient, and durable even under water.	www.musterkiste.com	yes, german/english
	Stainless steel foot	Stainless steel is considered one of the most classic and noble materials for use in creating ageless furniture design. Especially elegant is the combination of stainless steel with selected solid wood	www.haseform.de	yes, german /english
	Curtain	Mira x Plain 6882 Col. 61	www.mira-x.ch	yes,
	Felt	Woolfelt_Flame retardant (B1 DIN 4102), an eco-friendly natural product	www.daimer-filze.com	just german
21	Fire suppression	Minimaxol-fire drencher_WS 6 nG	www.minimax.de	yes, just german
22	Plumbing Pumping equipment	SOLOLIFT + CWC 3	www.grundfos.de	yes, just german
	Drinking water supply	Grundfos Hydrojet	www.grundfos.de	yes, just german
	Delivery pump	Grundfos ALPHA 2 25-60 180	www.grundfos.de	yes, just german
	PVT collector	Grundfos MAGNA 25-60	www.grundfos.de	yes, just german
22	Water storage tank	The ROTEX Sanicube is a combination of hot water storage tank and instantaneous water heater. This means that the actual heat is not stored in the domestic water itself, but in the storage tank water which is clearly separated from it. The volume of the stored domestic water is relatively small and is 19-29 litres, depending upon the type of storage tank. On the other hand, the total storage tank volume is 300 and 500 litres. This amount of heat that can be stored and also removed is accordingly large.	www.rotex.de	yes, german /english
	Electric heating element		www.rotex.de	yes, just german
	Duct	AFR 150_ Flexible singel-grooved aluminium duct DIN 150, to be used as connection to the main duct	www.maico.de	yes, german /english
	Flush switch	Sigma50	www.geberit.de	yes, just german
	Toilet brush set	VOLA T33	www.vola.com	yes, just german
	Toilet roll holder	VOLA T12, T13	www.vola.com	yes, just german
	One-handle mixer	VOLA 500T1 and 590	www.vola.com	yes, german /english
	Basin	ZEROX 450	www.blanco.de	yes, just german
	Three-hole mixer (kitchen)	VOLA KV4	www.vola.com	yes, german /english

23	HVAC (heating, ventilation and air conditioning)			
	Air conditioning appliance		www.polybloc.ch	yes, just german
	Cooling ceiling	Varicool UNI	www.zent-frenger.de	yes,
	Heat pump	Heat pump Typ WK 3	www.schwaemmle-gmbh.de	just german yes,
	Brine-air heat exchanger	EW-K 200_ Brine-air heat exchanger for brine earth heat exchanger, DN 200. Application examples: Single family-unit houses in combination with room air systems with heat recovery, Low energy and passive energy houses up to 200 m².	www.maico.de	just german yes, german /english
	Expansion vessels for heating, cooling and solar applications	reflex N _for heating and chilled water applications reflex S_for solar, heating and chilled water applications	www.reflex.de	yes, german /english
	Floor	Constitution From		
	Floor heating	SpeedUp Eco	www.danfoss.de	yes, just german
	Sensor Cable Temperature Sensor	TF25 (PT1000-1/3DIN)_Cable sensor for temperature measurement in gaseous media of heating, cooling or airconditioning systems (e.g. fresh air/ exhaust air ducts). Designed for locking on to control and display systems. In conjunction with an immersion pocket, also suitable for temperature measurement in liquid fluids(e.g. pipeline systems).	www.thermokon.de	yes, german /english
	Contact Temperature Sensor	AF25 (PT1000-1/3DIN)_Designed for locking on to control and display systems. For measuring temperature on pipes and arched surfaces. Contact temperature sensor VFG54 includes connection housing and clamp.	www.thermokon.de	yes, german /english
	Pendulumsensor for relative humidity	FTP VV_Pendulum sensor for sectional measurement of relative humidity (model FP), respectively for sectional measurement of relative humidity and temperature (model FTP) in large rooms (e.g. openplan offices, galleries, production plants etc.) Designed for lockingon control and display systems.	www.thermokon.de	yes, german /english
	Room Pendulum Temperatur Sensor	RPF 100 (PT1000-1/3DIN)_Pendulum sensor for sectional temperature measurement in large rooms (e.g. openplan offices, galleries, production plants etc.). Designed for locking on to control and display systems. Model RPF40 is specially designedas a radiation sensor withlongtime constant for radiant heaters.	www.thermokon.de	yes, german /english
	Combined room sensor CO2/Temperature	WRF04 CO2 VV LCD_The sensor is designed for the detection of carbon dioxide (CO2), temperature and relative humidity (optionally) in living spaces. Wherever people are staying in rooms, the CO2 concentration is an evident indicator for the room quality.	www.thermokon.de	yes, german /english

	Centrifugal fans, single inlet	The scroll housing of single inlet centrifugal fans is open on one side. The characteristic features of this ebm-papst product series are high efficiency, a low noise level, relatively small air flow with a high increase in static pressure, robust design and space-saving application.	www.ebmpapst.com	yes, german /english
25	Wind Direction Sensor compact Windsensor compact	Wind Direction Sensor Compact 4.319.00.161 0- 10 V_ Measuring value transmitter for the measurement of the horizontal wind direction, with analogue output signals. Windsensor Compact 4.35190.00.161 0-10 V_ Measuring value transmitter for the measurement of the horizontal wind velocity with digital output signal.	www.thiesclima.com	yes, german /english
		Hygro-Thermogeber compact_Instrument designed for measurement of temperature and air humidity. The data are output as electrical analogue signals. The transmitters consist of a capacitive humidity element and a Pt 100 resistance thermometer. For outside mounting we recommend the use of the weather- and thermal radiation shield.	www.thiesclima.com	yes, german /english
		Pyranometer GSM 10.7_Electrical measuring instrument to measure the global radiation. The measurement is coscorrected.	www.thiesclima.com	yes, german /english
	Precipitation Monitor	Precipitation Monitor_The instrument serves for detecting start and end of precipitation. It can be used as status indicator or as signal transmitter for the controlling of security devices against precipitation such as windows, venetian blinds, awnings.	www.thiesclima.com	yes, german /english
	Wireless Ceiling Multi Sensor 360°	SR-MDS_The battery and wireless ceiling multi sensor is designed for movement detection in room or office spaces. In addition, the sensor detects the ambient brightness in rooms. Radio telegrams according to EnOcean standard. With integrated solar energy storage for maintenacefree operation.	www.thermokon.de	yes, german /english
	Light Sensor	LI04/LI65_Sensor for light measurement in rooms and offices (model LI04, specially for wallmounting) or in outdoor areas (model LI65). Designed for lockingon control anddisplay systems. The sensors have an integrated colour filter (green filter) which isadapted to the sensitivity of human eyes.	www.thermokon.de	yes, german /english
	Wireless Key Card Activeated Switch	SR-KCS_ The SRKCS is a wireless, selfpowered transmitter which is designed to accept room or security card keys.	www.thermokon.de	yes, german /english
	Touch Panel EnOcean Transmitter			yes, just german yes,
	Photovoltaic collectors			just german
31-00 26				
20	Bath and kitchen	Slim-Line_ The new 3-chip-led bar with adjustable colour temperature and Ra 95	www.richter-lt.de	yes, german /english
	Ventilation Tower	X-BAR-HIP68-DC-500-RGB_LED Lighting	www.richter-lt.de	yes, german /english

Living room	High-Voltage Pendant Lights_ Pendant light can be positioned practically anywhere on the ceilling.	www.steng.de	yes, german /english
Floor lamp, sleeping, living	High-voltage free-standing lamps_ A free- standing light with a moveable shade that allows light to be pointed in various directions.	www.steng.de	yes, german /english
Exteriors	ORILED_ LED wall-embelt	www.zumtobel.com	yes, just german
Gap	MINIPLANO_3 accent LED 3200K 230V 3,6W	www.zumtobel.com	yes,
Corridor	MIREL_ Wallwasher	www.zumtobel.com	just german yes, just german
Roof Solar Cells	The monocrystalline Sunways Solar Cell is now provided with three energy feeder units (busbars) instead of two. This reduces the losses during the power generation in the solar module. This new contact design, in combination with the constant increase in the efficiency of the Sunways Solar Cells, results in extremely powerful and surface-effective solar modules.	www.sunways.de	yes, german /english
	Coloured design cells from Sunways combine power generation and aesthetics. The cells are available in emerald, gold, bronze and silver and therefore enable unique, customised PV system designs.	www.sunways.de	yes, german /english
Wall Solar Cells	Coloured design cells from Sunways combine power generation and aesthetics. The cells are available in emerald, gold, bronze and silver and therefore enable unique, customised PV system designs.	www.sunways.de	yes, german /english
Solar Cable Inverter	Sunways Solar Inverter AT 5000, AT 4500, AT 3600, AT 2700_ Thanks to HERIC® topology with innovative FP switching, the new AT Solar Inverters from Sunways achieve a constant yield at changing irradiation levels and temperatures. And that even across technological limits.	www.sunways.de	yes, english yes, german /english
	Certificate of compliance	www.sunways.de	yes, german /english

home+			

6. Structural Calculations - Contents

1. Description of bearing structure

Appendix 2 Structural Calculation

Structural Calculations

1. Description of bearing structure

The modules will be built as timber structures. In the following, the loading assumption will be determined according to the German Industrial Standard DIN 1055, Part 1-5. The module will be proven as a single, self-supporting load-bearing structure, not being connected to the neighbouring modules. The load of the glass-joints will be distributed in equal parts to the neighbouring modules.

The bracing in the longitudinal axis or in the frame respectively will be ensured by two rigid, all side supported frames that will be built from veneer plywood "ultralam R". In the lateral axis or perpendicular to the frame respectively, the structure is braced by the shear walls at the fronts. Those shear walls are manufactured from veneer plywood "ultralam X". By symmetrical arrangement of the walls, twisting is not to be expected for the structure. The roof loads (superstructure, snow) are transmitted to auxiliary girders, here cross girders, made of structured solid timber. These pass the loads on to the principal girders, here frames from ultralam R. On the bottom of the modules, cross girders (FJI) are used to accept the loads from dead weight (superstructure, floor covering, etc.) and the imposed load. Those loads are likewise transmitted to the frame. To obtain a

clear load transmission into the soil, the loads are concentrated to four steel footings per frame. Since the modules will be erected on different locations regarding the competition, the dimensions of the foundation should be adapted the respective soil characteristics.

For structural calculation see Appendix 2 in the end of the manual.



figure 1: timber module



figure 2: model of timber module

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7. Water Budget - Contents

- 1. General
- 2. Chart



Water budget

1. General

The water needs result from tasks, household use and the cooling systems. We have two tanks which have to be filled. The first tank is the freshwater tank with the 1900 liters. The second, recooling water tank is filled while water from the freshwater tank flows into the circulation systems and the thermal storage tank. After the second one is filled, the freshwater tank has to be refilled. So we have three filling periods and a water use about 3400 liters. The deionized water will not be provided by the SDE organization, as laid out in the recommendation in the WAT. For moistening we have included some litres but that will be not enough, the remaining water will provided with bottles. The water which has to be removed is stored in two tanks: the waste water tank and the cooling water tank. For tank location see construction drawings plan SO-206b and for details of the tanks PL-032b-034b.

Note: Greywatertank = constists grey water and black water

2. Chart

Household				
	liter / action	action / contest	liter / day	liter / contest
Cooking Party	10	2	2	20
evaporate water	2,3	5	1,15	12
Dishwasher	9	5	4,5	45
Clothes Washing	55	7	38,5	385
Shower (10 min)	50	16	80	800
Toilet	10	-	0	0
Basin (3 min)	3	50	15	150
Cleaning	8	4	3,2	32
Irrigation	3	10	3	30
Water in circulation				
Radiant Floor	37	1		37
PV/T	18	1		18
PCM-Decke	24	1		24
Connections	73	1		73
Heat exchander	6	1		6
consumption			147	1630,90

Energy Systems (deionized Water)			
	liter / filling	liter / day	liter / contest
Ventilation Tower (4 fiilings)	100		420
Indirect evaporation		10-30	300
water consumption energy systems		30	720

Watertanks for the conte	st		
	liter	dimensions	location
Freshwater*	1.900	300/80/80	*
Cooling water tank*	1.200	Ø 80 / I=445	*
Stratified storage**	300	59,5/61,5/159	**
deionized water tank	720	112,5/80/80	*
Greywater tank	2.920	460/80/80	*

Water need	3.400	liter / contest
Water removal	4.120	liter / contest

Note:

contest = 10 days

outside the footprint, included valves and pumps within the conditioned zone

home+			

8. Summary of Unlisted Electrical Components

- Contents

- 1. General
- 2. Datasheets
- 3. Certificates of parts
- 4. Declaration of Conformity



Summary of Unlisted Electrical Components

1. General

This section is submitted for those electrical components, which are not CE certificated.

We use this one electrical item in the kitchen, intergrated in the hanging board, in which the exhaust hood is also placed. The luminary is also used in the badroom, over the washing basin. The luminary's parts are certificated tough. Here is the summary of parts of the luminary:

LED BAR SLIMLINE (certificated)
POWER SUPPLY RICHTER (certificated)

DIMMER RICHTER ART-4 (certificated)

SYSTEMKANAL RICHTER (pending certification, but a conformity declaration is added)

2. Datasheets

2.1 LED Bar

Slim-Line (12V) PECHICA LED Bar 600mm with 3Chip LEDs Cuttable every 2 LED Adjustable colour temperature from 2700K to 8000K Includes self-adhesive heat tape Perfect heat dissipation by glue on metal (always necessary!) SLIMLINE The new 3-chip-led bar with adjustable colour temperature and Ra 95

► SPECIFICATION

3F EGII IGATION	
SUPPLY VOLTAGE	12V/DC
LENGTH	600mm
WIDTH	16mm
LED BEAM ANGLE	120°
COLOUR TEMPERATURE	2700K-8000K
LUMINOUS FLUX	609 LUMEN
COLOUR RENDERING INDEX	95
POWER	11,9 Watt
STRIP MATERIAL	Aluminium
OPERATING TEMPERATURE	-30°C~+70°C
STORAGE TEMPERATURE	-40°C~+85°C
WEIGHT	38 g
ORDERCODE	IT600/162700-8000



RICHTER LIGHTING TECHNOLOGIES GMBH GERMANY Böbingerstrasse 34, D-73540 Heubach, Tel.+49(0)7173-71440-, Fax.+49(0)7173-71440-12, email: info@richter-it.de RICHTER LIGHTING TECHNOLOGIES HONG KONG LTD UNIT C 19/F ROXY IND CTR 41-49 KWAI CHEONG RD NT email: brichter@richter-it.de

2.1 Systemkanal



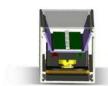


Der Richter Systemkanal ist ein innovativer, neuartiger Lichtkanal mit LED Technik.

Er zeichnet sich dadurch aus, dass der Systemkanal millimetergenau auf die gegebenen Maße eingepasst werden kann und die Ausleuchtung ohne Schatten oder dunkle Stellen durchläuft. Die komplette Technik ist im lediglich 50x55mm großen Kanal integriert- Schaltnetzteil, Reflektor, LEDs und Kabel sind im Kanal untergebracht.

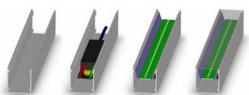
Der Richter Systemkanal kann abgehängt, auf Abstandshalter montiert, oder auch einbetoniert oder eingeputzt werden.

Aufbau:



Diffusor LED Profil einklickbar Integriertes Netzteil Aluminium Kanal

Montageschritte:



Entscheidender Vorteil ist, dass der 6050mm lange Grundkanal gekürzt, oder über Passstifte beliebig verlängert werden kann. Dieser wird dann fest eingebaut.

Im zweiten Bauabschnitt werden vom Elektriker einfach die speziell für den Kanal entwickelten Schaltnetzteile mit dem Reflektor eingeklickt, der gleichzeitig als Träger für die LEDs dient und deren Wärme an den Grundkanal abgibt.

Diese Baugruppe macht unsere light engine aus. Diese ist 1205mm lang und kann beliebig getrennt werden.

Die Rasterung der Platine liegt bei 30mm.

Dann wird einfach der Diffusor eingeklickt, der das Licht der LEDs in eine gleichmäßige Fläche verteilt. Zusätzliche Innovationen sind das Schaltnetzteil, welches durch handelsübliche Dimmer gedimmt werden kann, sowie die verschiedenen Ausleuchtungsoptionen, die der Kunde festlegen kann:

- -weiß 6500°Kelvin
- -warmweiß 3700°Kelvin
- -vom Kunden frei einstellbare Farbtemperatur von 2700°K bis $8000^\circ K.$

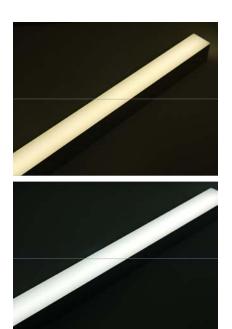
Das besondere ist hier, dass der Farbwiedergabeindex (Ra) bei dieser Variante konstant zwischen 91 und 92 .

- -rot als Effekt
- -blau als Effekt
- -grün als Effekt





Richter lighting technologies GmbH, GF: Bernd Richter, Böbinger Strasse 34, D-73540 Heubach, Tel. +49(0)7173-71440-0, Fax: +49(0)7173-71440-12
Steuernr: 83088/17364, USt.IDnr: DE255616061, HBR: 721171, Zollnr:6880843, Bankverbindung: KSK Ostalb, Kt.1000294743, BLZ: 61450050
Geschäftsführer Bernd Richter, Firmenbeirat: Prof. Dr.Dr. Eckbert Hering, Dipl.Oec.Michael Geiger, Prof. Michael Ilg



Ausschreibungstexte:

Pos. 1:

Richter System Lichtkanal; Aluminium-Strangpressprofil; eloxiert; 50x55mm (bxh); Länge 6050mm; lineare Verbindungsmöglichkeit mittels Kupplungsstifte; Aufnahme für Richter LED-System light engine; Diffusor PMMA weiß mit Snap-In Technik;

Pos. 2:

Richter LED-System light engine; Länge 1205mm; für Richter System Lichtkanal; Schnellmontage durch Klicksystem; teilbar alle 30mm; Lichtfarbe Kaltweiss (6500K);dimmbar; OnBoard-Schaltnetzteil; Steckerfertig; LED-Leistung ca. 29W; Eingangsspannung 230V/50Hz; inkl. Kabel 1200mm;

Alt. zu Pos. 2:

Richter LED-System light engine; Länge 1205mm; für Richter System Lichtkanal; Schnellmontage durch Klicksystem; teilbar alle 30mm; Lichtfarbe warmweiss (3700K);dimmbar; OnBoard-Schaltnetzteil; Steckerfertig; LED-Leistung ca. 29W; Eingangsspannung 230V/50Hz; inkl. Kabel 1200mm;

Richter lighting technologies GmbH, GF: Bernd Richter, Böbinger Strasse 34, D-73540 Heubach, Tel. +49(0)7173-71440-0, Fax: +49(0)7173-71440-12
Steuernr: 83088/17364, USt.IDnr: DE255616061, HBR: 721171, Zollnr:6880843, Bankverbindung: KSK Ostalb, Kt.1000294743, BLZ: 61450050
Geschäftsführer Bernd Richter, Firmenbeirat: Prof. Dr.Dr. Eckbert Hering, Dipl.Oec.Michael Geiger, Prof. Michael Ilg



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www.richter-lt.de



2.3 Dimmer



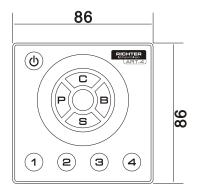


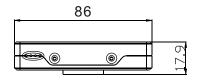
ART-4

BEDIENUNGSANLEITUNG

Bitte lesen Sie die Anleitung vor Inbetriebnahme gründlich durch.

Abmessungen in mm



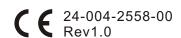




Technische Spezifikationen

Stromversorgung	DC 12-24V
Belastung	. 2A pro Kanal, 6A gesamt
Gehäuse	. Polycarbonat
DMX out	4-poliger Stecker
Power in & PWM out	6-poliger Stecker
Betriebstemperatur	0°C bis +40°C
Lagertemperatur	-20 °C bis + 70 °C
Gewicht	100g
Abmessungen	86(L) x86(W) x15.5(H)mm

Technische Änderungen vorbehalten!



ART-4 Bedienungsanleitung

3. Certificate of parts

3.1 Power Supply

Certificate of Conformity

Testing Requirements of European Directive 2006/95/EC

Certificate No. : CEZM09023

Certificate Holder: ZHUHAI NANYUXING ELECTRONICS CO.,LTD.

2, 5, 6/F, Block 25, Cuizhu Industry Zone, Zhuhai City, Guang Dong Address

Province, P.R.China.

This is to certify the following product of the certificate holder:

: LED power supply Product

Brand Name: Jan 44 8 X

: VA-05015W 15W, JL-1215A 15W, VA-05020M 20W, VA-05030D006 30W; VA-05045P 45W, VA-05060P 60W, VA-05100T 100W, VA-12005F 5W, VA-12020X 20W.

VA-12030D018 30W, VA-12030M 36W, VA-12040D006 40W, VA-12005D015 5W, VA-12060D019 60W, VA-12060D057-C 60W, VA-12060P 60W, VA-12100D023 100W, VA-12100D024 100W, VA-12100D060-C 100W, VA-12100T 100W, VA-12150T 150W, VA-2400SD015 5W, VA-2400SF 5W.

VA-24020X 20W, VA-24030D018/36W, VA-24030M 30W, VA-24040D006/40W, VA-24060D019/60W,

VA-24100D023 100W, VA-24100D024 100W, VA-24100T 100W, VA-24150D020 150W

VA-50100D024 100W, JL-0515A 15W, JL-1220A 20W, JL-1230D007 30W, JL-2415A 15W, JL-2420A 20W.

VA12009U 9W, VA-15060P.60W, VA-24060P.60W, VA-24150T.150W, VAS-05100D046 100W. VAS-12030D035 30W, VAS-12030D043 30W, VAS-12040D045 40W, VAS-12060D021 60W,

VAS-12060D024 60W, VAS-12150D046 150W, VAS-12150D047 150W, VAS-24030D035 30W.

VAS-24030D043-30W, VAS-24040D045-40W, VAS-24060D021-60W, VAS-24060D024-60W,

VAS-24100D021 100W; VAS-24100D024 100W, VAS-24150D046 150W, VAS-24150D047 150W

VA-12150D065-C 150W.

comply with the following standards:

IEC 61347-2-13:2006 Used in conjunction with IEC 61347-1:2003

Lamp controlgear Part 2-13: Particular requirements For d.c. or a.c. supplied

electronic controlgear for LED modules

Reference Report No.: ZM0900203

This certificate of conformity is based on an evaluation of a sample of the above mentioned product. Technical Report and occurrentation are at the Certificate Holder's disposal. This is to certify that the tested sample is in confirmity with above mentioned standards. This certificate does not imply assessment of the series-production of the product.

Signature: in k m

Date of issue: 2009 - 15 - 26

GUANGZHOU ELECTRICAL SAFETY TESTING INSTITUTE (CEST) Tel-86-20-89232852, Fax. 89232876, Website, New York of Found Testing and Cesting and No. 6, Harchengdong Street, Xingangdong Road, Haizhu District, Guangzhou, 510330, P.R.China

3.2 LED Bar



3.2 Dimmer



DECLARATION OF CONFORMITY

This is to certify that the following product

3 CH LED DIMMER Model NO.:RICHTER X-DIMMER-3

is in compliance with the following standards or specifications according to EMC Directive 89/336/EEC.

EN50081-1, EN55022 pr EN55103-1, EN50082-1, EN61000-4-2, EN61000-4-3 pr EN55103-2

is in compliance with the following standards or specifications according to Low Voltage Directive 73/23/EEC.

EN60598-2-1

This declaration is provided by the Manufacturer/Importer

NCW (Holdings) Limited
(Name)

Room 502-505, 5/F, Metro Centre II, 21 Lam Hing Street,
Kowloon Bay, Kowloon, Hong Kong
(Address)

This declaration is based on the tests which were conducted on the submitted sample(s) of the above mentioned product. Detailed result can be referred to test report no CET. Nr200719& LVT. Nr200719.

Manufacturer:

Date: May 2

Signature:

Name: NCW (Holdings) Limited

Test by:

Date:

Signature:

Name:

NCW (Holdings) Limited

NCW (Holdings) Limited

Room 502-505, 5/F, Metro Centre II Lam Hing Street, Kowloon Bay, Kowloon, Hong Kong.

Tel: (852) 2796-9786 Fax: (852) 2798-6545 E-mail: info@botex.com

4. Declaration of Conformity

Company Richter made a declaration of conformity for the Systemkanal, in base on the certificates of its parts:

EG-Konformitätserklärung

Für folgendes Erzeugnis

Wandsteuerung DMX-fähig ART-4E

wird bestätigt, daß es den Vorschriften, insbesondere den Schutzanforderungen, entspricht, die in der Richtlinie der Europäischen Gemeinschaft zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit (89/336/EWG), der Richtlinie zur Änderung der CE-Kennzeichnung (93/68/EWG) sowie dem Gesetz über die elektromagnetische Verträglichkeit von Geräten mit Stand vom 18.09.1998 festgelegt sind.

Diese Erklärung gilt für alle identischen Exemplare des Erzeugnisses, die nach den beigefügten Entwicklungs-, Konstruktions- und Fertigungszeichnungen und Beschreibungen, die Bestandteil dieser Erklärung sind, hergestellt werden.

Zur Beurteilung des Erzeugnisses hinsichtlich der elektromagnetischen Verträglichkeit wurden folgende einschlägige harmonisierte europäische Normen herangezogen, deren Fundstellen im Amtsblatt der Europäischen Gemeinschaften veröffentlicht wurden:

EN 50081-1; EN 55022 pr EN55103-1; EN 55082-1; EN 61000-4-2; EN61000-4-3 pr EN55013-2; EN 60598-2-1

Diese Erklärung wird verantwortlich für folgenden Hersteller/Importeur abgegeben:

Richter lighting	technologies GmbH
Böbinger Str.34;	73450 Heubach
07173/714400 /	07173/7144012
Marcel Knopf	
Projektleiter	
_30.04.10 Datum	rechtsverbindliche Unterschrift
	Böbinger Str.34; 07173/714400 / Marcel Knopf Projektleiter 30.04.10

home+			

9. Summary of reconfigurable Features - Contents

- 1. General
- 2. Plan

Summary of reconfigurable Features

1. General

There are several reconfigurable features at the building. Most are located inside the house and the regular footprint of the building. These features do not exceed the footprint because there is no difference between the closed and open condition with regard to the footprint.

First of all there is the door of the main entrance (1.). It is located at the first gap and module.

Adjacent to this the rotary-wing-doors (2.) of the southern facade are opened into the first gap and module and do not exceed the footprint, too.

The rotary-wing-doors (3.) of the north-facade are attended outwards. According to the rule 6.2e of the "rules and regulations" we assume that these doors do not exceed the footprint of the building. We classify them as "normal" doors which means that this components are exempt from rule 6.2. In addition to this they are located in the north facade.

There are another rotary-wing-doors (4.) at the northern gap which includes the ventilation tower. The doors are positioned at the upper section of the gap which reaches above the building. We assume that these doors also do not exceed the footprint according to the rule 6.2 as described above. In addition to this these doors are only for the maintenance of the ventilation tower.

To protect the interior from irradiation and to ensure the privacy of the inhabitants there are different curtains (5.). In the first module there is a curtain for sun shading, in the second and fourth module there curtains at the glazing for shading and privacy. These curtains do not exceed the footprint because the curtain's rail is located at the ceiling inside the modules.

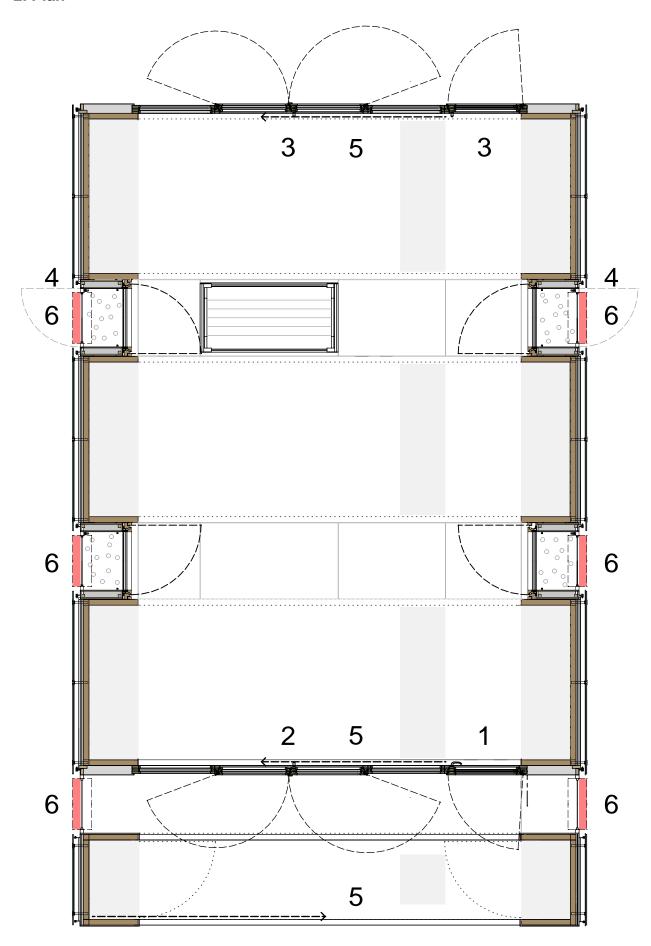
The only reconfigurable feature of this building to include it into the footprint calculation is lamella glazing (6.). Each of the three gaps consist lamella glazing on the west and east facade. In closed condition they do not exceed the footprint of the building. But they do in open condition.

In closed condition the footprint of the building is 73,485 m2. The additional footprint caused by opened lamella glazing is not too high. It is 0,408 m2.

According to this the maximum footprint of the building including lamella glazing in open condition is 73,893 m2.

For more details and calculations see plan "AR – 041a moveable components".

2. Plan



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10. Electric and Photovoltaic Chart

Chart

home+	
Electric and Photovoltaic Chart	



TEAMS ARE REQUIRED TO FILL IN THE FOLLOWING FORM AND SEND IT AS AN INDEPENDENT DOCUMENT, TOGETHER WITH DELIVERABLE #4 (CONSTRUCTION DRAWINGS AND PROJECT MANUAL)

UNIVERSITY: University of Applied Sciences Stuttgart

TEAM: Team HFT Stuttgart

	[Fill in]
GENERAL ELECTRICAL AND PHOTOVOLTAIC INSTALLATIONS:	
 Electrical supply voltage (phase-neutral) for which both installations have been designed (unit: V) 	230 V
 Electrical supply frequency for which both installations have been designed (unit: Hz) 	50 Hz
ELECTRICAL INSTALLATION:	
Notes:	
No details are required in this document about interior circuits, due to the fact that the minimum requirements given by the Spanish standard REBT for a highly electrificant The Organisation will supply the teams with a one-line diagram with the distribution the interior circuits, according to the Spanish REBT. Teams are reminded of the fact that the electrical installations shall be designed for supply with a maximum power of 15 kW, equivalent to 63 A (230 V / 50 Hz). For other	ed house. and protections of a single-phase er voltages and/or
frequencies the equivalent limit shall apply, by making use of the corresponding tran	stormation relation.
- House inner surface (unit: m²)	52,34 m²
- Expected maximum power (unit: W) In worst case	14.000 W
 Individual branch: Type of cable Cross-section (unit: mm²) 	Ölflex 1,5mm² - 4mm²
 General magnetothermic protection: Nominal current (unit: A) Circuit-breaking capacity (unit: A) 	13A – 20A 6000 A
 General differential protection: Nominal current (unit: A) Sensibility / Trip value (unit: mA) 	63 A 300 mA
PHOTOVOLTAIC INSTALLATION:	
 Nominal power of the inverter, or sum of the nominal power of inverters in case several inverters are used) (unit: W) [Note: nominal power of the inverter is the maximum output power without time imitations] 	13 500 W (10 800 W East, West, Roof)
- Brand and model of inverter(s).	5 x Sunways AT 2700
Optional, only for teams that are considering the use of a hard-wired battery bank to battery inverter) HARD-WIRED BATTERY BANK + BATTERY INVERTER:	
- Nominal operation voltage of the battery bank (unit: V)	1-
Nominal capacity of the battery bank (unit: Ah)	
	124
	2
Nominal power of the inverter (unit: W) Note: nominal power of the inverter is the maximum output power at the AC side without time limitations]	E

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home+			

11. Comprehensive Energy Analysis and

Discussion Report - Contents

Part 1

Basic concept

- 1. Bioclimatic concept
- 2. Power generation
- 3. Active Elements
- 4. Priorities

Part 2 Section I -

Influence of Energy Analysis on House Design and Competition Strategy

- 1. Thermal quality of the building envelope
- 2. Shading devices and glazing characteristics
- 3. Dimensioning of the heat pump, solar collectors and the storage tank
- 4. CFD-Simulation Optimization of air flow
- 5. Ventilation Tower
- 6. Performance and construction of P CM-ceiling
- 7. Performance and construction of PVT-cooling devices

Part 3 Section II -

Projected Performance of Final House Design on an Annual Basis

- 1. Weather Data
- 2. Internal gains
- 3. Solar thermal system
- 3.1. Yearly simulation Madrid
- 3.2. Yearly simulation Stuttgart
- 3.3. Competition simulation Madrid
- 4. House energy demand
- 4.1 Yearly simulation in Madrid
- 4.2. Yearly simulation Stuttgart
- 4.3. Competition simulation

Part 4 Section III – Electrical Energy Balance Report

- 4.1 List of the electric loads
- 4.2 List of the electric loads
- 4.3. Description of the PV installation
- 4.4. Description of the tools used for the simulations
- 4.5. Results of the simulations
- 4.6. Electrical balance
- 4.7. Competition simulation Madrid
- 4.8. Energy and Carbon Dioxide Recovery Time
- 4.9 Temporary Generation-Consumption Correlation

References

Annex

Comprehensive Energy Analysis and Discussion Report Part 1 Basic concept

The climate concept results from the basic idea of the architectural design, which employs traditional means from hot and arid climate zones and new technologies. The tower ventilation with evaporation and the use of thermal mass for cooling are among these traditional elements. We combine this thinking of traditional elements with modularity to produce an arrangement of modules and climate gaps. We can divide the concept in the three followings points Figure 1.1:

Bioclimatic concept:

- Building characteristics (envelope including ratio of openings, solar protection/shading, glare protection and materials)
- Passive elements (natural ventilation through climate gaps, natural conditioning though Ventilation Tower and attached solar chimneys, appropriate thermal insulation, heat and cold recovery, modularity and thermal mass)

Power generation:

Generation of electricity and hot water and also the aesthetic effect

Active elements:

 New and innovative technologies in extreme conditions (low energy cooling system (free cooling), radiative cooling, active ventilation and reversible heat pump)

All these elements are systems that act in combination to each other. At the same time, it is for us fundamental to increase the passive means and to understand the active ones only as back-up systems in the mentioned extreme temperature peaks (except for PV).

1. Bioclimatic concept

1.1. Building characteristics

The starting point of our house is a compact and highly insulated (see engineering narrative) volume, with a small surface to volume ratio and south orientation to make the solar irradiation controllable. While the steep summer sun is kept out by a porch, the flat winter sun can enter deep into the house. This high insulation is obtained with vacuum insulation panels and triple glazed windows.

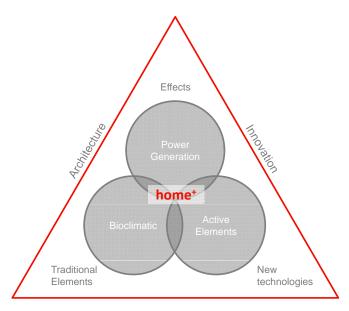


Figure 1.1: Synergy of the concept

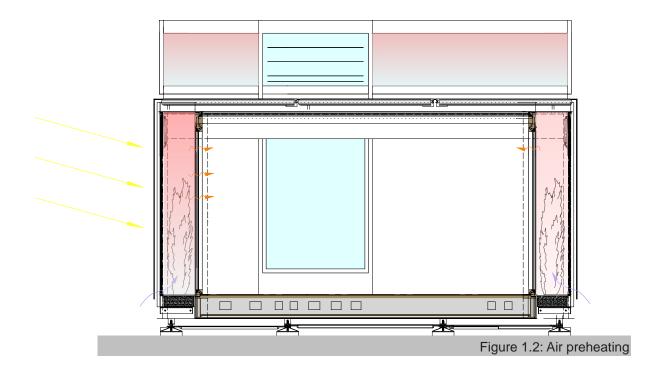
Together with a minimum air leakage we are able to reduce the heat losses (see construction drawings). The wood construction and other natural building materials will help keep the embedded energy as low as possible. All materials have been checked for the embedded energy by LCA (Life cycle analysis) and compared with other materials. (see Sustainability Report).

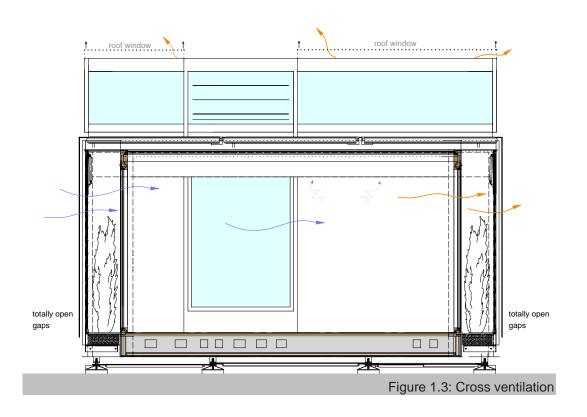
1.2 Passive Elements

In such a highly insulated building, the control of the supply air by ventilation plays a decisive role. The segmentation of the house into climate gaps and modules makes it possible to use the glass-covered gaps for natural lighting and ventilation (for natural lighting see bioclimatic analysis in the Sustainability Report). In order to get the best results in energy consumption, air quality, air temperature and handling through the different seasons, the building will have 3 phases of passive ventilation, which are as follows:

- Air preheating will be used when the ambient temperature is between 15°C- 21°C. Especially on sunny winter days it will help to heat the air in a passive way. The air, streaming through the lamella glazing at the base, will be heated up in the glazed gaps using solar power. While the outer windows (the lamella glazing) in the climate gaps are closed, the heated air can stream through the opened inner windows. The plants in these gaps humidify the air by evapo-transpiration which improves the air quality. (Figure 1.2)

- Cross Ventilation operates in moderate climate conditions when the ambient temperature is between 18°C- 24°C, during the day and/or at night the air flows through the totally opened gaps and thereby allowing a high air exchange through cross-ventilation. On hot summer days this is also used at night to cool down the mass of the building in a passive way. (Figure 1.3)
- The **Ventilation Tower** (VT) is one of the key elements of our passive cooling concept and is the last and highest climate gap. A new building component, which is also an important interior design feature and depicts the traditional tower ventilation in desert areas visualizing the climate concept. Accordant is described clearly in the following. The performance and construction of the energy tower and the hygiene are demonstrated in the chapter Section II. (Figure 1.4 and 1.5)





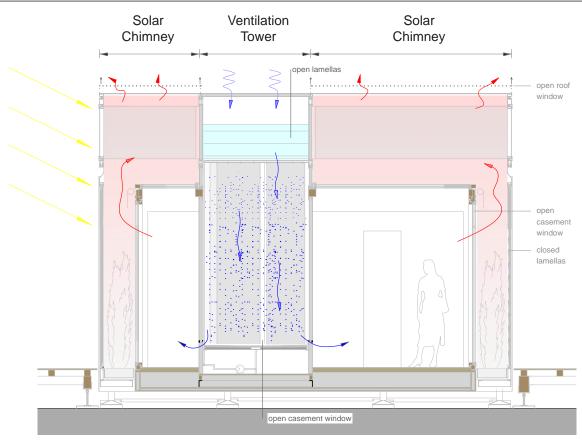


Figure 1.5: Ventilation Tower Section 2

Design and function principle of the Ventilation Tower

The Ventilation Tower is placed between the two zones in the interior, the sleeping zone and the living zone, in order to ventilate and to screen both zones. The height and the orientation of the VT results from the prevalent wind flow. Statistics have shown that the wind direction comes typically from the south or the north. So we have the possibility to catch the wind from both sides. The middle part of the climate gap has the function of the VT to ventilate and cool down the interior air without mechanical effort when ambient conditions are favorable. When the wind speed is high enough, the ambient air is caught by the tower, cooled through downdraught evaporative process and supplied to the building through the casement window at the basement of the VT.

The areas left and right of it are used as Solar Chimneys (SC), to expel the air. The glazed gap, which are higher than the other ones. On the inside,

absorber plates are installed to absorb the solar radiation through the glazing. They warm up and radiate the heat to the air inside the SC. This warm air will then extract the interior exhausted air and transport it to the outside. This is caused by thermal lift and also through the cooler air in the VT and the wind pressure. Through the orientation, the air inside the SC is heated up all day long. (Figure 1.5)

Operation of the Ventilation Tower

The condition to use the evaporative cooling is based on the comfort conditions. When the ambient air temperature is too extreme (too hot and too humid), we cannot use it because the humidity will rise above 55%. Otherwise if the humidity is too low, the air can be prehumidified. This means when the air is warm but dry (moisture content < ...g/m3) and the wind speed is high enough to grant sufficient air change rates the building is cooled and ventilate by the tower. Nevertheless this evaporation cooling operates in moderate climate conditions

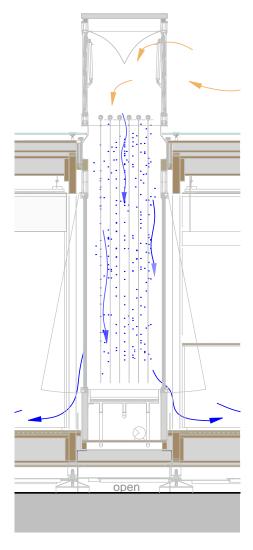


Figure 1.4: Ventilation Tower Section 1

in spring, autumn, in many summer mornings and also in some whole summer days. The cooling power depends on the relative humidity and the temperature at the time of use. If the SC and the VT are not being used, the inside glazing will stay totally closed while the outside lamella glazing in the SC will stay open to discharge the hot air.

1.3 Modularity

We are aware that the ventilation tower which is a key design feature of home+ is a very specific measure for a climate like Madrid. In this case, the tower cools the air down by evaporation. But the development of home+ allows also to adjust these climate gaps in other locations. For example in coast areas instead of the tower there can be wind turbines and in colder areas it can be a hot water tank or a chimney. For more details to the development of this passive concept see the Bioclimatic Analysis in the Sustainability Report.

1.4 Thermal Mass - Phase Change Materials - integrated ceiling (PCM)

Furthermore, the living comfort achieved by the thermal mass should not be underestimated. We reinforced this by using phase change materials (PCM), which can absorb more heating load than other materials. The house is equipped with 20 m² PCM ceiling (1 cm thick). The PCM used is a mix of salt hydrate and graphite (85/15%). The graphite increases the thermal conductivity of the material in order to enhance the heat transfer from the room to the PCM. With a melting temperature of about 22°C, the latent heat of the PCM is used for both cooling and heating purposes and smoothes the temperature variation in the room. A density of around 1500 kg/m³ allows also an increase of the thermal mass in the building (sensible heat). In summer, the PCM ceiling is actively regenerated by radiative cooling through the PV/T collectors. This is one of the innovations in our concept and uses low energy to discharge the PCM and is based on research and development work conducted by the HFT for some years already. As the performance of the ceiling solution promises a very high market potential it will also be developed further after the competition. The low energy cooling system is described in the following active components. In summary, we can say that the thermal mass, the ventilation tower and the preheated air or the cross ventilation through the gaps help to maintain the comfort level during most of the year.

2. Power generation

In order to produce energy the facades in the east, west and also the roof are covered with solar photo voltaic panels and PV/T collectors, which also influences the design of our house. A classic solar thermal system will provide the domestic hot water needs of the building and is integrated in the building envelope as sun shading element above the gaps. To reduce internal loads and save energy, low energy consumption electric appliances (devices and lighting) will be installed and for the all other electrical devices we have choose the efficient one's which are on the market available and useful for our propose.

2.1 Photovoltaic

For electricity generation, a large PV system of 12.5 kWp is installed on the roof and both, the west and east façades. Each façade is completely covered with 7 polycrystalline PV-Modules (3 kWp each) except for the gaps. On the roof, two different types of modules are installed; 12 small polycrystalline

PV-Modules (1.5 kWp) are located on the east and west sides and 12 monocrystalline PV/T modules (photovoltaic/thermal collectors) (5 kWp) in the middle of the roof. The conversion from DC current to AC current is done with 5 inverters respectively: one for the east façade, one for the west façade, one for the roof-edge and two for the PV/T-Modules. The innovation in this system is that within the polycrystalline PV glass/glass modules two different solar cells are combined and integrated. The reason for applying two different types of solar cells for roof and façades is a matter of design. Whereas the multicolor cells on the façade are an important design feature of our house, the monocrystalline cells on the roof have been selected to provide a maximum of power output per roof area. To link the two areas, we have introduced a new way to combine differently colored cells in a dot-like pattern to achieve a transitional effect from one to the other area: The façade modules will turn with their colors gold and bronze around the edge, then becoming black with the monocrystalline modules in the middle of the roof. (Figure 1.6)

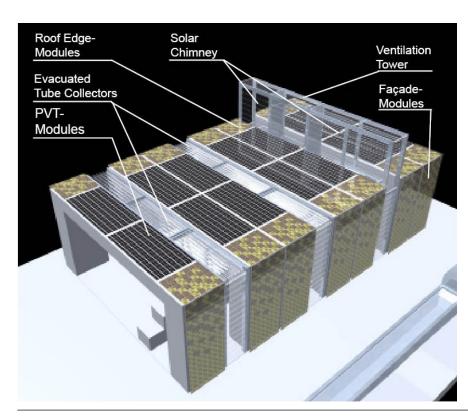
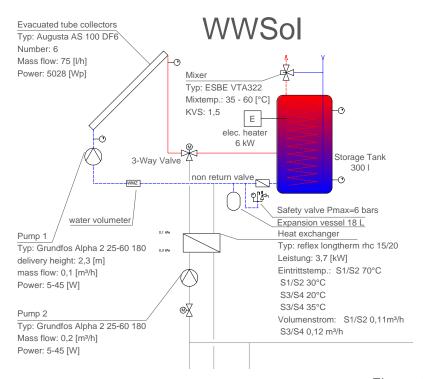


Figure 1.6: home+



2.2. Domestic hot water preparation (WWSoI)

A solar thermal system of 6.60 m² of evacuated tubes collectors is installed on the roof. The solar heat is stored in a 300 liter storage tank (solar tank) via an internal heat exchanger. Moreover these collectors are used to supply the thermal storage (heat sink tank) that serves as heat source for the heat pump in winter. During successive cold and cloudy days, a back-up is needed to provide domestic hot water. In this quite rare case for the Madrid climate, hot water has to be prepared by an electric heating rod. The dimensioning of the collector area is discussed later in the next part (Figure 1.7).

3. Active Elements

In order to satisfy the domestic hot water, heating, and cooling demands several active components have to be added to the basic concept of maximizing passive solar means and effects. In the following the active systems are described one by one, however it should be understood that they function only in

Figure 1.7: Domestic hot water preparation

cooperation with each other. (For the passive means see the bioclimatic analysis in the Sustainability Report.) For example the PV/T modules (described later) are one of the key elements adjacent to the ventilation tower. The cooled water produced at night is used for three systems: to re-generate the PCMceiling, directly for the radiant floor (free cooling mode) and to lower the temperature in the storage tank that is used during the day by the heat pump as heat sink. Also the domestic hot water preparation is integrated in two systems: for the hot water preparation with a connection to the storage tank, as said, and to heat up the heat sink tank in winter when needed. In the part "Air handling unit with evaporative cooling (AHU)" the connection with the heat pump for fast heating or cooling is described. All these systems are connected together by the building control devices.

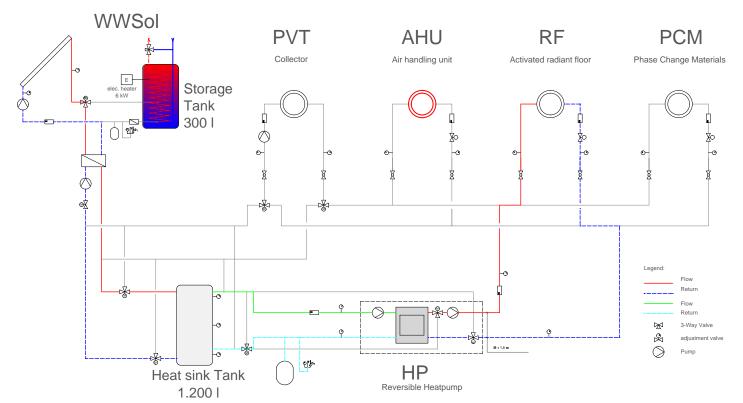
The figure 1.8 below shows the simplified hydraulic scheme of the system, more detailed schemas where all cases are shown can be found in the construction drawings ME-211-225 schematic diagram.

3.1 Building Control and Automation

To control the complex hydraulic system described above, a sophisticated building automation is essential. It takes into account the weather data gathered outside by our meteorological station and the indoor climate which is monitored by sensors located in the cupboard zone. Many parameters are measured: the room and ambient temperatures as well as those in the tanks, relative humidity, air quality. According to those parameters, the building automation system chooses an adequate mode for heating or cooling and ventilation. The corresponding devices are turned on or off automatically, mass flow rates and outlet temperature of the heat pump are appointed, valves and mixing valves are set according to the requirements. For the cooling scenario, this reaction occurs always in the following priorities:

- 1) PCM ceiling,
- 2) Ventilation tower,
- 3) Cross ventilation,
- 4) Active ventilation heat recovery,
- 5) Low energy cooling system (free cooling mode)
- 6) Indirect evaporative cooling
- 7) Reversible heat pump/ radiant floor

Passive technologies are prioritized and then the technologies that require low parasitical energy. But not only the conditioning systems are controlled, but also the sun shading elements and the lamella glazing. The windows in the gaps and the openings of the ventilation tower are connected to the building automation system, but have to be operated by hand. The building automation gives a specific visual signal to the inhabitants when the conditions allow the use of the ventilation tower and the inhabitants



In the drawings ME-221 till 225 is showed and dircribed the different possibilities of the hydraulic system depending the exterior conditions.

Figure 1.8: Hydraulic schema of the System

can decide if they want to use it. The inhabitants can control all these actions also by the touch panel.

3.2 Reversible heat pump (HP)

A reversible water/water heat pump provides heating in winter and cooling in summer to the house through an activated radiant floor (RF). On the source side, the heat pump is coupled with the so-called heat sink tank (1200 liters). In winter, the HP takes heat out of the heat sink tank and releases it into the house through the radiant floor. As described above, the heat sink tank is powered by the evacuated tube collectors. In summer, the HP extracts heat from the building (via the radiant floor) and releases it into the heat sink tank. The HP with its capacity cooling of 2.4 kW is another new development of the home+ SDE-team and a specialized company, intended to be developed further on after the competition.

3.3 Activated radiant floor (RF)

The activated radiant floor (30 m²) distributes the energy from the heat pump in winter and summer. It can also be activated in "free cooling" mode in summer. In this case, cold water is taken directly out of the heat sink tank and pumped to the radiant floor. This free cooling mode is only possible when the temperature in the tank is below 18-19°C. This tank has to be cooled down by radiative cooling through PV/T modules in the summer and heated up in the winter due to the evacuated tubes.

3.4 Photovoltaic-Thermal Modules (PV/T)

The hybrid photovoltaic and thermal modules have two mains functions: generate electricity (all year long during the day) and cool both heat sink tank and PCM ceiling during the night (summer) by radiative cooling to the clear night sky. Radiative cooling is based on the heat loss over long-wave radiation emission from one body towards another

body of lower temperature, which of acts as a heat sink. In our case, the cooled body is the PVT module surface and the heat sink is the sky (since the sky temperature is lower), especially during night, than the temperatures of most of the objects upon earth. As there are currently no appropriate PV/T modules on the market which are optimized for this very special use we had to develop them for the SDE. The development went through different 1:1 mockups and has been tested to be working very well. Our PV/T collectors are uncovered without any insulation box in order to maximize the heat losses to the ambient for night cooling applications. For this reason, there is no risk of water evaporation inside the collector during stagnation in summer. The maximum expected temperature in standstill is the same as a normal PV module (around 80°C) which is far from the evaporation temperature of pressurized system.

3.5 Air handling unit with evaporative cooling (AHU)

Whenever it is either too hot or too cold to get fresh air by just opening the windows or the ventilation tower, the mechanical ventilation system is activated. An integrated heat recovery system reduces heat losses in winter and unwanted heat gains in summer. In summer, additional cooling is provided through indirect evaporative cooling. The exhaust air is moistened as much as possible (close to saturation) and therefore cooled down before exchanging its heat with the ambient air through the heat exchanger. In extreme conditions, the reversible heat pump can supply cooling or heating to the mechanical ventilation system via an additional water/air heat exchanger. This allows a quicker response to the peak loads than the radiant floor.

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Part 2 Section I - Influence of Energy Analysis on House Design and Competition Strategy

From the beginning of the competition we developed a design based on bioclimatic aspects and passive solar means. Subsequently the design was modified and refined through analysis, e.g. technologies and weather data. The architectural and engineering design reached its final stage after elaborative simulation and testing.

During the past year extensive simulations as well as experiments including 1:1 prototype and mockups concerning the crucial components of our concept have been carried out. The results of these examinations led to various design decisions which have been integrated in the further planning of our building.

The simulations mainly dealt with:

- the thermal quality of the building envelope,
- shading devices and required radiation characteristics of glazing's to avoid unwanted solar gains,
- dimensioning of the heat pump, solar collectors and the storage tank,

- dimensioning of the photovoltaic components
- size and opening direction of windows with regard to optimal air flow.

Whenever possible we used approved simulation tools such as TRNSYS or INSEL. For specific problems like the behavior of the ventilation tower or the PV/T modules at night, we developed our own models.

The most innovative components of our concept such as the ventilation tower and the PV/T modules on the roof could not be dimensioned solely by simulation since the required input data were not available. They had to be determined experimentally. Therefore full-scale mock-ups and prototypes for these components were set up and tested which provided valuable information concerning their construction and energy output. At the beginning, we tested the market available PV/T hybrid collectors to get information about the power and the construction of them, but finally we decided to build the PVT collectors by ourselves. The behavior

of the ventilation tower was studied on more mockups; a 1:1 scale prototype for the maximal cooling load, construction and openings to the interior and a 1:20 scale mock-up for the wind tunnel tests was built. In this way it was possible to make pressure measurements on 59 pressure taps for the wind flow behavior.

Finally, several decisions were made for reasons of design or construction. For example, moveable sun shading had to be added at the south side of the loggia, because simulations showed that the diffuse radiation would increase the external loads in an unacceptable way. Effects of all of these changes on the performance of the building had to be checked. For this purpose design decisions were communicated and the simulation model was adjusted to these modifications continuously and the design changed according to the simulation results. Since the beginning of the design development, we used this strategy to control the deployment of the heating and cooling demand and respectively the building envelope.

In this way, it was possible to dimension the various components.

When most of the components have been conceived, a sophisticated simulation model was set up in TRNSYS 16 [1]. It covers the building itself and all technical components. As no regular TRNSYS types were suitable for our innovative components like the ventilation tower and the PV/T collectors we programmed new types based on physical theories and our experiments. This model was used for the annual analysis as well as for the development of the control strategy.

In the following, the questions are presented in detail. The long-term simulation results of the whole system are shown in the next Part 3. Tables and diagrams showing the respective simulation / experimental results are also included in the annex.

1. Thermal quality of the building envelope

Our first priority to ensure the temperatures is to reduce the exterior loads. This are reached through the high insulated envelope and forceful shading. The first interior layer consists of 75 mm of veneer plywood; it is part of the load bearing structure. Moreover it provides thermal mass to stabilize the indoor climate. On their outside, the plywood elements are covered with Vacuum Insulation Panels (VIP) which serve as thermal insulation. Another layer shields the sensitive VIPs from mechanical damage.

As the thermal conductivities of the VIPs on the one hand and wood on the other hand differ strongly (0.004 W/m·K vs 0.13 W/m·K, i.e. factor 30), however, the battens are thermal bridges which cannot be neglected. To reduce the influence of these weak spots, the VIPs are applied in two layers and integrated into a counter-batten system. Moreover the battens are made of highly insulating recycled polyurethane instead of wood wherever possible. Only the most heavily loaded battens which carry adjacent building elements are made of OSB. Table 1.1 in annex 1 shows these various layer and u-values, which are achieved for the walls, roof and floor. This data were also used in the simulation program TRNSYS. The layers are always defined from inside to outside.

2. Shading devices and glazing characteristics

Previous simulation studies show the influence of different glazing and shading strategies for each opening of the house. The choice of glazing (Version 11) was based on these simulation results. We choose this because the results are the best relation between the u-values, shading method and location. (Table 1.2 Annex 2)

The porch on the south side of the building offers weather protection for the underlying loggia and in addition provides efficient shading for the generous south glazing. Through the analysis of shading variations (Table 1.2), are also in the south a vertical sun protection necessary to prevent the warming up of the interior by diffuse light. Above the horizontal glazing of the gaps are located the evacuated tubes collectors (without reflector plates). The vertical windows within the gaps are protected with a highly reflective movable sunscreen of fabric, which are located between the insulation glazing the exterior lamella glazing. Table 1.3 shows the characteristics of the glazing for the windows, which results from the parametric studies.

	U (W/m²K)	g [-]	Tvis [-]
Triple glazing (north)	0.4	0.4	0.62
Triple glazing (all others)	0.52	0.58	0.74
Frame windows tower	1.8	-	-
Frame other windows	1	-	-

Table 1.3: Glazing and frame properties used for simulations

3. Dimensioning of the heat pump, solar collectors and the storage tank

For the dimensioning of the technical system the behavior of the building had to be simulated, firstly, in an annual view without consideration of the integral technology, to determine the energy consumption and the attacking heating load and cooling load. The only technical component the ventilation system with heat recovery and indirect evaporative cooling device is depicted in the model, as it is an established system with known behaviors. The simulation result shows the current heating or cooling load, which has to be covered by the innovative components - the PCM ceiling with the PVT-Modules, the ventilation tower, and radiant floor cooling with reversible heat pump. Due to the complexity of modeling the Ventilation Tower, they have not been integrated at first into the TRNSYS simulation model and have been simply ignored (Since the last Deliverable we have developed the model of the VT and the result are presented later in the next part and in the annex). Because the building is laid out primarily for the location in Madrid, afterwards three warmest summer months were simulated to determine the upcoming top load on one day.

These previous simulation had shown that in case of the consideration of the warmest day there arises a top cooling load of 2,7 kW which must be covered by the whole system (without the ventilation system). We used these results (after the deliverable #4)

for the dimensioning and commission of the heat pump and the other devices. Due to the heat pump is also used for the cooling in summer, results the dimensioning of them, of this top load results and is dimensioned about 2,4 kW (by 18°C cool water inlet temp. and 40°C condenser inlet temp.). In our case, the device used is not market available and will be manufactured for our needs as the air handling unit.

The collector area of 6,60 m² is quite large for 2 people hot water needs and a 300 liters tank. This area has been chosen together with the heat sink tank (source side of the heat pump) volume (1200 liters) in order to avoid the use of an additional electrical back-up in the heat sink tank for the climate of Madrid. Indeed, pure water is used the heat sink tank and attention has to be paid in winter to prevent freezing. Such a large collector area will cause stagnation in summer. In order to enhance the emptying behavior of the collectors during stagnation, the collectors are slightly titled (3°). Therefore, the amount of steam produced is limited to the collector volume and the expanded fluid is directed to the expansion vessel which has been especially dimensioned to avoid any damages of the collector loop components (pump, valve, heat exchanger,..) due to the propagation of superheated steam.

The base of these simulations are the strictly specification of the contest. The weather data which have been used are described in Part 3 Section II.

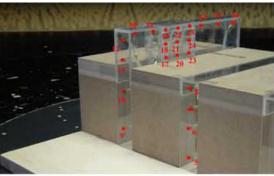
4. CFD-Simulation - Optimization of air flow

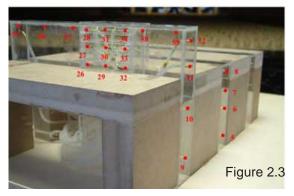
This work is based on CFD-Simulation generated by the program named FLUENT 6.3, developed by the Company ANSYS. The CFD stands for Computational Fluid Dynamics. That means the use of numerical methods and algorithms to solve diverse fluid mechanical problems. The equations are based on the fundamental laws of mechanics like the conservation of mass, momentum and energy. This results in Navier-Stokes equations that are a nonlinear partial differential equations set, that can be solved by computer iterations. There are many different CFD-Software suppliers on the market and some of them are more or less specialized on special investigation fields. Further the method can be used for a large variety of engineering tasks. The spectrum of applications ranges from aeronautics and space to the automotive industries.

Research targets

The designed building by the Team HFT for the solar decathlon Europe 2010 is strongly dependent on







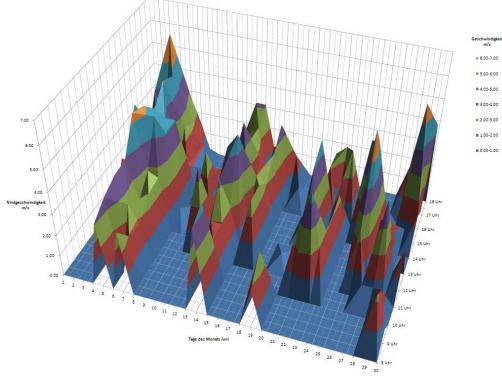


Figure 2.1

the wind conditions in Madrid. In the following work, the main aim is to analyze the internal airflow in the building caused by wind force.

Wind sources

First of all it was important to analyze the wind rate in Madrid. The data was gathered from the International Weather for Energy Calculation (IWEC) and source but also from Metenorm[2]. In the figure (2.1) you can see the South wind development during June. According to that data we can expect wind rates with highest values of 5 m/s almost every day.

Wind tunnel

The wind tunnel research and obtained data were the foundation for the program settings used for the calculations. For the wind tunnel tests, the Office "Wacker Ingenieure" (2.2) nearby Stuttgart built a model with scale 1:20 from the students' draft. In this way it was possible to make pressure measurements on 59 pressure taps that were installed in the model (2.3).

Simulations model

For the numerical simulation it is first important to build a digital model. That was done in a separate program called Gambit, a product from the company

Light gap

Furnishings

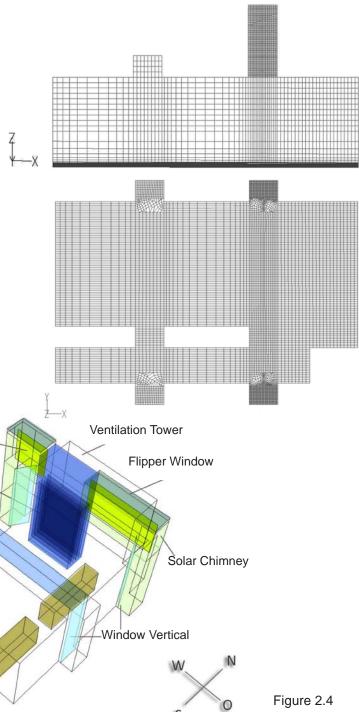
Absorber

Fabrics

ANSYS. This model was exported to Fluent and contains more than 600.000 Cells (2.4). The computer for calculations had an Intel CPU E8400 Due Core with 3.0 GHz and 3 GB RAM. One simulation took approximately 180 Min.

Fluent settings

Fluent is a very complex tool that has a big spectrum of adjustments. It takes a lot of time to learn how it works and which settings are appropriate.



Conditions, as for example here are the inlets and outlets used. The values for the pressure inlets were obtained from the wind tunnel measurements. This is very important because in that way we can gain realistic conditions of wind impacts.

Simulation cases

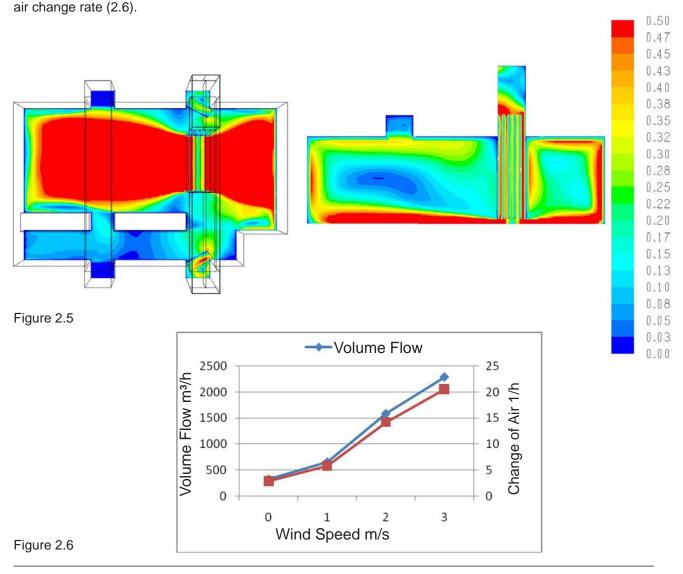
The simulation cases are subdivided according to the wind directions, meaning all four points of the compass and the special case without any wind.

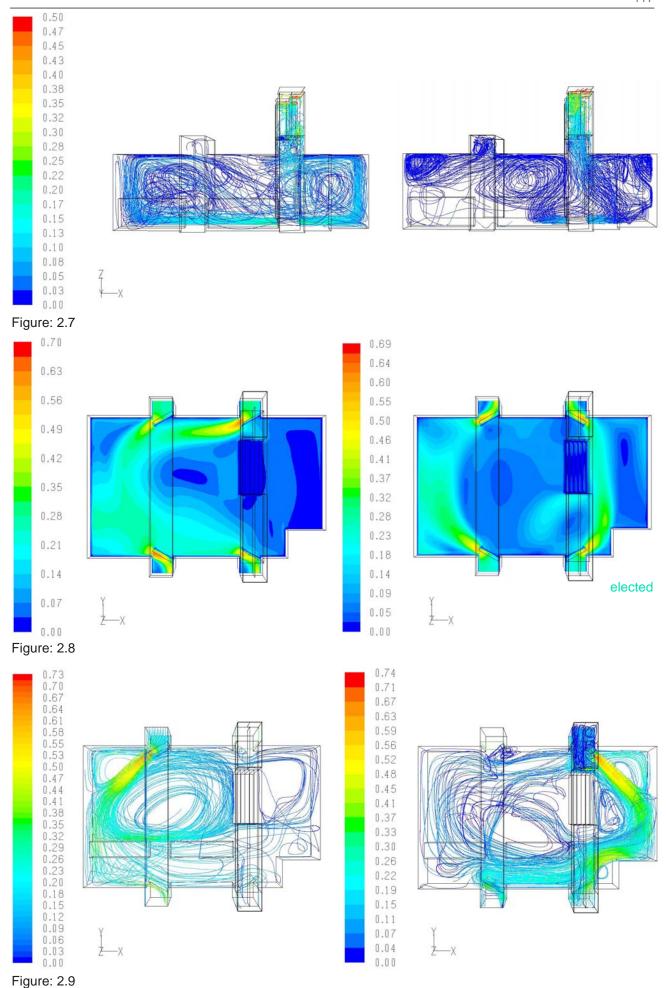
More than 20 simulations were calculated and only a few points are outlined here.

In Picture (2.5) shows a case with 3 m/s Wind speed. The red color gives an airflow that is higher than 0.5 m/s. According to EN ISO 7730, any speed above 0.2 m/s leads to drought characteristics. Further it was possible to see the volume flow and

For the interior air flow, it was possible to discover which minimal speed is required to obtain a quality air exchange. In the Picture (2.7), 0.1 m/s and right 0.2 m/s inlet air speeds remain as displayed by the path lines. In Picture (2.8) shows an investigation of an assortment of the window directions. In the left picture, a strong one sided flow is visible while the right picture shows a better air disposition. In this way, it was possible to decide in which direction the windows should open.

In the last Picture (2.9), path lines are shown from the top view. Here there are two variations with west wind, in each case with one window closed. This is important because the inhabitants control the windows by themselves. Therefore it is necessary to predict the airflow in each particular case.





5. Ventilation Tower

5.1. Performance and construction of the ventilation tower (mock-up)

In order to determine the performance capabilities of the Ventilation Tower, a 1:1 mock-up was built. The base construction of the mock-up is wood frame, 5.16 m in height, 1.96 m wide and 1.06 m deep. The frame was built of 8 x 8 cm construction studs. In the frame cavities as the wall of the energy tower, 8 cm thick PUR/PIR insulation boards (Linitherm Pal S) with aluminium and plastic flashing are used as an air/vapour barrier (figure 2.10 and 2.11). Within the tower in the upper wind openings, a wood structure was installed to support the mesh with a surface area of 4.9 m2 each. The mesh is made of thin cotton fabric and is completely moistened within 35 min. A water reservoir catches the moisture and leads it back into the water circulation by pump, so that only the evaporated water is lost. In order to measure the evaporative air cooling, humidity sensors capable of determining both air temperature and humidity were installed every 0.6 m (figure 2.12). In this way an altitude profile for the humidification and air cooling in the Ventilation Tower can be generated (figure 2.13). The air is cooled as depicted in the diagram from 30.7 to 21.8 °C with an air flow of 556 m3/h. The absolute humidity increases at the same time from 0.0058 to 0.0095 kg/kg and as such remains below the humidity limit 0.0106 kg/kg.

With the measurements made with the prototype, the flow parameters (heat, mass transfer, drive pressure etc.) of the Ventilation Tower could be determined and a simulation using an Excel spreadsheet was calculated. The simulation was validated using the measurements and a simulation using the climate data of Madrid was carried out. The simulation results included the air temperature and humidity of the exhaust volume of the Ventilation



Figure 2.10: Mock-up

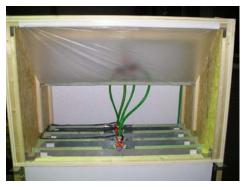


Figure 2.11: Mock-up inside



Figure 2.12: Mock-up inside

Tower and the required evaporation area. The calculated cooling was based on 25 °C. Since the Ventilation Tower does not operate continually and makes sense only at temperatures above 22°C, the simulation was done only at higher temperatures. This determines the operation times. The simulation shows that the Ventilation Tower will operate for up to 173 hours in June with a dynamic water supply of the meshes. The operation would make sense for

a further 86 hours in June, but the Ventilation Tower is not capable of conditioning the air adequately. During operation 400 m3/h will be transported on average through the Ventilation Tower. The median air temperature of the exhaust volume is 19.7 °C in this time, so that the Tower has a total cooling of 110 kWh in June (Figure 2.14 and 2.15). In this way, the Ventilation Tower can contribute extensively to hygienic air ventilation and cooling.

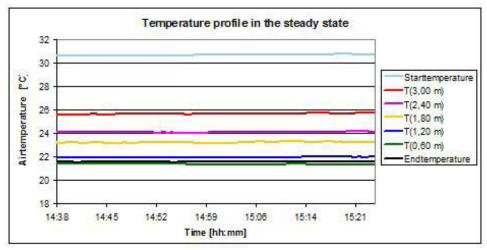


Figure 2.13: Mock-up inside

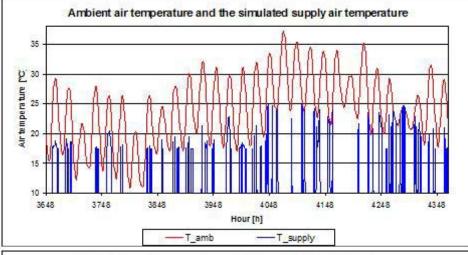


Figure 2.14: Simulation

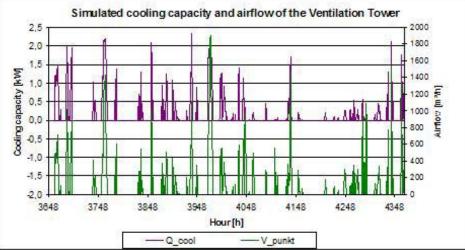


Figure 2.15: Simulation

5.2 Hygiene of the Ventilation Tower

As the water used inside the energy tower is absorbed by the air and consequently inhaled by the inhabitants of the house, questions of hygiene and health protection demand detailed attention. Legionella are small water-borne bacteria that can cause severe illnesses. They are found most likely in stagnant water at temperatures of 25 – 50°C, e.g. in hot water tanks. We want to take advantage of the well-known anti-bacterial effect of silver ions. By yielding silver ions continuously to the water, it can be kept aseptic.

Silver coated Textiles

Whereas the basic anti-bacterial effect of silver is universally known, further research allowing quantitative conclusions was rare until recently. This prevented the scientific principle from being transferred into reliable practicable applications. Within the last few years, however, intense research has been carried out which led to a deeper understanding of the mechanism, the development of disinfection devices on a laboratory scale, and finally to commercially available products. A research [3] project conducted by Silvertex corporation in cooperation with Technische Universität Dresden (Dresden Technical University) and several partners during 2006 - 2008 dealt with the development of silver coated 3D-textiles (pictures besides). Due to their high interior surface they allow for high rates of silver ion transmission into the adjacent water. The textiles can be integrated into tube systems as well as in water tanks. Various tests have shown that they not only keep water systems free from contamination, they even purify water that was contaminated intentionally beforehand. Long-term tests with 1m3tanks at 45°C proved reliable performance over several months [4].

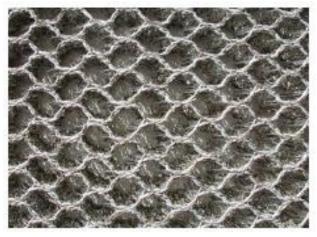


Figure 2.16: Silverized 3D-textiles

Although the risk of legionella growth within the energy tower seems rather low as no temperatures over 30°C are expected in the pump pit, a strategy to avoid bacterial contamination has been developed. It depends mainly on the application of silverized 3D-textiles (figure 2.16) in the pump pit. The base area of the pump pit will be lined with such textiles. Dimensions, characteristics and degree of silverization of the textile lining have to be configured in order to ensure:

- sufficient concentration of Ag+ ions in the circulating water
- a long-lasting depot effect for long-term functionality

The textile lining the pump pit therefore will be dimensioned in close cooperation with Silvertex, taking advantage of the company's long experience in the field of water dis-infection, in order to obtain a fully reliable safe system of passive air cooling.

5.3 Modeling Ventilation Tower

Caused by the complexity of modeling the tower, we had ignored them in the simulation model within the last deliverable #5. But after knowing the behavior due to the mock-up results mentioned in point 5.1 we had developed a model and integrated it in the whole simulations. In the next part are presented these results and in the annex this model is described.

6. Performance and construction of PCM-ceiling

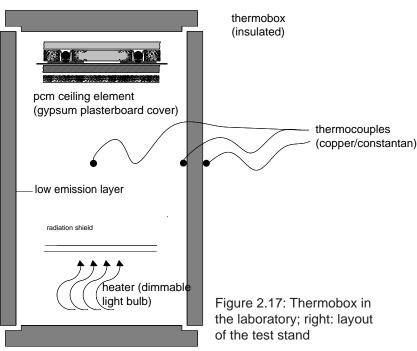
The heat quantity that can be stored in the passive cooling ceiling can easily be calculated based on the heat capacity of the integrated PCM boards. This capacity however can be fully utilised only if the construction of the ceiling allows for a sufficient heat transfer rate under the conditions of the contest. To make sure that the PCM ceiling will be able to completely load and unload during a day-night-cycle and thus contribute to the cooling load as intended a mock-up was built to measure its thermal absorption under realistic conditions. It consists of the ceiling element itself which is insulated on its upper side and four wall elements and a base made of aluminium cladded polyurethane foam boards which have a U-value of 0.30 W/(m·K). The cover of the setup can be removed so that the PCM compound boards can easily be replaced. A dimmable light bulb serves as heating device to simulate internal and irradiation loads. It can be controlled via a computer which simultaneously logs the measured data and controls the cooling load. A radiation barrier between

the light bulb and the cooling ceiling assures that the box is heated up exclusively by convection.

The mock-up is meant to represent the situation within the home+ building as accurate as possible. Therefore its size was dimensioned so that the ratio of ceiling surface to air volume exactly equates to the one present at the home+ building. The specific heat transmitting surface of the box per m³ of air volume, however, is much bigger than the one of the building due to geometry. To take into account the heat gains from the environment in a realistic manner nevertheless, the temperature difference between inside and outside has to be adapted taking into account the U-values of the thermobox's envelope, its heat transmitting surface and its volume of the space as well as the correspondent values of the real building.

At present the setup is being completed by connecting the cooling ceiling to a heat exchanger. Subsequently several day-night-cycles can be simulated in real time. The temperatures measured in the thermobox will give direct information about the performance of the PCM ceiling and its influence on the room temperature.





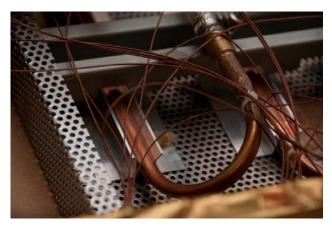


Figure 2.19: Detail of the mock-up



Figure 2.18: Mock-up of the ceiling

7. Performance and construction of PVT-cooling devices

PCM ceiling and Night sky radiative cooling system in general

Phase Change Materials are substances, which can absorb more heating load than other materials. They change their aggregate state from solid to liquid at a certain temperature. Through latent heat storage it releases the heat over a time-lag. During the day, the PCM ceiling of home+ uses the latent heat of the PCM to store the heat and maintain the room temperature around the melting temperature 21-23°C.

In the one period at night, the PCM ceiling is actively regenerated using cold water from the night radiative cooling system on the roof, the Photovoltaic/
Thermal hybrid collectors (PV/T collectors). In the remaining period the cold water will be stored in a cold storage tank and can be used during the day to activate the radiant floor, which cools down the interior temperature (free cooling) (Figure 2.20 and 2.21). Radiative cooling is based on heat loss by long-wave radiation emission from a body towards another body of lower temperature, which plays the role of a heat sink. In the case of buildings, the cooled body is the building surface and the heat sink is the sky (since the sky temperature is lower - especially at night - than the temperatures of most

of the objects on earth). Sky temperature during summer nights can be <0°C, with clear summer night sky conditions, sky temperatures of even -10°C could be achieved[5].

PV/T construction and experimental set-up

Water based PV/T collectors are normally used during the day for electricity generation and thermal applications. Depending on the application, the main objective might be either electricity production or thermal output. In the first case, the fluid has to cool down the PV cells as much as possible in order to increase their efficiency. In the second case, one expects a certain outlet temperature of the fluid for a certain application (domestic hot water preparation, thermal cooling ...). The design of the PV/T collectors will depend mainly of the objective defined. Figure 2.22 shows the two main types of PVT collectors available on the market which are uncovered (n°1) and covered (n°2)

To the knowledge of the authors, PVT collectors have not been used yet for night radiative cooling application. This kind of application requires a special construction of the PV/T module which allows a maximum heat loss by long-wave radiation emission from the collector toward the sky. That

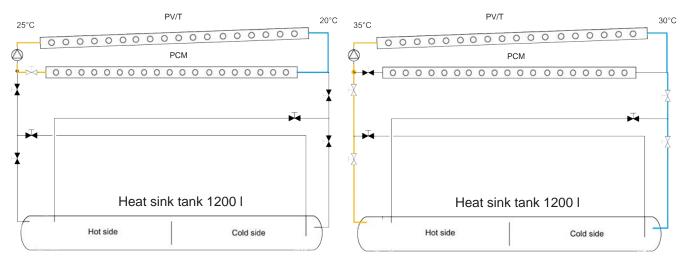


Figure 2.20: First period at night

Figure 2.21: Second period at night

is why the uncovered design has been chosen. Furthermore, the thermal contact between the absorber and the PV module has to be as high as possible.

Testing the PV/T-Modules

Within the last 10 years, the company PVTwins (Zen Renewables Netherlands) has put a lot effort in improving the thermal contact between absorber and PV, developing their own technique for the absorber/PV module assembly. Their uncovered PV/T collectors have been tested on the roof of HFT Stuttgart in order to estimate the cooling potential

during the night. To guaranty optimum night sky radiation it is necessary to have a clear view of the sky in all directions. The collector tested is a sample provided by PVTwins and has 0.64 m² aperture area. With this setup it is possible to determine the cooling power of two modules at the same time and also measure this with very high temperature differences between the water and ambient air, or at almost the same temperature levels.

This whole analysis of the "Zen renewables" PVT-collector and PV/T-collectors for night sky radiative cooling in general, has been done as a bachelor thesis.

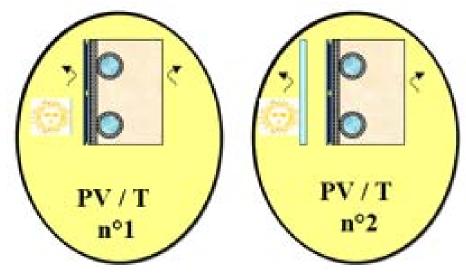


Figure 2.22: Uncovered and covered PVT collectors



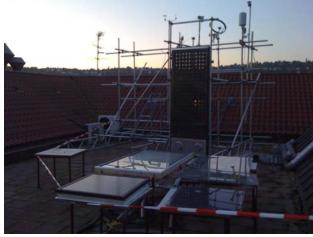


Figure 2.23 shows the collector tested

Figure 2.24 shows the experimental set-up on the roof

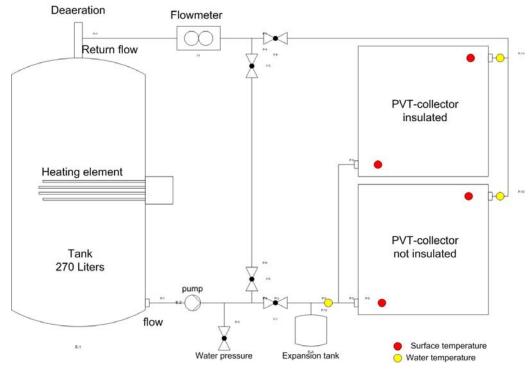
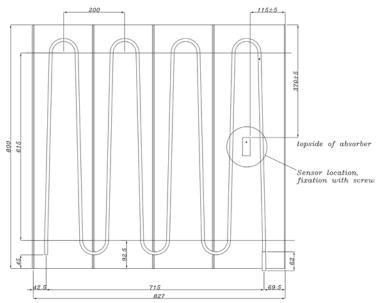


Figure 2.25: Scheme of the experimental set-up.

Figure 2.26 shows the backside of the absorber



System simulation model

A detailed model of the PV/T collector was generated in TRNSYS. It is a detailed physical model which is based on the approach developed by Duffie and Beckmann [6] for normal thermal collectors. This model has been adapted for an uncovered flat plate collector used for radiative cooling application by Erell and Etzion [7]. Based on the same approach a model has been developed for an uncovered and non-insulated PV/T collector used for night radiative cooling. Further details to the simulation model are given in the simulation input report and the results are given in the Part 3 of this document. This model has been validated against measurement data of the experimental set-up for a period of 45 hours (Figure 2.28).

The maximum deviation in outlet temperature between simulated and measured values is less than 2 °C. The deviation in the global energy balance over the period is less than 1 %. The model will be then used for system simulations.

The purpose of the system simulation is to check if the heat absorbed by the PCM ceiling and the heat ejected by the reversible heat pump into the tank during the day can be released to the environment by radiative cooling with PV/T collectors during the night. The results are positive since the temperature in the heat sink tank was kept low even while considering low performance of the heat pump. Therefore no additional back-up is necessary.

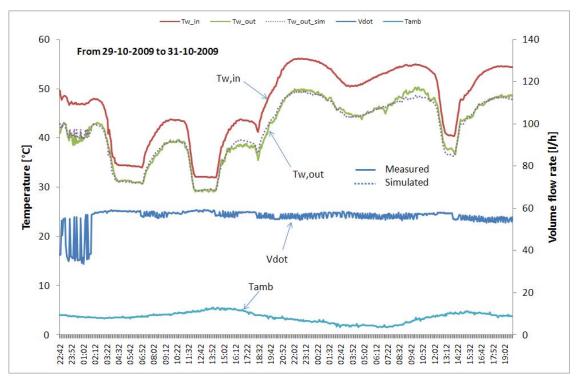


Figure 2.28: Measured and simulated of PVT collectors at the Stuttgart HFT.

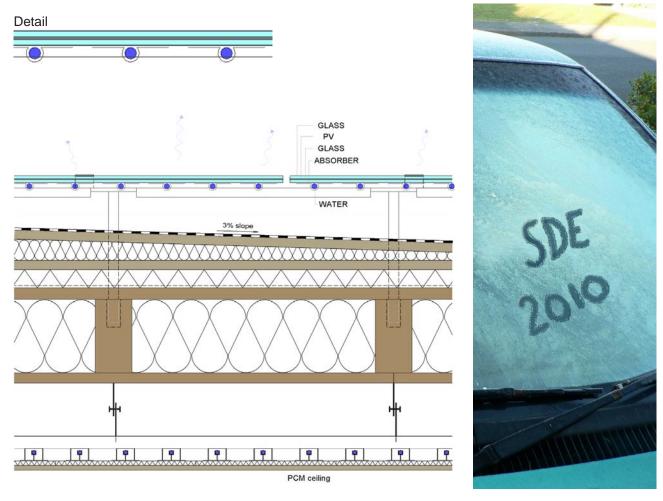


Figure 2.27: Scheme of the prototype which is being developed

Night radiative cooling with PV/T collectors for home+ during competition - Global concept

For the SDE competition, the night radiative cooling system consists of 39 m² of PV/T collectors located on the roof. The will be used during the night first to regenerate the PCM ceiling and then to cool down the 1.2 m³ storage tank used as a heat sink for the chiller during the day.

As no adequate collectors fitting the geometry of our building were commercially available we decided to built them ourselves. Thus the PV-modules from Ertex Solar had to be laminated with absorber plates and pipe coils. We chose preconfigured aluminium plates which were easy to handle as 15 mm copper pipes could be directly clipped into them.

Since the energy yield strongly depends on thermal transmission between the copper pipe and the glass surface finite elements simulations with FEMLAB were carried out to analyze the influence of the glue's thermal conductivity and possible air pockets (2.28). At the same time different kinds of glue were tested for their heat resistance and their thermal behaviour in general by exposing them to varying temperatures in a conditioning cabinet. Finally 500 m of copper pipes had to be bent, clipped into the absorber plates and put into a moulding tool. Like this they could be precisely glued to the PV modules.

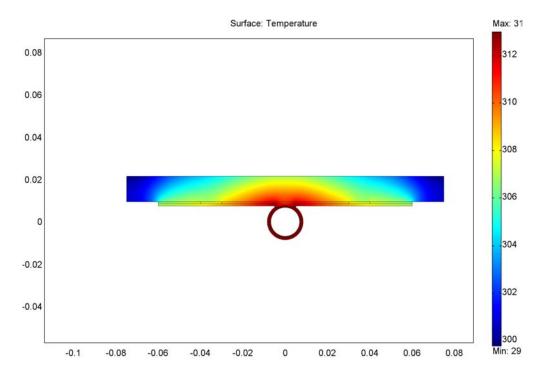


Figure 2.28
Figure 2.29: Building the PV/T collectors by students



Comprehensive Energy Analysis and Discussion Report

Part 3 Section II – Projected Performance of Final House Design on an Annual Basis

The long-term behaviour of the building was simulated using the aforementioned comprehensive TRNSYS 16 [1] model, in order to predict the energy consumption of the house and optimize the control strategy. It considers the interaction between all of the technical components and the room, e.g. the waste heat of storage tanks and machinery, as well as efficiency factors of the components. Thus it represents the indoor climate of the building in a realistic manner. Moreover, to produce conservative results and avoid overly optimistic projections, the hottest period of the climate data was used for the simulation. More information's to the simulation are given in the simulation input report in the next deliverable.

The results of the simulation will be presented in this part. First, the solar thermal plant is discussed, then the main features of heating and cooling consumptions of the different systems presented in detailed. Additionally, the results that influence the decisions on the dimensioning of the system are also discussed. In this part are also presented the results of the ventilation tower. The global electricity

balance which takes into account the consumption of all the equipments is discussed together with the results of the PV simulation in Part 4. Example days are shown in order to demonstrate how the comfort is maintained in the house. Different simulations have been done for different weather conditions and different uses of the building. An annual simulation for a normal use of the house has been realized for the weather conditions of Madrid and Stuttgart. And a simulation in competition condition has been done for the hottest period in Madrid. More information about TRNSYS can be found in Annex 3. As the annual simulation is meant to reproduce typical occupancy behaviour and energy responsible attitude rather than the exceptional conditions of the Solar Decathlon Europe, however, the internal loads and the permitted indoor temperatures were changed compared with the short-term simulation of the contest week. For the yearly simulations, the comfort criterion is to keep the house temperature always between 20 and 26°C. For the competition simulation, the house temperature has to be kept between 23 and 25°C. The internal loads are indicated in in Annex 4.

1. Weather Data

The version 6.0 of Meteonorm [2] has been used to provide the weather data of both Madrid and Stuttgart. The data generated with Meteonorm are Typical Meteorological Year (TMY) and they are based on measurement data between 1991-2000 for radiation and 1996-2005 for temperatures. The figures 3.1 and 3.2 in Annex 5 show monthly results of radiation and temperature for both locations. A more detailed description of Meteonorm software can be found in Annex 6.

2. Internal gains

Different loads patterns have been defined for yearly and competition simulations. The internal loads for the yearly simulation have been defined according to a normal use of the house (2 people living in the house and only one working outside during the day). The thermal and moisture gains due to the occupancy and the use of the different equipments of the house are shown in figure 3.3 for one week. The gains were separated in convective and radiative parts (conv and rad in the figure). Figure

3.4 shows the gains defined for the competition according to the planning given by the organisation committee. Those load profile has been read by the data reader of TRNSYS. More information on these internal gains and the schedules defined for the different equipments can be found in annex 4 and the datasheets of the appliances in annex 14.

3. Solar thermal system

3.1. Yearly simulation Madrid

Figure 3.5 and 3.6 show the main results of the simulation. The solar fraction is defined according the domestic hot water demand only. This means that it takes into account only the auxiliary energy needed for hot water (and not for the heat sink tank). The solar system can meet the DHW demand almost the all year except in winter when it has to supply heat to the heat sink store. The annual specific yield of the solar system is 263 kWh/m². It is not a very high value for DHW preparation. This is due to the relatively high area installed (6.6 m²) for a 2 people house. The dimensioning of the solar thermal system has been done in order to be able to feed the heat sink store in winter when the heat

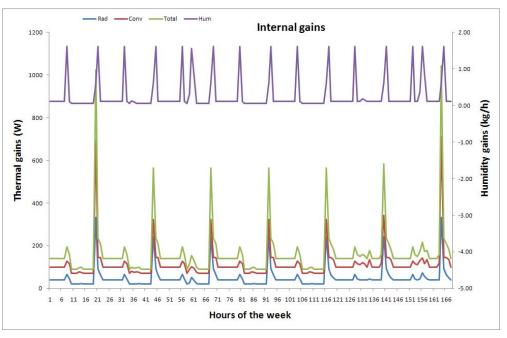


Figure 3.3: Internal gains for the year

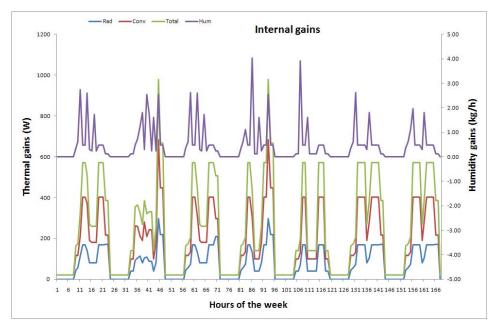


Figure 3.4: Internal gains for the competition

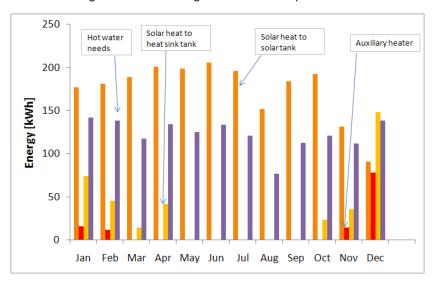


Figure 3.5: Monthly energy yield of the solar thermal system in Madrid

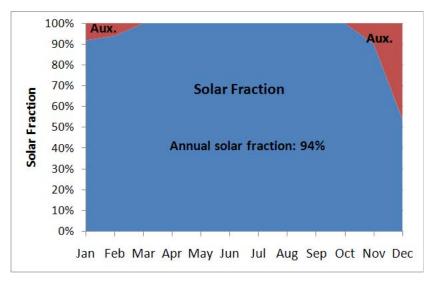


Figure 3.6: Solar fraction of the solar thermal system over the year in Madrid

pump is working in heating mode and takes heat out of the heat sink store. Figure 3.7 in Annex 7 shows how the solar system works in winter.

3.2. Yearly simulation Stuttgart

Figure 3.8 and 3.9 show the main results of the simulation. In this case, the solar fraction is much less than in Madrid since the solar system has to feed a lot more heat into the heat sink store for the heat pump operation. Actually, it is not enough to cover the demand of the heat pump and an additional auxiliary electrical had to be put in the

heat sink store. The electricity consumption of this heater will be discussed later on.

The solar specific yield of the solar system is similar to the one of Madrid (257 kWh/m²a) since the solar system runs much more in winter at low temperature for feeding the heat sink store.

3.3. Competition simulation Madrid

Figure 3.10 shows the main results of the simulation. 100 % of the hot water needs are covered by the solar system and the specific yield over the 3 months is 79 kWh/m².

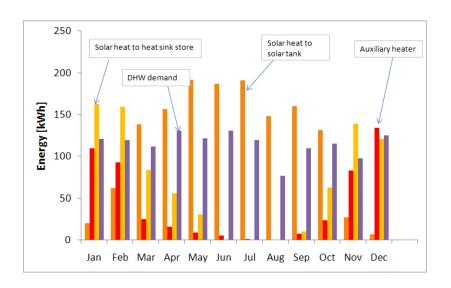


Figure 3.8: Monthly energy yield of the solar thermal system in Stuttgart

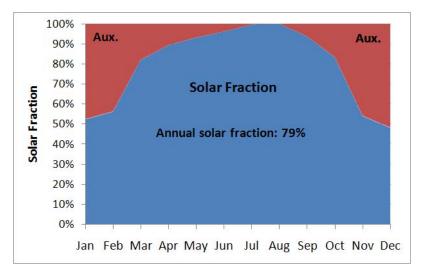


Figure 3.9: Solar fraction of the solar thermal system over the year in Stuttgart

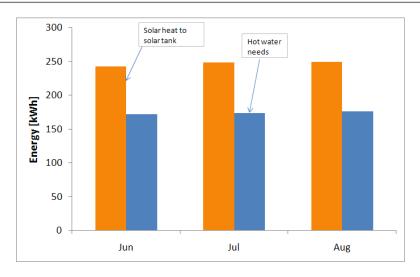


Figure 3.10: Monthly energy yield of the solar thermal system in Madrid (competition conditions)

4. House energy demand

In this part will be detailed the contribution of each system to the heating and cooling demand of the building. For the yearly simulations, as mentioned the comfort criterion is to keep the house temperature always between 20 and 26°C. For the competition simulation, the house temperature has to be kept between 23 and 25°C.

4.1 Yearly simulation in Madrid4.1.1 Heating demand

The heating demand of the house is covered with the heat pump through the radiant floor (Table 3.4)

4.1.2 Cooling demand

The cooling demand of the house is covered with different systems (Table 3.5 and figure 3.11)

For the radiant floor free cooling and heat pump modes have to be distinguished (Table 3.6)

Table 3.4: Heating demand of the house in Madrid

Total heating demand (kWh)	Specific heating demand (kWh/m²)	Annual COP of the heat
		pump in heating mode (-)
273 kWh	4.9	4.3

Table 3.5: Cooling demand of the house in Madrid

Total cooling demand (kWh)	2234
Specific cooling demand (kWh/m²)	39.9
Specific cooling energy through radiant floor (kWh/m²)	19.7
Specific cooling energy through indirect evaporative cooling (kWh/m²)	9.1
Specific cooling energy through ventilation tower (kWh/m²)	1.1
Specific cooling energy through PCM ceiling during the night (kWh/m²)	11.1

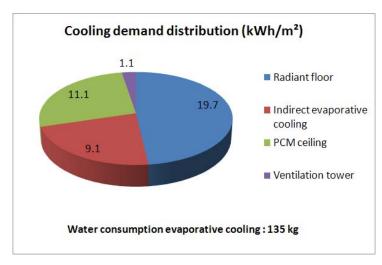


Figure 3.11: Cooling demand distribution (kWh/m²)

Table 3.6: Radiant floor cooling energy distribution

Total specific energy	Specific energy through	Specific energy through	Annual COP of the
through radiant floor	radiant floor in free	radiant floor in heat	heat pump in
(kWh/m²)	cooling mode (kWh/m²)	pump mode (kWh/m²)	cooling mode (-)
19.7	7.3	12.4	4.0

4.1.3 Radiative cooling with PVT collectors

Since radiative cooling with PVT collectors is a new concept, the simulation results are discussed in more details. The mean cooling power achieved with this system is shown in table 3.7. Since the temperature levels are not the same, different

cooling powers are achieved for the cooling of the PCM ceiling or for the cooling of the heat sink tank.

Another interesting feature to measure the efficiency of this process is the electrical COP (Table 3.8)

Table 3.7: Radiative cooling power with PVT collectors

Mean cooling	g power	global	Mean	coo	ling	power	when	Mean	cooling	power	when
(W/m²)			connec	ted	to	PCM	ceiling	connec	cted to	heat sinl	k tank
			(W/m²)				(W/m²)		
43.8	•		31.0					46.4			

Table 3.8: Electrical COP of radiative cooling with PVT collectors

Electrical COP global (-)	Electrical COP when connected	Electrical COP when connected
	to PCM ceiling (-)	to heat sink tank (-)
32.5	13.6	75.4

4.2. Yearly simulation Stuttgart

4.2.1 Heating demand

The heating demand of the house is covered with the heat pump through the radiant floor and also through the ventilation system with the heating coil (Table 3.9).

Table 3.9: Heating demand of the house in Stuttgart

Total	heating	Specific	heating	Specific	heating	Specific heating	Annual COP of the
demand ((kWh)	demand	global	demand	radiant	demand heating	heat pump in
		(kWh/m²)		floor (kWh/m²)		coil (kWh/m²)	heating mode (-)
2027 kWl	h	36.2		36.2		0.0	4.1

4.2.2 Cooling demand

The cooling demand of the house is covered with different systems (Table 3.10 and figure 3.12). For the radiant floor free cooling and heat pump modes have to be distinguished (Table 3.11). The radiant floor is operated most of the time in free cooling

mode. Since the heat sink store is maintain to a low temperature, the annual COP of the heat pump in cooling mode is very high. Therefore, the cooling concept is working with a really high efficiency.

Table 3.10: Cooling demand of the house in Stuttgart

Total cooling demand (kWh)	823
Specific cooling demand (kWh/m²)	14.7
Specific cooling energy through radiant floor	6.7
(kWh/m²)	
Specific cooling energy through indirect	2.5
evaporative cooling (kWh/m²)	
Specific cooling energy through PCM ceiling	5.3
during the night (kWh/m²)	
Specific cooling energy through ventilation	0.2
tower (kWh/m²)	

Table 3.11: Radiant floor cooling energy distribution in Stuttgart

Total specific energy	Specific energy through	Specific energy through	Annual COP of the
through radiant floor	radiant floor in free	radiant floor in heat	heat pump in
(kWh/m²)	cooling mode (kWh/m²)	pump mode (kWh/m²)	cooling mode (-)
6.7	5.0	1.7	5.4

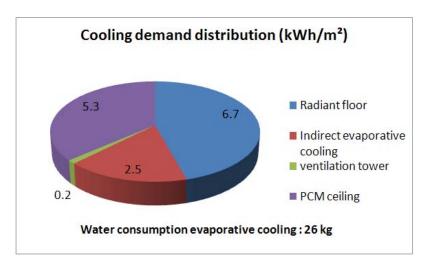


Figure 3.12: Cooling demand distribution (kWh/m²)

4.2.3 Radiative cooling with PVT collectors

The mean cooling power achieved with this system in Stuttgart is shown in table 3.12. Since the temperature levels are not the same, different cooling powers are achieved for the cooling of the PCM ceiling or for the cooling of the heat sink tank. Since the ambient temperature is lower than in Madrid, a higher cooling power is achieved when the system is connected to the PCM ceiling.

Nevertheless, since the heat pump runs less, the heat sink tank temperature is most of the time lower than the room temperature and then the cooling power obtained when the system is connected with the heat sink tank is lower. The another interesting feature to measure the efficiency of this process is the electrical COP (Table 3.13).

Table 3.12: Radiative cooling power with PVT collectors

Mean cooling p	power {	global	Mean	cool	ing	power	when	Mean	cooling	power	when
(W/m^2)			connec	ted	to	PCM	ceiling	connec	ted to	heat sin	k tank
			(W/m ²))				(W/m²)		
40.0			33.5					42.6			

Table 3.13: Electrical COP of radiative cooling with PVT collectors

Electrical COP global (-)	Electrical COP when connected	Electrical COP when connected
	to PCM ceiling (-)	to heat sink tank (-)
32.9	32.3	32.8

4.3. Competition simulation

Since the competition is in June in Madrid, cooling the house is the most challenging part. The simulation period is from June to August. The results will be detailed for the hottest week (unfavourable case) of this period and a "cold" week (favourable).

4.3.1 Unfavourable case

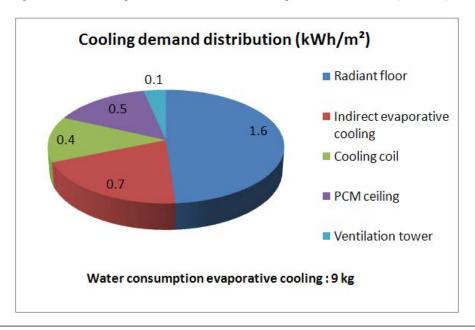
4.3.1.1 Cooling demand

The cooling demand of the house is covered with different systems during the hottest week (Table 3.14 and figure 3.13).

Table 3.14: Cooling demand of the house in Madrid during the hottest week

Total cooling demand (kWh)	179.9
Specific cooling demand (kWh/m²)	3.2
Specific cooling energy through radiant floor (kWh/m²)	1.6
Specific cooling energy through indirect evaporative cooling (kWh/m²)	0.7
Specific cooling energy through cooling coil (kWh/m²)	0.4
Specific cooling energy through PCM ceiling during the night (kWh/m²)	0.5
Specific cooling energy through ventilation tower	0.1
Average COP over the week (-)	3.05

Figure 3.13: Cooling demand distribution during the hottest week (kWh/m²)



For this extreme week, the radiant floor was not operated in free cooling mode. Figure 3.14 show the results of the simulation for the hottest days of the year (40°C outside) and that the temperature is kept below 25°C almost the all time.

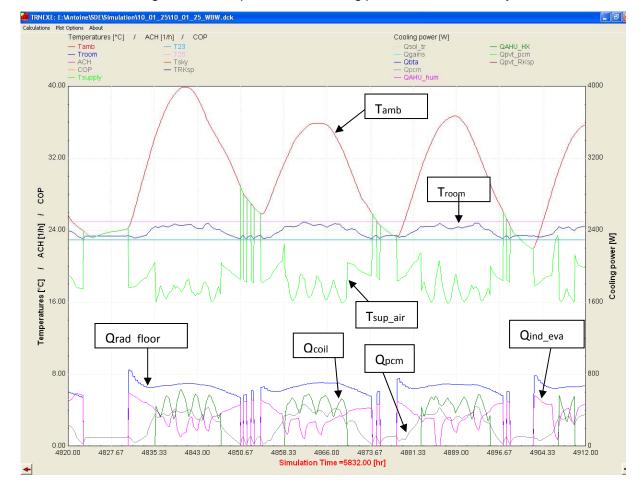


Figure 3.14: Temperature and cooling power for the hottest days

4.3.1.2 Radiative cooling with PVT collectors

The mean cooling power achieved with this system in Madrid during the hottest week is shown in table 3.15. Since the temperature levels are not the same, different cooling powers are achieved for the cooling of the PCM ceiling or for the cooling of the heat sink tank.

The cooling power achieved when the PVT collectors are connected to the heat sink store is really high because the heat pump releases a lot of heat during the day (temperature up to 60 °C) as seen in the figure 3.15.

Table 3.15: Radiative cooling power with PVT collectors in Madrid (hottest week)

Mean cooling pow	er global	Mean c	cooling	power	when	Mean	cooling	power	when
(W/m²)		connecte	d to	PCM	ceiling	connec	ted to l	heat sinl	k tank
		(W/m ²)				(W/m²)		
89.6		23.2	•	•		156.8	•	•	

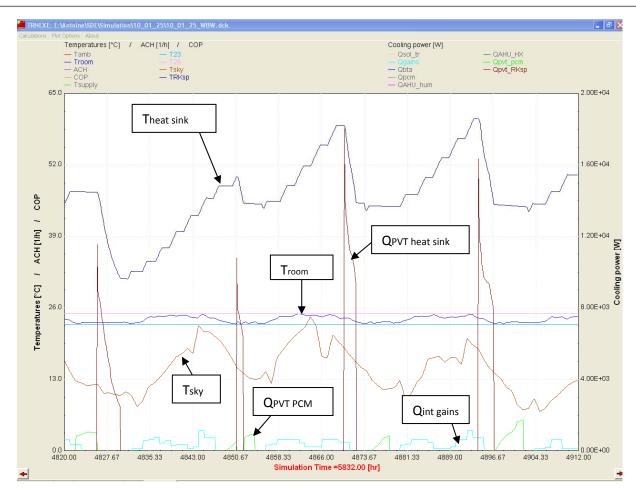


Figure 3.15: Radiative cooling with PVT collectors (Madrid hottest days)

Table 3.16: Electrical COP of radiative cooling with PVT collectors

Electrical COP global (-)	Electrical COP when connected	Electrical COP when connected		
	to PCM ceiling (-)	to heat sink tank (-)		
68.5	16.6	141.6		

4.3.1.3 Comfort criteria

Important parameters for the comfort inside the house are the operative temperature, the relative humidity and also the surface temperature of the activated radiant floor. Figure 3.16 shows the operative temperature, the room temperature and the surface temperature of the activated floor for the hottest week.

Figure 3.17 shows the psychrometric chart of the simulated room temperatures and humidity ratios.

The yellow zone defined of the psychrometric chart corresponds to the comfort zone defined by the organisation.

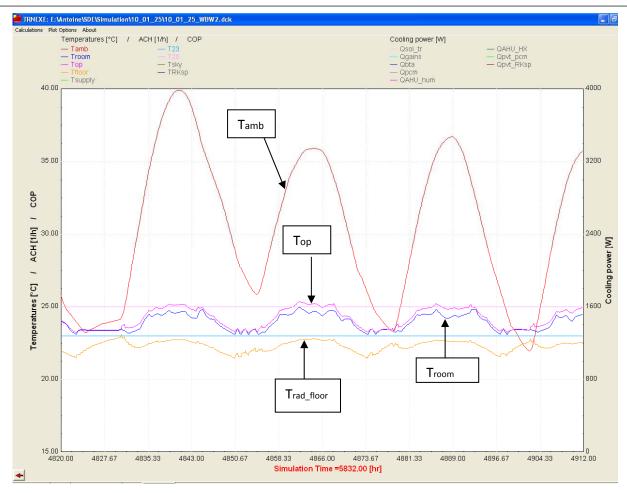


Figure 3.16: Temperature for thermal comfort in the house

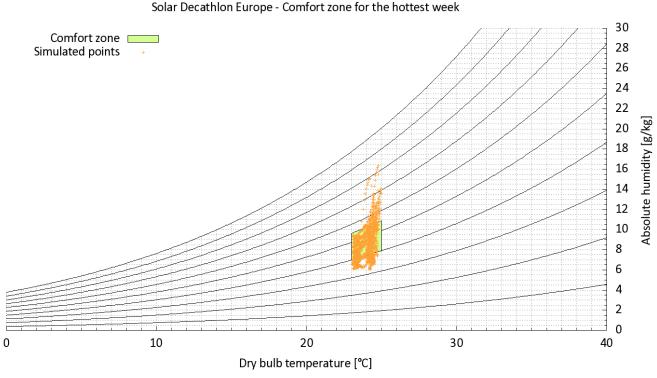


Figure 3.17: Psychrometric chart of the simulated values for the hottest values

4.3.2 Favourable case

4.3.2.1 Cooling demand

The cooling demand of the house is covered with different systems during the favourable week (Table 3.17 and figure 3.18) and also the radiant floor, free cooling and heat pump modes have to be distinguished (Table 3.18).

Table 3.17: Cooling demand of the house in Madrid during the temperate week

Total cooling demand (kWh)	124
Specific cooling demand (kWh/m²)	2.21
Specific cooling energy through radiant floor (kWh/m²)	1.19
Specific cooling energy through indirect evaporative cooling (kWh/m²)	0.72
Specific cooling energy through cooling coil (kWh/m²)	0.10
Specific cooling energy through PCM ceiling during the night (kWh/m²)	0.19
Specific cooling energy through ventilation tower (kWh/m²)	0.07

Figure 3.18: Cooling demand distribution during a favourable week (kWh/m²)

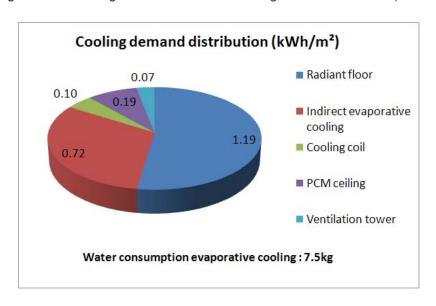


Table 3.18: Radiant floor cooling energy distribution for a temperate week

Total specific energy	Specific energy through	Specific energy through	Average COP of the
through radiant floor	radiant floor in free	radiant floor in heat	heat pump in
(kWh/m²)	cooling mode (kWh/m²)	pump mode (kWh/m²)	cooling mode (-)
1.19	0.93	0.26	5.1

4.3.2.2 Radiative cooling with PVT collectors

The mean cooling power achieved with this system in Madrid during the temperate week is shown in table 3.19. Since the temperature levels are not the same, different cooling powers are achieved for the cooling of the PCM ceiling or for the cooling of the heat sink tank.

Table 3.19: Radiative cooling power with PVT collectors in Madrid (temperate week)

Mean cooling	power	global	Mean	coo	ling	power	when	Mean	cooling	power	when
(W/m²)			connec	ted	to	PCM	ceiling	connec	ted to	heat sin	k tank
			(W/m²))				(W/m²)		
41.1			25.9					39.8			

Table 3.20: Electrical COP of radiative cooling with PVT collectors (temperate week)

Electrical COP global (-)	Electrical COP when connected	Electrical COP when connected		
	to PCM ceiling (-)	to heat sink tank (-)		
31.7	11.6	43.8		

Part 4 Section III - Electrical Energy Balance Report

4.1 Description of Methodology

Contemporaneous to the design development of the envelope we looked out to integrate efficient modules and to maintain the aesthetical requirements.

Since the beginning of the competition we focused on high energy generation. We analyzed different photovoltaic technologies regarding technical properties, module efficiency, design potential and the architectural integration into our building concept. In the beginning we investigated thin film modules in detail, but because of the lower module efficiency compared to crystalline modules we averted this technology. With our crystalline solution we are able integrate a more efficient energy layer outside the thermal covering. Another reason was the design aspect. Since thin film producers are working on higher module efficiency, design aspects are not as much in focus right now. Our solution allows a certain transparency and different coloring.

During the planning process the energy generation concept of the buildings was calculated according to the locations Stuttgart and Madrid. Energy demand of the house was simulated by average consumption data from German households and calculated against the generated energy. These calculations began with estimations and high uncertainties, but improved continuously throughout the planning. While architectural and design issues were discussed, the consequence to the energy generation concept always have been updated and considered into the decisions.

In the beginning the building was simulated in TRNSYS without including systems engineering and detailed electrical consumers. TRNSYS [1] is a flexible tool designed to simulate the transient performance of thermal energy systems. Through these first results of the building simulation the cooling and heating demand could be discussed. This was also the basis for the first PV dimensioning with the software INSEL. It provides plenty of well-validated simulation models, which support in particular with problems on renewable energy systems. The application fields of INSEL [8] cover the topics solar irradiance simulation, photovoltaics and solar thermal applications. The research centre zafh.net is currently developing simulation models for building energy research, energy management

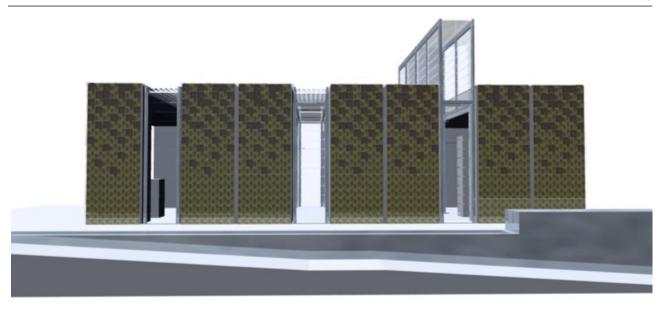


Figure 4.1: home+

of real estates, data communication. Weather data has been used from METEONORM, which is a comprehensive meteorological reference, incorporating a catalogue of meteorological data and calculation procedures for solar applications and system design at any desired location in the world.

In the next step the TRNSYS building model was extended with systems and control engineering. Predefined profiles of households including temporary asynchronous electrical loads (e.g. lighting and household appliances) were added to the model. We checked the assumptions of the household profiles with real data from the manufacturers of the considered appliances. It was important for us to get a precise image of the real system in TRNSYS to get an understanding of how architectural, design or systems engineering changes affect the overall performance of home+. Therefore we included the systems engineering very detailed up to every pump and valve. Through the results of our TRNSYS model we can predict the electricity production during the competition in Madrid very well. We included the expected weather conditions and a self developed user profile including the activities of the event calendar. A different user profile was created for our yearly

simulations. This profile consists of two persons with average activities where one person works abroad and one at home.

The sophisticated simulation model allowed us to analyze different variables. For example different weather conditions have been studied. Now all components have been configured to keep up the functionality of the building even if the worst case scenario takes place. Finally we optimized the photovoltaic modules according to orientation, alignment and integration into the design aspects of the architectural structure. Since the roof area has the highest irradiation and therefore has the greatest energetical potential, we agreed on mono crystalline modules. On the façade we simulated many options and found out, that we could consider colored, poly crystalline modules without decrease in efficiency, but with better integration options into the architectural design. Out of this requirement evolved a technical innovation since for the first time different colored cells are laminated together to one module. Through the simulation, different constellations regarding energy conversion were examined. This lead to the conclusion, that the PV modules on the roof should be connected to two inverters to maximize the energy yield.

Finally, we used the results of the simulations for the electrical energy balance. Therefore we subtracted the expected electricity demand of all consumers from the total produced energy yields. We also did a detailed analysis of the electricity we will be inducting into the system during the competition and how much we have to take out of the electricity grid.

4.2 List of the electric loads

The table in the annex 4 shows the schedule for the electrical household appliances and all interior and exterior lights during the contest week and in normal use. The technical characteristics to them are listed in the list of appliances and the lighting narrative. The data sheeds of the household appliances are in annex 14.

4.3 Description of the PV installation and conversion

For electricity generation, a large PV system of 12.5 kWp is installed on the roof and both, the west and east façades. Each façade is completely covered with 7 polycrystalline PV-Modules (3 kWp each) except for the gaps. On the roof, two different types of modules are installed; 12 small polycrystalline PV-Modules (1.5 kWp) are located on the east and west sides and 12 monocrystalline PV/T modules (photovoltaic/thermal collectors) (5 kWp) in the middle of the roof. The conversion from DC current to AC current is done with 5 inverters (Type AT 2700)

respectively: one for the east façade, one for the west façade, one for the roof-edge and two for the PV/T-Modules. Two different inverters for the PVT modules have been planned because some of them are shaded by the tower and some of them not. According to the simulation, 12.5 % more electricity can be produced if the PVT modules are connected to 2 different inverters (which mean 2 different MPP trackers).

The innovation in this system is that within the polycrystalline PV glass/glass modules two different solar cells are combined and integrated. The reason for applying two different types of solar cells for roof and façades is a matter of design. Whereas the multicolor cells on the façade are an important design feature of our house, the monocrystalline cells on the roof have been selected to provide a maximum of power output per roof area. To link the two areas, we have introduced a new way to combine differently colored cells in a dot-like pattern to achieve a transitional effect from one to the other area: The façade modules will turn with their colors gold and bronze around the edge, then becoming black with the monocrystalline modules in the middle of the roof. The manufacturer of the PV-Cells and inverters is Sunways AG in Konstanz (Germany). The Manufacturer of the PV glass pieces is ERTEX-Solar (Austria). More information are included in PV System Report.

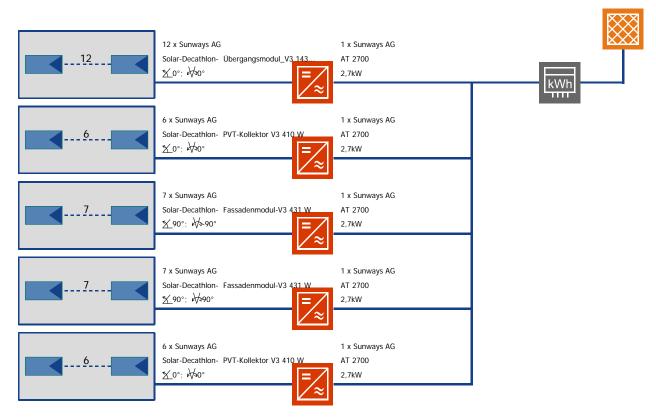
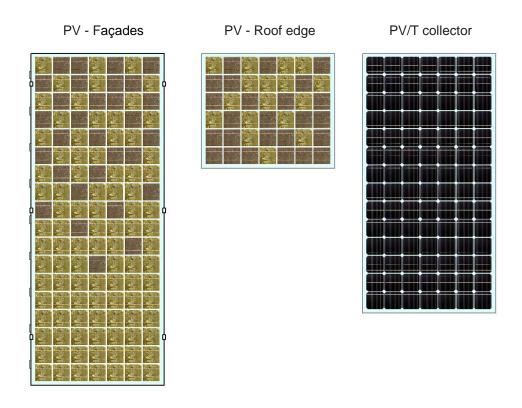


Figure 4.2: Schema of the PV modules / Inverters configuration



Earthing system, cables, wiring method and protection

All PV-glass panels are frameless, so there is no connection for grounding. The substructure will be connected to grounding. All modules connected to the inverters through the wiring routes beyond them and go under the terrace to the porch where the inverters are. For the cables we use special solar cables, which have a double insulation. In the PV system are integrated cutouts and discharger, on the grid site of the inverter.

considered. The detailed shading calculations have been done in TRNSYS and used as input in INSEL. Intentionally, the calculations have been assumed very pessimistic: once one PV module is a little bit shaded, the power output of the all array is set to 0. The choice and the dimensioning of the inverters have been done based on those calculations.

4.4 Description of the tools used for the simulations

The simulation of the PV system has been done using the simulation environment INSEL [8] which is especially appropriate for electrical system simulation. This software has been chosen because of its flexibility for simulating electrical system. Furthermore, since the electricity generation does not influence on the thermal behaviour of the house, it can be simulated separately without eliminating any useful interaction between the system and the building. More information about INSEL can be found in Annex 8.

Additionally, the PV system has been also simulated with the commercial software PV-Sol from the company Valentin [9]. Both results have been compared and will be shown in the results section. The results of them are very similar (difference less than 2%).

Weather data and shading

The weather data of Meteonorm [2] have been used for the PV simulation. The weather data processing (calculation of the radiation on different PV surfaces) have been done with TRNSYS and used as input in the INSEL simulation environment. Also the shading of the wind tower on the PV modules (of both south and north side of the tower) has been

NOTE:

During the last months, since the last deliverable, it was possible to develop some components of the system much more, in order to get results of the max. output power or energy consumption. The following components are studied and integrated in the whole analysis for the Electrical Energy Balance and that is also the reason way the annual energy consumption is decreased since the last deliverable:

- The ventilation tower is included in the simulation model after knowing the behavior from mock-up and contributed its part to the cooling load as a passive component.
- The area of the PV/T collectors is more than before.
- We have tested all the electrical household appliances to know about their real consumption, the reached temperature and the conductivity to the interior, whereas the results are better than expected.

As shown in the next pages the energy consumption of the simulation results are decreased and we are able to make properly specifications to the 50% rule of the electrical energy consumption which is 85 kWh during the competition as indicated in the favorable case.

4.5 Results of the simulations

The detailed simulation results are included in Annex 9-11.

4.5.1 Yearly PV simulation Madrid

The main results of the simulation done with INSEL are shown in Table 4.1 and figure 4.3.

Annual results Madrid	Value	Unit
Total module area	98.8	m²
Total power installed	12.55	kWp
Number of inverters	5	-
Total inverter consumption	136.8	kWh
Irradiance horizontal	162331	kWh
Irradiance on PV generator	123004	kWh
DC energy	12188	kWh
AC energy	11415	kWh
PV efficiency	9.91	%
Inverter efficiency	93.65	%
specific yield	910	kWh/kWp
Performance ratio	73.1	%
System efficiency	9.28	%

Table 4.1: PV simulation results for Madrid

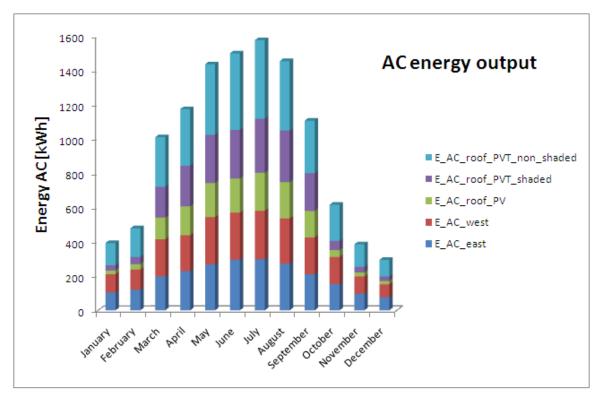


Figure 4.3: Monthly results of AC energy produced (Madrid)

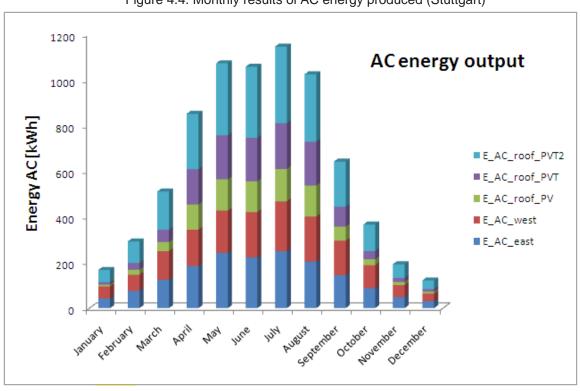
4.5.2 Yearly PV simulation Stuttgart

The main results of the simulation done with INSEL are shown in Table 4.2 and figure 4.4:

Table 4.2: PV simulation results for Stuttgart

Annual results Stuttgart	Value	Unit
Total module area	98.8	m²
Total power installed	12.55	kWp
Number of inverters	5	
Total inverter consumption	133.3	kWh
Irradiance horizontal	107716	kWh
Irradiance on PV generator	82402	kWh
DC energy	8050	kWh
AC energy	7445	kWh
PV efficiency	9.77	%
Inverter efficiency	92.48	%
specific yield	593	kWh/kWp
Performance ratio	71.1	%
System efficiency	9.03	%

Figure 4.4: Monthly results of AC energy produced (Stuttgart)



4.6. Electrical balance

4.6.1 Yearly simulation Madrid

The global electricity consumption over the year has been calculated according to the schedule defined and the control implemented. All equipments have been considered except the motor of the shading devices. Figure 4.5 shows the electricity consumption distribution.

MSR correspond to the electricity consumption of the building management system (control box). This consumption has been estimated with a constant power of 180 W. This value has been measured for a similar system. Figure 4.6 shows the electrical balance over the all year.

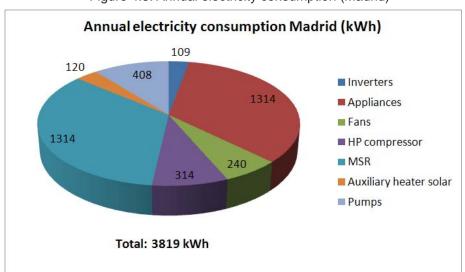


Figure 4.5: Annual electricity consumption (Madrid)

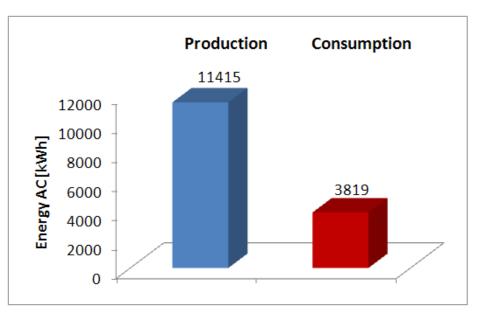


Figure 4.6: Annual electrical balance (Madrid)

4.6.2 Yearly simulation Stuttgart

The global electricity consumption over the year has been calculated according to the schedule defined and the control implemented. All equipments have been considered except the motor of the shading devices. Figure 4.7 shows the electricity consumption distribution.

The electricity consumption is a lot higher than for Madrid. This is mainly due to the electricity consumption of the heaters in the solar tank and in the heat sink tank.

Nevertheless, the electrical balance over the year is still clearly positive (figure 4.8).

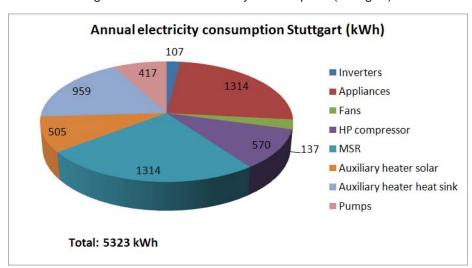


Figure 4.7: Annual electricity consumption (Stuttgart)

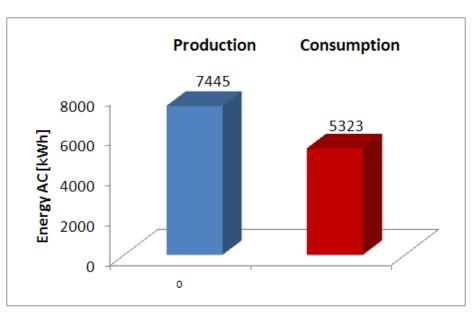


Figure 4.8: Annual electrical balance (Stuttgart)

4.7. Competition simulation Madrid

4.7.1 Unfavourable case: hottest week

The electricity consumption distribution during the hottest week is shown in figure 4.9 and the electricity balance over the week is shown in figure 4.10.

If we considered this consumption for an annual basis, the yearly consumption would be: **6682 kWh**

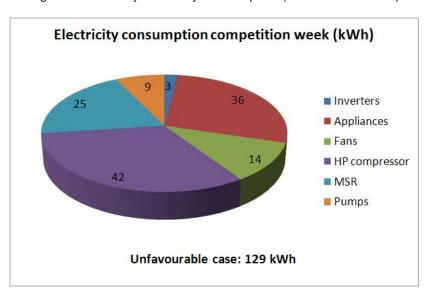


Figure 4.9: Weekly electricity consumption (unfavourable case)

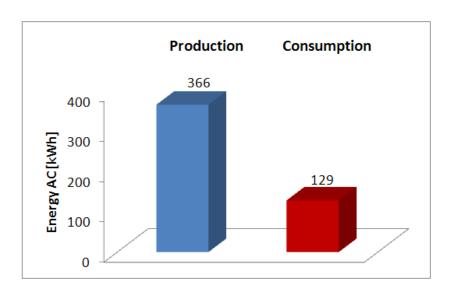


Figure 4.10: Electricity balance over the week (unfavourable case)

4.7.2 Favourable case: temperate week

The electricity consumption distribution during the hottest week is shown in figure 4.11 and the electricity balance over the week is shown in figure 4.12. If we considered this consumption for an annual basis, the yearly consumption would be: **4437 kWh**

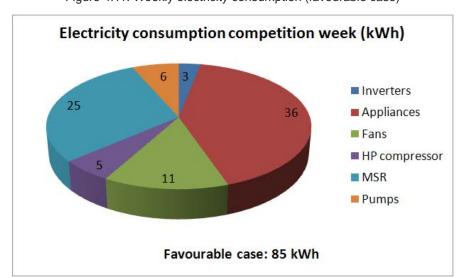


Figure 4.11: Weekly electricity consumption (favourable case)

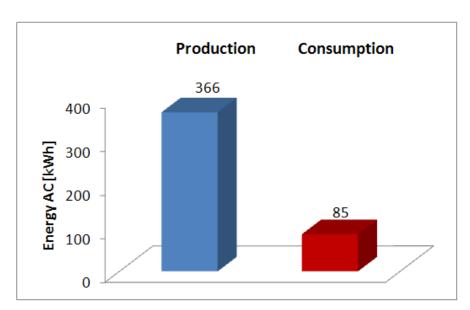


Figure 4.12: Electricity balance over the week (favourable case)

4.8 Energy and Carbon Dioxide Recovery Time

The payback time for the PV modules has been calculated according an EU funded project.

The methodology for the calculation of the Energy and Carbon Dioxide Recovery time for the PV modules is obtained from the Crystal Clear project and the data that is published by the Energy research Centre of the Netherlands. The most current information was presented by Mariska de Wild Scholten [10]. Therefore the calculation method and the data from her last presentation is used as the calculation basis and adapted to the home+installation and the location of Madrid (see table 4.3 in Annex 12).

The primary energy demand for mono- and polycrystalline modules is 2.860 MJ/m² respectively 2.699 MJ/m². Since we have a thicker glass in our Ertex modules we estimated our modules to be 6 mm thicker than the ones calculated by de Wild Scholten. Data from GaBi 4 Software was used for estimating the primary energy demand of the thicker glass. The software system GaBi is a tool for build up life-cycle-balances. The data for the module and the additional glass considered is summed up and related to our yearly specific gains.

We calculated with a density of 2500 kg / m3 which lead to 15 kg / m^2 . With a specific primary energy demand of about 17 MJ / kg this adds up to about 270 MJ / m^2 . The data for the module and the additional glass considered is summed up and related to our yearly specific gains.

According to our energy simulations the specific yields are 163 kWh/(m²*yr) and 92 kWh/(m²*yr) for mono- respectively polycrystalline modules. The energy yields are inducted into the Spanish national grid. The national grid mix for Spain is 11.43 MJ / kWh. Therefore 1 kWh inducted energy from our PV

devices substituted 11.43 MJ.

The energy payback time can be found by relating the energy gains to the primary energy used during the production phase. The division leads to 1.68 years for mono and 2.83 years for the polycrystalline PV modules.

The carbon dioxide payback time is calculated differently, but also obtained from a presentation of Mariska de Wild Scholten [11]. Firstly the specific carbon emissions per kWh are used to calculate the total carbon emissions that are emitted through the production of a 1 m² module. The specific CO2-e Emissions of one produced kWh are 29 g CO2 e for mono and 28 g CO2 e for polycrystalline modules. With the assumptions of de Wild Scholten of a PV lifetime of 30 years, system performance ratio of 0.75, solar irradiation of 1700 kWh/m²a and system efficiency of 0.14 (mono) and 0.132 (poly) the total amount of produced energy during the lifecycle can be calculated. When related to the specific GWP Emissions, the total GWP potential of the production of 1 m² PV can be concluded.

These emissions are related to the yearly electricity yield of the modules. In Spain 0.64 kg CO2 eq. are emitted during the generation of 1 kWh (GaBi 4 data set). The results in table 3 shows that the CO2 payback time for mono crystalline modules (1.49 years) and poly crystalline modules (2.41 years) is very low.

Restrictions

The results can only be seen as estimation.

Different studies use various system boarders for the calculation. In the Crystal Clear study the clean room and the technical building devices have not been considered which also have an impact on the results. If an end of life scenario is also taken into consideration, the payback time is lower.

4.9 Temporary Generation-Consumption Correlation

While it is important to know the factor of the total generation against the total consumption of our electrical devices, the temporary correlation between generation and consumption is also interesting to know. As it can be obtained from figure 4.13, home+ has an electricity surplus during the day and a demand during the night. However, the electricity induction into the grid mix during the day is very high compared to the electricity demand from the grid at night.

We calculated the correlation for one week in Madrid for an unfavorable case and a favorable case (see figure 4.14). While the induction in both cases outnumbers the grid demand it can be seen, that in both cases the hourly comparison between induction and demand is similar.

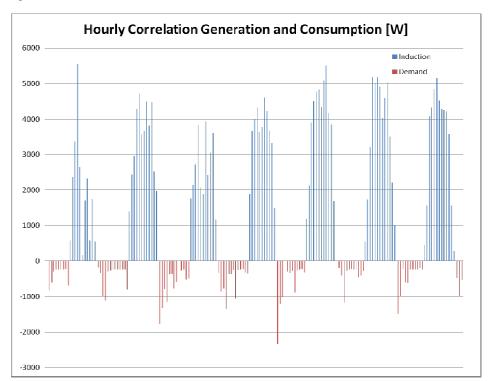


Figure 4.13: Hourly Correlation of Electricity Generation and Consumption for one week (favorable case)

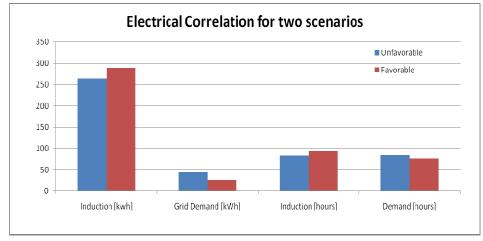


Figure 4.14: Electrical Correlation for favorable and unfavorable week in Madrid

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Annex 1
Table 1.1 House construction

	No	Layer	Thickness	Thermal conductivity	Thermal capacity	Densit y	U
			(m)	(W/mK)	(J/kgK)	(kg/m³)	(W/m² K)
	1	Massive wood	0.075	0.18	1600	700	
Wall facade	2	Vacuum Insulation filled with silica	0.040	0.007	1000	190	0.16
	3	OSB Plate	0.020	0.13	1700	600	
	1	OSB Plate	0.022	0.13	1700	600	
	2	Sheep wool	0.160	0.04	1000	50	
Doof	3	OSB Plate	0.025	0.13	1700	600	
Roof (without PCM)	4	Vacuum Insulation filled with perlite	0.040	0.013	1000	190	0.11
l Own	5	OSB Plate	0.020	0.13	1700	600	
	6	Sheep wool	0.050	0.04	1000	50	
	7	OSB Plate	0.020	0.13	1700	600	
	1	Floor cover (wood)	0.010	0.17	1400	600	
	2	Wood	0.030	0.13	1700	400	
	3	OSB Plate	0.030	0.13	1700	600	
Floor	4	Sheep wool	0.240	0.04	1000	50	0.10
(27.1 m ²)	5	OSB Plate	0.022	0.13	1700	600	
	6	Vacuum Insulation filled with silica	0.024	0.007	1000	190	
	7	OSB Plate	0.020	0.13	1700	600	
	1	Floor cover (wood)	0.010	0.17	1400	600	
	2	Dry radiant floor (wood)	0.030	-	-	-	
-	3	OSB Plate	0.030	0.13	1700	600	
Floor (Activate	4	Sheep wool	0.240	0.04	1000	50	0.10
d 30 m ²)	5	OSB Plate	0.022	0.13	1700	600	
	6	Vacuum Insulation filled with silica	0.024	0.007	1000	190	
	7	OSB Plate	0.020	0.13	1700	600	
	1	Massive wood	0.075	0.18	1600	700	
	2	Air gap	0.008	0.025	-	-	
Wall	3	OSB Plate	0.020	0.13	1700	600	
groove	4	Vacuum Insulation filled with silica	0.040	0.007	1000	190	0.13
	5	Sheep wool	0.042	0.04	1000	50	
	6	OSB Plate	0.012	0.13	1700	160	
Wall Tower	1	Vacuum insulation (silica) + thermal bridge	0.040	0.013	1000	190	0.308
	1	Massive wood	0.075	0.18	1600	700	
Wall	2	Vacuum Insulation filled with silica	0.040	0.007	1000	190	0.42
North- South	3	OSB Plate	0.020	0.13	1700	600	0.13
Journ	4	Sheep wool	0.050	0.04	1000	50	
	5	OSB Plate	0.012	0.13	1700	600	

Annex 2 Table 1.2 Parametric studies for glazing and shading

Versions	Shading 1	Shading 2	Shading 3	Shading 4	Shading 5	Shading 6
South	0.9 if G_süd >80 W/m²	without	without	without	without	0.9 if G_h >80 W/m²
East	0.75 if G_ost >80W/m²	0.75 if G_ost >80W/m²	0.75 if G_h >80W/m²	0.75 if G_h >80W/m²	0.75 if G_h >80W/m²	0.75 if G_h >80W/m²
West	0.75 if G_west>80W/m²	0.75 if G_west>80W/m² 0.75 if G_h>80W/m²	0.75 if G_h>80W/m²	0.75 if G_h>80W/m²	0.75 if G_h>80W/m²	0.75 if G_h >80W/m²
Roof	0.75 if G_h>80W/m²	0.75 if G_h>80W/m²	0.75 if G_h>80W/m²	0.5 Gap 0.7 Gap Tower	0.7 Gap 0.7 Gap Tower	0.5 Gap 0.7 Gap Tower

Versions	U (W/m²K)	g (-)	Tvis (-)
Glazing 1	0,40	0,41	0,63
Glazing 2	0,52	69'0	0,74
Glazing 3	2'0	0,222	0,436

	Versions	ions	Madrid	hid	Stuttgart	gart
	Glazing Version	Shading Version	Heating demand (%)	Cooling demand (%)	Heating demand (%)	Cooling demand (%)
Version 1	1	1	109,8	55,5	103,4	43,6
Version 2	2	1	84,3	85,8	91,8	90,1
Version 3	2	2	78,4	123,2	91,5	149,2
Version 4	2	3	78,4	123,2	91,5	149,2
Version 5	2	4	0'96	150,2	101,1	181,6
Version 6	2	5	101,9	128,5	103,4	146,4
Version 7	2 überall / 1 North	4	06,0	132,7	966	147,8
Version 8	2 uberall / 3 North	4	131,3	110,7	117,3	109,8
Version 9	2 W-O-D / 1 S-N	4	105,8	119,9	101,5	128,1
Version 10	2 W-O-D / 3 S-N	4	211,7	85,8	144,3	73,2
Version 11	2 überall / 1 North	9	100,0	100,0	100,0	100,0
Version 12	2 überall / 3 North	9	133,3	82,2	117,3	70,4
Version 13	2 W-O-D / 1 S-N	9	107,8	98,2	101,9	95,7
Version 14	2 W-O-D / 3 S-N	9	213,6	75,8	144,3	60,5

Annex 3 TRNSYS program description

The program TRNSYS is a complete and extensible simulation environment for the transient simulation of thermal systems including multi-zone buildings. It is used to validate new energy concepts, from simple solar domestic hot water systems to the design and simulation of buildings and their equipment, including control strategies, occupant behavior, alternative energy systems (wind, solar, photovoltaic, hydrogen systems), etc.

This program has an open, modular structure and the source code of the kernel as well as the component models is delivered to the users. This simplifies extending existing models to make them fit the user's specific needs. The DLL-based architecture allows users and third-party developers to easily add custom component models, using all common programming languages. In addition, this program can be easily connected to many other applications, for pre- or post processing or through interactive calls during the simulation (e.g. Microsoft Excel, Matlab, COMIS, etc.).

Trnsys is used for the following applications:

- Solar systems (solar thermal and PV)
- Low energy buildings and HVAC system (natural ventilation, slab heating/cooling, double façade, etc.)
- Renewable energy systems
- · Cogeneration, fuel cells
- · and all that requires dynamic simulation

In Trnsys each physical component e.g. a solar collector is represented as a so called TYPE and each Type of component is described by a mathematical model in the Trnsys simulation engine. All Types are connected than in the main visual interface Trnsys simulation studio which is the graphical simulation environment. The standard component library contains many Types but can also advanced by own. So the program suite of Trnsys consists the following:

- The Trnsys simulation Studio: to create projects by drag-and-dropping components to the workspace, connecting them together and setting the global simulation parameters.
- the simulation engine and its executable: is the digital library where the input files is read and create during the simulation output files and presents also the results graphically.
- the visual interface for the building input data: to enter input data of the building and to specify all the building structure details, as well as everything that is needed to simulate the thermal behavior of the building, such as windows optical properties, heating and cooling schedules.
- and the editor: to create stand-alone redistributable programs known as TRNSED applications.

Annex 4 Schedule of all Internal Gains

Table 3.1: Schedule in normal use (Note this chart is based on the EL-401b Preliminary Lighting Plan.)

	Days	Time	P	elec (W)	Total(W)
Persons	Monday-Friday	0-9, 19-24	2	0	120
		9-18	1	0	60
	Saturday, Sunday	0-24	2	0	120
Shower	Monday-Sunday	7-8, 20-21	1	0	0
Fridge	Monday- Sunday	0-24	1	25	20
Diswasher	Tuesday, Saturday	10-11:30	1	190	9,5
Oven	Monday, Saturday	19-20	1	1150	460
Cooker	Monday-Sunday	19-20	1	1200	240
Cooker hood	Monday-Sunday	19-20	1	76	15,2
		8-8:05,			
		13-13:05,			
Coffee machine	Monday-Sunday	19-19:05	1	200	40
Washing machine	Wednesday, Sunday	10-11	1	240	24
Dryer	Wednesday, Sunday	11-12:30	1	650	65
TV/DVD	Monday, Thursday	21-22	1	212	42,4
	Friday	21-23	1		
	Saturday, Sunday	21-23	1		
Computer	Monday, Friday	9-12, 14-19	1	20,7	10,35
	Saturday, Sunday	9-12	1		
HIFI	Monday, Friday	12-13	1	36	18
	Saturday, Sunday	13-14, 18-20	1		
Pendant Lamp	Monday-Sunday	19-20	1	27	27
Floor lamp (Livingroom)	Monday-Sunday	20-22	1	27	15
Kitchen (Board)	Monday-Sunday	19-20	1	15	29
Wall-washer (corridor) 1	Monday-Sunday	19-20	1	54	54
Wall-washer (corridor) 2	Monday-Sunday	19-20	1	54	54
Wall-washer (corridor) 3	Monday-Sunday	20-21	1	54	54
Bath Spotlight	Monday-Sunday	19-20	1	15	15
Gaps (6x)	Monday-Sunday	21-22	6	3,6	
X-Bar(Ventilation T)	Monday-Sunday	21-22	1	25	
Wall-washer (Loggia)	Saturday-Sunday	19-20	1	24	
Exterior light 13x	Saturday-Sunday	21-22	13	2	

Table 3.2: Schedule of the all internal gains during the contest week

Persons Monday 8-11, 21-23 2 11-13, 18-21 8 13-18 4 Tuesday 8-10, 14-21 2 10-14 4 21-23 8 8-11, 13-14, Wednesday 21-23 2	0 0 0 0	120 480 240
Tuesday 8-10, 14-21 2 10-14 4 21-23 8 8-11, 13-14,	0	
Tuesday 8-10, 14-21 2 10-14 4 21-23 8 8-11, 13-14,	0	240
10-14 4 21-23 8 8-11, 13-14,		
21-23 8 8-11, 13-14,	0	120
8-11, 13-14,		240
	0	480
Wednesday 21-23 2		
•	0	120
11-13,18-21 8	0	480
8-11, 13-18, Thurday 20-21 2	0	120
11-13, 19-20,	U	120
21-23 8	0	480
8-11, 13-18,		
Friday 21-23 2	0	120
11-13, 18-21 8	0	480
8-11, 15-18,		
Saturday 21-22 2	0	120
11-15, 18-21 8	0	480
8-11, 15-18,	_	100
Sunday 21-22 2	0	120
Monday, Wednesday, 10-10:10,	0	480
Shower Saturday 16-16:10 1	0	0
13- 13:10,	0	
15- 15:10,		
Tuesday 18- 18:10 1	0	0
15- 15:10,		
Thurday 17- 17:10 1	0	0
10-10:10, Friday 14-14:10 1	0	0
Friday 14-14:10 1 10- 10:10,	0	0
Sunday 16-16:10 1	0	0
Fridge Monday- Sunday 0-24 1	20	20
Monday- Wednesday 13-14:30		
	190	0.5
		9,5
Oven Monday, Wednesday, 13-14 1	1150	460
Saturday, Sunday 10-11		
Tuesday, Thursday 9-10, 20-21 1		
Cooker Monday, Wednesday, 9-10 1	1200	240
Tuesday 15-16, 20-21 1	1200	240
Thursday 13-14, 20-21 1		
Friday 13-14 1		
Cooker hood Tuesday, Thursday 20-21 1	76	15,2
Coffee machine Tuesday, Thursday	200	40
Washing machine Monday, Thursday, 14-15 1	240	24
Tuesday 16-17	240	24
Wednesday 13-14		
·		
Saturday, Sunday 15-16		

continuance Table 3.2: Schedule of the all internal gains during the contest week

	Days	Time	Pelec (W)	Total(W)
Dryer	Monday, Thursday,	15:30-16		
	Tuesday	18:30-19		
	Wednesday	15:30-16		
	Saturday, Sunday	17:30-18	1 69	50 65
TV/DVD	Monday	11-14, 18-21	1 2:	12 42,4
		10-12, 16-18,		
	Tuesday	21-23	1	
	Wednesday, Friday	11-13, 18-21	1	
		11-13, 18-20,		
	Thursday	21-22	1	
	Saturday, Sunday	11-15, 17-21	1	
Computer	Monday	11-14, 18-21	1 20	,7 10,35
		10-12, 16-18,		
	Tuesday	21-23	1	
	Wednesday, Friday	11-13, 18-21	1	
		11-13, 18-20,		
	Thursday	21-22	1	
	Saturday, Sunday	11-15, 17-21	1	
HIFI	Monday	11-14, 18-21	1 :	36 18
		10-12, 16-18,		
	Tuesday	21-23	1	
	Wednesday, Friday	11-13, 18-21	1	
		11-13, 18-20,		
	Thursday	21-22	1	
	Saturday, Sunday	11-15, 17-21	1	

home+

continuance Table 3.2: Schedule of the all internal gains during the contest week (lights)

	Days	Time	Pelec (W)	Total(\	N)
	Monday-Thursday,				
Pendant Lamp	Sunday	21-23			
	Saturday	21-24	1	27	27
	Monday, Wednesday,		<u>'</u>		
Floor lamp (Livingroom)	Sunday	21-23			
	Saturday	21-24	1	27	15
-	Monday-Thursday,				
Kitchen (Board)	Sunday	21-23	1	15	29
	Saturday	21-24	1		
	Monday, Wednesday,				
Wall-washer (corridor) 1	Sunday	21-23			
	Saturday	21-24	1	54	54
	Monday-Thursday,				
Wall-washer (corridor) 2	Sunday	21-23	1	54	54
	Saturday	21-24	1		
	Monday, Wednesday,				
Wall-washer (corridor) 3	Sunday	21-23			
	Saturday	21-24	1	54	54
		Monday,			
	Monday, Wednesday,	-			
Bath Spotlight	Sunday	Sunday			
	Saturday	Saturday	1	15	15
	Monday, Wednesday,				
Gaps (6x)	Sunday	21-23			
	Saturday	21-24	6	3,6	
	Monday, Wednesday,				-
X-Bar (Ventilation T)	Sunday	21-23			
	Saturday	21-24	1	25	
	Monday, Wednesday,				
Wall-washer (Loggia)	Sunday	21-23			
	Saturday	21-24	1	24	
	Monday, Wednesday,				
Exterior light 13x	Sunday	21-23			
	Saturday	21-24	13	2	

Annex 5 Weather Data

Figure 3.1: TMY Weather data for Madrid (Meteonorm 6.0)



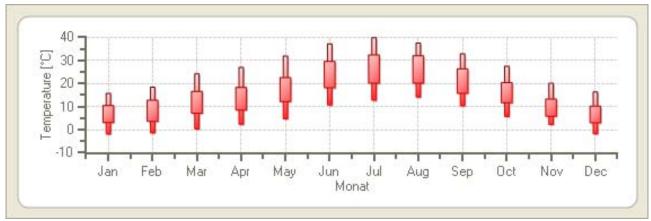
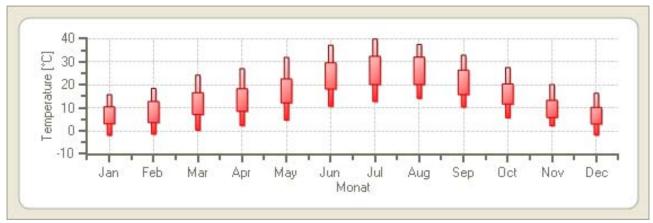


Figure 3.2: TMY Weather data for Stuttgart (Meteonorm 6.0)





Annex 6

Meteonorm software description

Meteonorm is a comprehensive meteorological reference, incorporating a catalogue of meteorological data and calculation procedures for solar applications and system design at any desired location in the world. [1] Including the following database for solar energy applications:

- a meteorological database containing comprehensive climatological data for solar engineering applications.
- a computer program for climatological calculations.
- a data source for engineering design programs in the passive, active and photovoltaic application of solar energy with comprehensive data interfaces.
- a standardization tool permitting developers and users of engineering design programs access to a comprehensive, uniform data basis.
- meteorological reference for environmental research, agriculture, forestry etc.

The database conceals not only numerous databases from all parts of the world but also a large number of computational models developed in international research programs.

Meteonorm is primarily a method for the calculation of solar radiation on arbitrarily orientated surfaces. The method is based on databases and algorithms coupled according to a predetermined scheme. It commences with the user specifying a particular ocation for which meteorological data are required, and terminates with the delivery of data of the desired structure and in the required format. Depending on user requirements, the calculation procedure employs between one and four computation models (Table below). The table shows the sequence in which the computational models are coupled in generating hourly radiation data on an arbitrarily orientated surface at a site for which no measurements are available.

Interpolation with monthly average value model Gh, Ta	Space dependent interpolation of horizontal radiation and temperature based on weather data taking
	altitude, topography, region, etc. into account
Hourly value generator Gh, Ta	Stochastic generation of time dependent global horizontal radiation and temperature data having a
	quasi-natural distribution and an average monthly value equal to the average value over 10 years
Radiation resolution Gh, Gdh, Bn	Resolution of global radiation into diffuse and direct Components
Radiation on inclined surface with	Calculation of hemispherical radiation on arbitrarily
skyline effect, hourly value model Gk	orientated surfaces taking the reduction due to skyline profile into account

In addition to the monthly values, Meteonorm provides maximum radiation values under clear sky conditions.

Owing to the comprehensive framework chosen for the present edition, certain inconsistencies could not be avoided. However, it is always possible to establish which data basis and algorithms were used. Differences between the various data bases and algorithms may be summarized as follows:

- Quality of basis data: The radiation data was subjected to extensive tests. The error in interpolating the monthly radiation values was 9%, and for temperature 1.5°C.
- Climatic variations: The radiation data base is based on 20-year measurement periods, the other parameters mainly on 1961-90 and 1996-2005 means. Comparisons with longer term measurements show that the discrepancy in average total radiation due to choice of time period is less than 2% for all weather stations.
- Computational models: The models used in Meteonorm are designed to calculate radiation on inclined surfaces and additional parameters. One or more models are used depending on data basis. If the results are to be passed on for further processing, the data basis and models used should be specified to ensure that the results are correctly interpreted.
- In general, the hourly model tends to overestimate slightly the total radiation on inclined surfaces by 0-3% (depending on model). The discrepancy compared to measured values is ±10% for individual months and ±6% for yearly sums.

Features

Database:

- Climatological data of 8'055 weather stations.
- Measured parameters: monthly means of global radiation, temperature, humidity, precipitation, days with precipitation, wind speed and direction,

sunshine duration.

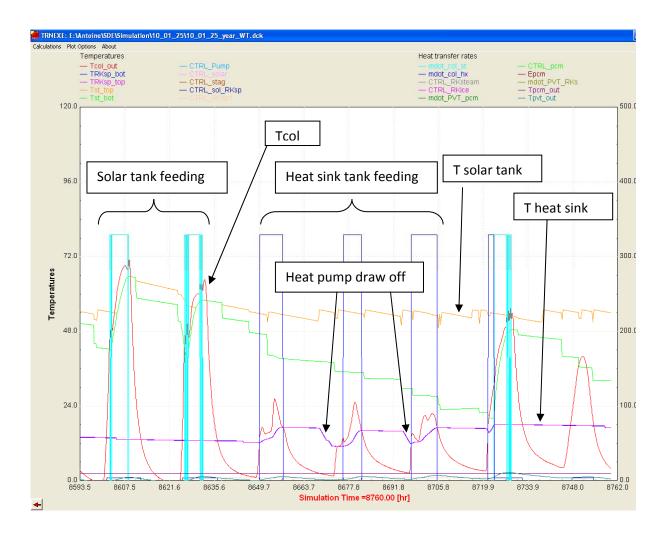
- Time periods 1961-90 and 1996-2005 for temperature, humidity, precipitation and wind seed selectable.
- Updated global radiation database for period 1981-2000.
- Use of satellite data for areas with low density of weather stations.
- Inclusion of climate change forecast (Hadley CM3 model).

Models:

- Interpolation models to calculate mean values.
- Minute time resolution for radiation parameters.
- Calculation of radiation for inclined surfaces with updated models.
- Enhanced temperature and humidity generation for building simulation.

Annex 7

Figure 3.7: Winter operation of the solar thermal system



Annex 8 INSEL program description

Insel is a general-purpose graphical modeling language for computer simulation. In the modular simulation environment the simulation models implemented and connected to each other. The software visualizes the energy systems and also makes possible to plan and monitor. For this purpose, Insel provides state-of-the-art functions as blocks for the simulation of meteorological data, electrical and thermal energy components, which can be interconnected to a concrete solution. These

blocks of the simulation models can be created in the graphic editor. The software has a block library which supported with data for photovoltaic modules, inverters, thermal collectors and meteorological parameters but can also be extended. The underlying block diagram can be hidden - but a possible change into the "detail view" remains accessible. In this detail view refinements of the model can be made and the details can be analyzed.

Annex 9
Detailed PV simulation results – Yearly simulation Madrid (INSEL)

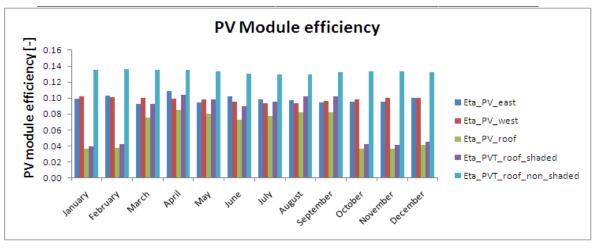
East Facade	Value	Unit
PV module ertex with sunways cells		
PV module in serie	7	
Module area	3.7	m²
Total area	25.7	m²
Module power	430.5	Wp
Power installed	3.01	kWp
Inverter	Sunways AT2700	
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4269	h
Inverter electrical consumption	28.0	kWh
Irradiance horizontal	42245	kWh
Irradiance east	24922	kWh
DC energy	2476	kWh
AC energy	2318	kWh
PV efficiency	9.93	%
Inverter efficiency	93.63	%
specific yield	769	kWh/kWp
Performance ratio	79.3	%
System efficiency	9.30	%

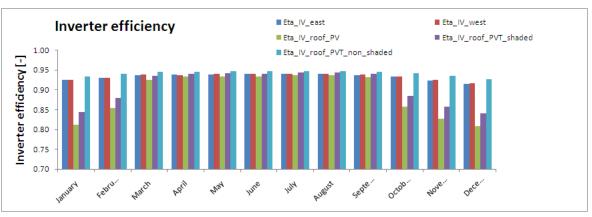
West Facade	Value	Unit
PV module ertex with sunways cells		
PV module in serie	7	
Module area	3.7	m²
Total area	25.7	m²
Module power	430.5	Wp
Power installed	3.01	kWp
Inverter	Sunways AT270	0
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4269	h
Inverter electrical consumption	28.0	kWh
Irradiance horizontal	42245	kWh
Irradiance west	25179	kWh
DC energy	2452	kWh
AC energy	2295	kWh
PV efficiency	9.74	%
Inverter efficiency	93.61	%
specific yield	762	kWh/kWp
Performance ratio	77.8	%
System efficiency	9.12	%

Roof PV	Value	Unit
PV module ertex with sunways cells		
PV Module in serie	12	
Module area	1.2	m²
Total area	14.4	m²
Module power	143.5	Wp
Power installed	1.72	kWp
Inverter	Sunways AT270	00
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4086	h
Inverter electrical consumption	26.8	kWh
Irradiance horizontal	23667	kWh
Irradiance roof shaded	23667	kWh
DC energy	1537	kWh
AC energy	1418	kWh
PV efficiency	6.49	%
Inverter efficiency	92.31	%
specific yield	824	kWh/kWp
Performance ratio	50.1	%
System efficiency	5.99	%

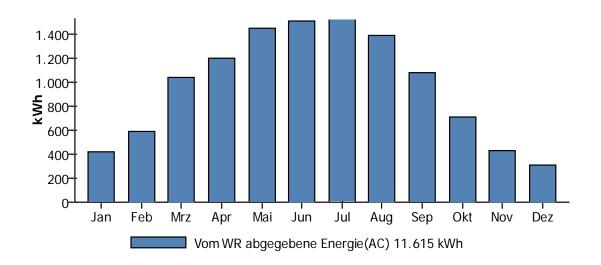
Roof PVT shaded		
PV module ertex with sunways cells6		
	6	
Module area	2.7	
Total area	16.5	
Module power	399.8	Wp
Power installed	2.40	kWp
Inverter	Sunways AT2700)
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4025	h
Inverter electrical consumption	26.4	kWh
Irradiance horizontal	27087	kWh
Irradiance roof shaded	22150	kWh
DC energy	2141	kWh
AC energy	1999	kWh
PV efficiency	9.66	%
Inverter efficiency	93.37	%
specific yield	833	kWh/kWp
Performance ratio	62.0	%
System efficiency	9.02	%

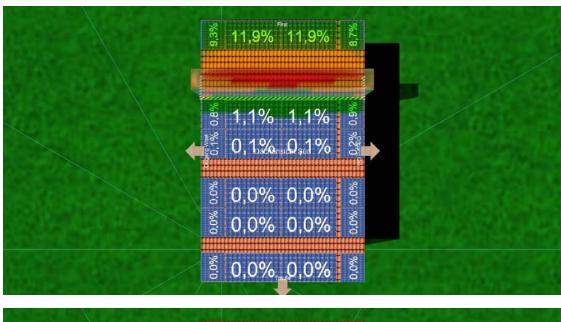
Roof PVT non shaded					
PV module ertex with sunways cells					
PV Module in serie	6				
Module area	2.7				
Total area	16.5				
Module power	399.8	Wp			
Power installed	2.40	kWp			
Inverter	Inverter Sunways AT2700				
Inverter consumption	6.5	W			
Inverter night consumption	0.06	W			
Inverter operation hour	4180	h			
Inverter electrical consumption	27.4	kWh			
Irradiance horizontal	27087	kWh			
Irradiance roof	27087	kWh			
DC energy	3584	kWh			
AC energy	3385	kWh			
PV efficiency	13.23	%			
Inverter efficiency	94.45	%			
specific yield	1411	kWh/kWp			
Performance ratio	85.8	%			
System efficiency	12.50	%			

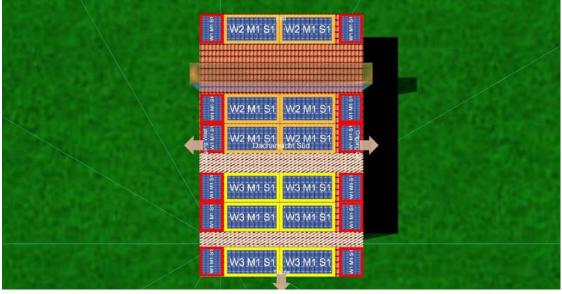




Annex 10
Detailed PV simulation results – Yearly simulation Madrid (PV Sol)







Annex 11
Detailed PV simulation results – Yearly simulation Stuttgart

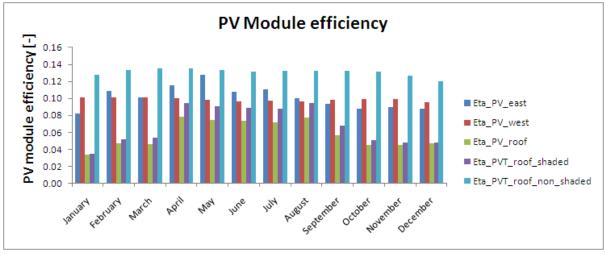
East Facade		
PV module ertex with sunways cells		
PV module in serie	7	
Module area	3.7	m²
Total area	25.7	m²
Module power	430.5	Wp
Power installed	3.01	kWp
Inverter	Sunways AT2700	
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4171	h
Inverter electrical consumption	27.4	kWh
Irradiance horizontal	28032	kWh
Irradiance east	17847	kWh
DC energy	1785	kWh
AC energy	1655	kWh
PV efficiency	10.00	%
Inverter efficiency	92.71	%
specific yield	549	kWh/kWp
Performance ratio	79.1	%
System efficiency	9.27	%

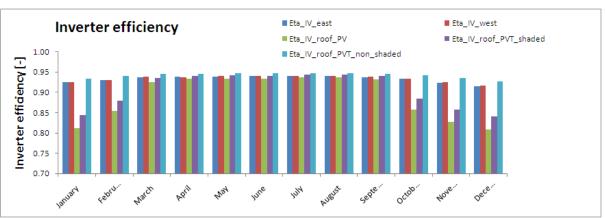
West Facade		
PV module ertex with sunways cells		
PV module in serie	7	
Module area	3.7	m²
Total area	25.7	m²
Module power	430.5	Wp
Power installed	3.01	kWp
Inverter	Sunways AT270	0
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4171	h
Inverter electrical consumption	27.4	kWh
Irradiance horizontal	28032	kWh
Irradiance west	16981	kWh
DC energy	1670	kWh
AC energy	1545	kWh
PV efficiency	9.83	%
Inverter efficiency	92.52	%
specific yield	513	kWh/kWp
Performance ratio	77.6	%
System efficiency	9.10	%

Roof PV		
PV module ertex with sunways cells		
PV Module in serie	12	
Module area	1.2	m²
Total area	14.4	m²
Module power	143.5	Wp
Power installed	1.72	kWp
Inverter	Sunways AT2	2700
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	3976	h
Inverter electrical consumption	26.1	kWh
Irradiance horizontal	15704	kWh
Irradiance roof shaded	15704	kWh
DC energy	935	kWh
AC energy	841	kWh
PV efficiency	5.96	%
Inverter efficiency	89.95	%
specific yield	489	kWh/kWp
Performance ratio	44.8	%
System efficiency	5.36	%

Roof PVT shaded		
PV module ertex with sunways cell		
PV Module in serie	6	
Module area	2.7	
Total area	16.5	
Module power	399.8	Wp
Power installed	2.40	kWp
Inverter	Sunways AT27	700
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	3899	h
Inverter electrical consumption	25.6	kWh
Irradiance horizontal	17974	kWh
Irradiance roof shaded	13896	kWh
DC energy	1280	kWh
AC energy	1174	kWh
PV efficiency	9.21	%
Inverter efficiency	91.72	%
specific yield	489	kWh/kWp
Performance ratio	58.0	%
System efficiency	8.45	%

Roof PVT non shaded						
PV module ertex with sunways	cells					
PV Module in serie	6					
Module area	2.7					
Total area	16.5					
Module power	399.8	Wp				
Power installed	2.40	kWp				
Inverter	Sunways AT2	2700				
Inverter consumption						
Inverter night consumption	0.06	W				
Inverter operation hour	4080	h				
Inverter electrical						
consumption	26.8	kWh				
Irradiance horizontal	17974	kWh				
Irradiance roof	17974	kWh				
DC energy	2380	kWh				
AC energy	2229	kWh				
PV efficiency	13.24	%				
Inverter efficiency	93.69	%				
specific yield	929	kWh/kWp				
Performance ratio	85.2	%				
System efficiency	12.40	%				





Annex 12

Table 4.3: Energy and Co2 Payback Calculation

Payback Time (CO2-eq. Emissions)	Avoided CO2eq. Emissions by PV generated energy	Carbon Dioxide Eq. Factor Power Grid Mix Spain	Energy Output per Year	Total CO2-eq. Emissions for Production of PV modules	Generated kWh during lifetime of PV modules	Specific CO2 eq. Emissions for PV produced electricity	Description	Energy Payback Time (Primary Energy Demand)	Avoided Primary Energy Demand by PV generated energy	Primary Energy Factor Power Grid Mix Spain	Energy Output per Year	Total Primary Energy Demand for Production of PV module	Additional primary energy considered for thicker glasses	Primary Energy Demand for Production of PV module	Description
years	[GJ/m²]	kg Co2 eq./kWh	(kWh/(m²*yr)	kg/m²	kWh/m²	g Co2 eq./kWh	Unit	years	y [GJ/year]	MJ/kWh	(kWh/(m²*yr)	ıle [MJ/m²]	[MJ/m²]	[MJ/m²]	Unit
1,49	104	0,64	163	155	5.355	29,00	Mono	1,68	1.863	11,4	163	3.130	270	2.860	Mono
2,41	59	0,64	92	141	5.049	28,00	Poly	2,83	1.048	11,4	92	2.969	270	2.699	Poly
CO2eq. Emissions Production PV / Avoided CO2 Emissions by PV	Energy Output per year and m ² * specific CO2 Emissions Grid Mix Spain	GaBi 4 data set (www.gabi-software.com)	energy simulation (see energy report)	Specific CO2 eq. Emissions * Generated power during lifetime PV	Wild-Scholten,M., presented at 2nd EPIA International Thin Film Conference on Nov 12, 2009; Assumptions: 1700 kWh/m² a * 75% system performance ratio * 30 years lifetime * 0,14 (mono) respectively 0,132 (poly) efficiency	Wild-Scholten,M., presented at 2nd EPIA International Thin Film Conference on Nov 12, 2009	Source of data	Primary Energy Production / Avoided Primary Energy Demand PV	Primary Energy Factor Power Grid Mix Spain * Installed Capacity at home+	GaBi 4 data set (www.gabi-software.com)	energy simulation (see energy report)	Addition of the first two numbers	GaBi 4 dataset on glass inkluding End of Life (see "Summary of considered materials" in the sustainability report), Asumption: Thickness of glass 0.006 m * density 2.500 kg/m3 = 15 kg/m2	Mariska de Wild-Scholten, 6. Workshop Photovoltaik-Modultechnik, 26-27 November 2009, Köln; http://www.apollon-eu.org/Assets/20091218-Energier%C3%BCcklaufzeiten%20f%C3%BCr%20PV-Module%20und%20Systeme%20-%20deWild%20-%20final.pdf	Source of data

Annex 13 Ventilation tower modelling

1. Introduction

One of the key components of the home+ energy concept is the so-called "Ventilation tower". The principle is inspired by wind towers (or wind catchers) that have been used in traditional architecture throughout the Middle East and Central Asia for centuries to promote natural ventilation, sometimes incorporating evaporative cooling. In a traditional wind tower, air entering through the windward opening at the top with positive wind pressure leaves the tower through openings that have a pressure coefficient that is lower. The air may be cooled if it flows over moist surfaces [12]. Such a process is called downdraught evaporative cooling and is used in our energy tower. Figure 1 shows the schema of the ventilation tower principle with moist textiles.

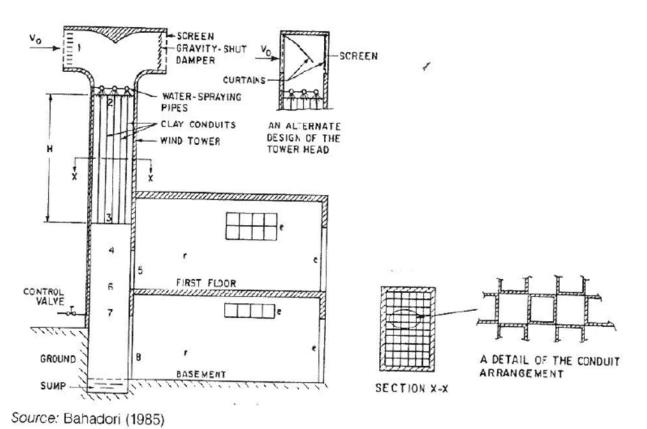


Figure 1: Schema of passive downdraught evaporative cooling principle (1)

2. Principle of operation

The main forces that move the air through a downdraught evaporative cool tower are:

- The wind pressure at its top inlet
- The increase in the specific weight of the
- Momentum transfer from the water to the air

not fully evaporated in the tower.

cooled air in the upper section of the tower

if large drops of water are sprayed that are

In our case, the last force is neglected since the water is not sprayed but used for textiles humidification.

3. Modelling approach

Downdraught evaporative cooling involves physical processes, such as airflow around buildings and natural ventilation with heat and mass transfer, which are very complex to predict theoretically. For this reason, the grey box approach has been used for the modelling of the ventilation tower, which is a mix of physical modelling (white box) and black box approach (fitted curves) based on experimental data. Table 1 shows which processes are determined experimentally (black box) and which processes are determined physically (white box).

All the experimental data used for the parameter identification come from the work of Micha Schneider [13].

Table 1: Grey box modelling approach of the ventilation tower

Black box approach

- Wind pressure coefficients (based on wind tunnel measurements)
- Pressure drop through the tower (based on ventilation tower experimental setup)
- Heat and mass transfer coefficients (based on ventilation tower experimental setup)

Physical model

- Tower geometry
- Number of textiles
- Heat transfer process
- Mass transfer process
- Energy balance

4. Wind pressure coefficients

The magnitude of the driving force can be estimated by the following formula:

$$\Delta p_a = \frac{1}{2} (C_{pi} - C_{pe}) \rho V_w^2$$

 Δp_a : is the pressure difference between inlet of the tower and the outlet from the space being cooled [Pa]

 \mathcal{C}_{pi} , \mathcal{C}_{pe} : the wind pressure coefficients at the inlet and outlet [-]

ρ: the air density [kg/m³]

 V_w : ambient wind speed [m/s]

In our case, the inlet is either the south or the north side of the ventilation tower depending on the wind direction. The outlet is the south of the north side of the solar chimney.

A model of the house has been tested in a wind tunnel in order to study the airflow behaviour around the house and determine the wind pressure coefficients at the different opening locations. Figure 2 shows the model in the wind tunnel with the different sensors used.

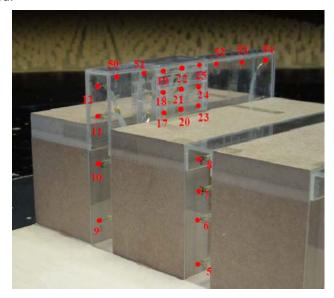


Figure 2: House model in the wind tunnel

Figure 3 shows the results of the wind tunnel measurements in function of the wind direction for the two possible inlets (south and north) of the ventilation tower. Figure 4 shows the measurement results for the two possible outlet on the solar chimney.

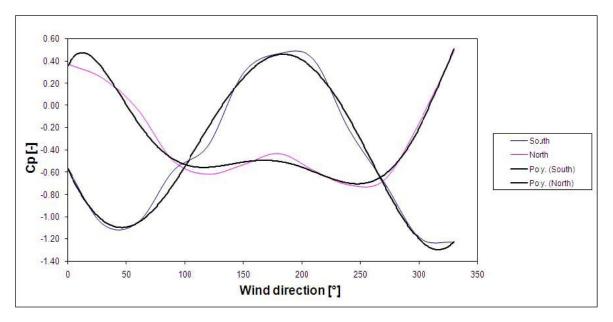


Figure 3: Wind pressure coefficients on the ventilation tower (measured and fitted)

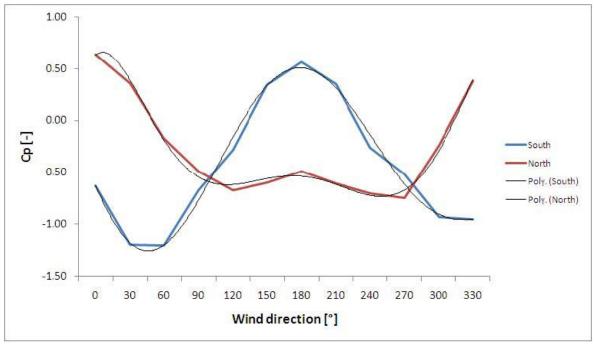


Figure 4: Wind pressure coefficients on solar chimney (measured and fitted)

Wind direction 0° (and 360°) corresponds to wind coming from the north and direction 180° correspond to wind coming from the south. Polynomial regressions have been performed for the four curves in order to use them in the model:

$$C_{p_south_tower} = A_1 w_d^6 + A_2 w_d^5 + A_3 w_d^4 + A_4 w_d^3 + A_5 w_d^2 + A_6 w_d + A_7$$
 (R²=0.98)

$$C_{p_north_tower} = B_1 w_d^6 + B_2 w_d^5 + B_3 w_d^4 + B_4 w_d^3 + B_5 w_d^2 + B_6 w_d + B_7$$
 (R²=0.98)

$$C_{p \ south \ sol} = C_1 w_d^6 + C_2 w_d^5 + C_3 w_d^4 + C_4 w_d^3 + C_5 w_d^2 + C_6 w_d + C_7$$
 (R²=0.99)

$$C_{p_north_sol} = D_1 w_d^6 + D_2 w_d^5 + D_3 w_d^4 + D_4 w_d^3 + D_5 w_d^2 + D_6 w_d + D_7$$
 (R²=0.99)

Table 2: Polynomial regression coefficients

A1	A2	А3	A4	A5	A6	A7
-3.81E-14	4.78E-11	-1.82E-8	1.81E-8	1.77E-4	-2.18E-2	-5.69
B1	B2	В3	B4	B5	В6	B7
-1.58E-13	1.71E-10	-6.9E-8	1.28E-5	-1.04E-3	2.05E-2	3.57E-1
C1	C2	С3	C4	C5	C6	C7
-1.07E-13	1.08E-10	-3.62E-8	3.87E-6	1.31E-4	-2.47E-2	-6.31E-1
D1	D2	D3	D4	D5	D6	D7
-1.48E-13	1.69E-10	-6.46E-8	1.18E-5	-8.99E-4	9.93E-3	6.28E-1

5. Air flow entering the building

An experimental setup of the ventilation tower (real size) has been built in order to study the cooling potential (Figure 4).







Figure 5: Experimental setup of the ventilation tower (textiles used as moist surfaces) [13].

The volume flow rate of the air entering the building is calculated using the following formula:

$$\dot{V}_{air} = \Delta p_a * \dot{V}_{sp}$$

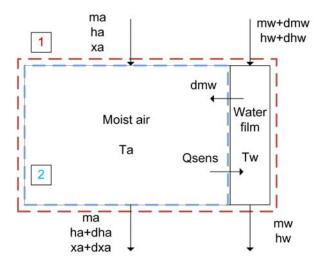
 \dot{V}_{sp} : is the specific volume flow rate related to the pressure drop caused by the building [m³/(h.Pa)].

This parameter is not constant but for simplicity it has been set to a constant value of 200 m³/(h.Pa). This value has been determined based on the measurement realised with the prototype. Also, in order to avoid to supply air with too big air change per hour (ACH), the maximum volume flow rate allowed has been set to 900 m³/h (which corresponds to ACH=6). This kind of control is realised in reality by control the lamellas aperture.

6. Physical modelling of downdraught evaporative cooling

The physical processes involving heat and mass transfer are modelled according to the mass and energy conservation laws (figure 5):

Figure 5: Schematic diagram of heat and mass transfer in the ventilation tower



The main assumptions made in the model are:

- Heat transfer occurs only through evaporation and convection processes.
 Radiation and conduction mechanisms are neglected.
- Heat losses or gains through the ventilation tower walls are neglected.
- The temperature of the moist surfaces (textiles) is considered constant

In the control volume 1 (red dashed-line), the mass balance gives:

$$d\dot{m}_w = \dot{m}_{air} dx \tag{1}$$

And the energy balance:

$$\dot{m}_w dh_w + h_w d\dot{m}_w = \dot{m}_a dh_a \tag{2}$$

The same analysis on the control volume 2 (blue dashed-line) gives:

$$\dot{m}_a dh_a = \dot{Q}_{lat} - \dot{Q}_{sens} \tag{3}$$

$$\dot{Q}_{lat} = d\dot{m}_w \Delta H_v = \beta \left(p_{sat}(T_w) - p_{pw}(T_a) \right) \Delta H_v dA \quad \eqno(4)$$

$$\dot{Q}_{sens} = \alpha (T_a - T_w) dA \tag{5}$$

Where:

 $d\dot{m}_w$: is the mass flow rate of evaporated water (kg/s)

 \dot{m}_{air} : is the mass flow rate of moist air in the ventilation tower (kg/s)

dx: differential humidity ratio of the moist air (kg/kg)

 \dot{m}_w : the mass flow rate of water flowing downward along the moist surfaces

 h_w , h_a : enthalpies of liquid water and moist air respectively (kJ/kg)

 \dot{Q}_{lat} : latent heat needed for water evaporation (W)

 \dot{Q}_{sens} : sensible heat needed for cooling down the air to water temperature (W)

 α : heat transfer coefficient (W/(m²K))

 β : mass transfer coefficient related to pressure difference (kg/(m²sPa))

 ΔH_v : evaporation enthalpy of water (kJ/kg)

 T_a, T_w : Temperature of moist air and water respectively (°C)

 $p_{sat}(T_w)$: water saturated pressure at water temperature (Pa)

 $p_{pw}(T_a)$: water vapour partial pressure at moist air temperature (Pa)

dA: differential area of moist surface in contact with the air (m²)

Combining equation (3) with (4) and (5) leads to:

$$\dot{m}_a dh_a = \beta \left(p_{sat}(T_w) - p_{pw}(T_a) \right) \Delta H_v dA - \alpha (T_a - T_w) dA$$
(6)

The heat and mass transfer coefficients have been determined experimentally for different high in the ventilation tower [2]. The mean values used for the model are shown in Table 1:

Table 1: Mean heat and mass transfer coefficients (experimental)

Heat transfer coefficient (W/(m²K))	7.0
Mass transfer coefficient (kg/(m²sPa))	2.24E-8

The temperature and the humidity ratio of the outlet air are calculated using the equation (6) and (1). The ventilation tower is segmented in small parts so the inlet air properties can be used to solve analytically the system of equations.

7. Model validation

The model has been compared with measurement data for different operating conditions and different volume flow rates. Figure 6 shows the comparison for a constant volume flow rate of 434 m³/h. Measured and simulated outlet air temperatures at the bottom of the tower are compared as well as the humidity ratio (in kg/kg).

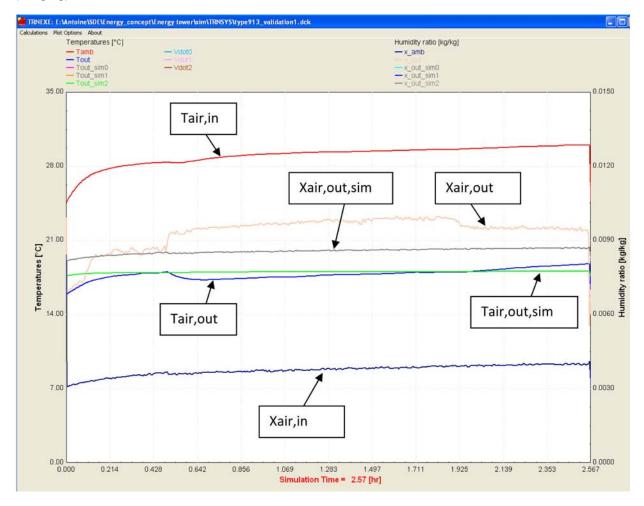


Figure 6: Comparison model / measurement in steady state operation.

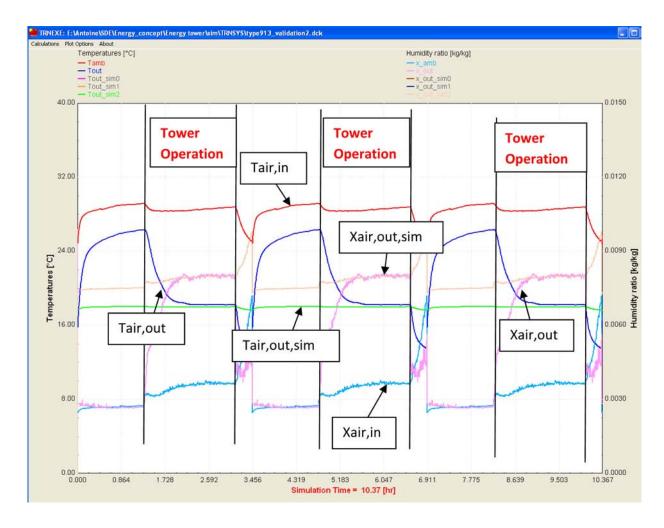


Figure 7 shows the comparison in transient operation of the tower.

The model can predict quite accurately the temperature and the humidity ratio of the incoming air. However, since it is not a dynamic model, the start-up phase of the ventilation tower, which consists of the humidification of the textiles is not modelled. In practise, this time needed for textile humidification (30 min approx.) has to be taken into account and the ventilation tower has to be opened after this period. For the simulation, it is assumed that the textiles are always humidified and the ventilation tower can be opened as soon as a cooling potential is possible.

8. Sensitivity analysis

A sensitivity analysis has been performed with the model in order to optimise the operation of the ventilation tower.

8.1. Ventilation tower segmentation

Figure 8 shows how the number of segments affects the results of the outlet temperature for a constant volume flow rate of 434 m³/h.

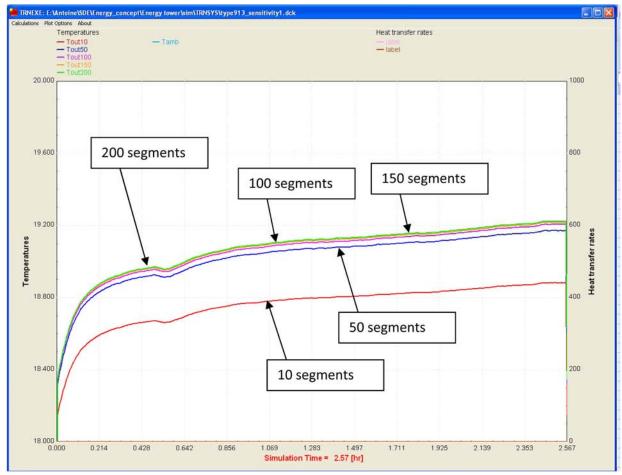


Figure 8: Influence of the number of segments on the outlet temperature (434 m³/h)

For the simulation a number of 175 segments has been chosen since increase this number does not improve much the results. This corresponds to a segmentation of the tower with 2 cm high elements.

8.2. Wind velocity and wind direction

The cooling potential of the ventilation tower has been simulated for different wind speed and different wind direction (figure 9). The supply temperature achieved with the ventilation is shown in figure 10. An ambient temperature of 30°C with 50% relative humidity and a constant water temperature of 22°C has been assumed for these calculations.

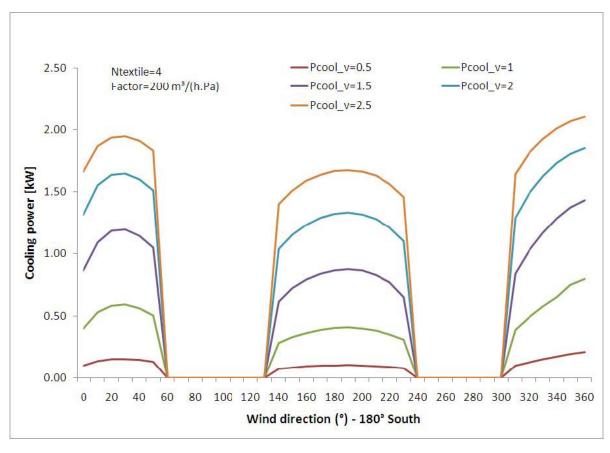


Figure 9: Cooling power according to wind velocity and wind direction

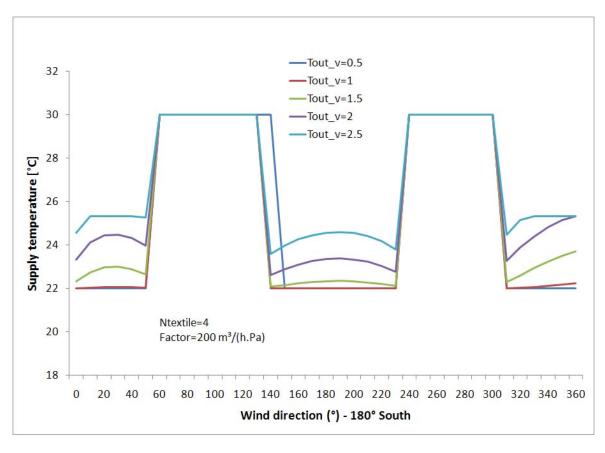


Figure 10: Outlet temperature of the supply air into the building

8.3. Number of textiles

The effect of the textiles number on the cooling power and on the outlet temperature is shown in figure 11 and 12. An ambient temperature of 30°C with 50% relative humidity and a constant water temperature of 22°C has been assumed for these calculations.

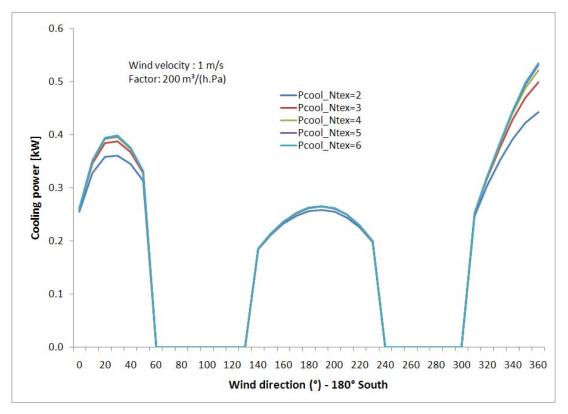


Figure 11: Effect of the textiles number on the cooling power

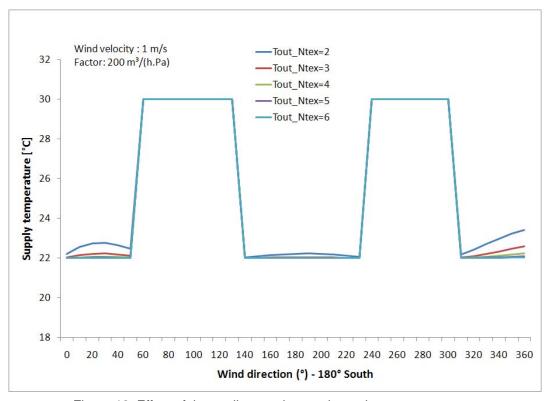


Figure 12: Effect of the textiles number on the outlet temperature

8.4. Cooling potential

In order to see the cooling potential of the ventilation tower for Madrid weather conditions, the 3 summer months have been simulated. The volume flow rate has been calculated using the specific volume flow rate of 200 m³/(h.Pa). When the volume flow rate calculated overcomes 900 m³/h, then the value is set constant to 900 m³/h. Also, a minimum value of 20 m³/h has been set in order to avoid numerical problems. An ambient temperature of 30°C with 50% relative humidity and a constant water temperature of 22°C has been assumed for these calculations.

Control of the ventilation tower:

The ventilation tower was used when all the following conditions are true:

- Tamb < Tamb,max
- Xamb < Xlim (0.011 kg/kg at T=25°C and RH=55%)
- Tamb > 22°C

$$T_{amb,max} = 23 + \frac{(x_{lim} - x_{amb})\Delta H_v}{c_{p,air}}$$

 ΔH_{ν} : Vaporization enthalpy of water (2442 kJ/kgK at 25°C)

 $c_{n,air}$: specific heat of moist air (1.027 kJ/kgK at T=25°C and RH=55%)

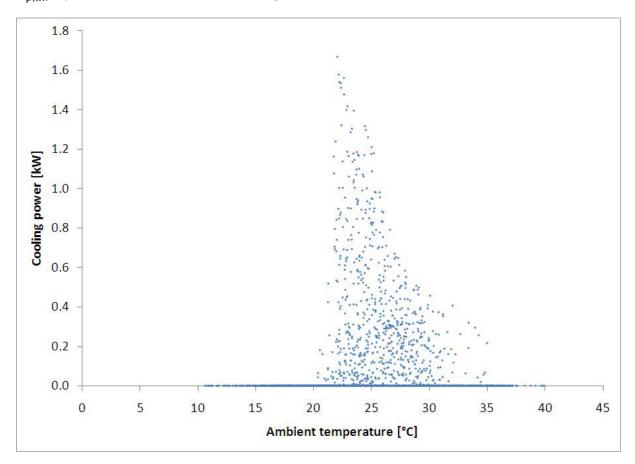


Figure 13: Cooling power depending on ambient temperature

Total effective cooling energy: 182 kWh (Daily cooling energy: 1.2 kWh/day)

Annex 14 Data sheed / Fridge

ICBP 3166 PremiumPlus BioFresh

http://www.liebherr.com/hg/products_hg.asp?menuID=101405!332121...

ICBP 3166 PremiumPlus BioFresh

Technische Daten Fassungsvermögen Funktionen Ausstattung Kühlteil Ausstattung Gefrierteil

Bedienungsanleitungen

Nischenmasse HBT 177,2 ÷ 178,8/56 ÷ 57/55

Energieeffizienzklasse A++
Energieverbrauch in 365 Tagen [kWh] 222
Kompressoren 1
Regelbare Kältekreisläufe 2
BioFresh ✓
NoFrost ■

Abtauverfahren Kühlteil automatisch Abtauverfahren Gefrierteil manuell Klimaklasse SN-T Lagerzeit bei Störung [h] 32 10 Gefriervermögen in 24 h [kg] Sternekennzeichen 4 Türmontage Festtür Türöffnungswinkel 115°



Dieses Modell ist erhältlich in: Deutschland

1 von 1 02.09.2009 09:41

Data sheed / Dishwasher

Datenblatt für elektrische Haushaltsgeschirrspüler

Nach Richtlinie 97/17/EG Anhang II

Miele						
Modellname/-kennzeichen			G 1562 SCVI			
Energieeffizienzklasse 1)						
A (niedriger Verbrauch) bis G (hohe	er Verbrauch)		Α			
Bezeichnung des Standardprogram			EnergieSpar			
Energieverbrauch 1) 2)		kWh	0,80			
Reinigungswirkungsklasse ¹)						
A (niedriger Verbrauch) bis G (hohe	er Verbrauch)		Α			
Frocknungswirkungsklasse 1)						
A (niedriger Verbrauch) bis G (hohe	er Verbrauch)		Α			
Standardbefüllung ¹)	, , , , , , , , , , , , , , , , , , , ,	Maßgedecke	9			
Vasserverbrauch 1)			9			
Dauer 1)		min	175			
Geschätzter Jahresverbrauch (220	Standardaragra		110			
•	Stanuaruprogra	kWh	176			
Energieverbrauch 1)		KVVII	1.980			
Wasserverbrauch 1)		10(4)				
Geräusch 3)		dB(A) re 1 pW	44			
Bauform						
Standgerät mit Arbeitsplatte			-			
Standgerät unterbaufähig			-			
Unterbaugerät (ohne Arbeitsplatte)			-			
ntegrierbar/Vollintegrierbar			-/•			
Abmessungen	1121-		00.5			'
Geräteabmessungen ⁴)	Höhe	cm	80,5			
	Breite	cm	44,8			
	Tiefe ⁵)	cm	57,0			
Sockelrücksprung vorne/hinten		cm/cm	Max 11,5 /			
Höhe für Unterbau		cm				
Höhe verstellbar		+/-cm	6,0			
Nettogewicht		kg	41,2			
Elektrischer Anschluss						
Spannung		V	230			
Anschlusswert		W	2.200			
Absicherung		A	10			
requenz		Hz	50			
Wasser-Versorgung	C 2/4"					
Oruckschlauch mit Verschraubung Kaltwasser	G 3/4"		•/•			
Narmwasser Narmwasseranschluss bis		°C	● / ● 60			
Name und Postanschrift des Anbiet	ore		Miele & Cie. KG, F	oetfach 33335 C	ütoreleh	
Name und Postanschnit des Anbiei Erklärungen:	.015		vilele a Cie. NG, P	ustracii, bbb25 G	utersion	

Ja, vorhanden

¹) Werte ermittelt nach Norm EN 50242 im Standardprüfprogramm bei Kaltwasserbefüllung.

²) Auf der Grundlage von Ergebnissen der Normprüfung für das vom Hersteller festgelegte Standardprogramm, bei Kaltwasserbefüllung. Der tatsächliche Energieverbrauch hängt von der Art der Nutzung des Gerätes ab.

³) Werte ermittelt nach Norm EN 60704. (im eingebauten Zustand)

⁴) Bei Unterbau- und Einbaugeräten Nischenmaße.

⁵) Tiefe einschließlich Wandabstand.

Data sheed / Oven

Datenblatt für Einbauherde / Einbaubacköfen

Nach Richtlinie 2002/40/EG Anhang II

Miele							
Modellname/-kennzeichen			H 5681 BL				
Energieeffizienzklasse 1)							
A (niedriger Verbrauch) bis G (hoher	Verbrauch)		Α				
Energieverbrauch 1) 2)	,						
Energieverbrauch konventionelle Be	heizuna	kWh	1,02				
Energieverbrauch Umluft/Heißluft		kWh	0.95				
Energieverbrauch für pyrolytische		kWh	0,00				
Selbstreinigung							
Nettovolumen 1)		- 1	66				
Тур							
Klein			-				
Mittel			-				
Groß			•				
Garzeiten 1)							
Garzeit konventionelle Beheizung		min	54,0		'		·
Garzeit Umluft/Heißluft		min	50,0				
Geräusch ²)		dB(A) re 1 pW					
Energieverbrauch Stand-By-Modus		Wh					
Größe des größten Backblechs 1)		cm ²	1.360				
Bauform			Einbau-Backofen				
Abmessungen							
Geräteabmessungen	Höhe	cm	58,0		'	'	
	Breite	cm	54,7				
	Tiefe 8)	cm	54,8				
Nischenmaße für Einbau	Höhe	cm	59,3-59,5				
	Breite	cm	56,0-56,8				
	Tiefe 8)	cm	55,5				
Innenabmessungen	Höhe	cm	38,6				
	Breite	cm	41,6				
	Tiefe 8)	cm	41,3				
Gerätetiefe bei geöffneter Tür		cm	115,0				
Nettogewicht 3)		kg	41,9				
Elektrischer Anschluss							
Spannung		V	230				
Anschlusswert		W	3.700				
Absicherung		Α	16				
Frequenz		Hz	50				
Name und Postanschrift des Anbiete	rs		Miele & Cie. KG, Po	stfach, 33325 G	ütersloh		
Erklärungen:							

[•] Ja, vorhanden

¹⁾ Werte ermittelt nach Norm EN 50304.

 $^{^{^{2}}\!\!)}$ 1) Werte ermittelt nach Norm EN 60704.

³) ²) 1) Beachten Sie bei Geräten für einen Schrankeinbau, dass der Schrank bzw. die Wand tragfähig genug ist.

Data sheed / Cooker

Geräteinformationen für Kochfelder / Kochmulden

Modellname/-kennzeichen			KM 5944 FL.BDG				
iodelinario, kerinzelerieri			TAM COTTT L.BBC	,			
auform							
rt des Kochfeldes	Kombination		-				
	Autark		•				
rägermaterial	Edelstahl		_				
	Glaskeramik		•				
Beheizung	HiLight		-				
	Induktion		•				
	Gas		-				
edienung	Sensorfelder +/-		-				
	Schalterknebel		-				
bmessungen							
Geräteabmessungen	Breite	cm	59,2				
	Tiefe	cm	49,2				
usschnittmaße für Einbau	Breite	cm	59,6				
	Tiefe	cm	49,6				
inbauhöhe		cm	5,1 5.1				
inbauhöhe mit Anschlusskasten ochzonen		cm	5,1				
ochzonen Ourchmesser bzw. Brennerart	1. Kochzone	mm	140-200				
dicililessei bzw. Breillerait	2. Kochzone	mm	100-160				
	3. Kochzone	mm	160-230				
	4. Kochzone	mm	100-230				
	5. Kochzone	mm	nicht vorhanden				
	6. Kochzone	mm	nicht vorhanden				
eistung der Kochzonen	1. Kochzone	W	1.850				
clotaing dor reconzencin	mit Booster I/II	w	2.900 / -				
	2. Kochzone	W	1.400				
	mit Booster I/II	W	1.800 / –				
	3. Kochzone	W	2.300			'	
	mit Booster I/II	W	3.000 / 3.700				
	4. Kochzone	W	1.400				
	mit Booster I/II	W	1.800 / –				
	5. Kochzone	W	nicht vorhanden				
	mit Booster I/II	W	-/-				
	6. Kochzone	W	nicht vorhanden				
	mit Booster I/II	W	-/-				
/armhaltezone			_				
lettogewicht		kg	10,8				
lektrischer Anschluss							
pannung		V	220-240				
nschlusswert		W	7.400				
bsicherung		Α	16				
änge des Anschlusskabels ²)		cm	144				
unkentstört			•				
letzrückwirkungsfrei			•				
lame und Postanschrift des Anbiete	rs		Miele & Cie. KG, Po	ostfach, 33325 Gü	itersloh		

[•] Ja, vorhanden

¹⁾ Toleranzbereich +/- 5 cm.

²) Die Länge setzt sich wie folgt zusammen. Die Länge des Kabels zwischen Kochfeld und Anschlusskasten beträgt 150 cm, die Länge ab dem Anschlusskasten beträgt 140 cm.

Data sheed / Cooker Hood

Geräteinformationen für Dunstabzugshauben

Modellname/-kennzeichen			DA420 V				
Modelliame, Remizelonen			D/(120 V				
Bauform							
Abluft/Umluft			• / -				
Jmrüstbar für Umluftbetrieb			•				
Wandbefestigung hinten			-				
Deckenbefestigung			•				
Schrankbefestigung oben/unten/se	itlich		-1-1-				
Abmessungen							
Geräteabmessungen	Höhe	cm	-				
	Breite	cm	90,0				
0 "1 1 "1 "1 "1 " 1 1 1 1 1 1 1 1 1 1 1	Tiefe	cm	60,0				
Gerätehöhe netto incl. Kamin	Abluft	cm	70,0-100,0				
Ni	Umluft	cm	75,0-100,0				
Nischenmaße für Einbau	Höhe	cm					
	Breite Tiefe	cm					
Tiefe	riele	cm					
Vindest		cm	55,0				
Mindestabstand über Kochstelle (G	:ae)	cm	65,0				
Ausstattung	100)	CIII	05,0				
Abluftanschluss oben/hinten/seitlich	2 1)		•/-/-				
Durchmesser des Abluftstutzens	1)	mm	150				
Rückstauklappe am Gerä		111111	•/-				
Gebläseeinstellung stufenlos/in Stu	fen (Anzahl)		-/3				
Intensivstufe 2)	iicii (Alizalii)		- <i>γ</i> σ				
,							
Fördervolumen ³)		2	480				
Abluft von – bis		m³/h					
Umluft von – bis		m³/h	400				
ntensivstufe Abluft/Umluft		m³/h	700 / 500	/	1	/	/
Nettogewicht ⁴)		kg	42,0				
Elektrischer Anschluss							
Spannung		V	230				
Anschlusswert		W	455				
Absicherung		Α	10				
änge der elektrischen Zuleitung		cm					
Schutzkontaktstecker/Festanschlus	SS		/ ●				
Funkentstört			•				
Netzrückwirkungsfrei			•				
Name und Postanschrift des Anbie	ters	N	Miele & Cie. KG, Po	ostfach, 33325 Güter	sloh		

- Ja, vorhanden
- 1) Maßgenaue La
- ²) Kurzfristig höhere Abluftleistung, verbunden mit höherer Geräuschentwicklung.
- ³) Abhängig vom externen Gebläse.
- ⁴) Beachten Sie, dass der Schrank bzw. die Wand oder Decke für das Gerät tragfähig genug sind (gegebenenfalls mit Vorsatztür).

Data sheed / Coffee Machine

Geräteinformationen für Einbau-Kaffeevollautomaten

/lodellname/-kennzeichen			CVA 3660			
Modelinarie/ Remizerenen			01/10000			
Bauform						
Standgerät			_			
Interbaugerät			-			
Einbaugerät			•			
Γüranschlag links/rechts			• / -			
Abmessungen						
Geräteabmessungen	Höhe	cm	37,2			
	Breite	cm	59,5			
	Tiefe	cm	31,3			
Nischenmaße für Einbau	Höhe	cm				
	Breite	cm				
	Tiefe	cm				
Gerätetiefe bei geöffneter Tür		cm				
Ausstattung						
Festwasseranschluss/Frischwasserbe	ehälter		- / ●			
Frischwasserbehälter		I	1,5			
Nespresso-System/Bohnenmahlwerk			• / -			
Kapselmagazin		Stk	20			
Bohnenbehälter		g	-			
Nettogewicht		kg	18,8			
Elektrischer Anschluss						
Spannung		V	220-240			
Anschlusswert		W	2.300			
Absicherung		Α	10			
unkentstört			•			
Netzrückwirkungsfrei			•			
Name und Postanschrift des Anbieter	S	l N	liele & Cie. KG, P	ostfach, 33325 G	ütersloh	

• Ja, vorhanden

Data sheed / Washing Machine

Datenblatt für elektrische Haushalts-Waschmaschinen

Nach Richtlinie 95/12/EG Anhang II

Miele						
Modellname/-kennzeichen			W 5841 WPS ECO			
			W 3041 WI 3 LCO			
Energieeffizienzklasse 1)	l l- \		^			
A (niedriger Verbrauch) bis G (hoher Ve	erbraucn)	1300	Α	1		
Energieverbrauch 1) 2)		kWh	1,05			
Waschwirkungsklasse 1)						
A (niedriger Verbrauch) bis G (hoher Ve	erbrauch)		Α			
Schleuderwirkungsklasse 1)						
A (niedriger Verbrauch) bis G (hoher Ve	erbrauch)	'	Α			
Verbleibende Restfeuchte 1)		%	44			
Maximale Schleuderdrehzahl 1)		U/min	1.600			
Füllmenge (Baumwolle) 1)		kg	7,0			
Wasserverbrauch 1)		J	55			
,		poin				
Dauer 1)		min				
Geschätzter Jahresverbrauch eines 4-P	Personen-H					
Energieverbrauch 1)		kWh	210			
Wasserverbrauch 1)		1	11.000			
Geräusch ⁵)						
Waschen		dB(A) re 1 pW				
Schleudern		dB(A) re 1 pW				
Bauform	_	(·) · · · · · · ·				
Kennzeichen Toplader/Frontlader		'	-/•			
Standgerät mit Arbeitsplatte			•			
Standgerät unterbaufähig			•			
Unterbaugerät (ohne Arbeitsplatte)			-			
Fahrbar			_			
Türanschlag rechts/links/sonst			•/-/-			
Abmessungen						
Geräteabmessungen ⁶)	Höhe	cm	85,0	1		
	Breite	cm	59.5			
	Tiefe 7)	cm	61,5			
Sockelrücksprung vorne/hinten	Ticic)	cm/cm	0,0/0,0			
Höhe für Unterbau		cm	82,0			
Höhe bei geöffnetem Deckel (Toplader)		cm	02,0			
Tiefe bei geöffneter Tür (Frontlader))		cm	107,4			
Höhe verstellbar		+/-cm	+0,8 / -0,0			
Nettogewicht		kg	96,0			
Elektrischer Anschluss		9	,-			
Spannung		V	220-240			
Anschlusswert		W	2.100-2.400			
Absicherung		A	10			
Frequenz		Hz	50			
Wasser-Versorgung						
Druckschlauch mit Verschraubung G 3/4	4"		-			
Kaltwasser			•/-			
Name und Postanschrift des Anbieters			Miele & Cie. KG, P	ostfach, 33325 C	Gütersloh	
Erklärungen:						

- Ja, vorhanden
- ¹) Werte ermittelt nach Norm EN 60456 im Standardp
- ²) Pro Waschprogramm auf der Grundlage von Erkenntnissen der Normprüfung für das Programm "Baumwolle, 60 °C". Der tatsächliche Energieverbrauch hängt von den Betriebsbedingungen des Gerätes ab.
- ³) Die Schleuderwirkung ist für Sie von großer Bedeutung, wenn Sie zum Trocknen Ihrer Wäsche normalerweise einen Wäschetrockner benutzen. Wird Wäsche, die in einer Waschmaschine der Schleuderwirkungsgradklasse A geschleudert wurde, in einem Wäschetrockner getrocknet, so wird dieser weniger als halb soviel Energie verbrauchen und damit auch weniger als halb so hohe Betriebskosten verursachen, als wenn die Wäsche in einer Waschmaschine der Schleuderwirkungsklasse G geschleudert wurde. Die zusätzlichen Kosten für das Trocknen von Wäsche, die in einer Waschmaschine der Schleuderwirkungsklasse G geschleudert wurde, liegen in der Regel um ein Vielfaches über den Stromkosten für das Waschen.
- ⁴) 200 Standardprogrammzyklen im Standardprogramm "Baumwolle, 60 °C".
- 5) Werte ermittelt nach Norm EN 60704.
- ⁶) Bei Unterbaugeräten Nischenmaße.
- 7) Tiefe einschließlich Wandabstand.

Data sheed / Dryer

Datenblatt für elektrische Haushalts-Wäschetrockner

Nach Richtlinie 95/13/EG Anhang II

Miele						
Modellname/-kennzeichen			T 8627 WP			
Energieeffizienzklasse 1)						
A (niedriger Verbrauch) bis G (hoher	Verbrauch)		A			
Energieverbrauch 1) 2)						
Baumwolle schranktrocken	60% Restfeuchte	kWh	1.80			
Baumwolle schranktrocken	50% Restfeuchte	kWh	1,55			
Baumwolle bügelfeucht	60% Restfeuchte	kWh	1,35			
Baumwolle bügelfeucht	50% Restfeuchte	kWh	1,10			
Pflegeleicht schranktrocken	40% Restfeuchte	kWh	0.60			
Füllmenge ¹)			5,55			
Baumwolle schranktrocken		kg	6.0			
Baumwolle bügelfeucht		kg	6,0			
Pflegeleicht schranktrocken		kg	3.0			
		Ng	3,0			
Trockenzeit ¹) Baumwolle schranktrocken	000/ D#	!	104			
	60% Restfeuchte	min				
Baumwolle schranktrocken	50% Restfeuchte	min	90			
Baumwolle bügelfeucht	60% Restfeuchte	min	81			
Baumwolle bügelfeucht	50% Restfeuchte	min	67			
Pflegeleicht schranktrocken	40% Restfeuchte	min	40		1	
Geschätzter Jahresverbrauch eines 4	1-Personen-Haushal					
Energieverbrauch 1)		kWh	138			
Gerätetyp 1)						
Ablufttrockner			-			
Kondensationstrockner			•			
Geräusch ⁴)	dB(A)	re 1 pW				
Bauform						
Standgerät mit Arbeitsplatte			•			
Standgerät unterbaufähig			•			
Unterbaugerät (ohne Arbeitsplatte)			-			
Standgerät für Wasch-Trocken-Säule)		•			
Türanschlag rechts/links			/ ●			
Abmessungen						
Geräteabmessungen	Höhe	cm	85,0			
	Breite	cm	59,5			
	Tiefe 5)	cm	59,6			
Sockelrücksprung vorne/hinten		cm/cm	0,0/0,0			
Höhe für Unterbau		cm	82,0			
Tiefe bei geöffneter Tür (Frontlader)		cm	106,0			
Höhe verstellbar		+/-cm	+1,45 / -0,7			
		kg	69,0			
Nettogewicht						
Nettogewicht Elektrischer Anschluss		9				
		V	220-240			
Elektrischer Anschluss			220-240 1.080-1.140			
Elektrischer Anschluss Spannung		V				
Elektrischer Anschluss Spannung Anschlusswert		V	1.080-1.140			
Elektrischer Anschluss Spannung Anschlusswert Absicherung	rs	V W A	1.080-1.140 10 50	Postfach, 33325 Güte	ersloh	

- Ja, vorhanden
- ¹) Werte ermittelt nach Norm EN 61121:2005.
- ²) Pro Trockenprogramm auf der Grundlage von Ergebnissen der Normprüfung für das Programm "Baumwolle schranktrocken". Der tatsächliche Energieverbrauch hängt von der Art der Nutzung des Gerätes ab.
- ³) Geschätzter Jahresverbrauch eines Vier-Personen-Haushalts, der zum Wäschetrocknen normalerweise den Trockner benutzt, bei einer Wäschemenge von 150 kg im Programm "Baumwolle schranktrocken", 280 kg im Programm "Baumwolle bügelfeucht" und 150 kg im Programm "Pflegeleicht schranktrocken".
- ⁴) Werte ermittelt nach Norm EN 60704.
- ⁵) Tiefe einschließlich Wandabstand. Bei Abluftanschluss hinten kann ein größerer Wandabstand erforderloch sein.

Data sheed / TV

Connect 32 Media Full-HD+ 100 Welcome to the age of networked entertainment.

- Loewe LCD-TV with 80 cm screen diagonal and high definition Full-HD-100Hz-technology.
- Receive Internet radio, with over 8.000 stations worldwide.
- Direct access to all multimedia content on the home network. PhotoViewer and MusicBox via USB port.





Technical information

- 24p motion picture display Automatic Movie Detection (AMD) Brightness cd/m²: 500
- Contrast adjustment depending on ambient light (OCP)
 Contrast ratio dynamic: 10.000 : 1
 Contrast ratio static: 1.300 : 1

- Contrast sensor

 Downscaling/upscaling

 Format options: 16:9, 4:3, Panorama, Cinema, Zoom
- Full-HD LCD technology
- Fully digitised signal processing HD ready
- Horizontal and vertical viewing angle: 178°/178°
- Image resolution: 1.920 x 1.080 Image+ Active
- PIP (AV)
- Picture format: 16 : 9 Picture frequency 100 Hz
- Response time: 6 ms
- Screen diagonal in cm: 80 Split Screen TV/Teletext [1]
- Vertical image correction

- Audio Out, controlled
- Audio output power in Watts: 2 x 20
 Closed 2-way speakers
- Number of speakers: 4
- PRX sound system Subwoofer Out
- Tone effects: Stereo, Panorama, 3D Surround

- Automatic station identificationEPG [2]
- Radio function: with DVB-C/DVB-S [3]

Operation:

68417W72

- Automatic Channel Programming (ACP)
 Automatic Signal Switch (ASS) Automatic Signal Switch (ASS)
 Automatic Volume Control (AVC) [4]
- Channel identification

- Channel-specific volume adaptation

- Content-sensitive help
 Current TV Programme [2]
 Digital Link, Digital Link Plus, Digital Link HD
- Electronic Instruction Manual Electronic Program Guide (EPG): (analogue/digital) [2]
- Favourites lists: 6
- L-Link
- Media network for accessing multimedia content in the
- network MusicBox
- NexTView-Link [2]
- On Screen Display (OSD) in foreign languages: D-E-I-F-NL-GB-P-PL-CZ-DK-S-HU-FIN-SLN-TR-SK-RS-GR
- Personalised teletext with direct access to bookmarked
- PhotoViewer
- Power switch
- Programme positions (incl. AV and radio): 4,000
- Remote control: Assist 2

 Teletext: TOP-/FLOF-Videotext/Level 2.5
- Teletext page memory: 2.000
 Video Timer
 via control unit: 5 Buttons

- Reception:

 Audio standard: Two-Channel FM/AM, Nicam
- Colour standard: PAL, SECAM, NTSC, NTSC-V, PAL-V (60Hz)
- Decoding System Audio: MPEG Decoding System Video: MPEG 2/MPEG 4
- Television standard: B/G, D/K, L. L. M. N. Tuner: DVB-T, DVB-C; analogue: cable, antenna [5]

Connectors:

- Antenna (analogue/digital): 1x
 Audio In (Cinch)
- Audio Out, controlled (Cinch)
- Common Interface (CI+): 1
- Component (YUV) input
- Copy function Euro-AV <>> Euro-AV
 Copy function Front-AV --> Euro-AV
- Digital-Audio In (Cinch)
- Digital-Audio Out (Cinch)Ethernet port RJ45
- Euro-AV/Scart total: 2

- Euro-AV/Scart, of which the following number are Component Video Input-ready: 1
- Euro-AV/Scart, of which the following number are RGB-ready: 1 Euro-AV/Scart, of which the following number are S-VHS/Hi8-ready: 2
- HDMI including HDCP: 2x
- Headphones: 3,5 mm S-Video In
- Side AV Video-/S-VHS. Hi-8 readv
- USB: 2
- Video In (cinch)

Optional function upgrades: DVB-S 2 (Single-Tuner) [7] Dolby Digital / dts [6]

- Motor control / RS 232 C / IR-Link

Accessories:

- Sequipment board for Floor Stand Trapeze
 Set-up solutions: Floor Stand Trapeze (can be adjusted to three heights); manual rotation: Floor Stand 4, rotary motor function: Floor Stand 4 MU
 Standard feature: Table Stand (manual rotation incl.)

- VESA adapter: VESA C 32Wall Mount: WM 56, Wall Mount Flex 32 L [8]

Miscellaneous:

- Mains voltage: 220 240 V / 50/60 Hz
- Power consumption in standby mode in watts: 0,9
- Power consumption in watts when the set is turned off: 0
- Rated wattage to EN 62087 (2009): 130

 VDE-safety standard (inspection seal)
- Weight (approx.) in kg: 18,8

- versignit (appinox.) in Kg: 18,8

 Technical specifications, delivery conditions, and other information are subject to change without notice.

 [1] Not with MPEG4.

 [2] Works only with channels broadcasting service information/Next/View data.

 [3] DVB-S only with integrated DVB-S 2 (Tuner).

 [4] Function depends on signal format emitted by station.

 [5] Freeview variants available for UK.

 [6] Dolbly is a registered trademark of the Dolby Laboratories Licensing Corporation.

 [7] Not available with Freeview interactivity in UK.

 [8] Only in conjunction with a corresponding adapter, to be ordered separately.

				83.1	83.1	
Article number	EAN	Colour options	83.1	85.9		\$4.0
68417T72	4011880117364	Chrome Silver	a 59.5	16.0	<u> </u>	
68417U72	4011880117388	☐ High Gloss White	Table Stand TV depth: 12.0	Floor Stand Trapeze TV depth: 12.0	Floor Stand 4/Floor Stand 4 MU TV depth: 12.0	Wall solution TV depth: 12.0
		_	Total depth: 21.9	Total depth: 40.5	ø base plate: 50.0	Total depth: 13.1



4011880117371 High Gloss Black

Data sheed / DVD

WD TV Live Media Player LAN/HDMI/Composite/USB2.0 - Druckansicht

Page 1 of 1

WD TV Live Media Player LAN/HDMI/Composite/USB2.0

K&M Artikelnummer: 25023

Geben Sie durch den WD TV Live Mediaplayer HD-Medien über Ihren Fernseher wieder.

HD-Videos, Fotos und Musik – dies alles ist auf Ihrem Computer, Ihren USB-Laufwerken und im Internet gespeichert.

Durch dem netzfähigen WD TV Live-HD-Mediaplayer können Sie eine ganze Welt von Full-HD-1080p-Medien über Ihren Fernseher wiedergeben.





Durchschnittliche Kundenbewertung: (basierend auf <u>2 Bewertungen</u>)
Schreiben Sie eine Bewertung für dieses Produkt und teilen Sie Ihre Meinung anderen Kunden mit!

Verfügbarkeit/Filialbestände

Versandzentrale: vorrätig Stand: 27.04.2010 08:13 Uhr

In 29 Filialen vorrätig! Bestände anzeigen K&M Preis

Online-Preis

Filial-Preis

Monatsrate

109, 99 € 109, 99 € 9, 66 € in den Warenkorb

Inkl. MwSt. + ab 6,99 € bei Versand

Die Monatsrate entspricht einer Finanzierung mit effektivem Jahreszins ab 9,90%, 12

Monaten Laufzeit, Bonität vorausgesetzt. Finanzierungen sind ab 100 € nur in unseren

Filialen möglich. Der Zinssatz gilt für Finanzierungen bis 1.000 €.

Beschreibung Details Bewertungen Vergleich Hersteller

Seite drucken

Produktbeschreibung	WD TV Live WDBAAP0000NBK - Digitaler Multimedia-Receive
K&M Artikelnummer	25023
Herstellerartikelnummer	WDBAAP0000NBK-EESN
K&M Produktgruppe	Festplatten / MediaPlayer
Produkttyp	Digitaler Multimedia-Receiver
Abmessungen (Breite x Tiefe x H	löhe) 12.6 cm x 10 cm x 4 cm
Gewicht	303 g
Lokalisierung	Mittlerer Osten, Afrika, Europa
Digital Player (Recorder)	Digital Player
Audio	Stereo
Fernbedienung	Fernbedienung
Stromversorgung	Wechselstrom 120/230 V (50/60 Hz)

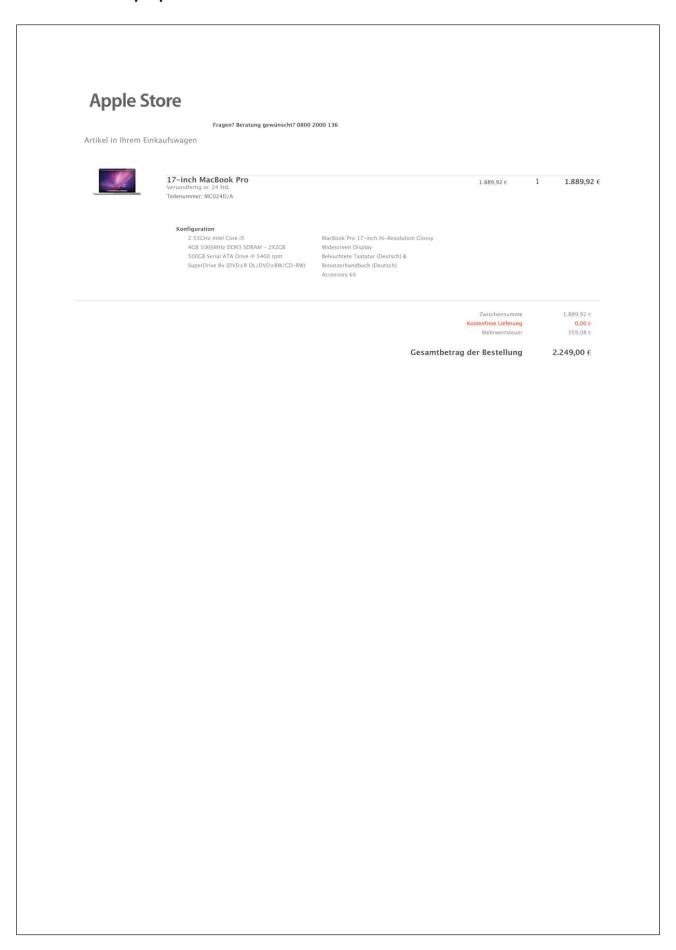
Bitte beachten Sie, dass Abbildungen ähnlich sein können und wir für die Produktinformationen keine Haftung übernehmen. Irrtum und Änderungen vorbehalten, Abbildungen sind ähnlich und können von der Originalware abweichen. Falls in der Bezeichnung des Produktes "Bulk" enthalten ist, kann das mitgelieferte Zubehör variieren. Alle unsere Endkundenpreise verstehen sich inkl. der gesetzlichen Mehrwertsteuer zuzüglich Versandkosten bei Versandbestellungen. Logos und Markenzeichen sind Eigentum der jeweiligen Hersteller.

- » Drucken (STRG + P)
- « Zurück

http://www.kmelektronik.de/shop/print.php

27.04.2010

Data sheed / Laptop



Data sheed / HIFI

WD TV Live Media Player LAN/HDMI/Composite/USB2.0 - Druckansicht

Page 1 of 1

WD TV Live Media Player LAN/HDMI/Composite/USB2.0

K&M Artikelnummer: 25023

Geben Sie durch den WD TV Live Mediaplayer HD-Medien über Ihren Fernseher wieder.

HD-Videos, Fotos und Musik – dies alles ist auf Ihrem Ihren USB-Laufwerken und im Internet Computer. gespeichert.

Durch dem netzfähigen WD TV Live-HD-Mediaplayer können Sie eine ganze Welt von Full-HD-1080p-Medien über Ihren Fernseher wiedergeben.







Schreiben Sie eine Bewertung für dieses Produkt und teilen Sie Ihre Meinung anderen Kunden mit!

Verfügbarkeit/Filialbestände

Versandzentrale: vorrätig Stand: 27.04.2010 08:13 Uhr

In 29 Filialen vorrätig! Bestände anzeigen

K&M Preis Online-Preis Filial-Preis Monatsrate
109, 99 € 109, 99 € 9, 66 € 9,66 € in den Warenkorb Inkl. MwSt. + ab 6,99 € bei Versand Die Monatsrate entspricht einer Finanzierung mit effektivem Jahreszins ab 9,90%, 12 Monaten Laufzeit, Bonität vorausgesetzt. Finanzierungen sind ab 100 € nur in unseren Filialen möglich. Der Zinssatz gilt für Finanzierungen bis 1.000 €.

Beschreibung Details Bewertungen Vergleich Hersteller

Seite drucken

Produktbeschreibung	WD TV Live WDBAAP0000NBK - Digitaler Multimedia-Receiver
K&M Artikelnummer	25023
Herstellerartikelnummer	WDBAAP0000NBK-EESN
K&M Produktgruppe	Festplatten / MediaPlayer
Produkttyp	Digitaler Multimedia-Receiver
Abmessungen (Breite x Tiefe x Höh	ne) 12.6 cm x 10 cm x 4 cm
Gewicht	303 g
Lokalisierung	Mittlerer Osten, Afrika, Europa
Digital Player (Recorder)	Digital Player
Audio	Stereo
Fernbedienung	Fernbedienung
Stromversorgung	Wechselstrom 120/230 V (50/60 Hz)

Bitte beachten Sie, dass Abbildungen ähnlich sein können und wir für die Produktinformationen keine Haftung übernehmen. Irrtum und Änderungen vorbehalten, Abbildungen sind ähnlich und können von der Originalware abweichen. Falls in der Bezeichnung des Produktes "Bulk" enthalten ist, kann das mitgellieferte Zubehör variieren. Alle unsere Endkundenpreise verstehen sich inkl. der gesetzlichen Mehrwertsteuer zuzüglich Versandkosten bei Versandbestellungen. Logos und Markenzeichen sind Eigentum der jeweiligen Hersteller.

- » Drucken (STRG + P)
- « Zurück

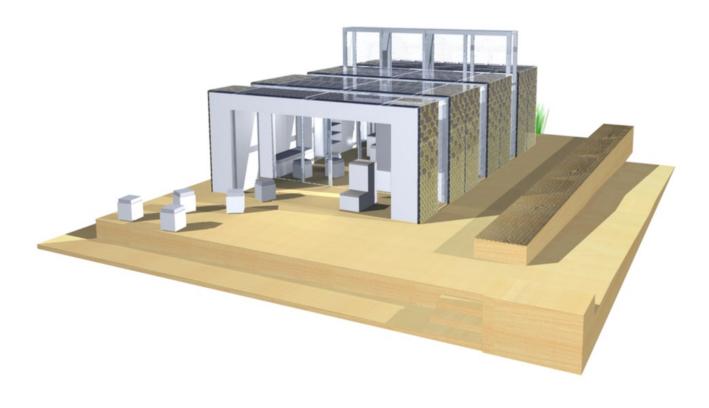
http://www.kmelektronik.de/shop/print.php

27.04.2010

home+			

12.1 Architecture Design Narrative - Contents

- 1. General
- 2. Exterior
- 3. Interior



Architecture Design Narrative

1. GENERAL

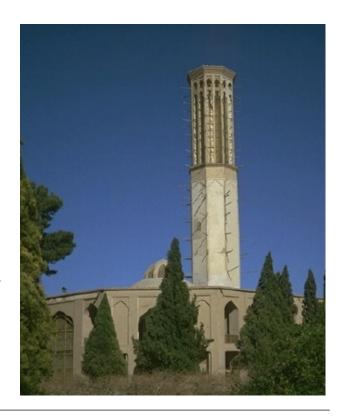
home+ is a small residential building prototype of 74 m², designed for 1 or 2 people. The building should be appropriate all around the globe and be developed to be accordingly mobile, as well as to be powered only with solar energy.

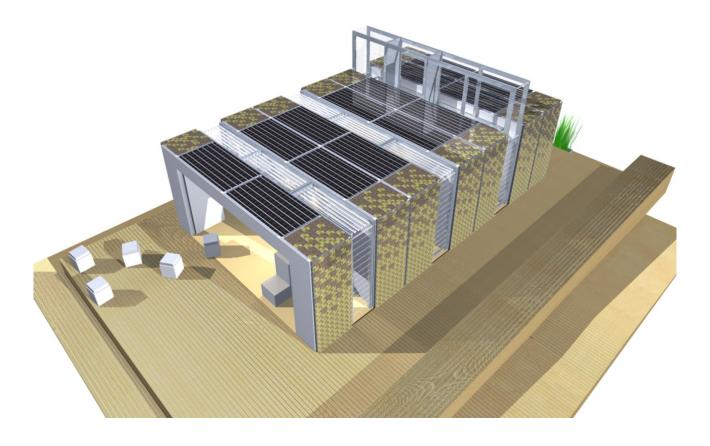
The clearness of display as well as the multifunctional use of elements by integration are the main topics to emphasize the composition of design and technology.

There are three main characteristics of home+:
The rhythm of modules and gaps forming a well structured east and west facade, the open space of the interior in north-south direction and the central ventilation tower, the heart of home+, raising above the building's roof.

Basically the idea originated from developing the building according to traditional construction principles of similar climate regions. The prototype primarily works with the highest possible thermal mass in the smallest possible building envelope to offer little absorption surface to the sun, to avoid heating up the building volume. Secondly, the highly insulated

building should be able to cool itself as much as possible. The so-called "ventilation tower" improves ventilation and cooling by catching the wind, cooling down the air through humidification and by transporting it into the interior. This keeps the interior temperature low and avoids an active cooling system in most cases. Therefore, a purely passive operation of the building is reached for most of the year.





This tower also plays a primary role in the interior design and shows the inhabitant the active use of regenerative energy. To visitors of home+ we compare the ventilation tower with an open in-house feature fireplace which is a kind of symbol for comfortable heat. In a similar way, our ventilation tower visually explains and typifies comfortable cooling by the look of white wet fabric softly flagging in the wind within the glazed ventilation tower.

Another focus is to keep the amount of so-called "grey energy" as low as possible. Therefore the prototype is going to be built of most possibly ecological building materials, for example the primary construction is made of wood.

Because of the required mobility, the building is made of different modules, including the living areas, secondary rooms as well as the climatically activated building joints.

This modularity and expandability offers a large flexibility for different configurations and therefore different kind of user schemes.

2. EXTERIOR

The design is based on architectural and energetic considerations. The starting point is a compact, highly insulated volume, with a small surface to volume ratio. This volume consists of four layers (1).:

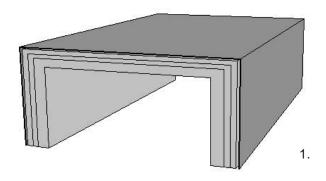
The inner layer of the building, the main structure, is made of solid timber. As mentioned before, this material is ideal for two reasons, it provides a light weight structures and it is a very ecological material due to its CO2-saving potential.

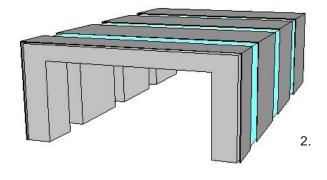
The second layer is a highly efficient evacuated insulation (vacuum insulation). It provides a very low U-Value with a slim wall. This reduces heat losses in winter and thermal gains in summer and creates a high level of comfort.

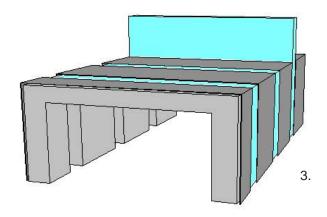
The third layer is waterproofing to protect the structure. The chosen waterproofing membrane provides a maximum of solar reflectance to again reduce solar thermal loads in summer.

The fourth layer consist of glass/glass photovoltaic modules. This power envelope supplies the building with electrical energy. It is fixed with a small gap to the other layers. The active solar photovoltaic layer appears delicate, it hovers above the main structure.

This volume, consisting of the four mentioned layers contains and frames the interior and is segmented into four building modules (2). Each building module accommodates another use. The first module contains a loggia, the second a living room, the third a dining room and the last one the bedroom. Secondary rooms are included in allocation to the main areas. For example contains the dining-room-module a kitchen or the bedroom-module a bathroom.







Exterior



The modules are positioned with interspaces between them. These gaps are part of the design concept to point up the modularity. But the gaps are much more than only design. They are used for lighting, ventilation, pre-heating in winter and passive cooling in summer. They also allow for a visual connection to the outside and offer very different view axes withinthe building and to the outside by nicely framing the exterior.

One of these gaps is higher than the others, containing the "ventilation tower" (3). Based on traditional principles of climate control, the ventilation tower is a key element for the energy concept as well as for the outer appearance of the building and the interior space.

The modules and the gaps are bound together by the building's power envelope, which consists of photovoltaic elements and thermal vacuum tube collectors. The elements are made of photovoltaic cells of three different colours: gold, bronze and black. The black cells are on the roof for maximum energy benefit. The gold cells are on the facade. These cells are bound together by a gradient-like "pixelation" of bronze cells over the roof-edge.

The modular design of the building not only facilitates the transport to and the assembly in Madrid, but also includes ideas about a modular building system for different requirements. By using the same building modules it is possible to create living and working space for singles, couples, small or even bigger families or apartment-sharing communities in detached and semi-detached, as well as in multi-family houses. Another important feature is the climatic component. For the dry and hot situation in Madrid the ventilation tower with evaporative cooling will be the best choice. For every climatic situation home+should equipped with another climatic component. Wind turbines at a coast for example are able to benefit from the guaranteed wind.

3. INTERIOR

The concept allows for a clear visual understanding of the functions of each module from inside and outside. East and west facades are closed as far as possible (1), the north and south facades provides a view to the environment for the inhabitants.

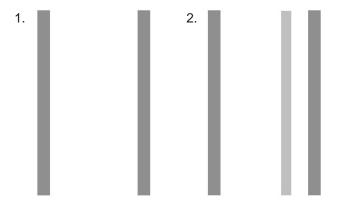
In the recommended layout, the building gets a clear north-south direction while remaining modifiable to the given situation. The eastern and western facades have been allocated with utility functions. The west side offers built-in storage zones. Each living area is expanded by a secondary area at the eastern end, separated by another zone of utility functions (2) that supports both, the living and the secondary area.

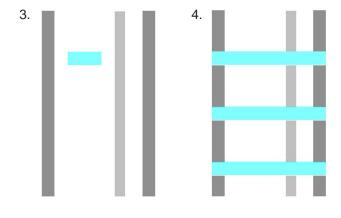
Therefore the building receives a clear structure in the north-south direction which contains and frames the ventilation tower (3). It divides the larger living area in the south from the smaller and more private area in the north and provides the building with cool air.

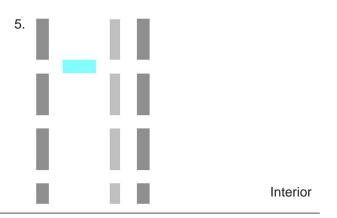
This structure is subdivided and distinguished by the building joints (4). The joints provide illumination and ventilation on the interior and have climatic functions. Therefore they are called "Climate Gaps". Therefore every module of the building receives a process optimised function. This guarantees variability of the modules.

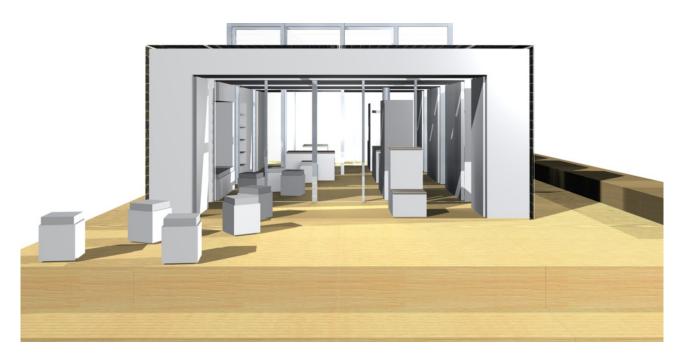
The building is entered from the south through a frontal bracket that serves as sun shading, supported by a curtain, and provides the living room with a covered terrace. The entrance is located in the secondary area in the east. This area leads, accompanied by multifunctional furnishing on left, through the house. This furnishing is not a room-high, closed wall but allows views between the areas through re-

cesses to obtain the impression of the ample interior. In the living module, this furnishing is equipped with a media wall containing TV, HIFI and a touch panel serving as the interface for the building automatization. The built-in furnishing at the west provides the living room with an alcove. It is face to face with the media wall with in-built speakers for high quality media entertainment. In addition to the alcove there are some seats for comfortable gathering of friends and family.









The dining room follows, separated optically by a joint element with an kitchen in the secondary area and a kitchen block between. The furniture in the living and dining area is variable and allows multifunctional use of the largest interior space in the flat. Most situations only require a "dining corner" for two people. But by the furnishing it is possible to enlarge the table by another and several seats, usually used an another room or stored in the in-built storage at the west. Therefore, this space can be used for a dinner event for eight people. The living and dining area can be extended to the terrace by opening the glazing or optically separating it from the outside by a curtain.

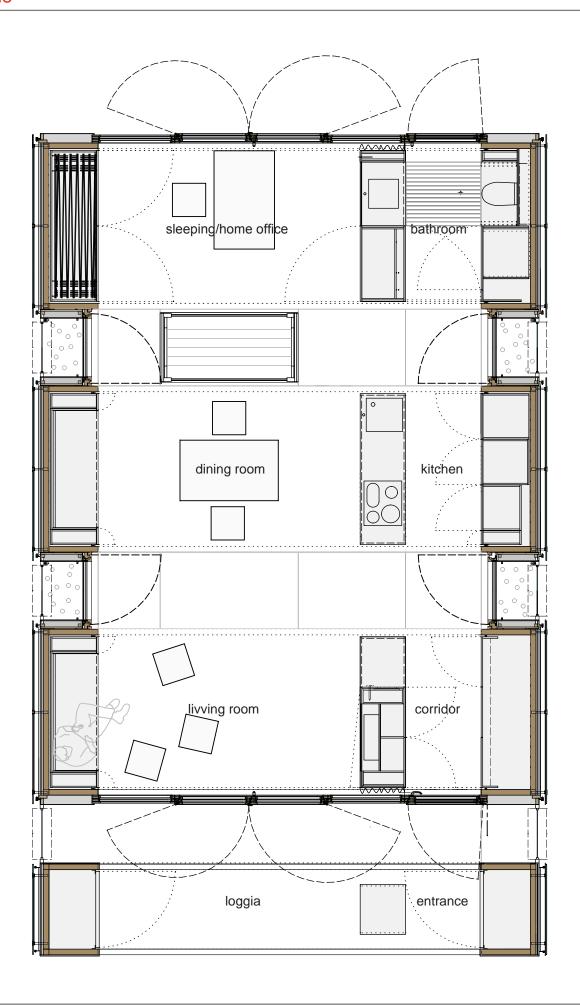
In the next joint, the ventilation tower stands as a central element. As a partition, it divides the dining area and the bedroom. This feature is the heart of home+. It is a kind of symbol like a fireplace where the family gathers. And it is the connector of design and technology because it combines both. The ventilation tower visually explains and typifies comfortable cooling through the image of white wet fabric softly flapping in the wind within the glazed ventilation tower.

It is also equipped with reconfigurable furnishings

to use the space as a home office by day. Adjacent to it the bathroom is located. The furnishing between bathroom and bedroom/home office includes a switchable glazing for optical separation with the guarantee of privacy.

As the other spaces are flexible for use in different ways, the spaces for toilet, shower and basin are arranged to create an optimized space-saving bathroom. The north facade is equipped with ample glazing to allow an excellent view to the landscape and with a curtain to ensure the privacy of the inhabitants.

To feel comfortable and to prevent immoderate energy losses by switching the lights, each area has its own natural light exposure by having overhead glazing in the gaps. There are evacuated tube collectors on the top of the gaps to protect the interior from direct irradiation. By orientating the absorber of the evacuated tubes like a shed roof towards the sun, the inhabitants are able to see the sky to the north. Each special use, like working or cooking, gets its own pointed lighting for optimized conditions. Artificial lighting supports the design by highlighting the gaps and the ventilation tower.



home+			

12.2 Acoustic Report - Contents

- 1. Theoretical calculation of sound insulation solutions
 - A: Facades, acoustic performance of the glazing
 - B: Facades, acoustic performance of the opaque elements
 - C: Roof, acoustic performance of the opaque elements
 - D: Facades and roof, calculation of the different facades and the roof from the acoustic performance of the elements
- 2. Measurement of sound insulation of constructed solutions
- 3. Estimation of the indoor reverberation time

Acoustic Report

1 Theoretical calculation of sound insulation solutions

A Facades, acoustic performance of the glazing

The weighted sound reduction index of the glazing was calculated according to $G\ddot{o}sele^{[1]}$ and compared with measurements of ift-Rosenheim GmbH for glazing of similar composition. Calculated weighted sound reduction index: $R_{w,R} = 40 \text{ dB}$ according to equation (1)

(1)
$$R_{W,R} = 25 \lg \frac{d_{W1} + d_{W2}}{d_0} + 15 \lg \frac{d_S}{d_0} + 32 dB - 2 dB$$

with

 $\begin{array}{ll} {\rm d_{W1}:} & {\rm thickness\ inner\ pane\ (6\ mm)} \\ {\rm d_{W2}:} & {\rm thickness\ outer\ pane\ (6\ mm)} \\ {\rm d_{S}:} & {\rm space\ between\ inner\ and\ outer} \end{array}$

pane (32 mm)

k_r: correction term frame (-2 dB)

B Facades, acoustic performance of the opaque elements

Estimation of sound insulation took place according to "Berger mass law", combined with the calculation of the additional improvement of sound reduction index by the lining (vacuum insulation and wooden panel). The weighted sound reduction index of the opaque parts of the facades was calculated to:

 $R_{w,R}$ = 45 dB according to equation (2) and (3)

(2)
$$R_R = 20 \lg \frac{m' \times \omega}{2 \times Z} - 3dB$$

with

m': mass per m² (60 kg/m²)

 ω : $2\pi f$

Z: 428 kg/m²s

Construction glazing:

Pane VSG 6 mm

Space between panes 16 mm

Pane Float 4 mm

Space between panes 16 mm

Pane ESG 6 mm

Calculations were carried out in third octave bands and weighted according to DIN EN ISO 717-1.

Calculated weighted sound reduction index:

 $R_{wR} = 48 \text{ dB}.$

Now resonance frequency of the additional lining was calculated with equation (3)

(3)
$$f_0 = 160\sqrt{\frac{s}{m}}$$

with

m': mass per m² (16 kg/m²)

s': dynamic stiffness (40 MN/m³)

f_o: resonance frequency

Resonance frequency of the lining was calculated to 253 Hz. According to Table D.3 of European Standard DIN EN 12354-Part 1 this means an worsening of calculated weighted sound reduction index of -3 dB. As a result the weighted sound reduction index of the opaque parts of the facades was calculated to: $R_{wR} = 48-3 \text{ dB} = 45 \text{ dB}$.

Composition of elements:

inside

wood construction (FSH)
 vacuum insulation
 wood panel
 75 mm (60 kg/m²)
 48 mm (40 MN/m³)
 20 mm (16 kg/m²)

- waterproofing

air-layer 70 mmglass printed with PV 12 mm

C Roof, acoustic performance of the opaque elements

Estimation of sound insulation took place with equations for the calculation of double leaf constructions. The single leafs were calculated with equation (4). The complete double leaf construction with equation (5).

(4)
$$R_{i} = 20 \lg \left(\frac{\pi \times f \times m'}{\sqrt{2} \times v_{s} \times \rho_{L}} \right) dB$$

with

m': mass per m² (17/20 kg/m²)

 $v_s^* \rho_L$: 428 kg/m²s

(5)
$$R_R = R_1 + R_2 + 20 \lg \left(\frac{4p \times f \times d}{v_s} \right) dB$$

with

d: thickness insulation (160 mm)

 v_s : 340 m/s

Calculations were carried out in third octave bands and weighted according to DIN EN ISO 717-1.
Calculated weighted sound reduction index: $R_{w,R} = 63 \text{ dB}.$

Composition of elements:

inside

- OSB panel 22 mm (17 kg/m²)

- insulation 160 mm

- OSB panel 25 mm (20 kg/m²)

vacuum insulation 40 mminsulation 120 mm

- waterproofing

substructure

- glass printed with PV 12 mm

D Facades and roof, calculation of the different facades and the roof from the acoustic performance of the elements

The calculations were performed according to European Standard DIN EN 12354-Part 3, "Estimation of acoustic performance of building from the performance of elements – Part 3: Airborne sound insulation against outdoor sound", from September 2000.

The sound reduction index R' was calculated according to equation (6). Calculations were carried out in third octave bands and weighted according to DIN EN ISO 717-1.

(6)
$$R' = -10\log\left(\sum_{i=1}^{n} \tau_{e,i} + \sum_{f=1}^{m} \tau_{f}\right) dB$$

with

 $\tau_{e,i}$: the sound power ratio of radiated sound power by a facade element i due to direct transmission of incident sound on this element, relative to incident sound power on the total facade.

the sound power ratio of radiated sound power by a facade or flanking element f in the receiving room due to flanking transmission, relative to incident sound power on the total facade.

n: number of facade elements for direct transmission.

m: number of flanking facade elements.

The sound transmission through the different building elements was calculated according equation

(7)
$$\tau_{e,i} = \frac{S_i}{S} 10^{-R_i/10}$$

with

R: sound reduction index of element i, in decibels

S_i: the area of element i, in m²

South and north façades, composed of glazing (12,9 m 2 , $R_{w,R}$ = 40 dB) and

opaque elements with PV (8 m², $R_{wR} = 45 \text{ dB}$)).

The calculated weighted sound reduction indices for the façades are:

$$R'_{wR} = 40,5 \text{ dB}$$

$$R'_{45^{\circ}w} = 41,5 \text{ dB}$$

$$D_{ls, 2m, nT, w} = 44,3 dB$$

West and east façades, composed of glazing (4,9 m², $R_{w,R}$ = 40 dB) and opaque elements with PV (22,86 m², $R_{w,R}$ = 45 dB).

The calculated weighted sound reduction indices for the façades are:

$$R'_{w.R} = 44 \text{ dB}$$

$$R'_{45^{\circ},w} = 45 \text{ dB}$$

$$D_{ls, 2m, nT, w} = 46,6 dB$$

Roof, also composed of glazing (8,2 m², $R_{w,R}$ = 40 dB) and opaque elements with PV (52 m², $R_{w,R}$ = 63 dB).

The calculated weighted sound reduction indices for the roof are:

$$R'_{w.R} = 49,5 \text{ dB}$$

$$R'_{45^{\circ}w} = 50,5 \text{ dB}$$

$$D_{ls, 2m, nT, w} = 48,8 dB$$

Literature

[1] Gösele, Karl: Berechnung der Schalldämmung von Fenstern (Calculation of the sound insulation of windows), 1983, Stuttgart.













Pictures: Measurement of sound insulation

2 Measurement of sound insulation of constructed solutions

As proposed in the guideline the air noise insulation of the front facade (South facade) was measured. The method used was according to the standard DIN EN ISO 140-5. Measurement of sound insulation in buildings and of building elements — Part 5: Field measurement of airborne sound insulation of facade elements and facades (ISO 140-5 : 1998); German version EN ISO 140-5 : 1998. Measured was the weighted sound reduction index R'_{45°,w}.

$$R'_{45^{\circ},w} = 41 \text{ dB}.$$

The result for the complete south facade was

The sound reduction index R'_{45°} over frequency in third octave bands is shown in picture 1.

3 Estimation of the indoor reverberation time

Calculations were performed according to Sabine (8) and (9).

(8)
$$R_{T60} = 0.163 \frac{V}{A}$$

(9)
$$A = \alpha \times S$$

with

RT₆₀ reverberation time in s

V volume in m³

A equivalent sound absorption area in

 ${\rm m^2}$

lpha absorption coefficient

S Area in m²

All surfaces were considered. Absorption coefficients are shown in table 1.

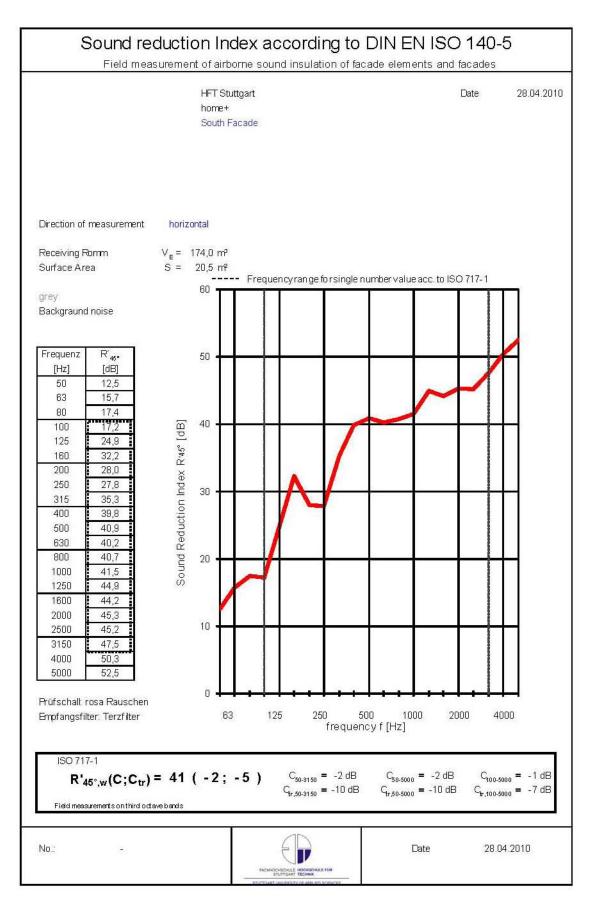
Calculated reverberation time in octave bands is shown in table 2.

Table 1: Absorption coefficients α of different surfaces and materials

Material	125	250	500	1000	2000	4000	Area
	[Hz]	[Hz]	[Hz]	[Hz]	[Hz]	[Hz]	$[m^2]$
Parquet floor	0,1	0,07	0,05	0,06	0,06	0,06	40
Plasterboard ceiling	0,15	0,10	0,10	0,10	0,10	0,10	37
Open joint in ceiling	0,5	0,95	1	1	1	1	5
Windows	0,25	0,15	0,1	0,06	0,03	0,03	40
Seat cushions (felt)	0,2	0,25	0,3	0,4	0,4	0,4	6
Furniture surfaces	0,15	0,10	0,10	0,10	0,10	0,10	40

Table 2: Calculated reverberation time in s

Home+ 0,69 0,64 0,65 0,76 0,8),73



Picture 1: Sound reduction index of the south facade of home+

home+			

12.3 Lighting Design Narrative

- 1. Natural Lighting
- 2. Artificial Lighting

Lighting Design Narrative

1. Natural Lighting

The light design of the house has been carefully developed to fit in the overall design concept of the project and to support the basic architectural ideas.

The northern and southern facade are entirely planned as a glazing, which has the function of providing the user with the feeling of being outside. Through these big glazings, the daylight will get inside of the house, and illuminate the bedroom and the living room during the winter time(see figure 3).

In the summer time, the southern porch will have the function to stop the direct sunlight, and give the loggia and at the same time, the living room, shadow. Still, the sunlight will be reflected inside of the house through the terrace(see figure 2). Still, the user will have the chance to protect himself from beeing seen with the opaque blind in the outside of the porch. On the other hand, in the house interior the user will have a sun blind to protect the house interior of too much luminosity.

In the house interior, in the middle zones of the house, the daylight will come inside in between

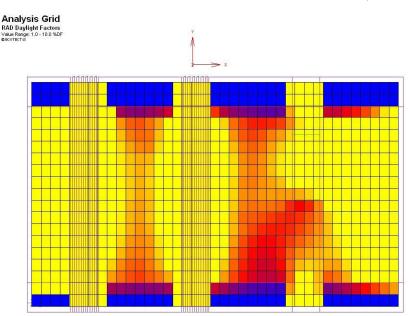


Figure 1: Daylight Factor, Simulation with Desktop Radiance

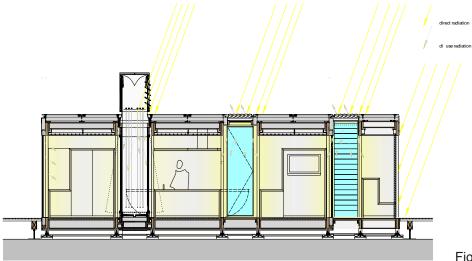


Figure 2: Summer Natural Light

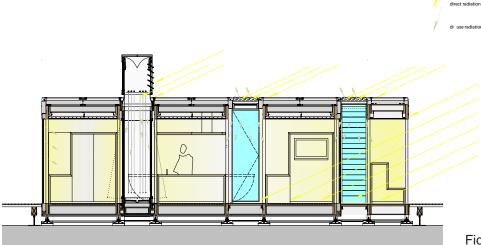


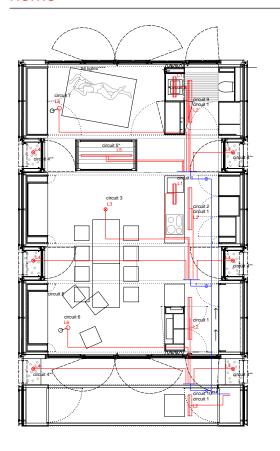
Figure 3: Winter Natural Light

the solar gaps, which will be lighten with a textile sunblind at the east and west side. At the ceiling, on the horizontal glassing, solar collectors are planned which will used for the warm water production but also for sun protection. This is an innovative form of sun protection, since we are gaining energy and and the same time, avoiding excess of radiation in the house interior.

We have simulated these passive measures to control the sunlight, likeporch, the coming light in between the gaps, etc, in ordner to proof if the house is enough illuminated in a cloudy day, as you can see in the Figure 1. We have received good results so that our planning for the natural lighting is correctly developed.

2. Artificial Lighting

During the night, we want to use artificial lighting, where it is necessary and convenient for the use of the house. For contest manners, accentual lighting is planned to highlight the main characteristics of the house. So we distinguish between house lighting and contest lighting.



2.1. House Lighting

The architectural design of our prototype is very clear and logical. We have divided the house in a primary and a secondary zone. (See figure 4)

In the secondary zone, we have placed functions like the wardrobe, the kitchen and the bathroom. These rooms would be secondary, and serve the primary rooms, which would be the living room, the dining room and the bedroom. These rooms are placed in the primary zone, which is on the west side of the house. Both zones are divided through a mobiliary chain, which goes along inside the house. Still, this division or barrier is made in a subtil way, and does not blockade the sight from the multifunctional room or the bedroom to the secondary areas, in this case, the kitchen or the bathroom.

So, for the illumination of the house interior, we decided to illuminate in the subtil and indirect way

L1 Light silf for Cooking integrated in the exhaust hood LED, 15 W; Product SYSTEMKANAL, RICHTER 50°55°500mm

L2 Wallwasher for Secondary Area for illumination of the east cupboards Fluorescent Lamp, 54 W/24 W Product MREL, ZUMTOBEL 1248/625°114*85 mm,
L3 Pendent Lamp for Dining Fluorescent Lamp, 27 W Product REL, 20MTOBEL 1248/625°114*85 mm,
L3 Pendent Lamp for Dining Fluorescent Lamp, 27 W Product RE-LIGHT CIASSIC, STENG LICHT PRM SWW -G

L4 Uplight in the gap for illumination of plants LED, 36 W Product MINIPLANO, ZUMTOBEL d166 mm.21/20mm; 135mm deep
L5 Uplight inside the Tower for tower illumination (right)lighting of the house) LED, 4/25W - 100 W Product X-BAR, RICHTER Semme Somm ** Carmo-Soform** Carmo-Soform**

***circuit 10: will be controlled from the motion senso

Figure 4: EL-401g Lighting Plan

the secondary area, so that the user gets the feeling of an expansion of the room. This is very important if you notice that the building is limited in its size, so that we react to this situation through optical means, in this case, with artificial light. We used for this manner wallwashers (fluorescent lamps) to illuminate the modules/cupboards of the secondary area. These wallwashers should be integrated in the ceiling, so that the inhabitant only sees a subtil light slit. See figure 5

At day, the gaps assume this job and give the user the feeling of space expansion because they unit the exterior with the interior space and at the same way, they bring light into the house. On the other way, the gaps are illuminated through a LED uplight, which has the function to accentuate the plants inside of the gap. This gives the user the sensation of a connection with his exterior during the night and it gives the house a more cosily character.



Figure 5: Simulation with Dialux of the artiticial light without gaps lighting

Concerning to the rule 40.4 Safety against the risk of inadequate lighting, the next calculation has been made to assure the compliance to this rule. (see Figure 6)

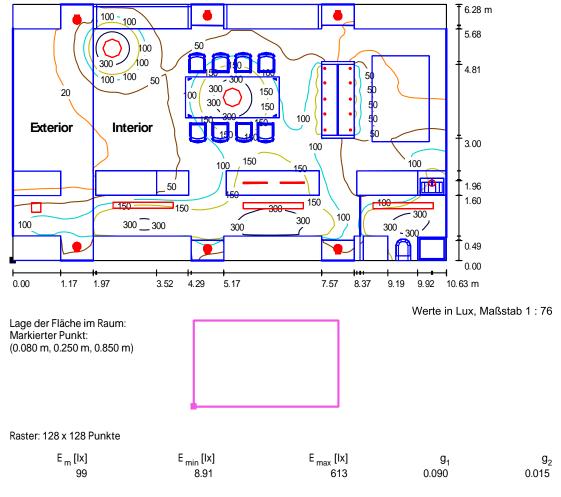


Figure 6: Isolines of the Illuminance (lux) of the house interior, calculations with Dialux

home+

In the bedroom/working place and the multifunctional lamp, see figure 7. For the dinner party, we will room, one fluorescent floor lamp is planned for reading or working manners, which can be connected in each room as needed. For the eating room, a direct fluorescent light is also planned from the same design line of the floor lamp. These luminaries are very important since they are the only one that have a very visible presence in the house. All other luminaries are mostly non visible to the user. (See figure 8)

These luminaries have an special feature. It varies in position. It can be a floor lamp and a pending

need for example two pending lamps, so we can use the floor lamp and place it in the ceiling as a pending lamp. In the normal situation we have a floor lamp n the bedroom, or living room, depending of the needs, and a pending lamp for a table of four persons.

In the kitchen, additionally to the wallwasher for the secondary zone, we have planned to use also a direct lighting over the working area integrated in the pendant exhaust hood, an LED slit. This is the case of the bathroom, where the same luminary is used



Figure 7: Different positions for the luminaries of the dining room, sleeping room and iving room.



Figure 8: Simulation with Dialux of the interior artiticial light with contest lighting

over the washing basin.

As you can see, we use only energy saving lamps, just like LED or fluorescent lamp. Some of our luminaries are certificated with an eco+certificate, which is the case of thewallwashers in the secondary zone that are used as main illumination. This classification is provided to those products which offer a special benefit for people and the environment. The criteria involved go far beyong technical data such as installed load. Eco+luminaires are characterised by high lighting quality at low energy consumpetion, and they are made of environmentally compatible materials. For more information, please see http://www.zumtobel.com/download/PR_ecoplus_UK.pdf

ZUMTOBEL



Here is a summary of the used luminaires in the building and their consumption, Figure 9:

by switchs and a touch panel. In Figure 10 you can see the circuits that control each switch and the control pannel.

In the mobiliary chain we have planned a double switch that control the corresponding area. So in case of the kitchen, you can switch on the pending lamp on the dining table or the wallwasher for that module, as an example.

From the control panel all the house illumination (interior and exterior can be controlled. There is a special program that visualizes the house and special designed for the house of the future, so that the user can press in the panel an area, and the lights of this area will be turned on or turned off.

An all circuits switch is located on the bed, so that the user can switch all the lights off resting in his bed, to maximize the comfort.

A very interesting performance of the control panel is that there are some situations already programed. The user can decide from the dinning and cooking situation, to the lounge and tv szenario and even the contest szenario. Depending to this szenarios, the right illumination will be set on.

2.2. Effect Lighting

AREA	APPLIANCE	PRODUCER / PRODUCTCODE	QUANTITY AND MEASURE B/T/H	ENERGIE- RANGE	CONSUMTI ON	FACILITIES	CONNECTE D LOAD	CONNECTIC N PORTS
(Diningroo Floor lamp Line-shape (cooking) Wallwashe zone) Wallwashe Line-shape (bathroom) Uplight (ye	Pendant lamp (Diningroom)	STENG, fluorescent lamp, PRM SWW -G	1x				27W/unit	
	Floor lamp (Livingroom)	STENG, fluorescent lamp, QRL SWW -G	1x				27W/unit	
	Line-shaped light (cooking)	RICHTER, LED, Nr. RL- 1408085600	1x				15W/unit	
	Wallwasher (cupboard zone)	ZUMTOBEL, fluorescent lamp, Nr. 4218609	3x				54W/unit	
	Wallwasher (loggia)	ZUMTOBEL, fluorescent lamp, Nr. 70394992	1x				24W/unit	
	Line-shaped light (bathroom)	RICHTER, LED, Nr. RL- 1408085600	1x				15W/unit	
	Uplight (gaps)	ZUMTOBEL, LED, Nr. 24169174	6x				3,6W/unit	
	Uplight (Ventilation T)	RICHTER , LED, N- 26-001-0861-00	4x				25W/unit	
	Wall-embed light (exteriors)	ZUMTOBEL, LED, Nr. 60812570	13x				2W/unit	

Figure 9: Summary of luminaires interior and exterior

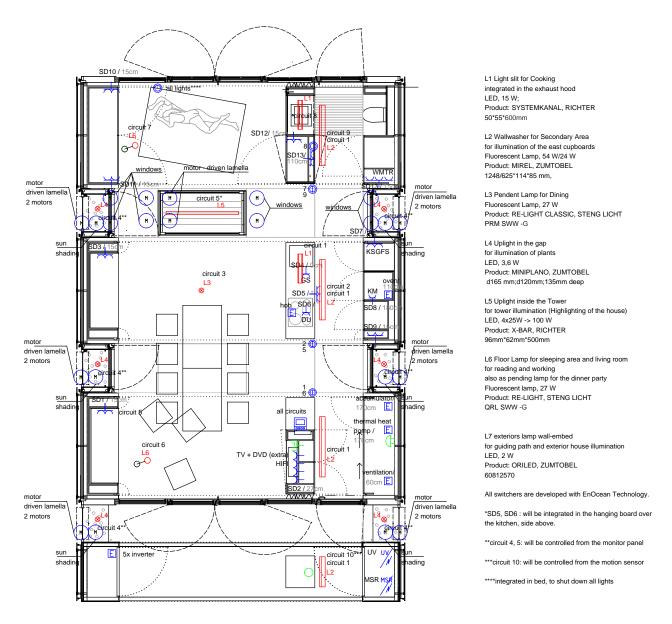


Figure 10: EL-601 AC Circuit Layout

The ventilation tower is an important architectural element that characterizes the house. Under that aspect, the tower will be accentuated with LED uplight illuminating the textile membranes inside of it and the tower itself. See Figure 11.

This uplight can be variable in colour. The change of colours will demonstrate in a optical way the changes of temperature of the air in circulation and reflect in this way, the function of the tower which is to achieve a comfortable interior temperature.

Besides, an another important characteristic of the house are the gaps. They will shine through their own illumination with LED uplights, and mostly through the interior illumination of the house. So the house will shine through its gaps and transport its modularity so good at night as day.

The facade will be illuminated in a subtil way by



Figure 11: Simulation with Dialux of the iartiticial light of the contest lighting

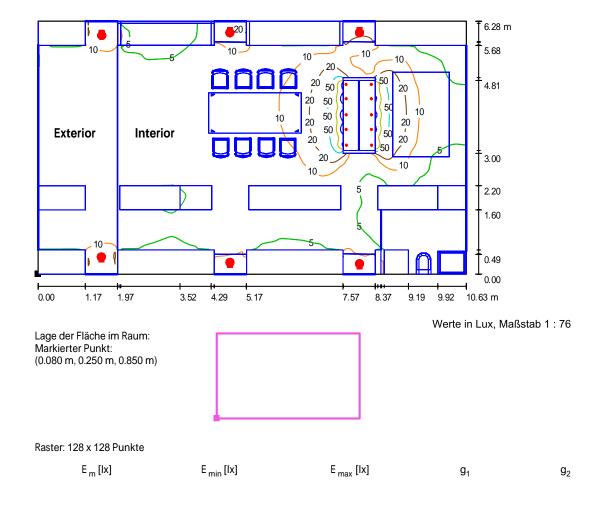


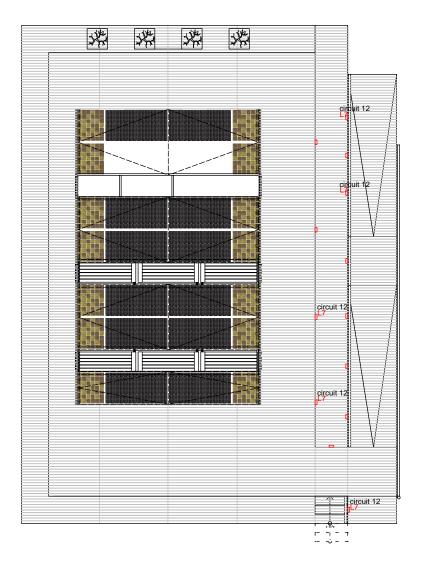
Figure 12: Isolines of the Illuminance (lux) of the contest lighting, calculations with Dialux

home+

exterior illumination (just for evacuation manners), which was carefully placed in the axis of the modules.

2.3. Illumination of Exteriors

Not only the house interior will be illuminated, but also the exteriors of the house. This illumination avoids possible falling in the night, and shows the visitor the path and way out. In this case, we use low energy LED. We intergrated them in the exterior mobiliary, in which the water tanks and other devices are placed. See Figure 13



L7 exteriors lamp wall-embed for guiding path and exterior house illumination LED, 2 W Product: ORILED, ZUMTOBEL 60812570

Will be controlled by the touch pannel

Figure 13: Illumination of the house exteriors

home+			

12.4 Engineering Design Narrative - Contents

A. Construction and Envelope

Load-bearing structure

House's building envelope

Photovoltaic

B. Energy Analysis

System Design

Building Control and Automatization

- -Domestic hot water preparation (WWSoI)
- -Reversible Heat Pump (HP)
- -Activated radiant floor (RF)
- -PV/T Modules (PV/T)
- -Phase Change Materials integrated ceiling (PCM)
- -Ventilation tower and cross ventilation -

passive component

-Air handling unit with evaporative cooling (AHU)

C. Arrangement of wiring and supply pipelines

General description

- -Air handling unit
- -Warm and cold water supply
- -Evacuated tube collectors
- -PV/T collectors
- -Activated PCM-ceiling and radiant floor
- -Waste water
- -Pump systems
- -Distilled water

D. Explanatory report on electrical engineering

Exploitation of heavy current

Exploitation of telecommunication /

broadband cable / FOC

- -Telecommunication
- -Broadband cable

High voltage system

-Low voltage switchgearNormal grid (AC voltage)

-Low voltage installation system

Sub-distributions

-Installations

Illumination systems

- -Interior lighting
- -Exterior lighting

E. Fire protection

F. Description of HVAC

Engineering Design Narrative

A. Construction and Envelope

The key design characteristic of home+ is the rhythmic arrangement of building modules and gaps. The building volume mainly consists of four modules, three with the same dimensions and an additional smaller loggia module. The modules have no wall openings in the east and west, the gaps have the function of climate gaps to ventilate and expose the interior. This arrangement results not only from the separation of the floor areas and functions but also follows aspects of modularity, installation and transport.

Load-bearing structure

The four modules are built as timber structures.

Load assumptions comply with the German
Industrial Standard DIN 1055, Part 1-5. Each module
has been checked as a single, self-supporting
load-bearing structure, not being connected to
the neighboring modules. The load of the glazed
gaps is distributed in equal parts to the neighboring
modules. The bracing in the longitudinal axis
or in the frame respectively is ensured by two
rigid, all side supported frames that are built from

veneer plywood "ultralam R". In the lateral axis perpendicular to the frame, the structure is braced by the shear walls at the fronts. Those shear walls are manufactured from veneer plywood "ultralam X". The differences between the "ultralam X and R" is that X is glued crosswise and R regular. Due to the symmetrical arrangement of the walls, twisting is not expected in the structure. The roof loads (dead load, additional substructure elements, snow etc.) are transmitted to auxiliary cross girders made of structured solid timber. These pass on the loads to the principal girders made of "ultralam R". At the bottom of the modules, cross girders (FJI- Finnjoist) are used to accept the loads from dead weight (other structural components, floor covering, etc.) and the imposed load. Those loads are likewise transmitted to the frame.

To obtain a clear load transmission into the soil, the loads are concentrated to four steel footings per frame, respectively eight footings per module. The cross girders (FJI) are double-T beams which has solid wood bars and a division bar of Oriented Strand Board (OSB). Since the modules will be erected in different locations (Madrid, Stuttgart, fair BAU2011 Munich, etc.), the foundation is adaptable



Figure 1: timber module



Figure 2: model of timber module

to the respective ground characteristics.

The gaps are made of a glass structure and can be disassembled into three parts:

- Two wall constructions as a prefab wall element with the outer frame of lamellas,
- Inner window and lateral insulation with steel covering
- 3) Horizontal glazing with its frame construc tion. The gap with the ventilation tower has two more parts; the lantern which rises above the roof and the energy tower inside the house.

House's building envelope

The walls and the roof of the building are composed of several material layers with different distinct functions. The interior layer consists of 75 mm of veneer plywood; as mentioned above it is part of the load bearing structure. Moreover it provides thermal mass to stabilize the indoor climate. On the outside, the plywood elements are covered with Vacuum Insulation Panels (VIP) which serve as thermal insulation. As the whole construction is meant to be recyclable, the VIPs are not bonded or glued to the plywood elements. Instead they are integrated

between battens which are fixed to the wall so they can be easily removed when the building is disassembled. Moreover, VIPs that are damaged, for example during construction work, can be replaced with little effort as long as the final layers are not applied. As the thermal conductivities of the VIPs and the wood differ by the factor 30 (0.004 W/m•K vs 0.13 W/m•K), the battens are thermal bridges which cannot be neglected. To reduce the influence of these weak spots, the VIPs are applied in two layers and integrated into a counter-batten system. Moreover the battens are made of highly insulating recycled polyurethane instead of wood wherever possible. The most heavily loaded battens which carry adjacent building elements are made of Oriented Strand Board (OSB). Calculations using the finite element program FEMLAB showed that thereby the target U-value of < 0.12 W/m²K can be achieved. (figure 3)

Another layer protects the sensitive VIPs from mechanical damage. While this layer was originally meant to be made of wood fiber boards, it was changed to OSB in order to be more robust. Thus smaller parts of the substructure carrying the photovoltaics can be attached to it. Waterproofing is

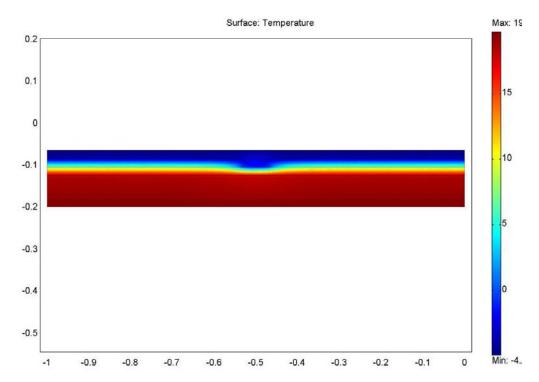


Figure 3: VIP

made by a polyolefin membrane. This was chosen, because it has less environmental impacts than PVC foil. Photovoltaic cells laminated onto large panes of glass are the final "solar active" layer. The glass/ glass modules are mounted on a substructure made of galvanized steel rails with a visually important distance to the underlying wall construction. In this way the PV envelope seems to levitate weightless over the building.

In the roof and floor construction spaces between the timber girders are filled with sheep wool. With one additional layer of VIP the extraordinary U-value equivalent to the one of the walls is achieved.

Photovoltaic

For electricity generation, a large PV system of 12.5 kWp is installed on the roof and both, the west and east façades. Each façade is completely covered with 7 polycrystalline PV-Modules (3 kWp each) except for the gaps. On the roof, two different types of modules are installed; 12 small polycrystalline PV-Modules (1.5 kWp) are located on the east and west sides and 12 monocrystalline PV/T modules (5 kWp) in the middle of the roof.

The innovation in this system is that within the polycrystalline PV glass/glass modules two different

solar cells are combined and integrated. The reason for applying two different types of solar cells for roof and façades is a matter of design. Whereas the multicolor cells on the façade are an important design feature of our house, the monocrystalline cells on the roof have been selected to provide a maximum of power output per roof area. To link the two areas, we have introduced a new way to combine differently colored cells in a dot-like pattern to achieve a transitional effect from one to the other area: The façade modules will turn with their colors gold and bronze around the edge, then becoming black with the monocrystalline modules in the middle of the roof. All the PV-modules are frameless glass/glass panels with laminated PV-Cells in gold and bronze or black monocrystalline cells. To improve the light transmission as well as the visual appearance we have used low-iron glass. The glass in the façades and the roof edges is coated and transparent, whereas the glass of the PVT-Modules has also a white coating in the 4th layer. This design of the PV-Modules was not only a technical challenge to combine two different cells, but also the size of the glass/glass Modules poses a productionrelated challenge.



Figure 4: home+

B. Energy Analysis

From the beginning of the competition we developed a design based on bioclimatic aspects and passive solar means. Subsequently the design was modified and refined through analysis, e.g. technologies and weather data. The architectural and engineering design reached its final stage after elaborative simulation and testing. During the past year extensive simulations as well as experiments including 1:1 prototype and mock-ups concerning the crucial components of our concept have been carried out. The results of these examinations led to various design decisions which have been integrated in the further planning of our building. The simulations mainly dealt with: the thermal quality of the building envelope, shading devices and required radiation characteristics of glazings, dimensioning of the heat pump, solar collectors and the storage tank, dimensioning of the photovoltaic components and size and opening direction of windows with regard to optimal air flow. Whenever possible we used approved simulation tools such as TRNSYS or INSEL. For specific problems like the behavior of the ventilation tower or the PV/T modules at night, we developed our own models.

The most innovative components of our concept such as the ventilation tower and the PV/T modules on the roof could not be dimensioned solely by simulation since the required input data were not available. They had to be determined experimentally. Therefore full-scale mock-ups and prototypes for these components were set up and tested which provided valuable information concerning their construction and energy output. At the beginning, we tested the market available PV/T hybrid collectors to get information about the power and the construction of them, but finally we decided to build the PV PV/T collectors by ourselves. The behavior of the ventilation tower was studied on more mock-ups;

a 1:1 scale prototype for the maximal cooling load, construction and openings to the interior and a 1:20 scale mock-up for the wind tunnel tests was built. In this way it was possible to make pressure measurements on 59 pressure taps for the wind flow behavior. Finally, several decisions were made for reasons of design or construction. For example, moveable sun shading had to be added at the south side of the loggia, because simulations showed that the diffuse radiation would increase the external loads in an unacceptable way. Effects of all of these changes on the performance of the building had to be checked. For this purpose design decisions were communicated and the simulation model was adjusted to these modifications continuously and the design changed according to the simulation results. Since the beginning of the design development, we used this strategy to control the deployment of the heating and cooling demand and respectively the building envelope. In this way, it was possible to dimension the various components. When most of the components have been conceived, a sophisticated simulation model was set up in TRNSYS 16. It covers the building itself and all technical components. As no regular TRNSYS types were suitable for our innovative components like the ventilation tower and the PV/T collectors we programmed new types based on physical theories and our experiments. This model was used for the annual analysis as well as for the development of the control strategy.

System Design

In order to satisfy the domestic hot water, heating, and cooling demands several active components have to be added to the basic concept of maximizing passive solar means and effects. In the following the active systems are described one by one, however it should be understood that they function only in cooperation with each other. (For the passive means



Figure 5: prototypes , mock-ups and testings (Ventilation Tower, PCM, PV/T collectors and wind tunnel)

see the bioclimatic analysis in the Sustainability Report.) For example the PV/T modules (described later) are one of the key elements adjacent to the ventilation tower. The cooled water produced at night is used for three systems: to re-generate the PCM-ceiling, directly for the radiant floor (free cooling mode) and to lower the temperature in the storage tank that is used during the day by the heat pump as heat sink. Also the domestic hot water preparation is integrated in two systems: for the hot water preparation with a connection to the storage tank, as said, and to heat up the heat sink tank in winter when needed. In the part "Air handling unit with evaporative cooling (AHU)" the connection with the heat pump for fast heating or cooling is described. All these systems are connected together by the building control devices. In part F are showed the different possibilities of the hydraulic system depending the exterior conditions.

- Building Control and Automation

To control the complex hydraulic system described above, a sophisticated building automation is essential. It takes into account the weather data gathered outside by our meteorological station and the indoor climate which is monitored by sensors located in the cupboard zone. Many parameters are measured: the room and ambient temperatures as well as those in the tanks, relative humidity, air quality. According to those parameters, the building automation system chooses an adequate mode for heating or cooling and ventilation. The corresponding devices are turned on or off automatically, mass flow rates and outlet temperature of the heat pump are appointed, valves and mixing valves are set according to the requirements. For the cooling scenario, this reaction occurs always in the following priorities:

1) PCM ceiling

- 2) Ventilation tower
- 3) Cross ventilation
- 4) Active ventilation heat recovery
- 5) Low energy cooling system (free cooling mode)
- 6) Indirect evaporative cooling
- 7) Reversible heat pump/ radiant floor

Passive technologies are prioritized and then the technologies that require low parasitical energy. But not only the conditioning systems are controlled, but also the sun shading elements and the lamella glazing. The windows in the gaps and the openings of the ventilation tower are connected to the building automation system, but have to be operated by hand. The building automation gives a specific visual signal to the inhabitants when the conditions allow the use of the ventilation tower and the inhabitants can decide if they want to use it. The inhabitants can control all these actions also by the touch panel.

- Domestic hot water preparation (WWSoI)

A solar thermal system of 6.60 m² of evacuated tubes collectors is installed on the roof. The solar heat is stored in a 300 liter storage tank (solar tank) via an internal heat exchanger. Moreover these collectors are used to supply the thermal storage that serves as heat source for the heat pump in winter. During successive cold and cloudy days, a back-up is needed to provide domestic hot water. In this quite rare case for the Madrid climate, hot water has to be prepared by an electric heating rod. The collector area is quite large for 2 people hot water needs and a 300 liters tank. This area has been chosen together with the heat sink tank volume (1200 liters) in order to avoid the use of an additional electrical back-up in the heat sink tank for the climate of Madrid. Indeed, pure water is used the heat sink tank and attention has to be paid in winter to prevent freezing. Such a large collector area will cause stagnation in summer. In order to

enhance the emptying behavior of the collectors during stagnation, the collectors are slightly titled (3°). Therefore, the amount of steam produced is limited to the collector volume and the expanded fluid is directed to the expansion vessel which has been especially dimensioned to avoid any damages of the collector loop components (pump, valve, heat exchanger,...) due to the propagation of superheated steam. More information on the calculation of the expansion device can be seen in the Solar Thermal System report.

- Reversible Heat Pump (HP)

A reversible water/water heat pump provides heating in winter and cooling in summer to the house through an activated radiant floor (RF). On the source side, the heat pump is coupled with the so-called heat sink tank (1200 liters). In winter, the HP takes heat out of the heat sink tank and releases it into the house through the radiant floor. As described above, the heat sink tank is powered by the evacuated tube collectors. In summer, the HP extracts heat from the building (via the radiant floor) and releases it into the heat sink tank. The HP with its colling capacity of 2.4 kW is another new development of the home+ SDE-team and a specialized company, intended to be developed further on after the competition.

-Activated radiant floor (RF)

The activated radiant floor (30 m²) distributes the energy from the heat pump in winter and summer. It can also be activated in "free cooling" mode in summer. In this case, cold water is taken directly out of the heat sink tank and pumped to the radiant floor. This free cooling mode is only possible when the temperature in the tank is bellow 18-19°C. This tank has to be cooled down by radiative cooling through PV/T modules.

- PV/T Modules (PV/T)

The hybrid photovoltaic and thermal modules have two mains functions: generate electricity (all year long during the day) and cool both heat sink tank and PCM ceiling during the night (summer) by radiative cooling to the clear night sky. Radiative cooling is based on the heat loss over long-wave radiation emission from one body towards another body of lower temperature, which of acts as a heat sink. As there are currently no appropriate PV/T modules on the market which are optimized for this very special use we had to develop them for the SDE. The development went through different 1:1 mock-ups and has been tested to be working very well. Therefore, our new PV/T collector technology is also on the list of components that we will further work on after the competition. Our PV/T collectors are uncovered without any insulation box in order



Figure 6: Facilities niche already build

to maximize the heat losses to the ambient for night cooling applications. For this reason, there is no risk of water evaporation inside the collector during stagnation in summer. The maximum expected temperature in standstill is the same as a normal PV module (around 80°C) which is far from the evaporation temperature of pressurized system.

Phase Change Materials - integrated ceiling (PCM)

The house is equipped with 20 m² PCM ceiling (1 cm thick). The PCM used is a mix of salt hydrate and graphite (85/15%). The graphite increases the thermal conductivity of the material in order to enhance the heat transfer from the room to the PCM. With a melting temperature of about 22°C, the latent heat of the PCM is used for both cooling and heating purposes and smoothes the temperature variation in the room. A density of around 1500 kg/

m³ allows also an increase of the thermal mass in the building (sensible heat). In summer, the PCM ceiling is actively regenerated by radiative cooling through the PV/T collectors. This ceiling is another innovative component of our house and is based on research and development work conducted by the HFT for some years already. As the performance of the ceiling solution promises a very high market potential it will also be developed further after the competition.

Ventilation tower and cross ventilation – passive component

The passive ventilation tower supplies fresh air to the house without mechanical effort when ambient conditions are favorable. When the wind speed is high enough, the ambient air is caught by the tower, cooled through downdraught evaporative process and supplied to the building (figure 5).

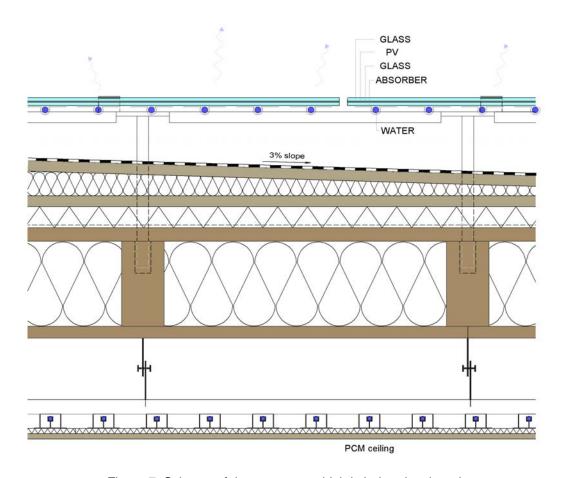


Figure 7: Scheme of the prototype which is being developed

The air is exhausted through openings on the gaps with the help of solar chimneys (absorber plates). Additionally, passive cross ventilation can cool down the house during the night through the gaps. We are aware that the ventilation tower which is a key design feature of home+ is a very specific measure for a climate like Madrid (hot and dry). When setting up home+ in different climatic zones, it can be replaced by components customized for the respective climatic conditions.

The exhaust air is moistened as much as possible (close to saturation) and therefore cooled down before exchanging its heat with the ambient air through the heat exchanger. In extreme conditions, the reversible heat pump can supply cooling or heating to the mechanical ventilation system via an additional water/air heat exchanger. This allows a quicker response to the peak loads than the radiant floor.

-Air handling unit with evaporative cooling (AHU)

Whenever it is either too hot or too cold to get fresh air by just opening the windows or the ventilation tower, the mechanical ventilation system is activated. An integrated heat recovery system reduces heat losses in winter and unwanted heat gains in summer. In summer, additional cooling is provided through indirect evaporative cooling.

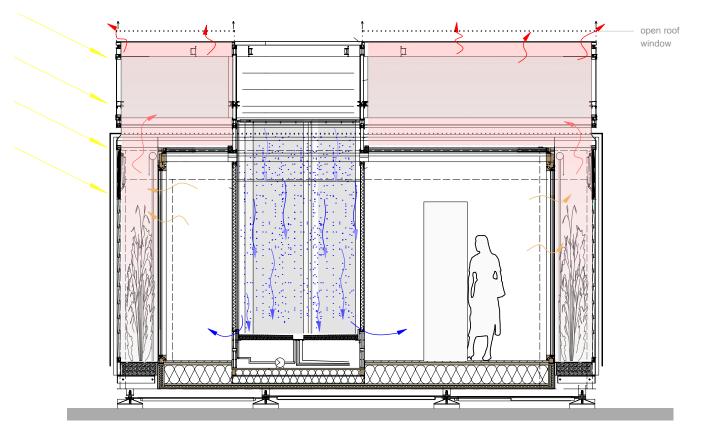


Figure 8: Ventilation Tower and Solar Chimneys

C. Arrangement of wiring and supply pipelines

General description

The wiring in our house is simple and well integrated in the floor, the ceiling cover and the board niche, so that a quick and easy assembling of the modular house elements is guaranteed. The board niche in the mounting area in module 1 is defined to our facilities board. It contains the air handling unit with heat exchanger, the reversible heat pump and a thermal storage tank as well as the complete IT unit for the building services. It is the technical heart of our house. Nearly all circuits and pipes are passing this point. In the area where the partition furniture is placed all main cable-lines enter in the floor assembly. Thence they divide to supply all installed devices. These lines pass the floor assembly through small openings in the bearing structure. In detail this means one opening for hot and cold water supply as well as an opening for the floor and ceiling cooling system. Furthermore there is an opening for the HVAC pipes and one more for the main electric line. Only the electric line continues until Module no. 1, where the house service con-nection and the electricity meter is located. The photovoltaic components

as the inverter are located in the board niche on the Westside. All electrical and pipelines are completely preassembled in the modules. Therefore it is necessary that all connection parts for water-, wastewater- and HVAC lines are flexible. Beyond the house, four tanks are placed as a distinguishing element of the ramp and the patio. They contain normal water, fresh water, waste water and the heat sink tank. Through pipelines which are passing the floor assembling they supply appropriate devices.

- Air handling unit

Additionally to the passive systems we integrated also a air handling unit in our house. We designed the system that in this way that supply air is injected at the west side of the building in floor height under the furniture which is located in the niche. Exhaust air is deducted on the opposite side through the ceiling in the bath room and in the area of the facilities board. From there it is heads directly to the heat exchanger in the ait handling unit.

Exhaust air gets deducted in gap no.1 at a height of approx. 2 meters on the right side of our entrance. Passing through the heat exchanger the pipes continue and pass in the floor assembling of module 2. In there the silencers for supply air and also exhaust air



Figure 9: Pipelines in the floor already build

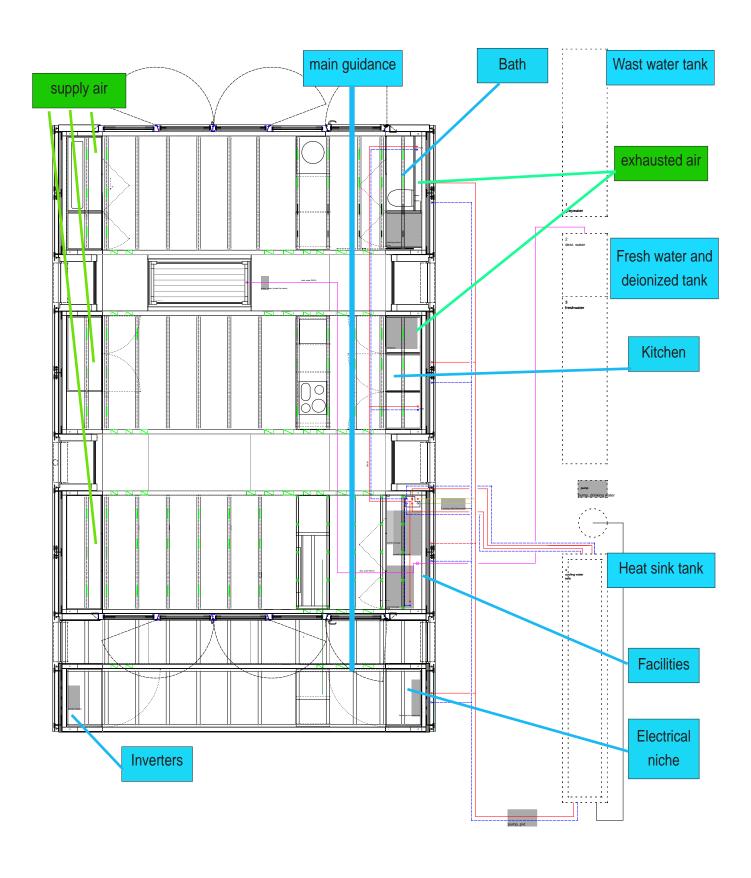


Figure 10: Guidance only for the cooling case and deionized water

are located. Afterwards the pipe changes the direction in the area of gap no. 2 and continues parallel to the west facade in the direction of the sleeping room thence heading up to in direction the roof. Exhaust air gets diverted through the roof.

- Warm and cold water supply

Drinking water supply occurs from the fresh water tank beyond the modules. From there the pipes for the hot water pass the heat storage tank which is located in the facilities board of module no.1. After passing there the pipes it is divided to supply all necessary devices e.g. custom water use.

- Evacuated tube collectors

The six thermal collectors, placed above the glazing gaps on the roof are connected in series. While the storage tank is located in the facilities board, the circulation pipe goes through the roof and connects the first three collectors in the first gap with an insulated pipe. Than this pipe goes through the above insulation in the roof, to the other side of the module and connects the last three collectors. At last, the hot water will be stored in the thermal storage tank. The connecting pipe from one gap to the other is constantly in the insulation of the module, only small and flexible pipes have to be added in the assembly to connect the collectors. All these small pipes will be insulated after installation to prevent heat losses.

- PV/T collectors

The PVT collectors which generate cool water at night in the roof store the water in the mentioned heat sink tank in the terrace. On the backside of the PV modules are glued copper pipes and the water circulates through the 4 PV/T modules in each module roof. Caused by that the heat sink tank is besides the building none of the PV/T modules have to break through the thermal layer of the house and vertical pipelines on the facade connect the collec-

tors with the tank. From this tank then goes pipes in both PCM-ceiling and reversible heat pump through the mentioned break-through in the floor within the facilities board.

- Activated PCM-ceiling and radiant floor

Water pipes in the ceiling and in the floor guarantees ambient cooling through the competition week in Madrid. The pipelines for the activated ceiling goes from the facilities niche horizontal through the floor in each module niche and then vertical on the backside of the furnishing on the eastside to connect the PCM-ceiling. Respectively the radiant floor.

- Waste water

Waste water is lead off centrally from the bathroom to the waste water tank.

- Pump systems

In addition to the water-water heat pump we installed a pump which supplies the deionized water for the ventilation tower in gap no.3 and for the indirect evaporative cooling within the air handling unit.

Furthermore we installed two pumps underneath the building in the area of the patio supplying the PVT collectors and the cooler storage. A pump-ing system is also installed under the bath to maintain the eduction to the waste a water tank.

- Distilled water

There is a separate tank with distilled water for the ventilation tower because of hygienic reasons. Moreover, we use the distilled water for the indirect evaporative cooling within the air handling unit. The water is runs firstly through the pipes in the facilities niche. There it can be divided. One way heads to the air handling unit, the other way runs along our main line inside the floor assembling until gap no. 3. From there the pipes continue vertically in the area of the insulating level of the ventilation tower.

D. Explanatory report on electrical engineering

Exploitation of heavy current

The feed for the building will be realized by the organizers in terms of a single-phase alternating voltage line with 63 A. The energy demand of the building arises from the balance as illustrated below. Thereof results an approx. overall performance of 25 kW in case of a complete occupancy rate. As a matter of course, 25 kW cannot be assumed because in this situation a concurrency is not taken into consideration. Therefore an effective overall performance of 14 kW is assumed.

Exploitation of telecommunication / broadband cable / FOC

- Telecommunication

A development of the building is not planned at the moment.

- Broadband cable

A development of the building is not planned at the moment.

High voltage system

- Low voltage switchgear

Normal grid (AC voltage)

The counter space contains the counters for the building and the solar power system.

- Low voltage installation system

Sub-distributions

Based on the counter space, the exploitation of heavy current is realized to the sub-distribution which is arranged next to it. All protection schemes for all modules are included in the sub-distribution. Every circuit breaker is used in the form of a double-pole version. The wiring of each module takes place in the hollow floor and the roof. In the hollow floor, there are clamp-connections installed to separate the components for the transport.

- Installations

The new EnOcean technology is implanted for the lightning control. Furthermore, every control function can be used through a touch panel as well.

Illumination systems

The illumination is planned by an electrical engineering technical crew.

- Interior lighting

In the living area, wall respectively ceiling lamps as well as spotlights are installed, partially with LED or with conventional illuminants.

- Exterior lighting

Outdoors, LED spotlights are integrated into the terrace.

E. Fire protection

In case of fire, there are two exits, one at the north and the other one at south.

For fire suppresion, there are two fire extinguishers planned (21A-113B 6kg each). One outside the house, at the entrance, and one inside the house, in the wardrobe. There will be adhequated signage to signal the position of the extinguishers.

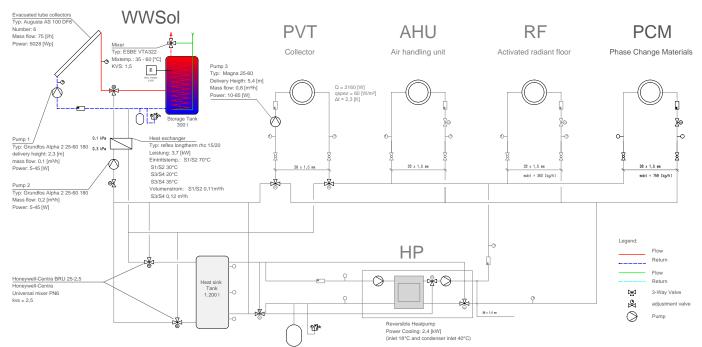
There are two evacuation possibilites. One trough the ramp and another one at the entrance using the stairs.

During the night, the stairs, the ramp and the evacuation paths will beilluminated to assegurate a safe evacuation also.

For the interior and exterior materials, we are taking into consideration the requirements about Health and Safety and Fire Protection.

All the interior and exterior materials have a fire reaction type of C-s2d0. And therefore they have a low flammability. The structure's fire resistance is R 30.

F. Description of HVAC

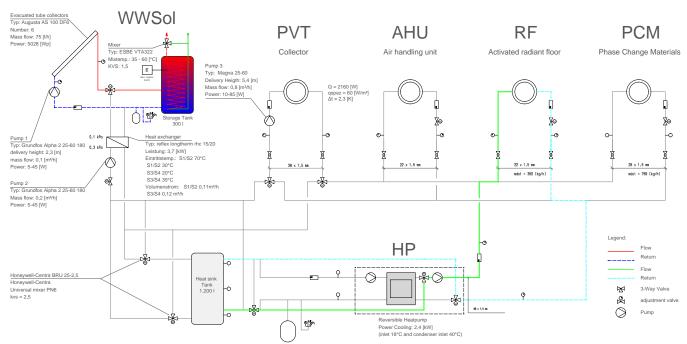


Case 1: Summer Day (without heat pump and without recooling tank)

Case 1 (see plan ME-221a)

Assumptions: Summer morning or moderate day in spring or autumn, ambient temperature around 22°C

In most hours of the year, when ambient conditions are moderate, the building can be cooled passively, without any mechanical effort, by using the ventilation tower. When the air is warm but dry (moisture content < ..g/m3) and the wind speed is high enough to grant sufficient air change rates, the ambient air is caught by the tower, cooled by the downdraught evaporative process and supplied to the building. The air is exhausted through openings on the gaps with the help of solar chimneys (absorber plates). Additionally, passive cross ventilation can cool down the house during the night through the gaps. If necessary, additional cooling energy can be provided by turning on the radiant floor (cf. case 2).

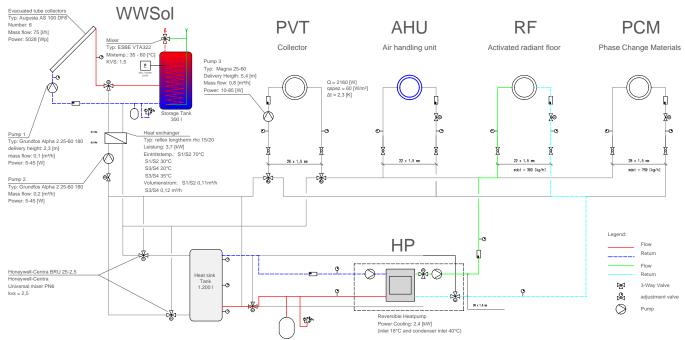


Case 2: Summer Day (without heat pump and recooling tank)

Case 2 (see plan ME-222a)

Assumptions: sunny day, ambient temperature around 28°C, temperature heat sink tank <21°C

During summer, the domestic hot water is supplied completely through the evacuated tubes and the heat is stored in the 300 liter hygienic storage tank. If the water temperature in the heat sink tank is below 19°C, the building can be cooled with low energy. In this case the cool water that was generated during the night on the roof (described in Case 4a) can be fed directly into the radiant floor ("free cooling"-mode). Depending on ambient air conditions, this mode of operation can be combined either with the ventilation tower or with the mechanical ventilation. When the tank temperature reaches 21°C, the reversible heat pump starts running (cf. case 3).



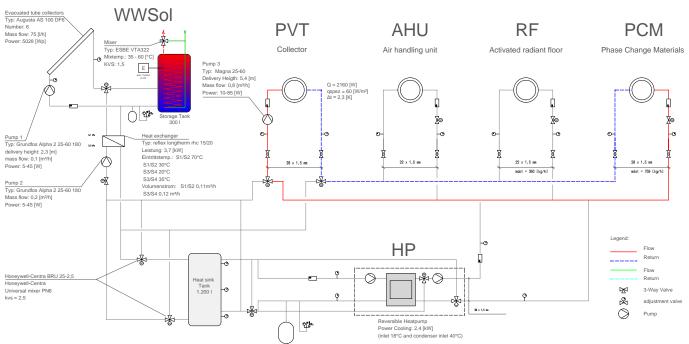
Case 3: Summer Day (with HP)

Case 3 (see plan ME-223a)

Assumptions: sunny day, ambient Temperature > 28°C, humid, Temperature heat sink tank >21°C

Case 3 and 2 are very similar - the only difference is that in case 3 the temperature in the heat sink tank is too high to operate in "free cooling" -mode.

The reversible heat pump has to be turned on. It extracts heat from the building via the radiant floor and rejects it into the heat sink tank. This situation will occur mainly during hot and humid periods and thus will be combined with the use of the air handling unit. In especially hot days the indirect evaporative cooling in the air handling unit provides additional cooling power.



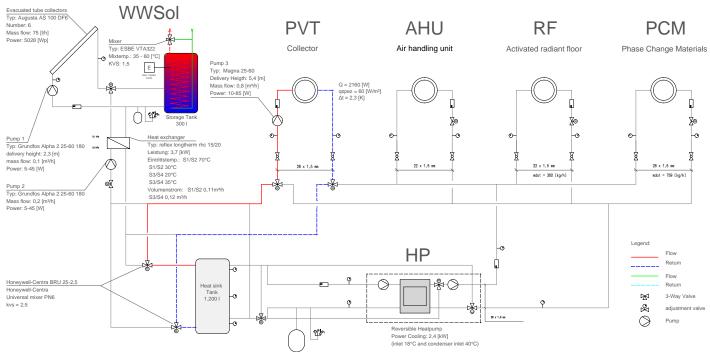
Case 4a: Summer night (1 - 5 h)

Case 4a (see plan ME-224a)

Assumptions: first part of clear summer night

The Phase Change Material (PCM) integrated in the suspended ceiling smoothes the temperature variation in the room and stores heat during the day. At night the PCM has to be discharged. As the diagram shows the PCM ceiling is actively regenerated by the PV/T collectors. This energy-saving method of discharging the PCM is one of the innovations in our concept. The Photovoltaic Thermal collectors are simple glazed PV glass modules on the roof with absorber fins and copper pipes on the back side. The PV/T collectors have two main functions: generate electricity (all year long) and cool both heat sink tank and PCM ceiling during the night (summer) by radiative cooling to clear sky. Radiative cooling is based on the heat loss by long-wave radiation emission from a body towards another body of lower

temperature, which plays the role of a heat sink. The clearer the sky is the lower temperatures can be reached. The time of discharging dependents on the temperature of the cool water generated from the PV/T collectors.

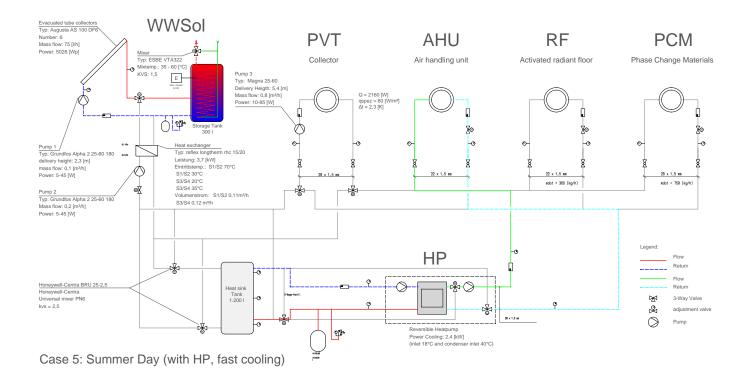


Case 4b: Summer night (22 - 1 h)

Case 4b (see plan ME-225a)

Assumptions: second part of clear summer night

As soon as the PCM ceiling is discharged the PV/T collectors are used to cool down the heat sink tank. If the temperature of the heat sink tank is higher than the solidification temperature of the PCM at the beginning of the night, however, cases 4a and 4b have to be interchanged: First the heat sink tank has to be cooled down, then the PCM.

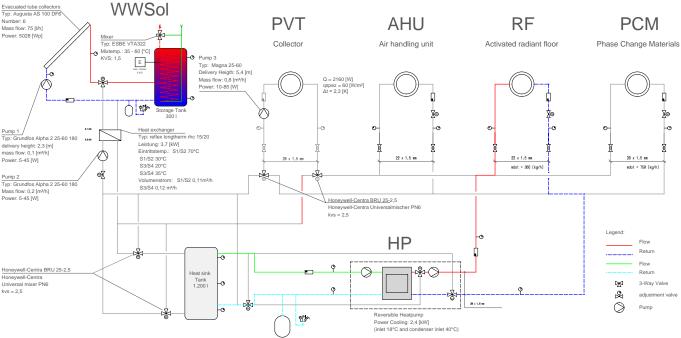


Case 5 (see plan ME-226a)

Assumptions: very hot day and night, ambient temperature >28°C, fast cooling

The diagram shows the possibility to cool down the interior very fast. The consumer circuit of the reversible heat pump is coupled through a heat exchanger to the supply air within the air handling unit (AHU) and thus supplies cooler air. The source side of the heat pump is also coupled to the heat sink tank. This case will be used to discharge high internal loads quickly, for example when there is a party with many persons or when the dwellers come home. During the competition this used after the public tours to assure the comfort conditions.



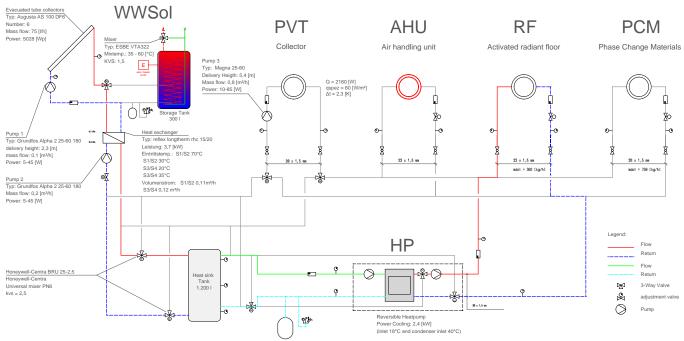


Case 6: Winter, sunny day

Case 6 (see plan ME-211a)

Assumptions: clear and sunny winter day

In winter the evacuated tube collectors are used to heat up the storage tank. This way it can be used as a heat source for the heat pump which operates the radiant floor. At a clear winter day the irradiation is sufficient to supply also domestic hot water. As the air in the climate gaps is preheated by irradiation, it might be possible to open the windows for air change. If the air turns out to be too cold, the mechanical ventilation has to be turned on.



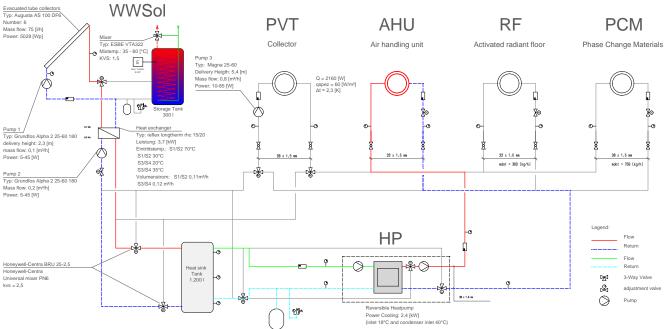
Case 7: Winter, without sun

Case 7 (see plan ME-212a)

Assumptions: successional cloudy winter days

At cloudy and cold winter days the building is heated by the heat pump just like described in case 6. However as irradiation is low during these days it will not be enough to both prevent the thermal storage from freezing and supply domestic hot water. In these cases (which fortunately occur quite rarely in Madrid), hot water has to be prepared by an electric heating rod. We have selected this robust and very efficient system to guarantee a source for the HP during the winter and dimensioned the absorber area for this worst case. To minimize heat losses due to air change the air handling unit (RLT) with heat recovery is active. At current stage the PV/T collectors have no function during winter. However we are going to analyze if they can be used as thermal collectors during the winter days after the competition in Stuttgart.





Case 8: Winter, without Sun (fast Heating)

Case 8 (see plan ME-213a)

Assumptions: successional cloudy winter days, fast heating

The diagram shows the possibility to heat up the interior very fast. The consumer circuit of the heat pump is coupled through a heat exchanger to the supply air within the air handling unit (RLT) and by this the air is supplied to the interior preheated. This case will be used to ensure the comfort conditions very quickly, for example in when the dweller comes home or on a very cold day.

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12.5 Solar Thermal System - Contents

- 1.1 Describtion of the Domestic hot water preparation (WWSoI)
- 1.2 Supporting Structure
- 1.3 Maintenance
- 1.4 Effectiveness of the insulation
- 1.6 Parametric studies
- 2. Simulation
- 2.1. Domestic hot water (DHW) draw off profiles
- 2.2 Simulation Results
- 2.2.1 Yearly simulation Madrid
- 2.2.2 Yearly simulation Stuttgart
- 2.2.3 Competition simulation Madrid

References

Annex

Solar Thermal System

In our design we have always aimed for potential multi-usage of components which are an important aspect of a successful architectural integration of solar systems:

- The PV System is not only an essential system for such a solar house; it also gives distinction to the face of the building.
- The monocrystalline PV modules on the roof have the added function of providing cooling energy at night.
- The evacuated tube collectors act as the key shading device for the light gaps between the modules.
- The ventilation tower with the two solar chimneys on both sides of the solar driven adiabatic cooling slot also is a key design feature for the interior of the house.

1.1 Describtion of the Domestic hot water preparation (WWSoI)

The solar thermal system for domestic hot water DHW preparation consists mainly of evacuated tube collectors, pipes, pumps and a hot water storage. The collector area is quite large for 2 people hot water needs and a 300 liters tank. The basic scheme

of the system is shown in figure 1.

This area has been chosen together with the heat sink tank volume (1200 liters) in order to avoid the use of an additional electrical back-up in the heat sink tank for the climate of Madrid. Indeed, pure water is used the heat sink tank and attention has to be paid in winter to prevent freezing. This allow to increase the use of the solar heat in winter and also the efficiency of the collectors since the system is operated with low temperature. On the other hand, such a large collector area will cause stagnation in summer when there is no heating demand. In order to enhance the emptying behavior of the collectors during stagnation, the collectors are slightly titled (3°). Therefore, the amount of steam produced is limited to the collector volume and the expanded fluid is directed to the expansion vessel which has been especially dimensioned to avoid any damages of the collector loop components (pump, valve, heat exchanger,..) due to the propagation of superheated steam. More information on the calculation of the expansion device can be seen in the Solar Thermal System report.

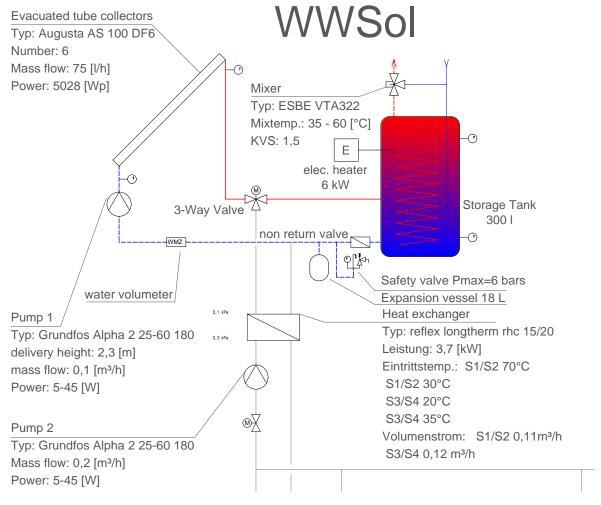


Figure 1 Hydraulic Schema of the system

home+

The hot water preparation occurs on the roof of the glazed gaps, where the evacuated tube collectors are installed. Due to the vacuum in the tubes, these collectors have lower heat losses to the ambient than flat plate collectors and are therefore more efficient even during the winter when only low radiation is available.

They also offer more energy in the early hours of the day. The direct-flown tubes are installed horizontally on the roof by orientating only the absorber fins within the tubes towards the sun (25°) without disturbing the shape of the house. In order to have the highest possible benefit of the this area: we chose the efficient collectors, the location with sunlight during the most of the day, the tubes do not impact the photovoltaic area and are installed also as a sun shading device above the glazed gaps by letting in the diffuse light from the north like a shed roof.

Constrained by the dimensions in the narrow space, we can install 6 with a net absorber area of 6,6 m² (figure 2). Searching for an applicable market available collector we find out that the company Augusta Solar had the smallest and the efficient ones, so we chose for this reason the collector type the DF 6.

The solar heat is stored in a 300 liter storage via an internal heat exchanger from the company Rotex. This hygienic storage tank prepares fresh water for use and avoids also contamination with legionellae. So the heat is stored in a storage medium (water) around the heat exchanger and a second heat exchanger provides the DHW.

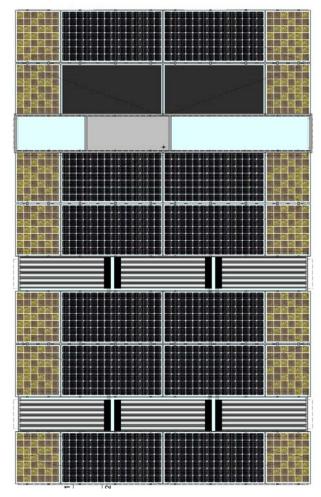


Figure 2

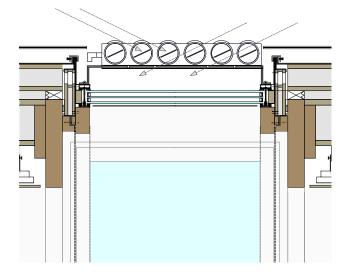


Figure 3

The solar tank is equipped with a back-up electrical heater in order to deliver heat during a potential period without sun in winter. Knowing about the electrical consumption of the heater we have stayed with this decision, also for hygienic reasons. The simulation results show that in the case of Madrid this is only a fraction and the PV System is designed to maintain this energy demand. The system covers 94% of the DHW needs during the year in Madrid without using the electrical heater. In Stuttgart this is 79% and also with a positive accumulated electrical energy balance.

Additionally, in winter when it is necessary, the solar thermal system releases heat into a second tank, the heat sink tank as mentioned above. This tank (1200 liters) is used as heat source by the heat pump which provides heating in winter to the house through an activated radiant floor. As the simulation has shown, in successive extreme cold days the temperature of the heat sink tank decreases, so the evacuated tube collectors has to heat up in first priority also this tank. (figure 4). Such design allows a very efficient operation of the heat pump since the heat source temperature never goes below 5°C. The seasonal performance factor (annual COP) of the heat pump in heating mode has been calculated to 4.3 for the Madrid climate. (figure 4)

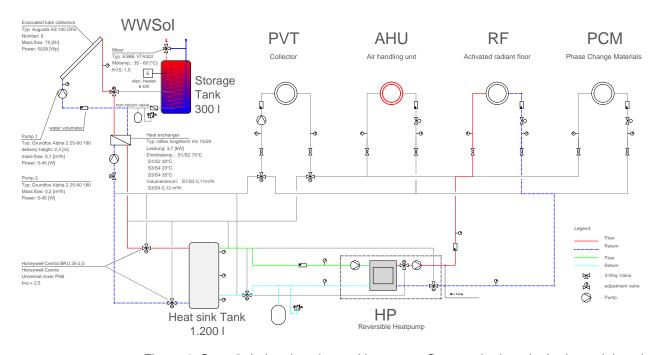


Figure 4: Case 2 during the winter without sun. Storage the heat in the heat sink tank.

1.2 Supporting Structure

The six thermal collectors on the roof are connected in series. While the storage tank is located in the technical storage, the circulation pipe goes through the roof and connect the first three collectors in the first gap with an insulated pipe. Than this pipe goes through the above insulation in the roof, to the other side of the module and connects the last three collectors. At last, the hot water will be stored in the thermal storage tank. The connecting pipe from one gap to the other is constantly in the insulation of the module, only small and flexible pipes have to be added in the assembly to connect the collectors. All these small pipes will be insulated after installation to prevent heat losses. (see also the construction drawings SW-001 Solar water heating and the architectural detail AR-355a GAP 2)

The temperature in the tank will be monitored for the analysis. As it needs to heat up the heat sink tank in the winter the system reacts and the heat, generate of the tubes will stored for a specified period in this tank.

1.3 Maintenance

The solar thermal modules have to be cleaned at least once a year with fresh water. The lifetime of the modules is estimated with > 25 years, the pumps and the control technique have an expected lifetime of > 10 years. The glazed gaps below the collectors can be cleaned in a conventional way like all other windows. The only detail is that the wiper has to contain a long rod to clean the horizontal windows under the collectors from the east and west side. All components are easily accessible: the storage tank is only behind the cubicle door as the pump, the collectors can be demounted from above without changing anything, only the pipes have to be disconnected.

1.4 Effectiveness of the insulation

A significant measure for the evaluation of a hot water storage tank is the surface heat loss. The storage tank material (PP) and the all-round heat insulation using PU foam keep these heat losses to a minimum. At an average storage tank temperature of 58 °C and an ambient temperature of 20 °C, the heat loss is just 82 W, this corresponds to a temperature loss in the storage tank water of just 3.5 degrees per day. The heat energy consumption for hot water preparation is thus low. This saves precious energy.

1.5 Parametric studies

In the deliverable 4 we have clearly show the parametric studies for the solar water heat. Since this time we have complete the system and we integrate it in the whole concept.

For the Energy and Carbon Dioxide recovery time see the Sustainability Report.

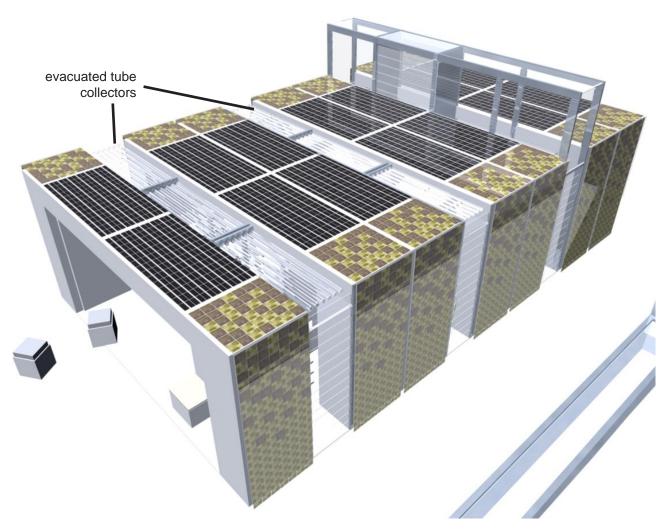


Figure 5: home+

2. Simulation

For the solar thermal system a detailed simulation model has been developed and implemented in the Simulation Studio in TRNSYS [1]. More details in the Simulation Input Report.

2.1. Domestic hot water (DHW) draw off profiles

The normal mean DHW consumption for northern Europe is around 50 liters/person/day. For a more realistic simulation, the DHW profile was generated with the program from Jordan and Vajen [2,3] which can be downloaded free of charge from the homepage of the Solar Energy Laboratory of the University of Wisconsin, Madison [4]. This profile was generated for one year with a time step of 6 min (figure 6). For the competition, another profile has been used according to the instructions of the organization. Figure 6 shows the profile for the week of the competition.

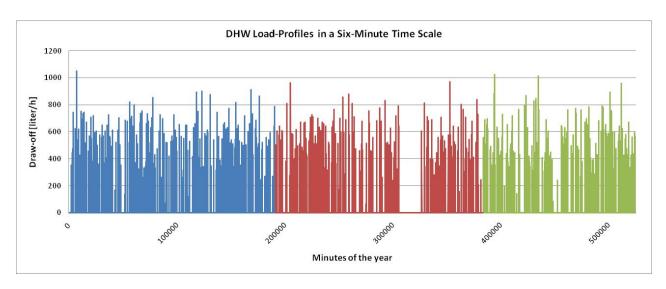


Figure 6: DHW Draw-off profile used for the yearly simulation (6 min time step)

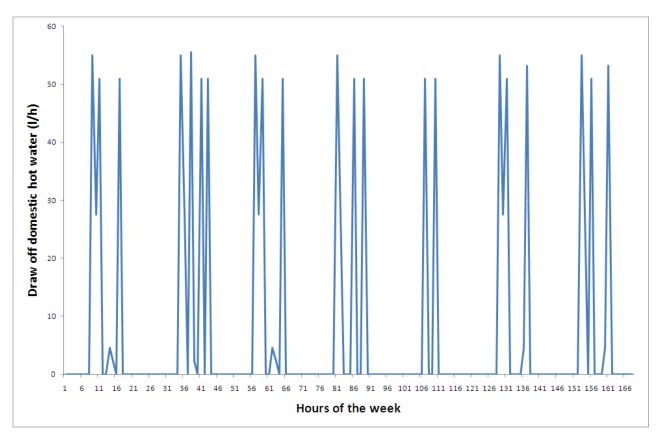


Figure 7: DHW draw-off profile for the competition (1 hour time step)

2.2 Simulation Results

2.2.1 Yearly simulation Madrid

Figure 8 and 9 show the main results of the simulation.

The solar system can meet the DHW demand almost the all year except in winter when it has to supply heat to the heat sink store. The solar fraction is defined according the domestic hot water demand only. This means that it takes into account only the auxiliary energy needed for hot water (and not for the heat sink tank).

The annual specific yield of the solar system is 263 kWh/m². It is not a very high value for DHW preparation. This is due to the relatively high area installed (6.6 m²) for a 2 people house. The dimensioning of the solar thermal system has been done in order to be able to feed the heat sink store in winter when the heat pump is working in heating mode and takes heat out of the heat sink store. Figure 10 shows how the solar system works in winter.

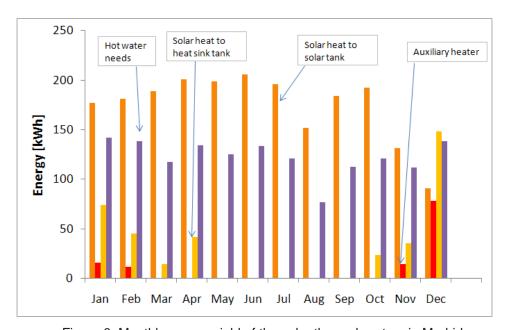


Figure 8: Monthly energy yield of the solar thermal system in Madrid

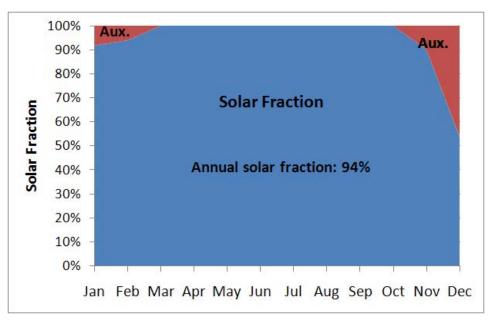


Figure 9: Solar fraction of the solar thermal system over the year in Madrid

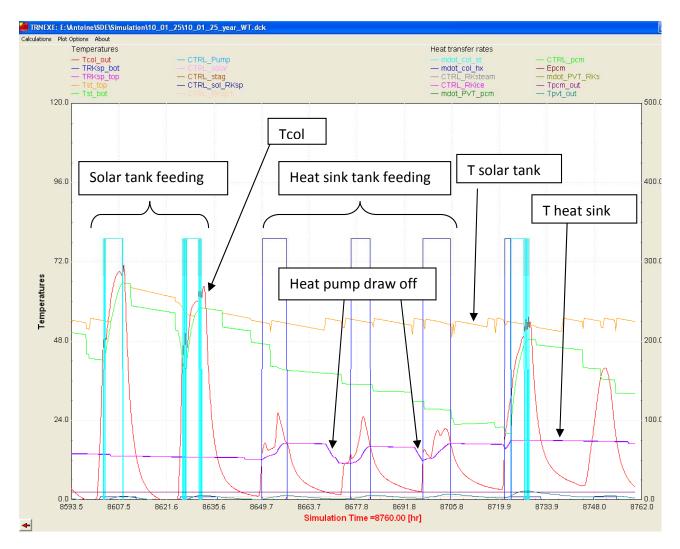


Figure 10: Winter operation of the solar thermal system

2.2.2 Yearly simulation Stuttgart

Figure 11 and 12 show the main results of the simulation.

In this case, the solar fraction is much less than in Madrid since the solar system has to feed a lot more heat into the heat sink store for the heat pump operation. Actually, it is not enough to cover the demand of the heat pump and an additional auxiliary electrical had to be put in the heat sink store. The electricity consumption of this heater is discussed in the Comprehensive Energy Analysis and Discussion Report, chapter 3.

The solar specific yield of the solar system is similar to the one of Madrid (257 kWh/m²a) since the solar system runs much more in winter at low temperature for feeding the heat sink store.

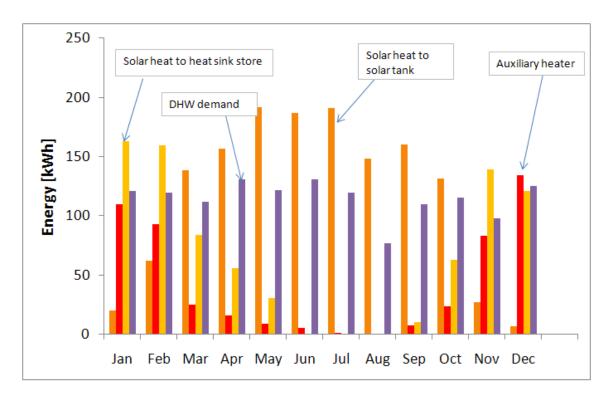


Figure 11: Monthly energy yield of the solar thermal system in Stuttgart

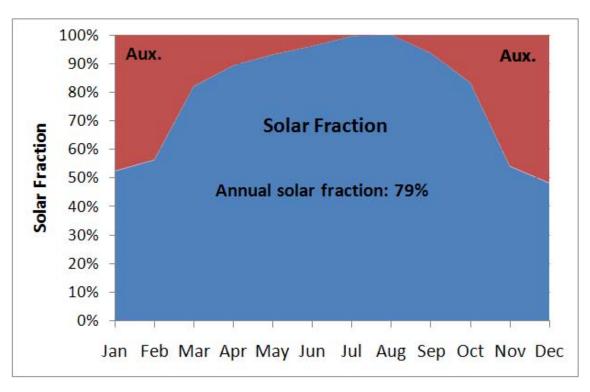


Figure 12: Solar fraction of the solar thermal system over the year in Stuttgart

2.2.3 Competition simulation Madrid

Figure 13 shows the main results of the simulation.

100 % of the hot water needs are covered by the solar system and the specific yield over the 3 months is 79 kWh/m².

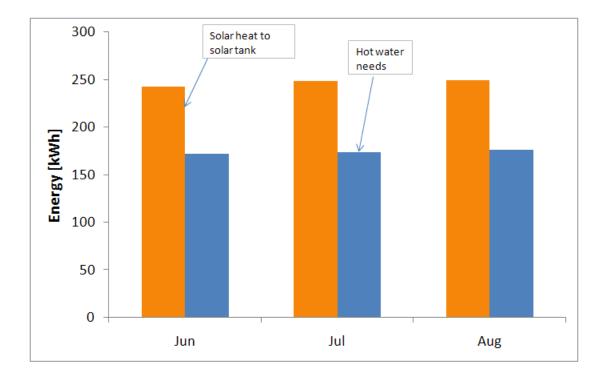


Figure 13: Monthly energy yield of the solar thermal system in Madrid (competition conditions)

References:

[1] A Transient System Simulation Program, TRNSYS 16.01.0003, Solar Energy, Laboratory, Univ. of Wisconsin-Madison, http://sel.me.wisc.edu/trnsys

[2] Jordan U., Vajen K., Influence of the DHW profile on the Fractional Energy Savings: A case study of a solar combi-system, Solar Energy, Vol. 69 (suppl.), Nos 1-6, 197-208,2000

[3] Jordan U., Vajen K., Realistic DHW profiles for different time scales, V.2.0, Universität Marburg, May 2001

[4] http://sel.me.wisc.edu/trnsys/trnlib/library15.htm#IEA26Load

Annex 1: Dimensioning of the expansions tank / Page 1

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File:D:\PhD\SDE\Energy_concept\Solar thermal\expansion_volume_solarpraxis.EES
                                                                                                                 5/1/2010 6:54:05 PM Page 1
      EES Ver. 8.400: #1036: For use only by students and faculty in the Department of Mechanical Engineering, HfT Stuttgart
A<sub>col</sub> = 1.1 Augusta collector area
N<sub>col</sub> = 6 Number of collectors
V<sub>col</sub> = 1.4 volume of fluid inside one collector Augusta DF6 in liters
d<sub>pipe</sub> = 0.018 internal diameter of the pipe
L<sub>pipe</sub> = 20 Length of the pipe
T<sub>st</sub> = 271 Standstill collector temperature from SPF report
\delta_h = 3 difference in height between the expansion vessel and the collectors
V<sub>hx</sub> = 9.2 volume inside the internal heat exchanger of the heat storage tank
p<sub>max</sub> = 6 maximal operating pressure from SPF report in bar
T<sub>0</sub> = 15 initial temperature during the filling of the collector field
n = 0.000654 coefficient of thermal expansion for 40% propylene glycol/60% water
T<sub>min</sub> = 10 temperature during the filling for example
T<sub>max</sub> = 160 mean temperature of the circuit during stagnation
P<sub>eva</sub> = 140 Evaporation/steam power per surface area in W/m² for vacuum tube collector
P<sub>loss</sub> = 25 specific heat losses for pipes in W/m
p<sub>sv</sub> = 660 Pressure of the safety valve in kPa
p_{cc} = 50 overpressure recommended for small solar plants in kPa
Calculate the total collector area
A_{tot} = A_{col} \cdot N_{col}
Calculate the volume of fluid inside the collectors
V_c = N_{col} \cdot V_{col}
Calculate the volume inside the pipes
V_{pipe} = 3.142 [] \cdot d_{pipe} \cdot L_{pipe}
Calculate the volume of the collector circuit
V_{cc} = V_{pipe} + V_{hx}
Calculate the total fluid volume in the circuit
V_i = V_{pipe} + V_{cc} + V_c
Calculate expansion liquid volume
```

Dimensioning of the expansions tank / Page 2

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EES Ver. 8.400: #1036: For use only by students and faculty in the Department of Mechanical Engineering, HfT Stuttgart

$$V_e = V_i \cdot n \cdot [T_{max} - T_{min}]$$

Calculate the volume of the water reservoir for liquid losses and liquid retractation compensation

$$V_{re} = Max [3, V_i \cdot 0.029]$$

Calculate the usefull volume of the expansion vessel

$$V_{use} = V_e + V_{re} + V_v$$

Calculate the lenght of the pipes that can be filled by steam

$$L_{steam} = P_{eva} \cdot \frac{A_{col}}{P_{loss}}$$

Calculate the maximum volume of vapor in the circuit

$$V_v = V_c + 3.142 [] \cdot d_{pipe} \cdot L_{steam}$$

Calculate nominal volume of the expansion vessel

$$V_n = P_f \cdot V_{use}$$

Calculate the pressure factor

$$P_f = \frac{p_{final} + 100}{p_{final} - p_{max}}$$

Calculate the maximal operating pressure in kPa

$$p_{final} = p_{sv} - p_{sv} \cdot 0.1$$

Calculate the geodesic pressure in kPa

$$p_{geo} = \delta_h \cdot \frac{100}{10}$$

Calculate the gas pressurization in the expansion vessel

$$p_{gas} = p_{cc} + p_{geo}$$

Calculate the pressure equivalence of the water reservoir

$$p_{re} = [p_{final} - p_{gas}] \cdot \frac{V_{re}}{V_{use}}$$

Calculate initial pressure for fiiling

$$p_{initial} = p_{gas} + p_{re}$$

Dimensioning of the expansions tank / Page 3

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SOLUTION

Unit Settings: [kJ]/[C]/[kPa]/[kg]/[degrees]

Acol = 1.1	Atot = 6.6	$\delta h = 3$	$d_{pipe} = 0.018$	$L_{pipe} = 20$
Lsteam = 6.16	n = 0.000654	Ncol = 6	pcc = 50	Peva = 140
$P_f = 1.35$	pfinal = 594	$p_{gas} = 80$	pgeo = 30	pinitial = 192.6
Ploss = 25	p _{max} = 6	$p_{re} = 112.6$	psv = 660	To = 15
$T_{max} = 160$	T _{min} = 10	$T_{st} = 271$	$V_c = 8.4$	$V_{cc} = 10.33$
$V_{col} = 1.4$	$V_e = 1.948$	$V_{hx} = 9.2$	$V_i = 19.86$	$V_n = 18.49$
$V_{pipe} = 1.131$	$V_{re} = 3$	$V_{use} = 13.7$	$V_{V} = 8.748$	

No unit problems were detected.

Annex 2: Inspection Report of the collectors / Page 1



C938

Solar Collector Factsheet augusta-solar AS 100 DF6



- Leistungsmessung EN12975:2006
- Qualitätstest EN12975:2006

AS 100 DF6 Modell Тур Vakuumröhrenkollektor Hersteller augusta-solar GmbH Adresse Zirbelstrasse 54

DE-86154 Augsburg Telefon +49 (0821) 419 020-10 +49 (0821) 419 020-20 **Telefax** Email info@augusta-solar.de Internet www.augusta-solar.de **Testdatum** 12.2008





Dimensionen		Technische Daten	
Bruttomass Länge	2.097 m	Minimaler Volumenstrom	40 l/h
Bruttomass Breite	0.721 m	Nennvolumenstrom	80 l/h
Bruttofläche	1.512 m ²	Maximaler Volumenstrom	120 l/h
Aperturfläche	1.112 m ²	Flüssigkeitsinhalt	1.4
Absorberfläche	1.019 m ²	Maximaler Betriebsdruck	6 bar
Leergewicht	36 kg	Stagnationstemperatur	271 °C
No. 1		VAC 14 A 1	

Montagearten

- \checkmark Aufbau auf Schrägdach
- Einbau in Schrägdach
- $\sqrt{}$ Ständeraufbau für Flachdach
- Fassadenmontage

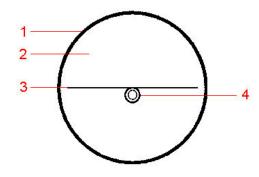
Weitere Angaben

- Module in verschiedenen Grössen erhältlich
- Abdeckung auswechselbar

Hydraulischer Anschluss

Kupferrohr, Nennweite 18 mm

Aufbau



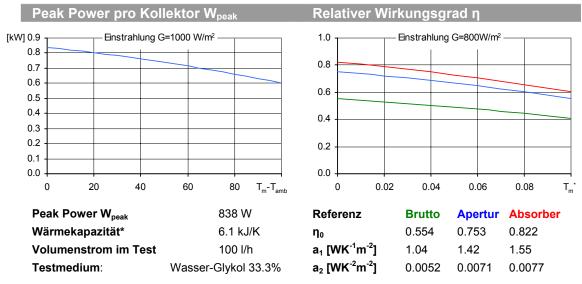
- 1 Abdeckung
- 2 Vakuum
- 3 Absorber
- 4 Koaxialrohr

SPF Testing, Institut für Solartechnik SPF, Hochschule für Technik Rapperswil HSR, CH-8640 Rapperswil, Switzerland 10.12.2008 / SCFv3.0de www.solarenergy.ch

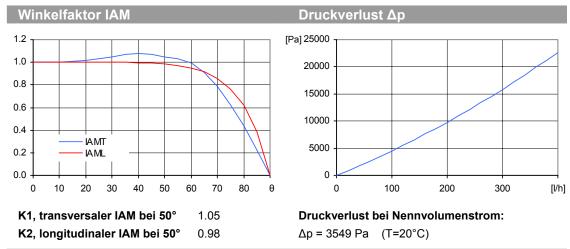
Inspection Report of the collectors / Page 2



C938



^{*)} Spezifische Wärmekapazität C des Kollektors ohne Fluidinhalt, bestimmt nach 6.1.6.2 der EN12975-2:2006



SPF Anlagensimulation mit Polysun

Kurzbeschreibung der Anlage Klima: Schweizer Mittelland, Kollektorausrichtung: Süd, Kaltwasser 10°C, Warmwasser 50°	Flächenbedarf** Anzahl Kollektoren	Solarertrag**
Brauchwarmwasser: Fss* = 60% Speicher 450 Liter, Kollektorneigung 45°, Tagesenergiebedarf 10 kWh (4-6 Personen) Energiebedarf Referenzsystem 4200 kWh/Jahr	4.09 m ² 3.7 Kollektoren	623 kWh/m ²
Wasservorwärmung: Fss* = 25% 2 Speicher: 1500 Liter & 2500 Liter, Kollektorneigung 30°, Brauchwarmwasserbedarf 10'000 l/Tag (200 Personen) Tagesverluste (Zirkulation und Speicher) 60 kWh, Energiebedarf Referenzsystem 191'700 kWh/Jahr	59.2 m ² 53.2 Kollektoren	812 kWh/m ²
Heizungsunterstützung: Fss* = 25% Kombispeicher 1200 I, Kollektorneigung 45°, Tagesenergiebedarf 10 kWh (4-6 Personen), Gebäude 200 m², mittelschwerer Bau, sehr gute Dämmung, Heizleistungsbedarf 5.8 kW (Aussentemperatur -8°C), Energiebedarf Heizung 12140 kWh/Jahr Energiebedarf Referenzsystem 16340 kWh/Jahr	11.1 m ² 10.0 Kollektoren	495 kWh/m ²

^{*)} Fractional solar savings: Endenergieanteil, der sich dank der Solaranlage im Vergleich zu einem Referenzsystem einsparen lässt.

SPF Testing, Institut für Solartechnik SPF, Hochschule für Technik Rapperswil HSR, CH-8640 Rapperswil, Switzerland 10.12.2008 / SCFv3.0de www.solarenergy.ch Seite 2/2

^{**)} Flächenbedarf und Solarertrag beziehen sich auf die Aperturfläche des Kollektors.

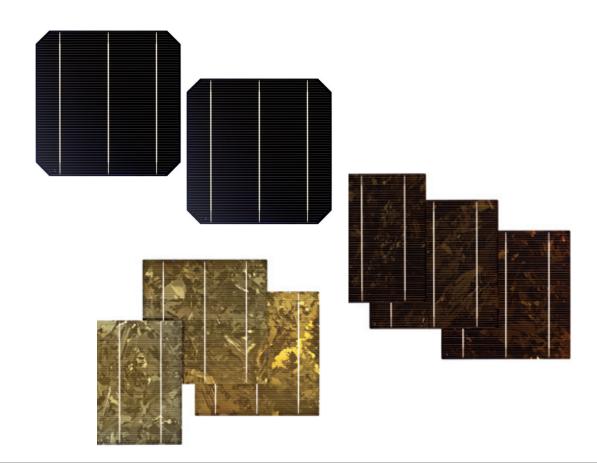
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12.6 Photovoltaic System - Contents

- 1. General Description
- 2. Design Specifications
- 3. Maintanace Plan
- 4. Inverters certificates
- 5. Simulation
- 6. Maintain the PV Technology Limitations Rule 8.1

References

Annex



Photovoltaic System

1. General Description

Contemporaneous to the design development of the envelope we looked out to integrate efficient modules and to maintain the aesthetical requirements. Since the beginning of the competition we focused on high energy generation. We analyzed different photovoltaic technologies regarding technical properties, module efficiency, design potential and the architectural integration into our building concept. In the beginning we investigated thin film modules in detail, but because of the lower module efficiency compared to crystalline modules we averted this technology. With our crystalline solution we are able integrate a more efficient energy layer outside the thermal covering. Another reason was the design aspect. Our finally solution allows a certain transparency and different coloring.

During the planning process the energy generation concept of the buildings was calculated according to the locations Stuttgart and Madrid. Energy demand of the house was simulated by average consumption data from German households and calculated against the generated energy. These calculations began with estimations and high uncertainties, but improved continuously throughout

the planning. While architectural and design issues were discussed, the consequence to the energy generation concept always have been updated and considered into the decisions.

Finally we optimized the photovoltaic modules according to orientation, alignment and integration into the design aspects of the architectural structure. Since the roof area has the highest irradiation and therefore has the greatest energetical potential, we agreed on mono crystalline modules. On the façade we simulated many options and found out, that we could consider colored, poly crystalline modules without decrease in efficiency, but with better integration options into the architectural design. Out of this requirement evolved a technical innovation since for the first time different colored cells are laminated together to one module.

2. Design Specifications

The electrical connection of the PV installation is shown in the system overview Figure 2, see also Annex 1.

2.1 Photovoltaic Generation

For electricity generation, a large PV system of 12.5 kWp is installed on the roof and both, the west and east façades. Each façade is completely covered with 7 polycrystalline PV-Modules (3 kWp each) except for the gaps. On the roof, two different types of modules are installed; 12 small polycrystalline PV-Modules (1.5 kWp) are located on the east and west sides and 12 monocrystalline PV/T modules (5 kWp) in the middle of the roof. The conversion from DC current to AC current is done with 5 inverters. The manufacturer of the PV-Cells and inverters is Sunways AG in Konstanz (Germany). The Manufacturer of the PV glass pieces is ERTEX-Solar (Austria).

The innovation in this system is that within the polycrystalline PV glass/glass modules two different solar cells are combined and integrated. The reason for applying two different types of solar cells for roof and façades is a matter of design. Whereas the multicolor cells on the façade are an important design feature of our house, the monocrystalline cells on the roof have been selected to provide a maximum of power output per roof area. To link

the two areas, we have introduced a new way to combine differently colored cells in a dot-like pattern to achieve a transitional effect from one to the other area: The façade modules will turn with their colors gold and bronze around the edge, then becoming black with the monocrystalline modules in the middle of the roof.

The other special feature in the PV installation is that the monocrystalline PV modules on the roof have the added function of providing cooling energy at night. This way, they become a new and innovative type of hybrid photovoltaic and thermal collectors (PV/T) collectors and they are useful nearly 24h in summer. During the day, they produce electrical energy and cold water at night. Over the last year, we have developed this idea and built several test prototypes. Many different aspects have been optimized, mainly the thermal transport from the PV surface to the heat fluid in the pipes. Through the absorber and copper pipes beyond the PV surface, the water in the circulation cools down by radiation to the night sky. Because the two PV/T modules north of the ventilation tower are shaded most of the time, they are not equipped with PV cells but act only as radiation exchange surface with the sky.



Figure 1: home +

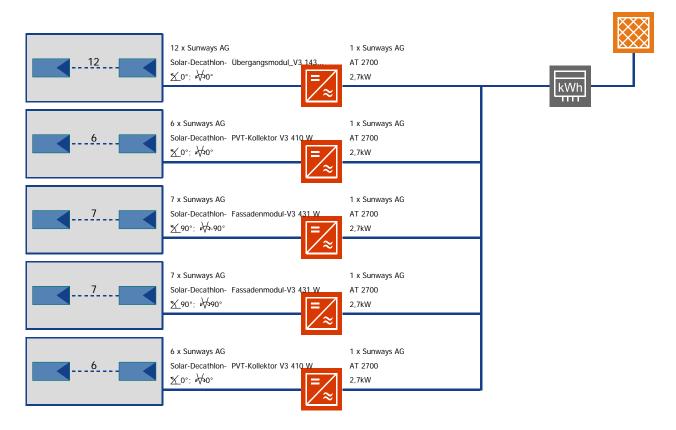


Figure 2: Electrical interconnections of the PV system

Furthermore, the PV/T collectors are uncovered without any insulation box in order to maximize the heat losses to the ambient for night cooling applications. For this reason, there is no risk of water evaporation inside the collector during stagnation in summer. The maximum expected temperature in standstill is the same as a normal PV module (around 80°C) which is far from the evaporation temperature of pressurized system.

At the beginning, we tested the market available PV/T hybrid collectors to get information about the power and the construction of them, but finally we decided to build the PV/T collectors by ourselves, which are already done as shown in the figure 3. More Information to the PV/T collectors can be found in the Energy Analysis. (See figure 1 and the Construction Drawings AR-031 ROOF, AR-113 elevation building east and AR-115 elevation building west)



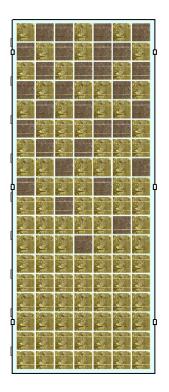
Figure 3: PV/T collector

For the technical datasheets of the PV-Cells and glass pieces see the Constructions Specification and the module characteristics are in Annex 2. The drawings of the PV-Modules from the company Ertex are in Annex 3.

Module Characteristics

All the PV-modules are frameless glass/glass panels with laminated PV-Cells in gold and bronze or black monocrystalline cells. To improve the light transmission as well as the visual appearance we

have used low-iron glass. The glass in the façades and the roof edges is coated and transparent, whereas the glass of the PVT-Modules has also a white coating in the 4th layer. This design of the PV-Modules was not only a technical challenge to combine two different cells, but also the size of the glass/glass Modules poses a production-related challenge. We had also planned to use coated glass, but due to the size and the thick of the glass it was not possible.



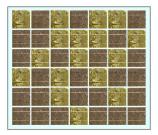




Figure 4

Figure 5

Figure 6

East-/West Façade:

Size: 1194 x 2972 mm

Thickness total: 11,7 mm

Electrical Power: 430 Wp

Module-Efficiency: ca 12%

Cell-Efficiency: ca. 13%

Cells: polycr. gold and bronze

Certification: IEC 61215 Ed.2.0

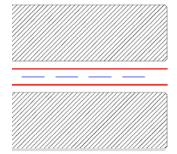
Roof Edge:

Size: 1194 x 1028 mm
Thickness total: 17,7 mm
Electrical Power: 143,5 Wp
Module-Efficiency: ca 11,6%
Cell-Efficiency: ca. 13%
Cells: polycr. gold and bronze
Certification: IEC 61215 Ed.2.0

Roof PV/T:

Size: 1194 x 2324 mm
Thickness total: 17,7 mm
Electrical Power: 410 Wp
Module-Efficiency: ca. 14,7%
Cell-Efficiency: ca. 17%
Cells: monocr. Black
Certification: IEC 61215 Ed.2.0

Figure 7: Glass detail PV/T collector



8 mm toughened safety glass (clear glass)

0,76 mm PVB coat Solar cell

0,76 mm PVB coat

8 mm toughened safety glass (clear glass) white coat RAL 7035 on # 4

2.2 Choice of the number of inverters

All converters are products of SUNWAYS AG (Type AT 2700). The conversion from DC current to AC current is done with 5 inverters respectively: one for the east façade, one for the west façade, one for the roof-edge and two for the PV/T-Modules. Two different inverters for the PV/T modules have been planned because some of them are shaded by the tower and some of them are not. According to the simulation, 12.5 % more electricity can be produced if the PV/T modules are connected to 2 different inverters (which mean 2 different MPP trackers).

2.3. Earthing system, cables, wiring method and protection

All PV-glass panels are frameless, so there is no connection for grounding, thus will be connected the substructure to grounding. The grounding line connected the substructure from one facade through the roof the other facade. Thereby will be connected the PV-substructure (galvanized steel rails) of all 4 modules of the house to the ground. Inside the house we are use TN-S system and for the connection of the building we have prepared all measures for TT- system.

All modules are connected to the inverters through the wiring routes beyond them and go under the terrace to the porch where the inverters are. For the PV cabling we have provide ductworks in every module in the middle on each façade. The cables we used are special solar cables, which have a double isolation. In the PV system are integrated cutouts and discharger, on the grid site of the inverter. The datasheets of the cables and the calculation of the dimension, to guarantee the protection against direct and indirect contact, are attached in the annex. The calculations to guarantee the fault protection, protections against overload on the DC side and against short-circuit surrents are also included in the annex.

3. Maintenance Plan

The PV modules have to be cleaned at least once a year with fresh water. The lifetime of the modules is estimated with > 25 years. The inverters and the other electrical components should be checked frequently and possibly renewed after > 10 years.

4. Inverters certificates

The electrical data of the converters is shown in annex 4 (Datasheet and certifications from Sunways).

5. Simulation

Software used

The simulation of the PV system has been done using the simulation environment INSEL [1]. This software has been chosen because of its flexibility for simulating electrical system. Furthermore, since the electricity generation does not influence on the thermal behaviour of the house, it can be simulated separately without eliminating any useful interaction between the system and the building.

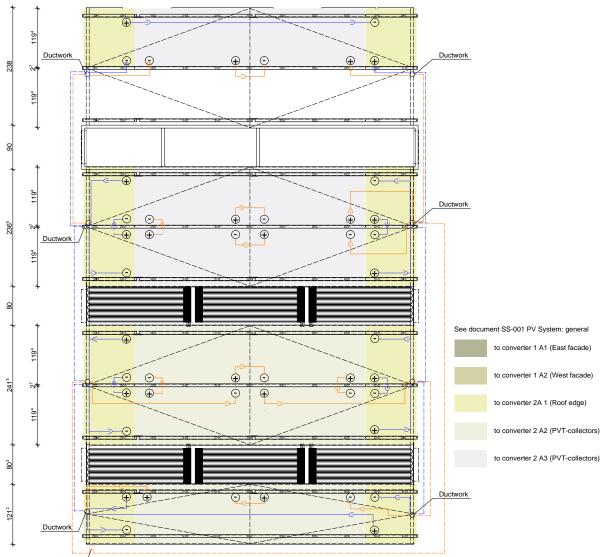
Additionally, the PV system has been also simulated with the commercial software PV-Sol Expert 4.0 from the company Valentin [2] and the results are very similar (difference less than 2%). Both results have been compared and will be shown in the Annex 5-7. (The Electrical Energy Balance are included in the Comprehensive Energy Analysis and Discussion Report)

Weather data and shading

The weather data of Meteonorm [3] have been used for the PV simulation. The weather data processing (calculation of the radiation on different PV surfaces) have been done with TRNSYS [4] and used as input in the INSEL simulation environment. Also the shading of the ventilation tower on the PV modules (of both south and north side of the tower) has been considered. The detailed shading calculations have been done in TRNSYS and used as input in INSEL. Intentionally, the calculations have been assumed very pessimistic: once one PV module is a little bit shaded, the power output of the all array is set to 0. The choice and the dimensioning of the inverters have been done based on those calculations. More information about INSEL and Metenorm can be found in the Annex of the Comprehensive Energy Analysis and Discussion Report.

6. Maintain the PV Technology Limitations Rule 8.1

- a. The price of the bare photovoltaic cells are
 ca. 3 € pre Wp. (based on the information of the manufacturer)
- b. The encapsulated photovoltaic modules are for all commercial available. For the PV Modules we have used 3 various and normal cells, which were combined together in a new design. We have planned these modules in corporation with Sunways and Ertex. They have also certificate this modules. The material price of these modules are ca. 5700 € per kWp (5,70 € per Wp)
- c. The colored polycrystalline cells are normal silicium cells, the color results of a surface treatment.
- d. All inverters have a sum of the maximum output power of 13,5 kW.



to converter AT 2700 2 A1; 2 A2; 2 A3 see SS-001 PV SYSTEM: GENERAL P 2

Figure 8: PV wiring roof (SS-011a)

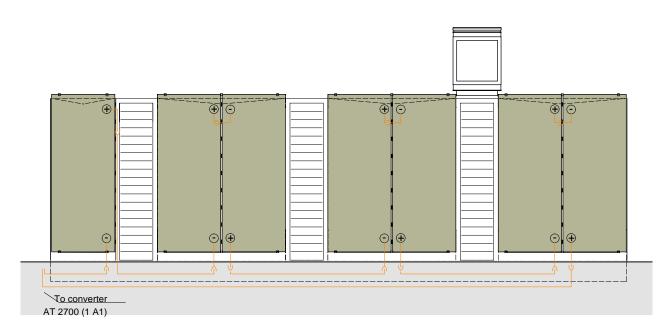


Figure 9: PV wiring east facade (SS-012a)

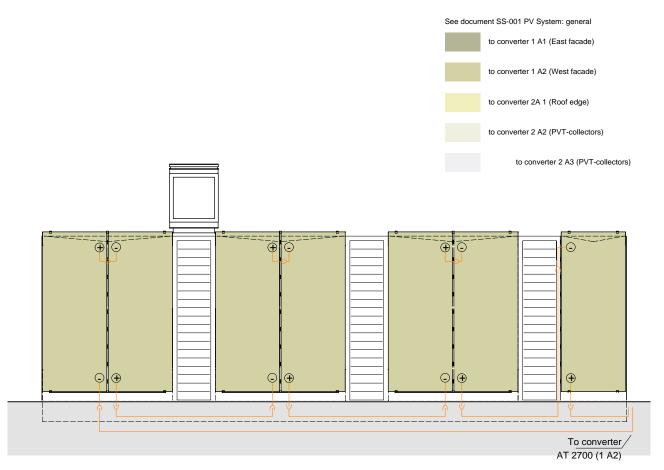
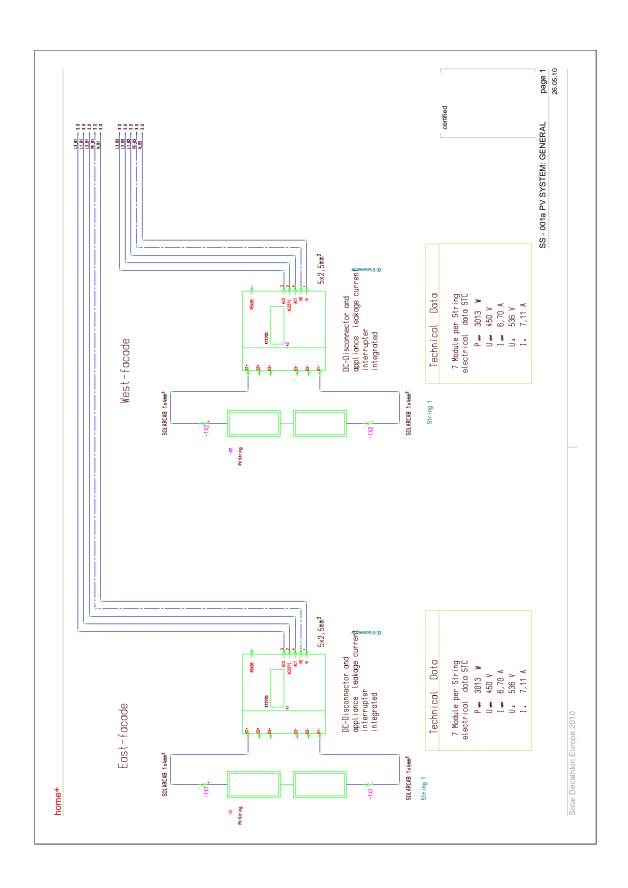


Figure 10: PV wiring west facade (SS-013a)

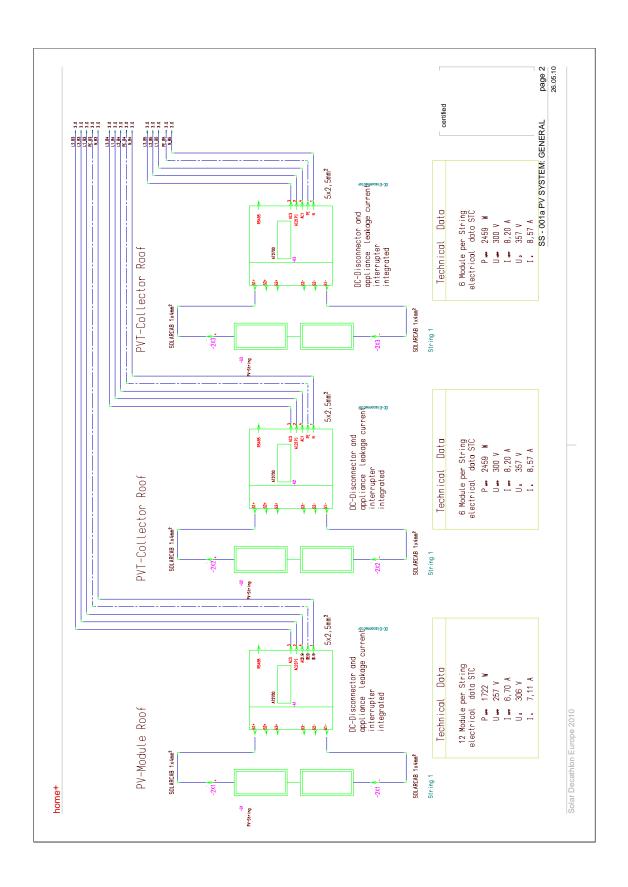
References:

- [1] Schumacher, J. "Digitale Simulation regenerativer elektrischer Energieversorgungssysteme", Dissertation Universität Oldenburg, 1991 www.insel.eu
- [2] Valentin Energiesoftware, PVSOL. http://www.valentin.de/index_en_page=pvsol_grid
- [3] Meteotest (2003). Meteonorm handbook, Parts I,II and III. Meteotest, Bern, Switzerland. http://www.meteotest.ch
- [4] A Transient System Simulation Program, TRNSYS 16.01.0003, Solar Energy, Laboratory, Univ. of Wisconsin-Madison, http:\\sel.me.wisc.edu\trnsys

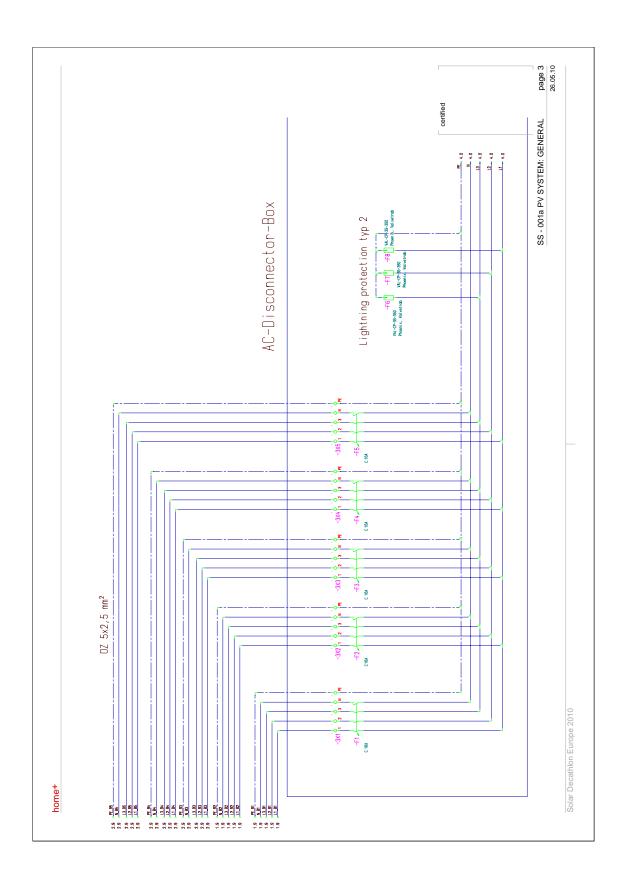
Annex 1: SS-001 PV System General Page 1



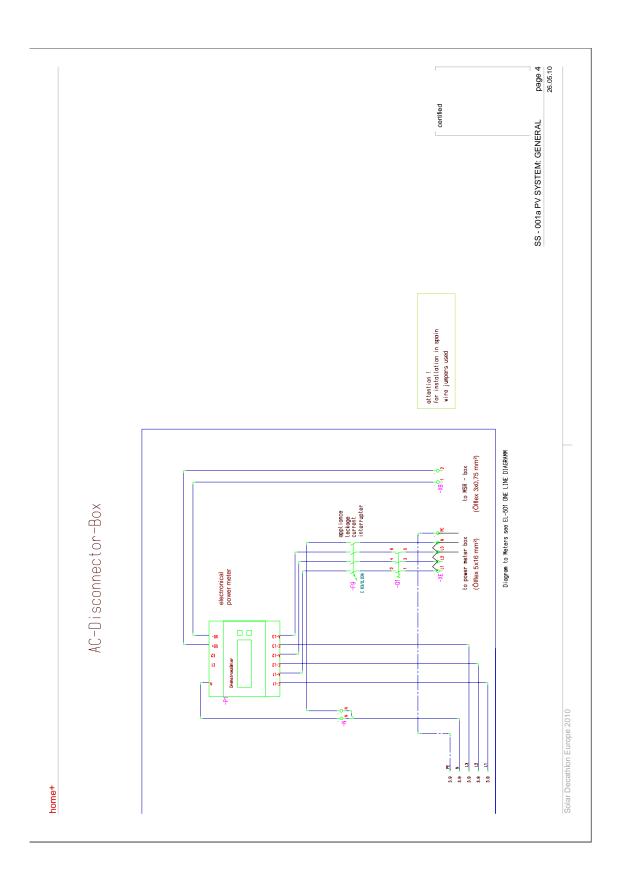
SS-001 PV System General Page 2



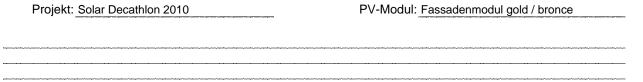
SS-001 PV System General Page 3



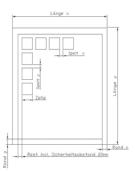
PV System General Page 4



Annex 2: Facade PV module characteristics



				Eingabe				
	Rahmen		alle Angaben	in mm		Zellen		
Breite (Länge x)	Rand x	Höhe (Länge y)	Rand y	Zelle	Spalt x	Spalt y	Anzahl x	Anzahl y
1194	0	2972	0	156	5	6	7	18



	Aus	gabe	
	alle Längena	ngaben in mm	
Rahmenlänge x netto	Zellenlänge x	Rahmebreite y netto	Zellenbreite y
1194	1122	2972	2910
Rest links/rechts:	36,0	Rest oben/unten:	31,0
incl. Sicherheitsabstand von 20mm pro Seite	Sicherheitsab stand eingehalten	incl. Sicherheitsabstand von 20mm pro Seite	Sicherheitsabs tand eingehalten

0
0
3
_

Zelltransparenz

Modulfläche brutto m²	Modulfläche netto m²	reine Fläche d. Zellen m² abz. Löcher	Gesamt Anzahl Zellen
3,548568	3,548568	3,066336	126

Zellen Parallel	Zellen Reihe
1	126

Transparenz 13,59%

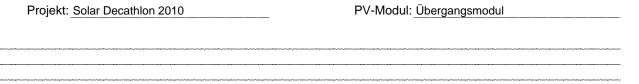
	Eing	abe der Zellend	laten (Alle Ei	ngaben in den	Grundeinheite	en V,A)	
Temp. Koeff. Leerlaufspannung α Uoc (V/K)	Temp. Koeff. α Uoc (%/K) oder (%/C°)	Temp. Koeff. α Uoc (V/K) oder (V/C°)	Kurzschlussstro m Isc	Strom bei max. Leistung Impp	Leerlaufspannun g Uoc	Spannung bei max. Leistung Umpp	Nennleistung
-0,002	-0,360		7,11	6,7	0,608	0,51	3,417

^nur eines von beiden^

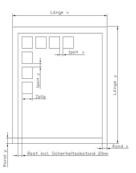
Erre	chnete Mod	duldaten (Alle '	Werte in der	jew. Grundeinh	eit)
Temp. Koeff. erlaufspannung α Uoc (V/K)	Kurzschlusss trom Isc	Strom bei max. Leistung Impp	Leerlaufspannu ng Uoc	Spannung bei max. Leistung Umpp	Nennleistung Pnenn
-0,231	7,11	6,7	76,608	64,26	430,542

Temp. x in C°	Modulleerlaufsp annung Uoc bei x C°
-12	85,167432

Roof small PV module characteristics



				Eingabe				
	Rahmen		alle Angaben	in mm		Zellen		
Breite (Länge x)	Rand x	Höhe (Länge y)	Rand y	Zelle	Spalt x	Spalt y	Anzahl x	Anzahl y
1194	0	1028	0	156	5	6	7	6



	Aus	gabe	
	alle Längena	ngaben in mm	
Rahmenlänge x netto	Zellenlänge x	Rahmebreite y netto	Zellenbreite y
1194	1122	1028	966
Rest links/rechts:	36,0	Rest oben/unten:	31,0
incl. Sicherheitsabstand von 20mm pro Seite	Sicherheitsab stand eingehalten	incl. Sicherheitsabstand von 20mm pro Seite	Sicherheitsabs tand eingehalten

Zellen Parallel	Zellen Reihe

Zelltransparenz

Anzahl Löcher x

Anzahl Löcher y

Durchmesser (mm)

Loci	ner
1,227432 1,227432 1,022	112 42

Transparenz 16,73%

Eingabe der Zellendaten (Alle Eingaben in den Grundeinheiten V,A)							
Temp. Koeff. Leerlaufspannung α Uoc (V/K)	Temp. Koeff. α Uoc (%/K) oder (%/C°)	Temp. Koeff. α Uoc (V/K) oder (V/C°)	Kurzschlussstro m Isc	Strom bei max. Leistung Impp	Leerlaufspannun g Uoc	Spannung bei max. Leistung Umpp	Nennleistung
-0,002	-0,360		7,11	6,7	0,608	0,51	3,417

^nur eines von beiden^

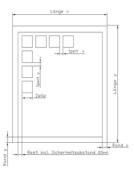
Errechnete Moduldaten (Alle Werte in der jew. Grundeinheit)						
Temp. Koeff. Leerlaufspannung α Uoc (V/K)	Kurzschlusss trom Isc	Strom bei max. Leistung Impp	Leerlaufspannu ng Uoc	Spannung bei max. Leistung Umpp	Nennleistung Pnenn	
-0,077	7,11	6,7	25,536	21,42	143,514	

Temp. x in C°	Modulleerlaufsp annung Uoc be x C°
-12	28,389144

Roof big PVT module characteristics



Eingabe								
	Rahmen		alle Angaben	in mm		Zellen		
Breite (Länge x)	Rand x	Höhe (Länge y)	Rand y	Zelle	Spalt x	Spalt y	Anzahl x	Anzahl y
1194	0	2324	0	156	6	6	7	14



Ausgabe								
alle Längenangaben in mm								
Rahmenlänge x netto	Rahmebreite y netto	Zellenbreite y						
1194	1128	2324	2262					
Rest links/rechts:	33,0	Rest oben/unten:	31,0					
incl. Sicherheitsabstand von 20mm pro Seite	Sicherheitsab stand eingehalten	incl. Sicherheitsabstand von 20mm pro Seite	Sicherheitsabs tand eingehalten					

Anzani Locher y	U
Durchmesser (mm)	3

Zelltransparenz

Anzahl Löcher x

Modulfläche brutto m²	Modulfläche netto m²	reine Fläche d. Zellen m² abz. Löcher	Gesamt Anzahl Zellen
2,774856	2,774856	2,384928	98

Zellen Parallel	Zellen Reihe
1	98

Transparenz 14,05%

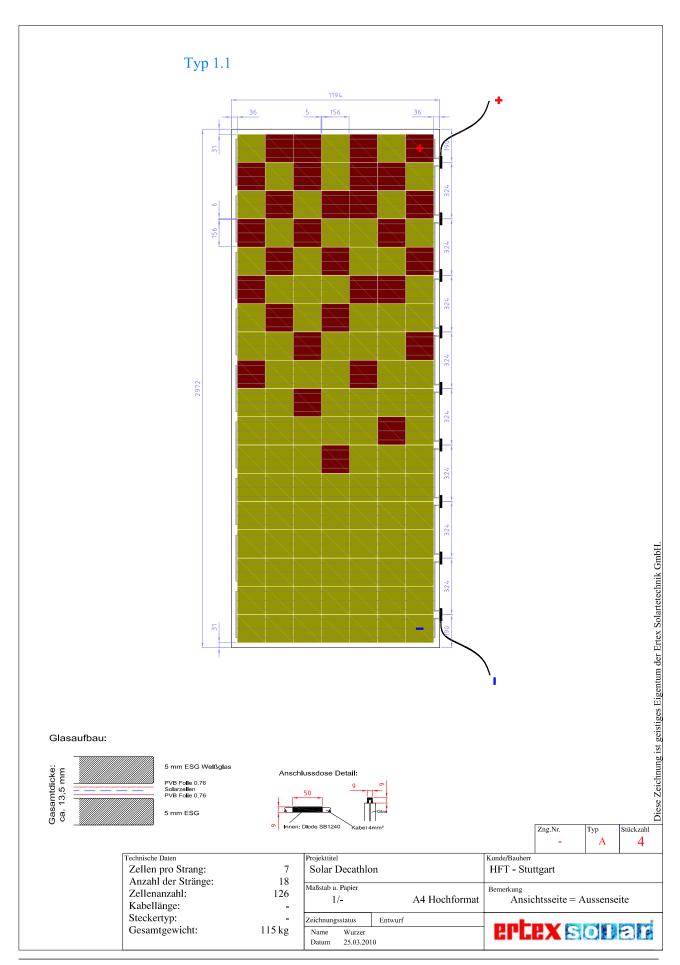
Eingabe der Zellendaten (Alle Eingaben in den Grundeinheiten V,A)							
Temp. Koeff. Leerlaufspannung α Uoc (V/K)	Temp. Koeff. α Uoc (%/K) oder (%/C°)	Temp. Koeff. α Uoc (V/K) oder (V/C°)	Kurzschlussstro m Isc	Strom bei max. Leistung Impp	Leerlaufspannun g Uoc	Spannung bei max. Leistung Umpp	Nennleistung
-0,002	-0,360		8,57	8,2	0,608	0,51	4,182

^nur eines von beiden^

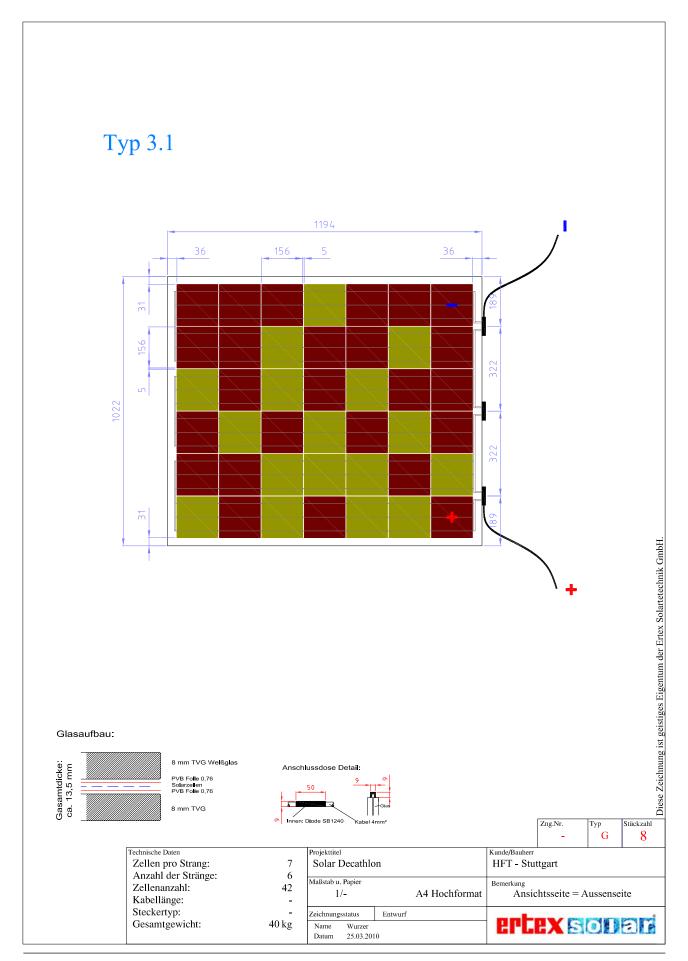
Errechnete Moduldaten (Alle Werte in der jew. Grundeinheit)						
Temp. Koeff. Leerlaufspannung α Uoc (V/K)	Kurzschlusss trom Isc	Strom bei max. Leistung Impp	Leerlaufspannu ng Uoc	Spannung bei max. Leistung Umpp	Nennleistung Pnenn	
-0,180	8,57	8,2	59,584	49,98	409,836	

Temp. x in C°	Modulleerlaufsp annung Uoc bei x C°
-12	66,241336

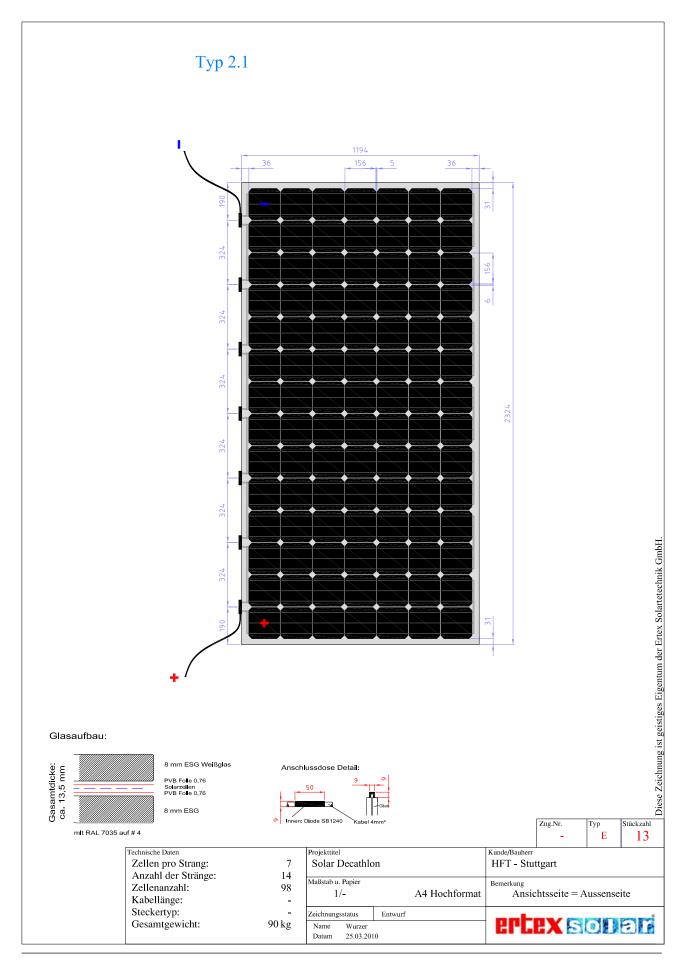
Annex 3: Actual drawings of the PV-Modules from the company Ertex / Facade



Actual drawings of the PV-Modules from the company Ertex / Roof-edge



Actual drawings of the PV-Modules from the company Ertex / PVT Module



Certificate from the company Ertex



Photovoltaikmodul

Zertifikat



Zertifikat Nr.: 40981-03-PV Issue 1 IEC

Typenbezeichnung: VSG 340

gatsinhaber: Ertl G

Zertifikatsinhaber:

Hersteller:

Ertl Glas AG, Dieselstraße 6, 3362 Mauer, Österreich

Ertl Glas AG, Abt. Photovoltaik Dieselstraße 6, 3362 Mauer, Österreich Die im Anhang gelisteten Produkte erfüllen die Anforderungen gemäß

IEC 61215 Ed.2.0 "Terrestrische kristalline Silizium-Photovoltaik-(PV)-Module Bauartzulassung"

Anforderungen der genannten Norm wird im Prüfbericht Ref.-No. 2.04.00485.1.0a, der integraler Bestandteil dieses Zertifikats ist, dokumentiert. Dieses Zertifikat ist das Ergebnis der von **arsenal research** an Mustern des Erzeugnisses durchgeführten Prüfungen. Die Einhaltung der

Das Zertifikat bescheinigt die Konformität der geprüften Produkte und identisch gefertigter Erzeugnisse, berechtigt jedoch nicht zur Führung von Prüfzeichen des OVE. Die Zertifizierung beinhaltet nicht die Überwachung des Fertigungsprozesses.

Das Zertifikat ist gültig bis 2012-08-11.



Akkreditiert vom Bundesminister für Wirtschaft, Familie und Jugend

i.A. K. Wallur

Dipl.-Ing. W. Martin Leiter Prüfwesen & Zertifizierung



Wien, 2009-08-11 Österreichischer Verband für Elektrotechnik

Annex 4: Inverters certificates



Bureau Veritas E&E Product Services GmbH

Businesspark A96 86842 Türkheim Germany + 49 (0) 8245 96810-0 info-tur@de.bureauveritas.com

Certificate of compliance

Applicant:

Sunways AG

Photovoltaic Technology Macairestraße 3 – 5 78467 Konstanz Germany

Product:

Automatic disconnection device between a generator

and the public low-voltage grid

Model: AT2700, AT3600, AT4500, AT5000

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with DIN V VDE V 0126-1-1:2006-02 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with insulating function which the distribution network provider can access at any time.

Applied rules and standards :

DIN V VDE V 0126-1-1 (VDE V 0126-1-1):2006-02 and "Generator at the public low-voltage grid, 4th edition 2001, guideline for connection and parallel operation of generators in the public low-voltage grid" with VDN additions (2005) from the German Electricity Association (VDEW) and Association of network operator (VDN).

The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate of valid safety specifications for the specified use in accordance with regulations.

Report number:

06KFS180-VDE0126

Certificate nummer:

U08-155

Date of issue:

2008-09-19

Valid until:

2010-08-29

Andreas Aufmuth

CE Declaration of Conformity

We herewith declare that the following products are in accordance with the provisions of the EMC directive 2004/108/EC and the EC low voltage directive 2006/95/EC as well as the other below-mentioned norms.

Norm	Description of the norm	NT 2500, NT 2600, NT 3700, NT 4000, NT 4200, NT 5000, NT 6000, NT 8000, NT 10000	AT 2700, AT 3600, AT 4500, AT 5000	PT 30k PT 33k
EN 50178:1997 IEC 62103:2003	Electronic equipment for use in power installations	X	х	х
EN 61000-3-2:2008	Limits for harmonic current emissions < 16 A per phase	х	х	
EN 61000-3-3:2006	Limitation of voltage fluctuations and flicker < 16 A per phase	х	х	
EN 61000-3-11:2000	Electromagnetic compatibility (EMC) by equipment > 16 A and < 75 A per phase	х	х	х
EN 61000-3-12:2005	Limits for harmonic currents produced by equipment > 16 A and < 75 A per phase	х	х	х
EN 61000-6-2 :2006	Generic standards – Immunity for industrial environments	х	х	х
EN 61000-6-3:2005	Generic standards – Emission standard for residential, commercial and light-industrial environments	х	х	
EN 61000-6-4:2007	Generic standards – Emission standard for industrial environments	х	х	х
IEC 62109-1:2003	Electrical safety of static inverters and charge controllers for use in photovoltaic (PV) power systems	Х	Х	х

Konstanz, 01.01.2009

Place Date Thomas Hauser PDM Solar Inverter



Presently applicable edition can be obtained upon request.

Page 1/1 SD151012A version 07/09 Sunways AG Macairestraße 3-5 D-78467 Konstanz Telefon +49 (0)7531 996 77-0 Telefax +49 (0)7531 996 77-10 info@sunways.de www.sunways.de

SOLAR INVERTER



Sunways Solar Inverter AT 5000, AT 4500, AT 3600 y AT 2700

Gracias a la topología HERIC® con circuito FP de nuevo desarrollo, los nuevos inversores de conexión a red de la serie AT de Sunways garantizan una producción solar óptima incluso en condiciones de radiación y temperatura variables y más allá de cualquier límite tecnológico.

Proyección flexible de instalaciones - Tecnología de silicio y de capa fina

Gracias a su rango ampliado de tensiones de entrada de 150 V a 680 V, los inversores de conexión a red de la serie AT ofrecen la máxima flexibilidad en la proyección de instalaciones solares. La innovadora tecnología sin transformador que incorporan permite a los Sunways Solar Inverter AT alcanzar unos niveles de eficiencia elevados y constantes incluso con tensiones CC oscilantes y distintas clases de potencia suministrada por los generadores. La topología HERIC® con circuito FP se encarga de eliminar las tensiones negativas no deseadas sobre todo en el caso de módulos de capa fina.

Todo en uno – Todo de serie

- · Interruptor-seccionador CC integrado
- · Pantalla gráfica retroiluminada y teclado
- · Potente registrador de datos interno de 128 MB
- · Interconexión de inversores a través de bus CAN
- · Interfaz Ethernet para la conexión en red
- · Interfaz para conexión directa de módem
- $\cdot\,\,$ Mensajes de alarma por e-mail en caso de anomalías
- Relé de aviso sin potencial para la conexión de dispositivos de alarma externos
- Salida de impulsos 50 para la comunicación con pantallas Sunways
- Servidor web integrado para funciones de visualización y configuración a través de navegador



Información y Ventas

Sunways AG · Photovoltaic Technology · C / Antic Cami Ral de Valencia, 38 · E · 08860 Castelldefels (Barcelona) Telèfono +34 93 664 944-0 · Fax +34 93 664 944-7 E-Mail info@sunways.es · www.sunways.de



Datos técnicos Sunways Solar Inverter AT

	AT 5000	AT 4500	AT 3600	AT 2700
Referencia	SI250AT2A	SI245AT2A	SI236AT2A	SI227AT2A
Entrada CC				
Potencia máxima del generador solar	6000 W	5500 W	4400 W	3300 W
Corriente máxima CC	22,0 A	22,0 A	15,5 A	15,5 A
Rango de tensión MPP	236 V 600 V	214 V 600 V	242 V 600 V	181 V 600 V
Tensión de vacío CC máxima	680 V			
Número de entradas por cada MPP-Multitracking	2 x Tyco Solarlok			
Número de MPP-Multitracking	1			
Salida CA				
Potencia nominal de salida CA	5000 W	4500 W	3600 W	2700 W
Potencia máxima CA	5000 W	4500 W	3600 W	2700 W
Corriente nominal CA	21,7 A	19,6 A	15,7 A	11,7 A
Corriente máxima CA	23,0 A	21,0 A	17,0 A	12,5 A
Frecuencia nominal	50 Hz			·
Margen de tolerancia de frecuencia	48,0 Hz 51,0 Hz	(según RD 1663/2000, I	RD 661/2007)	
Tensión de red	230 V (monofásica	-	•	
Rango de tensión CA	-15% +10% (sec			
Factor de distorsión con Pn	< 4%	,,		
Factor de potencia reactiva (cos phi)	aprox. 1			
Protección contra funcionamiento en isla	sí			
Control de defecto a tierra	RCD			
Aislamiento galvanico	integrado. Cumple	RD 1663/2000		
	3			
Rendimiento	6,5 W			
Consumo en modo standby Consumo nocturno	< 0,06 W			
Eficiencia máxima	95,5%	95,5%	95,5%	95,5%
	95,0%	•	•	94,7%
Eficiencia europea	•	95,0%	94,9%	•
Eficiencia MPP (static)	99,99%	99,99%	99,99	99,99%
Tecnología	topologia HERIC	FP, sin transformador		
Otros Interruptor-seccionador CC	interno, mecánico			
Dimensionado de protecciones conexión a red	25 A	25 A	25 A	16 A
Interfaces de datos			otencial, salida de impu	
Interfaces de datos Interfaces para sensores	radiación, tempera		otericiai, sailua de IIIIpt	aisos su, mouem
Pantalla		da, 128 x 64 puntos		
Monitorización		•	rado Supways Commun	nicator Portal Cuma
	aviso activo por e-r	nan, servidor web integ	rado, Sunways Commu	meator, Fortal SUNW
Grado de protección IP según IEC 60529 Humedad relativa máxima	95%			
	/-	ı		
Refrigeración	convección natura			
Rango de temperaturas	-25°C 40°C (a po			
Comportamiento en sobrecarga		el punto de trabajo		
Dimensiones (Al x An x F)	59 x 35 x 21 cm			
Peso	29 kg			
Tipo de montaje	mural			
Nivel de ruido	< 35 dB (A)			
Garantía estándar (opcional)	5 años (10 / 15 / 20			
Certificado	CE, RD 1663/2000,	RD 661/2007		

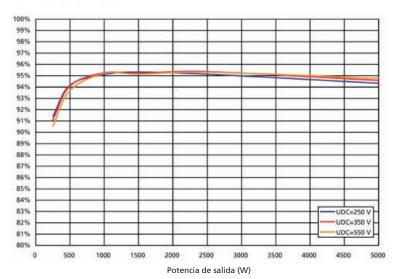
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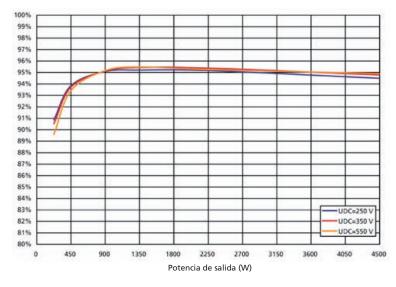
Curva de eficiencia Sunways Solar Inverter AT

Curva de eficiencia AT 5000



Potencia de sa	alida (%)	5,0	10,0	20,0	30,0	50,0	100,0	Max	Euro
Eficiencia	250 V	91,4	94,2	95,1	95,3	95,1	94,3	95,4	94,8
	350 V	91,1	94,1	95,3	95,2	95,4	94,6	95,5	95,0
	550 V	90.5	93.7	95.2	95 1	95.3	94.8	95.5	94 9

Curva de eficiencia AT 4500

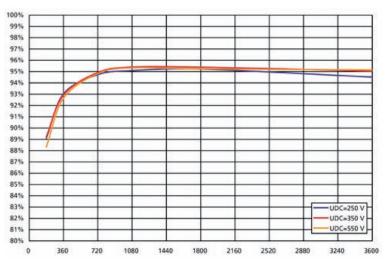


Potencia de sa	lida (%)	5,0	10,0	20,0	30,0	50,0	100,0	Max	Euro
Eficiencia	250 V	90,9	93,9	95,1	95,2	95,2	94,5	95,4	94,8
	350 V	90,5	93,7	95,1	95,4	95,4	94,8	95,5	95,0
	550 V	89,6	93,4	95,2	95,5	95,3	94,9	95,5	94,9

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Curva de eficiencia Sunways Solar Inverter AT

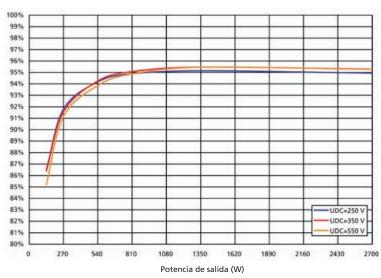
Curva de eficiencia AT 3600



Potencia de salida (W)

Potencia de sa	alida (%)	5,0	10,0	20,0	30,0	50,0	100,0	Max	Euro
Eficiencia	250 V	89,1	93,0	94,7	95,1	95,2	94,5	95,3	94,7
	350 V	89,2	92,9	94,9	95,4	95,4	95,1	95,5	94,9
	550 V	88.3	92.6	94.8	95.3	95.2	95.1	95.5	94.8

Curva de eficiencia AT 2700



Potencia de sal	lida (%)	5,0	10,0	20,0	30,0	50,0	100,0	Max	Euro
Eficiencia	250 V	86,5	91,8	94,2	94,9	95,1	94,9	95,3	94,5
	350 V	86,4	91,6	94,3	95,1	95,5	95,3	95,5	94,7
	550 V	85,2	91,2	93,9	94,9	95,5	95,3	95,5	94,6

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Annex 5: Yearly PV simulation Madrid

The main results of the simulation done with INSEL are shown in Table 1 and figure 8:

Table 1: PV simulation results for Madrid

Annual results Madrid	Value	Unit
Total module area	98.8	m²
Total power installed	12.55	kWp
Number of inverters	5	-
Total inverter consumption	136.8	kWh
Irradiance horizontal	162331	kWh
Irradiance on PV generator	123004	kWh
DC energy	12188	kWh
AC energy	11415	kWh
PV efficiency	9.91	%
Inverter efficiency	93.65	%
specific yield	910	kWh/kWp
Performance ratio	73.1	%
System efficiency	9.28	%

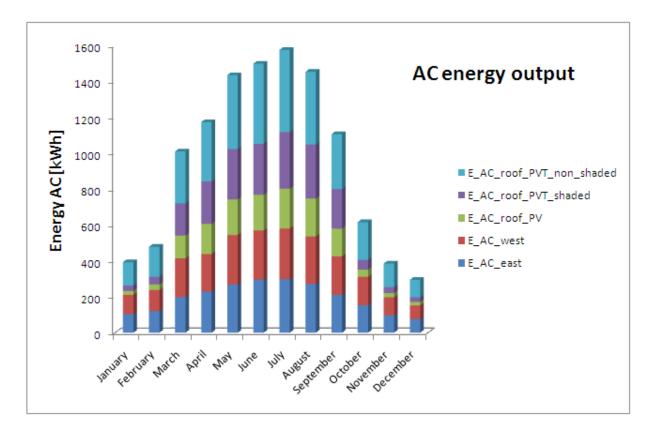


Figure 8: Monthly results of AC energy produced (Madrid)

Annex 6: Detailed PV simulation results – Yearly simulation Madrid (INSEL)

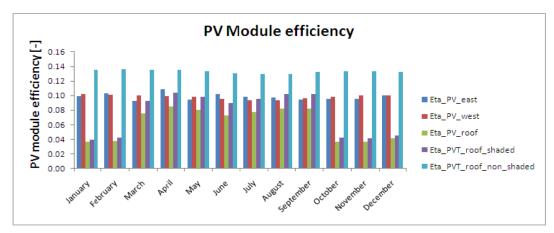
East Facade	Value	Unit
PV module ertex with sunways cells		
PV module in serie	7	
Module area	3.7	m²
Total area	25.7	m²
Module power	430.5	Wp
Power installed	3.01	kWp
Inverter	Sunways AT2700	
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4269	h
Inverter electrical consumption	28.0	kWh
Irradiance horizontal	42245	kWh
Irradiance east	24922	kWh
DC energy	2476	kWh
AC energy	2318	kWh
PV efficiency	9.93	%
Inverter efficiency	93.63	%
specific yield	769	kWh/kWp
Performance ratio	79.3	%
System efficiency	9.30	%

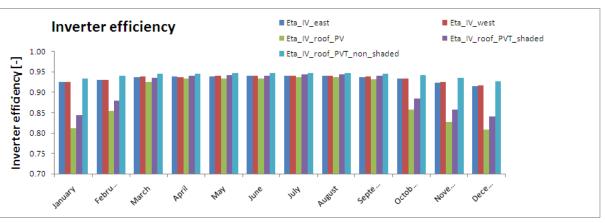
West Facade	Value	Unit
PV module ertex with sunways cells		
PV module in serie	7	
Module area	3.7	m²
Total area	25.7	m²
Module power	430.5	Wp
Power installed	3.01	kWp
Inverter	Sunways AT2700	
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4269	h
Inverter electrical consumption	28.0	kWh
Irradiance horizontal	42245	kWh
Irradiance west	25179	kWh
DC energy	2452	kWh
AC energy	2295	kWh
PV efficiency	9.74	%
Inverter efficiency	93.61	%
specific yield	762	kWh/kWp
Performance ratio	77.8	%
System efficiency	9.12	%

Roof PV	Value	Unit
PV module ertex with sunways cells		
PV Module in serie	12	
Module area	1.2	m²
Total area	14.4	m²
Module power	143.5	Wp
Power installed	1.72	kWp
Inverter	Sunways AT2700	
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4086	h
Inverter electrical consumption	26.8	kWh
Irradiance horizontal	23667	kWh
Irradiance roof shaded	23667	kWh
DC energy	1537	kWh
AC energy	1418	kWh
PV efficiency	6.49	%
Inverter efficiency	92.31	%
specific yield	824	kWh/kWp
Performance ratio	50.1	%
System efficiency	5.99	%

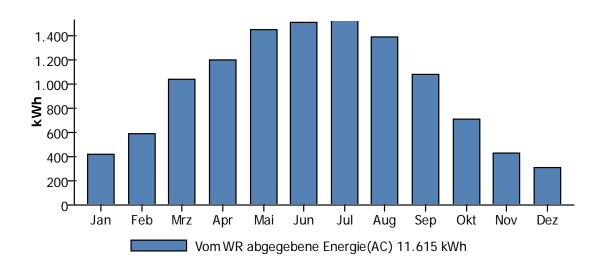
Roof PVT shaded		
PV module ertex with sunways cells6	- 1	
	6	
Module area	2.7	
Total area	16.5	
Module power	399.8	Wp
Power installed	2.40	kWp
Inverter	Sunways AT2700	
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4025	h
Inverter electrical consumption	26.4	kWh
Irradiance horizontal	27087	kWh
Irradiance roof shaded	22150	kWh
DC energy	2141	kWh
AC energy	1999	kWh
PV efficiency	9.66	%
Inverter efficiency	93.37	%
specific yield	833	kWh/kWp
Performance ratio	62.0	%
System efficiency	9.02	%

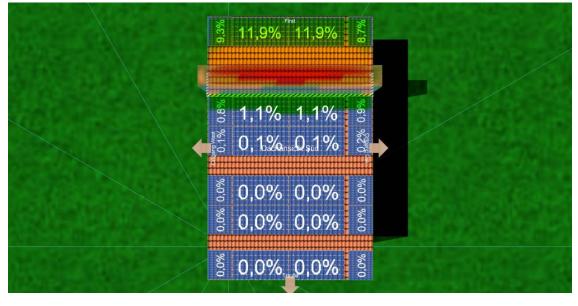
Roof PVT non shaded		
PV module ertex with sunways cells		
PV Module in serie	6	
Module area	2.7	
Total area	16.5	
Module power	399.8	Wp
Power installed	2.40	kWp
Inverter	Sunways AT2700	,
Inverter consumption	6.5	W
Inverter night consumption	0.06	W
Inverter operation hour	4180	h
Inverter electrical consumption	27.4	kWh
Irradiance horizontal	27087	kWh
Irradiance roof	27087	kWh
DC energy	3584	kWh
AC energy	3385	kWh
PV efficiency	13.23	%
Inverter efficiency	94.45	%
specific yield	1411	kWh/kWp
Performance ratio	85.8	%
System efficiency	12.50	%

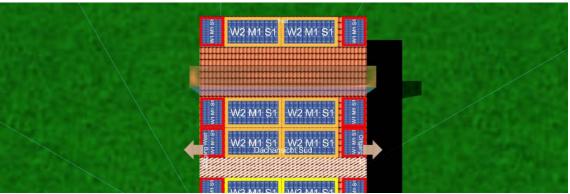




Annex 7: Detailed PV simulation results – Yearly simulation Madrid (PV-Sol)







Annex 8: Datasheet of PV-Connector Type MC4

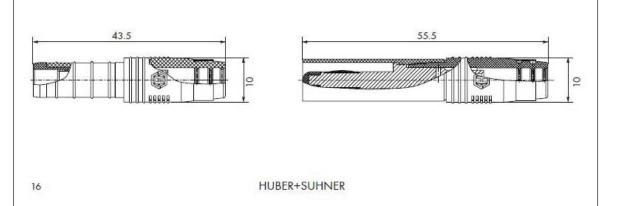
RADOX® SOLAR CONNECTOR 4 mm²



Technical Data	Solar female part	Solar male part		
ltem no.	24500072	24500070		
Diameter	4mm			
Contact carrier	brass tin-plated			
Contact principle	copper beryllium lamell	a contact		
Disengagement force in mated condition	~ 55N			
Compatible cross-sections	4.0mm² RADOX® solar cable			
Termination type	crimp with HUBER+SUF	INER tongs		
Plastic material	grip hood	lamella connector		
Material	TPE	PA 6.6		
Fire resistance	UL 94 - HB	UL 94 - VO		
Halogen free	no halogen, DIN VDE 0)472 (part 815)		
Chemical resistance	UV- and ozone resistant			
Temperature range	-40°C up to +110°C			
Current carrying capacity	38A			
Max. system voltage	1000V/DC			
Transition resistance	< 4mΩ			
Protection type	II .			
Protection mode	IP 67 in mated condition			

Characteristics

- Small profile
- Wide temperature range
- High current capacity
- Constant low transition resistance
 - High mechanical resistance
- Easy assembly
- UV- and ozone resistant
 - Protection mode IP67 in mated condition
 - TÜV approval



Annex 9: Datasheet of Solar cable

RADOX® SOLAR CABLE SINGLE-CORE





Conductor stranded tin-plated copper, fine wired acc. to IEC 60228, class 5

Insulation RADOX® black

Coating RADOX®, see schedule for colors

General characteristics

Cable made of electron-beam cross-linked insulation and coating; high resistance against heat, cold, oil, abrasion, ozone, UV and weather; with improved reaction in case of fire, low smoke, halogen free, flame retardant; flexible, easy to strip, very low space requirement, extremely mechanically robust, very long lifetime.

Application

Specifically designed for connecting photovoltaic system components inside and outside of buildings and equipment with high mechanical requirements and extreme weather conditions. For permanent installations.

Cross section	Conductor design n x mm	Conductor diameter rated mm	Cable diameter rated mm	Colour	Weight rated kg/100m	Item no.
2.5 *	50 x 0.26	2.01 ± 0.05	5.2 ± 0.15	black	4.6	12529714
4.0 *	56 x 0.31	2.54 ± 0.05	5.8 ± 0.15	red	6.6	12545801
4.0 *	56 x 0.31	2.54 ± 0.05	5.8 ± 0.15	blue	6.6	12537896
4.0 *	56 x 0.31	2.54 ± 0.05	5.8 ± 0.15	black	6.6	12545802
6.0 *	81 x 0.31	3.30 ± 0.10	6.9 ± 0.20	black	9.2	12552756
6.0 *	81 x 0.31	3.30 ± 0.10	6.9 ± 0.20	red	9.2	12568182
6.0 *	81 x 0.31	3.30 ± 0.10	6.9 ± 0.20	blue	9.2	12568183
10.0	78 x 0.40	4.30 ± 0.10	8.1 ± 0.15	black	14.4	12537897
16.0	119 x 0.40	5.30 ± 0.10	9.5 ± 0.20	black	21.0	12567377

Selection from range; different sizes and colors on request

^{*}Approvals: TÜV Rheinland design tested, certificate R 02210086

Technical Data	
Voltage Rating	1000V DC or 600/1000V AC
Alternating test voltage	4000V AC (50Hz, 1 min.)
Temperature range	-40°C up to +120°C
Temperature range (TÜV)	-40°C up to +110°C
Max. conductor temperature at short circuit	+280°C (max. 5s)
Min. bending radius	cable diameter < 8mm: 4xD; cable diameter > 8mm: 6xD

Cables have passed the following fire tests:

Vertical flame spread of a single cable IEC 60332-1, EN 50265-2-1 Content of halogen hydracid Omg/g IEC 670754-1, EN50267-2-1 Corrosivity of combustion gases IEC 60754-2, EN 50267-2-3 Smoke density IEC 61034-2, EN 50268-2

10 HUBER+SUHNER

Annex 10: Wire Dimensining (AC Main)



mcSale.at GmbH Europaplatz 4 4020 Linz

0732 - 656900

Wire Dimensions

Projekt: SDC 2010 EUROPE Editor: Siegfried Baumgartner

Einstellungen/Eingaben:

Voltage: Alternating current 230 V Voltage drop: 1,5 %

Conductor: Copper (57 Sm/mm²)

System: Wire with insulation/Coating made of thermoplastic PVC

 Capacity:
 13.500,00
 W
 Cos Phi:
 1,00

 Wire length (one-way):
 8,00
 m
 Simultaneity factor:
 1,00

Hauling:

Laying System: AddValue

B2 - Plastic-sheated cable in conduit

Laying configuration: bundled

in Conduit/Duct along the wall

Ambient temperature: 25 °C Solve circuits: 1 Clearance(a): without clearance

Results of calculations:

 Normal current:
 58,70 A
 Fire compartment ratio:
 --

 maximum Ampacity Iz:
 73,14 A
 Breaking current 0,4 s:
 315,00 A

 Operating Voltage at fuse:
 63 A
 Breaking current 5 s:
 315,00 A

 Potential drop:
 1,43 V (0,62 %)

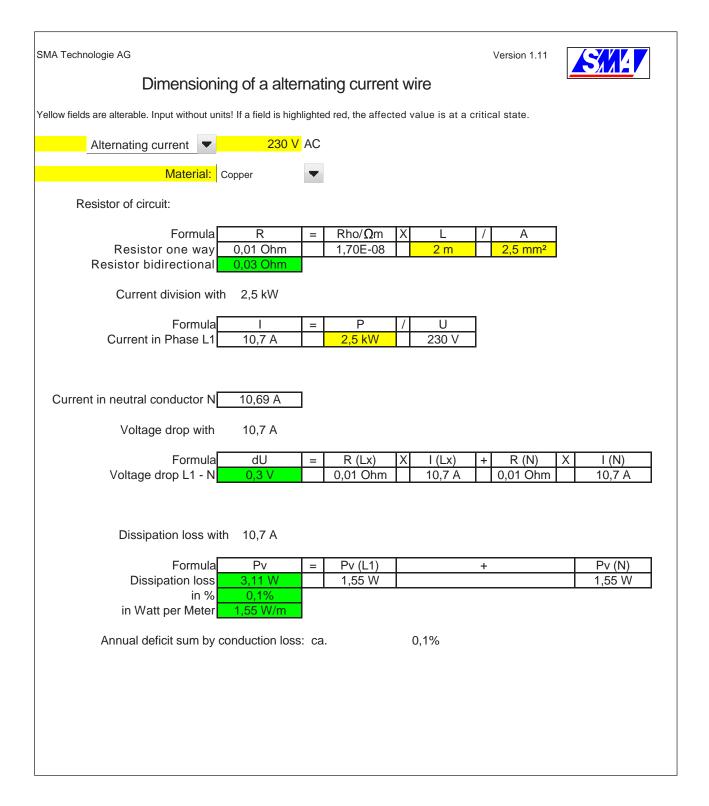
Results of cross section calculations:

Heating: 16,00 mm² Short circuit current 0,4 s: 16,00 mm² Potential drop: 16,00 mm² Short circuit current 5 s: 16,00 mm² Fire compartment length: Suggested standard cross section: 16,00 mm² mm²

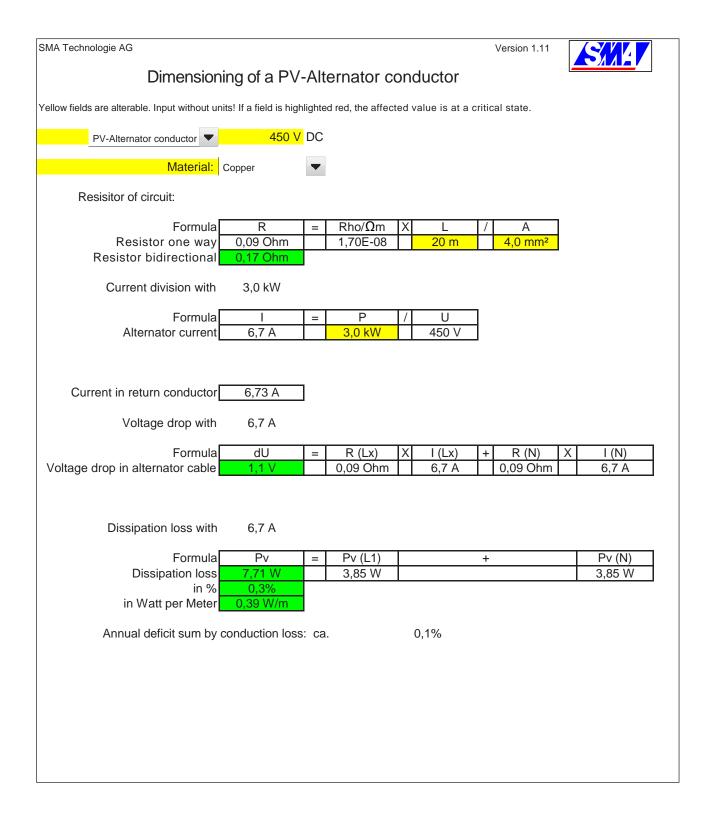
Short circuit current was considered for the cross section calculation.

Page 1

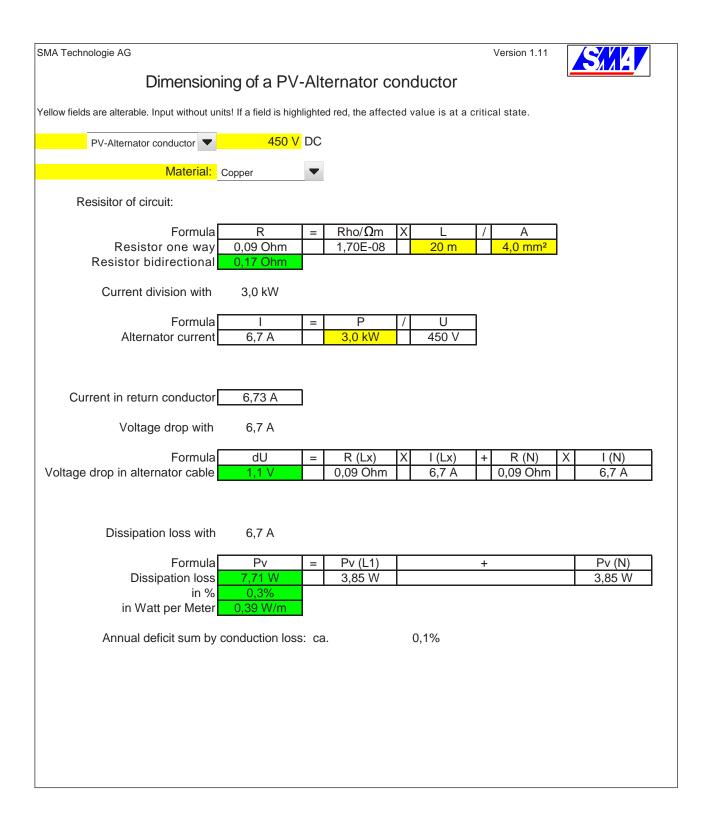
Annex 11: Dimensioning of alternative current wire (AC Converter)



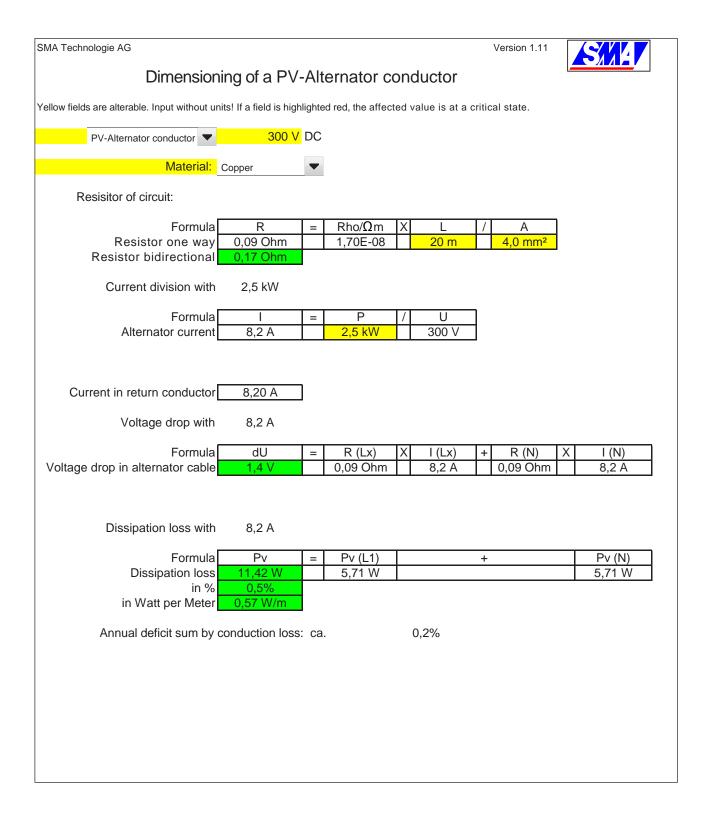
Annex 12: Dimensioning of PV-Alternative conductor (DC East Façade)



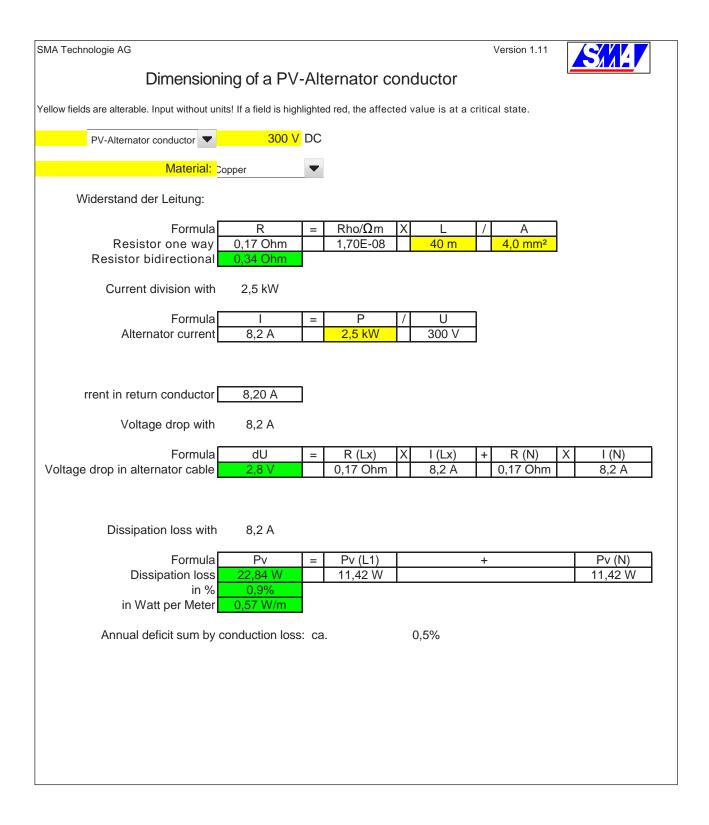
Annex 13: Dimensioning of PV-Alternative conductor (DC West Façade)



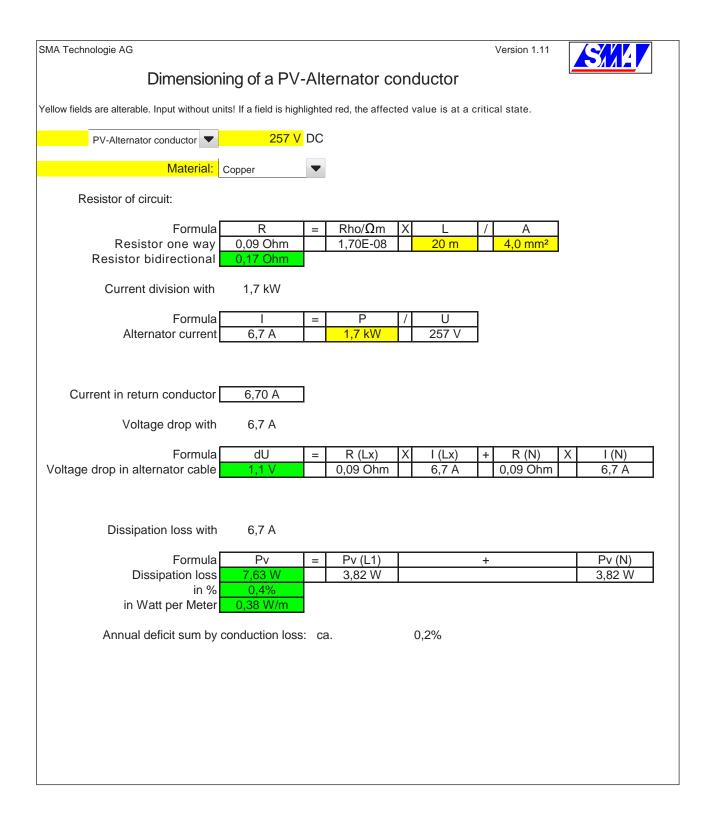
Annex 14: Dimensioning of PV-Alternative conductor (DC Roof 1)



Annex 15: Dimensioning of PV-Alternative conductor (DC Roof 2)



Annex 16: Dimensioning of PV-Alternative conductor (DC Roof Edge)



Annex 17 Photovoltaic System Design – Summary List

712.312	Types of distribution system	TN-C-System
712.312.2	Types of system earthing	•
	Indicate the type selected, from the following options: None of the live conductors on the DC side is earthed. One of the live conductors on the DC side is earthed, if	Yes
	there is at least simple separation between the DC side and the AC side.	
712.4	Protection for safety	All Modules have
712.41	Protection against electric shock	protection class 2
712.411	Protection against direct and indirect contact	
	Measures adopted to guarantee protection against direct	
	and indirect contact.	
712.413	Fault protection	Included in AT 2700
	Measures adopted (and protective devices used) to	See Annex
740,400	guarantee fault protection on the DC and AC sides	
712.433	Protection against overload on the DC side	
	Measures adopted to guarantee protection against overload on the PV modules and DC cables (PV string	
	cables, PV array cables, PV DC main cable).	
712.434	Protection against short-circuit currents	
7 12.707	Measures adopted to guarantee protection against short-	
	circuit currents on the PV supply cable.	
712.444	Protection against electromagnetic interference in buildings	
	Measures adopted to minimize voltages induced by	
	lightning.	
712.5	Selection and erection of electrical equipment	Observed
712.511	Compliance with standards	See Annex
	Compliance with standards of the PV modules and	
	junction boxes used.	
712.512	Operational conditions and external influences	observed
	Voltage compatibility between the PV strings/PV array/PV generator and inverter.	Observed
	If blocking diodes are used, reverse voltage compatibility	
	with the corresponding PV strings.	
712.513	Accessibility	
	Location of electrical equipment (PV modules, junction	Outside of the
	boxes, inverter, protection devices, etc.) must guarantee	conditioned zone in
	proper operation and maintenance, according to good	the Loggia see
	design & installation practices and manufacturers'	drawing SS-0041
	indications.	
712.52	Wiring systems	
712.522	Selection and erection in relation to external influences	The earlier or
	Selection criteria of DC cables (PV string cables, PV	The cables are
	array cables and PV DC main cables) to minimize the risks of earth faults and short-circuits.	double insulated
	Selection criteria of wiring systems in order to withstand	
	the expected external influences.	
712.53	Isolation, switching and control	
712.536	Isolation and switching	observed
	Means of isolating the PV inverter from the DC side and	observed
	AC side.	
	Warning labels to be placed on all junction boxes	
712.54	Earthing arrangements, protective conductors and	Drawing SS-031
	protective bonding conductors	
	Location of protective equipotential bonding conductors, if applicable.	Observed and to be determined
	L STANGER AND A	I CETERMINEC



home+			

12.7 List of Appliances - Contents

1. Chart

List of Appliances

1. Chart - Household Appliances

AREA	APPLIANCE	PRODUCER / PRODUCTCODE	QUANTITY AND MEASURE B/T/H
kitchen	Freezer/ Refrigerator	Liebherr - ICBP 3166 Premium Plus BioFresh	570 x 550 x 1780 mm useful capacity (R) 2071 useful capacity (F) 57I
	Dishwasher	Miele - G1562 SCVI	448 x 570 x 810 mm
	Oven	Miele - H5681 BL (66l cooking chamber)	595 x 596 x 548 mm
	Cooker	Miele - KM5944	592 x 492 mm
	Cooker Hood	Miele - DA150 (with recirculated-air operation)	999 x 490 x 150 mm
	Coffee Machine	Miele - CVA3660	595 x 372 x 293
bath	Washing machine	Miele - Softtronic W5841 WPS EcoComfort	595 x 615 x 850 mm
	Clothes dryer	Miele - Softtronic T 8627 WP EcoComfort	595 x 596 x 850 mm

ENERGI E- RANGE	CONSUMTION	FACILITIES	CONNEC T-ED LOAD	CONNECTION PORTS
A++	222 kWh/year	electric 220-240 V	120 W	1 x grid
A	wattage 0,80 kWh, water 9l	electric 220-240 V water, waste water	2200 W	1 x concrete pipe, 1 x waste pipe, 1 x grid
А	1,02 kWh (normal) 0,95 kWh (hot-air)	electric 220-240 V	3700 W	1 x grid
-	addicted from use	electric 220-240 V	7400 W	1 x grid
-	addicted from use	electric 220-240 V	1 x grid	1 x grid
-	addicted from use	electric 220-240 V	2300 W	1 x grid
A	wattage 1,05 kWh (ww-use 0,05 kWh), water 55l	electric 220-240 V water, waste water	2300 W	2 x concrete pipe (cold water, hot water) , 1 x waste pipe, 1 x grid
А	1,55 kWh at 1400 revolution per minute	electric 220-240 V	1140 W	1 x waste pipe, 1 x grid

2. Chart - Multimedia Appliances

AREA	APPLIANCE	PRODUCER / PRODUCTCODE	QUANTITY AND MEASURE B/T/H
TV, Computer, DVD	TV	Loewe - Connect 32 Media Full-HD+100 LCD-TV Dolby- Surround Modul	831 x 548 mm resolution (pixel) : 1920 x 1080
	Computer	Apple - Mac Book Pro	17"
		Netgear DG834GB Wireless ADSL Firewall Router	175 x 120 x 28 mm
	DVD	WD TV Live Media Player	126 x 100 x 40 mm
		IOCELL NetDisk 1000GB	161,3 x 213,5 x 48mm
	HIFI	Loewe - Subwoofer 66213U10	430 x 340 x 249 mm
		pureSonic Soundboard 300 - 40 PW	2 x 500x410x45mm 2 x 600x410x45mm

ENERGI E- RANGE	CONSUMTION	FACILITIES	CONNEC T-ED LOAD	CONNECTION PORTS
-	addicted from use	220-240 V	130 W	1 x HDMI 5 x Audio 1 x grid
-	addicted from use	230 V	20,7 W	1 x grid 1 x W-Lan
-	addicted from use	-	-	1 x grid 1 x Ethernet 1 x W-Lan
-	addicted from use	120-230V	-	1 x grid 1 x HDMI 1 x USB
-	addicted from use	120 - 220V	-	1 x grid 1 x Ethernet 1 x USB
-	addicted from use	100-240 V	18 W	1 x grid 1 x Audio
-	addicted from use	-	40W	1x HIFI

home+			

12.8 Communication Plan - Contents

- 1. Analysis of the situation
- 2. Defining Communication's Role & Developing an effective Strategy
- 3. Communication Strategy
- 4. Fundraising Strategy
- 5. The Progress of Communication activities
- 6. Sponsors and Foundations
- 7. Cost Estimation
- 8. Evaluations and Lessons learnt

Communication Plan

1. Analysis of the situation

At the start of Solar Decathlon 2010, the challenge for Team Stuttgart was to develop a strategic fit between the university's goals and capabilities and it's changing communication and marketing opportunities regarding the SDE2010 - a strategic plan that makes most sense given the HFT's specific situation, opportunities, objectives, and resources. Before the beginning of the SDE, the HFT had no experience with fundraising and no communication office (except a press office that coordinates the communications with the media). Therefore a fundraising and communication office was established that is primarily responsible for the Solar Decathlon Europe 2010. Two part time staff member were engaged for this office. The next step was the creation of the communication plan, starting with the situation analysis.

The situation analysis is the foundation of the strategic planning process in our plan. It includes an examination of both the internal factors (to identify strengths and weaknesses) and external factors (to identify opportunities and threats). Furthermore a cost estimation for fundraising and communication was conducted. (see chapter 8)

2. Defining Communication's Role & Developing an effective Strategy

According to the mission of the HFT "We turn know-ledge into skill and people into personalities", Team Stuttgart started the marketing planning process by defining a guiding philosophy - the marketing and communication concept - that suggest that the university's strategy should revolve around building profitable relationships with internal partners at the HFT and external partners, as well as generating sources of finance.

That means on the one hand the internal communication should try to activate existing, direct and indirect contacts with the support of friends, endowments, advisory boards, students and professors. On the other hand the external communication should try to find new contacts with companies, endowments and public institutions.

All contacts should be collected in a professional data bank. This allows the access to relevant data in order to guarantee coordinated activities. The contact data will include details, interests and objectives. The goal is to create value for potential sponsors and partners and built strong and profitable relationships.

Second, marketing and communication should build good relationships with the HFT's various target audiences by obtaining favourable publicity, building a good corporate image and identity, organising events and handling or heading off unfavourable rumours and stories.

The basis of the team's approach to fundraising and communication is the cost estimation for Communication and Fundraising. It was built on a participation of sponsors from industry, science and government institutes.

Given the situation analysis, the first task for the team was to choose the mission by conducting a market analysis. After this, the Branding Strategy and a Corporate Image and Design were developed. According to the cost estimation, the communication infrastructure was set up (the University engaged two part time employees for communication and fundraising). The first task for the new Team was to design a fundraising and communication strategy the fundraising and communication logic by which we hope to create this partner value and achieve these profitable relationships. To set up a effective communication strategy the Team decided first by which means it will attempt to build awareness and inform partners and the public. Thereupon it identified the target audience, determined the objectives, designed the communications and selected the channels.

As a next step the Communication & Fundraising-Team decided which partners/sponsors it would like to work with (segmentation and targeting), how it will serve them (differentiation and positioning) and how it will approach them.

2.1 Defining the Mission

To define the mission, the Team asked itself some crucial questions: What is our business? Who are

Team Stuttgart Mission:

Wohnen von morgen schon heute -Our contribution to the future

Team Stuttgart Philosophy:

Building profitable relationships with internal partners at the HFT and external partners, as well as generating sources of finance

the partners we want to work with (media/companies/institutions/public)? What is of value to this partners?

It decided that mission statements are at their best when they reflect a vision, an almost "impossible dream" that provides a direction for the Team for the entire competition.

For the development of the mission, following aspects were taken into consideration:

- (1) It should be short and concise
- (2) It should be easy to remember
- (3) It should be easy to translate into foreign languages
- (4) It should communicate more about the project's willing
- ...but still let enough space for personal interpretations and identification
- (6) ...and as last but not least, it should be capable of registration and legal protection

After brain storming, the motto "Our contribution to the future" brought together these aspects best. The sentence transports not only the idea of the project, but also the main idea of the organization, which is to achieve an awareness of the future and the environment. The word "...contribution..." focuses on a collaboration, not just for the participating teams, but also for the public, who can also take part in the cause and make its own contribution. And at last, the word "...our..." makes perceivable not only the



image01: color study for the new brand

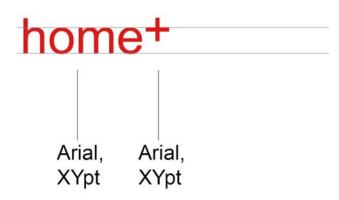


image02a: typography for the new brand

team presence, but more importantly the teamwork character of the competence. For these reasons, the team decided to take this sentence as team's motto and project's guideline.

2.2 Branding Strategy & Corporate Image and Design

The creation of a brand for the project is an important issue for the communication of the project, because the brand name becomes the basis on which a whole story can be built around (for example the houses's special qualities). Brands are more than just names and symbols. They are a key element in the relationships with partners and the public. Before establishing the brand, the Communication and Fundraising Team and the Corporate Design-Team decided to establish a mission for the brand and a vision of what the brand must be and do. First and foremost, the teams decided that the brand must capture the partner's and publics preferences and loyalty. Furthermore, it should enjoy a high level of awareness, engage potential partners on a deep, emotional level and deliver a promise that is simple and honest.

When it came to the brand development, the Team decided to modify and extend the brand of the HFT Stuttgart. The intension was, to give the project instant recognition and faster acceptance. During the past months, the brand of the HFT Stuttgart has been reconsidered from the direction of the university and it was decided to make changes in the corporate image of the HFT Stuttgart. This new corporate design of the university will come into effect in March 2010, so that a recognition of the corporate image of the home+ project with the university probably wouldn't be available. Under these circumstances and in order to achieve an identification of the home+ brand and HFT Stuttgart brand after these important changes in the corporate image of the university, the home+ corporate design should be reviewed again. A colour study and typography was made for the corporate design and identity of the HFT Stuttgart. As consequence, the team used this colour study as base for the new brand of home+ (image01). The team decided to take a strong colour for the brand so that the name of the project could be retained in the mind. It should be also be a warm colour to transport keywords like energy and awareness. Under these aspects, a red colour was chosen for



image02b: new brand with extension

the brand.

The typography remained as so far, in order to keep a global identification with the organisers' corporate image (image03a). The colour of the text would be a grey with 60% saturation. In addition, a brand name had to be found - a name that include the following:

- (1) It should suggest something about the project's benefits and qualities,
- (2) It should be easy to pronounce, recognize, and remember.
- (3) The brand name should be distinctive.
- (4) The name should easy to translate into foreign languages.
- (5) It should be capable of registration and legal protection.

Therefore the team has chosen the brand name "home+" - a brand name that includes all the aforementioned criteria. The name refers not only to our house, but to our whole planet and therefore to the ongoing climate change debate. The "+" suggests something about the benefits of this house, the incorporated technologies, the production of energy, and the positive effect on climate change. The Team's conviction is that this brand is highly memorable, very reflexive and that it connects with the public and the partners to whom it is directed. Last but not least, it does not infringes on existing brand names.

Taking into consideration all these aspects, colour, typography and name, the logo was derived (image021). In some cases, an extension for the logo is needed for flyers or for explicative purposes, for example home+living, home+cooking, or even for the legend or motto. This extension should be easy distinguished from the logo (image02b).

3. Communication Strategy

Communications are the means by which we attempt to inform and remind partners and the public - directly or indirectly - about the competition and our brand. Our intention is to show how and why the house is used, by what kind of person, and where and when. The target audience can learn about who builds the house and what we and the brand stanfor. Second, communication should generate new sources of finance.

3.1 The Communication Mix

Our communication mix consists of 5 major modes of communication

- 1. Events
- 2. Public relations and publicity
- 3. Direct marketing
- 4. Interactive marketing
- 5. Word-of-mouth

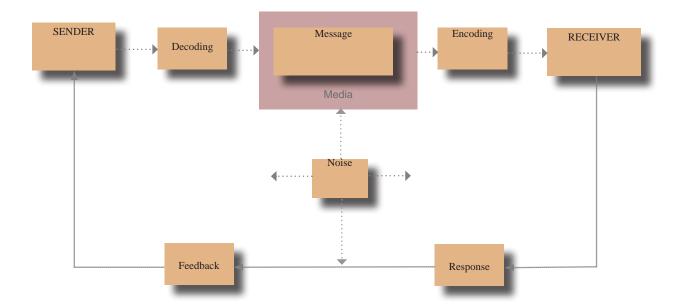
3.2 Steps in Developing the Communication

3.2.1 Identify the Target Audience

The process must start with a clear target audience in mind:

The first target group are **potential buyers** of the house. The decision was made in favour of a narrowly defined costumer group seeking a distinctive mix of benefits. We identified ecology-minded peop-

Elements in the Communications Process



le, business-nomads and small and wealthy households in Germany. The team chose this audience because the potential buyers have a distinct set of needs; they are prepared to pay a premium for the offer that satisfies them; the niche is fairly small but has size, profit, and growth potential and is unlikely to attract many other competitors (excluding the other SDE participants); and the niche gains certain economies through specialization.

Our communication target audience also include the particular publics and the general public. Through press and media we aim to contribute to the dissemination of the competitions idea and to the awareness building of society on the importance of renewable energy, sustainability and the environment and, of course, solar energy.

We also try to develop the existing strengths and improve the profile of the university as an innovate institution of education.

Another target audience is the **university environment.** On the one hand, we try to promote university research and to establish new strategic partnerships with other universities, the HFT's various audiences, friends of the university and alumni. On the other hand, we want to inform students, professors and staff about the project's progress and try to convince them to support the project.

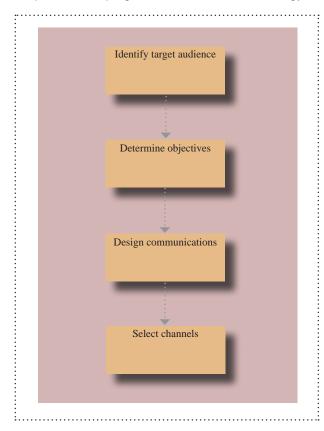
In addition to universities, we also want to arouse interest in schools. Our intention is to show how and why the house is used and to inform about the importance of renewable energy and disseminate conscience of the environment in the youngests.

The last target group are enterprises and public institutions (e.g. political institutions and associations). Besides the fundraising activities, we will try to build strategic partnerships, improve relations, try to raise awareness, communicate the current project status and use enterprises and public institutions as information multipliers.

3.2.2 Determine the Communications Objectives

Following the identification of the target audience, the Team determined the communications objectives. Given that most of the target audience is unaware and has no name recognition of the project and the competition, the Team's task was to build

Steps in developing our Communication Strategy



awareness and contribute to the dissemination of the project and its Technologies (e.g. for the general public, university and its environment, enterprises, public institutions and the potential buyers). The target audience that has/gains competition/brand awareness must be convinced to develop a category need for the house/to participate in or support the project. The task is that target groups set up a desired emotional state, for example conviction or purchase intent.

3.2.3 Design the Communications

To achieve the desired response, the Team had to solve three problems: what to say (message strategy), how to say it (creative strategy), and who should say it (message source).

Message Strategy

By searching for appeals, themes, or ideas that will tie into the brand positioning and help to establish points-of-parity, the Team decided that the communication strategy should revolve around an axismessage, that is related directly to the quality of the house and value of the brand.

We have chosen the appeal: "Wohnen von morgen schon heute" in German and for international use "Our contribution to the future". It is an rational-reward promise following results-of-use experience. The appeals evoke the desire for future living and piques curiosity.

Depending on to whom the team will direct the communication, the message differs in its specification (see below).

Creative Strategy

Creative Strategies are the way we want to translate our message in a specific communication. With reference to our target audience we will choose between informational or transformational appeals.

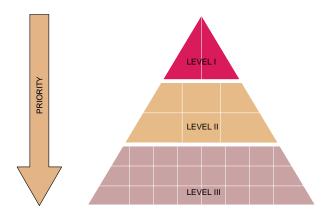
Informational appeals elaborate on the houses attributes or benefits. For example as product description for enterprises in the construction branch, technical press and the professional public: "A house as electricity station".

To attract attention of potential buyers we will use two-sided messages and inform the audience with a informational and climatic presentation.

On the other side, we use transformational appeals. Transformational appeals elaborate on a non-product related benefit. Thus, we want to stir up emotions and attract attention.

Therefore we use positive emotional appeals. For example pride and curiosity in combination with a "borrowed device": "The Solar Construction World Championship - Stuttgart wants to win". With this approach we want to attract global enterprises and the general public through media. Another positive appeal would be to mention strength through coope-

Division in abilities (donation/sponsoring or/and a donation in kind)



ration: "Shaping the future together".

Alternative approaches would be negative appeals such as "fear and guilt". For example referring to the negative impact of climate change and global warming to get attention from the public.

All in all, the objective must always be to bring concepts on a piece of paper to life in the minds of the target audience.

Message Source

We think that messages delivered by popular sources can achieve higher attention, which is why we are trying to get a celebrated spokesperson for our project. An example would be an trustworthy likeable politician with expertise.

3.2.4 Select the Communication Channels

To select efficient means to carry the message is an important task regarding the fragmentation of communication channels. Within the communication we differ between personal and nonpersonal channels.

Personal Communication Channels

Sending the right message to the right target group is a crucial point in our communication. Personal Communication Channels let two or more persons communicate face-to-face, person-to-audience, over the **telephone**, or through **e-mail**. With these

exclusive partner sponsor level I support us as a main sponsor with a donation

premium partner sponsor level II support us as a sponsor with a donation or material

service partner sponsor level III support us as sponsor with materials and/or know how

channels we want to get in touch with companies, other universities, schools and the media. The communication via mail and telephone is also very import to inform strategic partners and to keep good relationships.

Nonpersonal Communication Channels

Nonpersonal channels are communications directed to more than one person and include in our case media, events and public relations.

Media: print media (newspapers and professional magazines); broadcast media (radio and television); electronic media (videos; Web page); display media (posters)

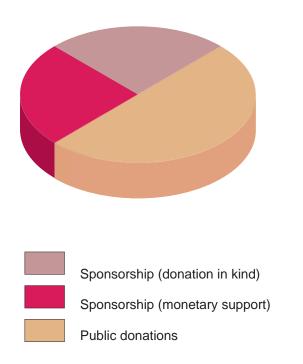
Events: include appearance at fairs, symposia, conferences, workshops, organisation of promotional events and informational events, as well as less formal activities that create interactions with students, professors and university staff.

Promotion: include information brochures, flyer and inlays

Public Relations: include communications directed internally to employees and students of the university or externally to other firms, the government and media, e.g. via newsletter.

Although personal communication is often more effective than mass communication, mass media might be the major means of personal communication. That's why

Division in sections



the Team decided to get in touch with media (especially through newspapers, the Web page, radio broadcastig -HoRadS- and professional journals) and reach the general public and potential buyers/interested people. On the other side opinion leaders, the government and company CEOs are the main target to create a trickledown effect and let them carry the message to others (staff, enterprises, public) and finally get a lot of people talking and think about the competition.

4. Fundraising Strategy

4.1 Fundraising - Structure

The experience of the HFT Stuttgart in national and international fundraising was mediated to students and professors in a tutorial and workshop for fundraising by a running project of HFT Stuttgart for innovative adobe building in Morocco, and courses about fundraising, both supported by the external professi-

onal fundraising agency Swisscontact Deutschland qGmbH.

With the support of the rectorate, it was possible to establish an administrative officer and an assistant for fundraising for the Solar Decathlon project. Together with the student fundraising group, they investigate all external possibilities for the project, coordinate and document the contacts between HFT Stuttgart partners and sponsors and oversees all that using a professional data bank (salesforce). Johannes Schwegler, the general manager of Swisscontact Deutschland gGmbH, supports the team as a consultant.

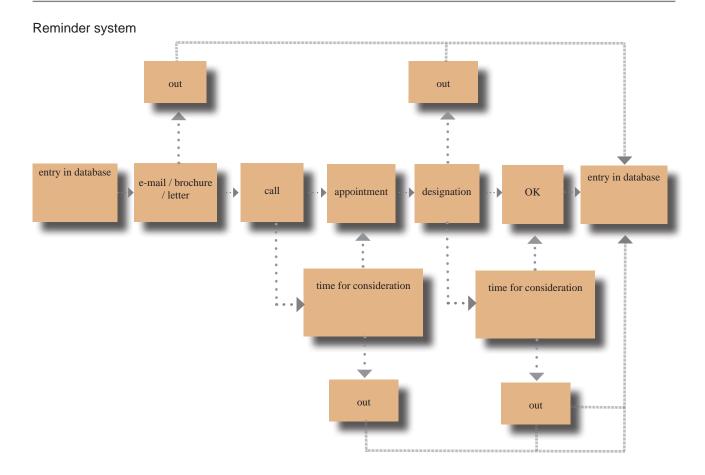
The fundraising group works in close cooperation with the project management and the university administration.

To guarantee good communication, meetings are held regularly in the Solar Decathlon communication and fundraising office.

4.2 Segmentation & Targeting

As a next step the FR-Team analysed how it will create differentiated value for targeted segments and what position the Team wants to occupy in this segments. Our sponsor concept for the industry is pyramid divided into three segments.

Incurred expenses are distributed over three levels of sponsors. First, the Team aims to acquire one or two exclusive partners as the main sponsors who support them financially. These sponsors do not necessarily have to be in the construction business, but have to support the main objectives and idea of the competition. The enterprises in these segment are usually global players with their head office in or around Stuttgart. To approach these companies the FR-Team tries to activate existing, direct and indirect contacts with support of friends, endowments, advisory boards, students and professors. The challenge is to build relationships with decision-makers and



try to convince them to support the Team financially. The targets will be addressed at the beginning of the life-cycle stage of the house by the FR-Team/project manager with support of partners that have already an existing connection to the targets.

In the second level the team intend to find several premium partners from the building industry and related fields, who will support them financially as well as with material and their know-how. Finally the aim is to find service partners at the lowest level who will support the team with various material donations and their expertise. To approach these potential partners the Team tries to activate existing contacts and will also try to establish contacts directly with various marketing and communication tools.

In addition to the sponsoring pyramid, the Team will also try to get funding from foundations and public institutions (German Federal Ministry of Economics and Technology)

The Team's intension is to acquire 50 per cent of the

target costs from public institutions and 50 per cent through sponsorships and donations.

4.3 Differentiation & Positioning

With reference to the available resources, the distinct characteristics of different potential partner groups and the construction life-cycle stage of the house, the Team decided to *plan* positions that will give the project the greatest advantage in selected target areas. That means the Team differentiated its prototype house by building a unique bundle of benefits that appeals to a substantial group within the pyramid. For example the key aspects of delivery for LEVEL 1 partners are geographic solidarity, corporate social responsibility, climate change, an ecologically oriented image for partners and the promotion of future-oriented education.

Meanwhile, at LEVEL 2 the approach to prospective sponsors is more innovative and technically orien-

Poster - University Event





Newsletter 12/09



Wie meistern wir de zusumt in oautenmischer sient und we seinen Houser in 2U saften aus? Frogen, is sich aufgrund der gegebenen Umständie wie Resourcerverbrauch und Kilmwerfünderung seil nagnen Wisse sich aufgrund der gegebenen Est ein genau diese Fragen, auf die ein Studentenkam der HFT Studyraus internationalen Studentenkamt Studentenkamt und und 2010 Güssen beiten möcht. Im vergangen stehen möchte sollt der studen der Studentenkamt und der Studentenkamt und zur der Studentenkamt zu de



Projektpräsentation bei der Deutschen Bank

Auf Einiadung der Deutschen Bank Stuftgart präsertlierten Süderten des Ferma Stuftgart an 25. Noverbeir ihren Betrag zum Solar Deathino Europe 2010. Zeil der Veranstaltung ware "die Anneesenden über zuhaftiges erreigtstuffen sollte studieren der Veranschließer einer Veranschließer zu und -strategien zu informieren. Das interesse der Zuhörer war sehr größ und es wurde angereigt über Vörhrkendrit und entreigen der sie der stellt der Studieren der auf seine Studieren der Anneesenden eingehen. Des Team dieser Veranställung sollsche Bank für de Erindung zu dieser Veranställung sollsche Bank für de Erindung zu dieser Veranställung sollsche Bank für de Erindung zu deuter Veranställung sollsche Bank für der Bank zu deuter veranställung sollsche Bank für der Bank zu der Bank zu deuter der schauser der Bank zu der



Baubeginn in Blaustein bei Ulm

Wir liegen mit unserem Wettbewerbsbeitrag sehr gut m Zeitglan. Dezreit wird noch intensiv an den letzter Feinheiten der Konstruktionspläne getürfeit und gezeichnet Jamit haben wir alle Ziele für dieses Jahr erreicht und die forfertigung der Hotzkonstruktion konnte noch vor der Weihnachtsfeiertagen in den Produktionshallen unseres Fartners, der Firma Müller Hotzbau, beginnen.

1
NEWSLETTER 12/09 TEAM HFT STUTTGART

Internal Events

Date	Name
18.03.2009	Kick-Off Event
15.04.2009	Workshop I
06.05.2009	Workshop II
2729.05.2009	Workshop Madrid
10.06.2009	Workshop III
25.06.2009	University Event (Presentation)
23.11.2009	Construction Engineer Day
14.04.2010	University lecture of the architectural faculty held by
	students of the SDE Team home+
23.07.2010	Best Of (Presentation)
27.07.2010	University Open Day (House Tours)

tated. The quintessence in this level is to promote the innovative products of prospective partners. The target group are mainly small and medium-sized enterprises from the construction branch. The aim is to create a win-win situation for both, the SDE-Team and the sponsor.

For this reason a "catalogue of services" was developed, in which the various services, offered by the HFT, are priced for every segment of the pyramid.

4.4 Approach to sponsors

The companies, institutions and media collected in the data bank get a one page documentation.

This is used as an invitation as well as information for potential partners. It describes the timeline of the project, short information, the answers to frequently asked questions, and the HFT Stuttgart concept including interdisciplinary learning and research, future protection and cooperation with the economy and required partnerships.

After the one page documentation has been sent, a telephone inquiry is made with regard to interest and an appointment to discuss the next steps.

To prepare the partner optimally for the appointment,

home+

the Team sends a 15 page brochure as background documentation which covers all general procedures. It describes goals and subtopics, relevance for the HFT Stuttgart, economy and society, activities and measures, project phases and budget, methods of learning and realisation and necessary support. Positive and negative feedback are collected in the data bank.

In order to illustrate the project for potential sponsors, a booklet is being prepared.

5. The Progress of Communication activities

To build good relationships with companies and get in touch with the selected target groups we have planned and realized several internal and external activities to coordinate distributed information about the project and increase attractiveness for potential sponsors:

5.1 Internal Communication

The internal communication is directed to the target audience "university environment" and contains the communication within the university, friends, alumni and other universities. The SDE is the major project of the HFT and therefore, internal communication is a crucial point for a positive image of the project within the university to gain support and to avoid enviousness and distrust.

For internal communications we use the following modes of communication:

Events

University or partner sponsored activities to create brand awareness within the university and provide information about our project and the competition.

Public relations

Programs designed to promote the project's/ competition's image within the university environment.

Word-of-mouth

People-to-people oral communications that relate to the current status or the experiences.

With the creation of the communication and fundraising office at the HFT, new strategic partnerships with friends of the university and alumni were established through our Kick-Off-Event. These new contacts help us to get in touch with potential partners and the public. The following internal activities were already conducted.

Events

Kick-Off Event:

Opening event with a multimedia presentation for all students and professors engaged in the Solar Decathlon Europe.

Workshops and "jours fixe":

Workshops with all student teams, including the specialist engineers and interior designers at the HFT Stuttgart take place in regular intervals. At the "jours fixe" the representatives of the student teams meet every Monday. Here we try to communicate the current status of the project and exchange experiences.

University-Event:

Following the Workshop in Madrid, a University event with a presentation of the concept design has taken place. All students, professors and administration of the HFT Stuttgart were invited to join this event. On Thursday 25th of June, we presented our draft to the students and staff of the HFT Stuttgart. The aim was to give students a better understanding of solar building based on the example of our project. The event received great feedback. Another internal event is planed as soon as the construction

Brochure - Front page



Poster - IRES 2009



Flyer/ Postcard - University Event





of the building starts (February 2010)

Buildings Physics Meeting:

On November 27 the meeting of the building physics 2009 took place at the HFT Stuttgart. Professionals from this sector and students of the programmes Master in Sustainable Energy Competence and Bachelor Building Physics took part. The team used this opportunity to present the architectural qualities of home*, especially the energy components in detail. Results of advanced simulations and the achieved solutions were depicted and discussed. The intention of this event was to promote further university research in the field of energy efficient building construction.

University lecture

An university lecture about the climate debate, in the context of an class about Environmental Architecture was held by students of the SDE Team home⁺ to students of the HFT. Also the SDE Competition and the project were introduced.

Public Relations

To communicate the current status and event dates within the university, newsletters are sent out regularly to students and professors, as well as reports in the university newspaper "Stallgeflüster". Public Relations within the university was made in form of newsletters, articles in the University nespaper, posters, flyers and brochures. (see External Communications). Besides, an specially designed exhibition box (including our home+ model) is permantly presented at the architectural school with posters of SDE and home+ which have been exhibited in the corridors of the architectural faculty.

5.2 External Communication

Together with the PR-office of the HFT Stuttgart, the Team uses several tools such as:

Advertising

Any form of nonpersonal presentation and promotion of ideas.

Events

University or partner sponsored activities to create brand awareness and provide information for potential buyers, sponsors and foundations, public institutions and the general and particular public

Public relations

A variety of programs designed to promote or protect the project's image

Interactive marketing

Online activities and programs designed to engage the target groups and directly or indirectly raise awareness and improve the image and get in touch.

All those activities aim to increase the attractiveness of the Solar Decathlon to potential sponsors, foundations, the media, potential buyers, enterprises, public institutions and the general and particular publics. We would like to invite them to participate and to support the project.

Advertising

For advertising the Team has created a fundraising and information brochure (our major document that contains every information about the competition and our building). We have also designed and developed flyers, posters for fairs and events, postcards, information brochures, invitation cards for events, greeting cards, and press kit (together with the other German teams for collective communication actions). We hand out and distribute this short and concise information at universities, in all kind of events, schools, streets, etc, so that the people get to know about the competition, our project and the SDE ideas.

Television:

Beyond that, we have an cooperation with the film production company TEAMWERK. It accompanies the team over the period of the Solar Decathlon. Amongst others, they produce film sequences about events and the progress of the project for our website. Furthermore a documentation of the competition in Madrid is planned. The film company will sell the entire footage to SWR television (part of

First concept of a flyer



ARD, the German national television).

Book documentation:

Together with the other german universities we have planned to publicize a book for the people to know about the event and these new technologies after the competition. The book is planned at the moment in at least 2 languages.

Radio Broadcasting:

To gain the attention of young people and thanks to the support of HoRadS, we made an interview at the German university radio explaining and giving information about the SDE and the project. This radio is listened to all the universities around. For more information see our News in the website.

Earth Day:

On the 22nd April 2010, the Earth Day, the German TV channel SWR Baden-Württemberg has broadcast a summary of our roofing ceremony on 20th April 2010 and also about the SDE competition and our project home*. For more information, see out website.

Metro-TV:

A very innovative form of advertisement was to show an article at the Metro-TV at the metro sta-tions

Lange Nacht der Museen



Metro TV



in Stuttgart. With support of public broadcast Rundfunkgesellschaft mbH, the Team became the opportunity to broadcast information about the project. For more information see our News in the website.

Covers on the truck trailers:

As the house will be transported at end of May to Madrid on truck trailers, we have also planned to make covers to protect the house modules with printed logos of the SDE and home⁺ and so that they will be seen from cars and by pedestrians along the way to Madrid and advertise the SDE competition.

Fan-Trip:

A Fan-Trip to the Vila Solar in Madrid for interested parties is organized by the Team.

Live Stream (planned):

DeuBau Essen - exhibition booth



Event at the Architectural Association



A Live Stream of Madrid will be sent and shown on monitors at the HFT, while we are in the competition.

Events

Project-Presentation on fairs

CONSENSE STUTTGART

Thanks to the support of the German Society for Sustainable Construction (DGNB) and the Trade Fair Stuttgart, we succeeded in a short term realisation of an exhibition SDEurope on the consense in Stuttgart from 23 to 24 June 2009. Between the exhibition hall and the large auditorium, posters of all four German teams were presented prominently, as well short films about all 20 participating teams.

DEUBAU ESSEN AND BAUTEC BERLIN

With support of the Messe Essen GmbH we succeeded in getting a booth for our Team and the other three other German paticipants at the Deubau in Es-

home+

sen and Bautec Berlin, both important construction trade fairs in Germany. From 12.-16.01.2010 and 16.-20.02.2010 we contributed to the dissemination of the competition in Germany and explained the building concept to a large audience. The exhibitions were a great success, the project highly aroused the public and professional interest.

LANGE NACHT DER MUSEEN

At the opening of the Long Night of Museums, our project was presented at the City Gallery of Sindelfingen. In addition to posters for the competition and a current model of the home⁺, a small team of students demonstrated a physical test and answered questions from curious visitors, in particular school classes. The exhibition is about the relationship between art and architecture. Among others, there are projects by Behnisch & Partner, Transsolar and many other engineers and artists. The exhibits can be visited until 24. January 2010 in the City Gallery of Sindelfingen.

At the moment we are in touch with several trade fair organizers and organized booths for our the Team and the other german participators on the following exhibitions and events:. See Future Actions.

Project-Presentations

VIP-EVENT STUTTGART

In July, we organized an VIP-Event at the Archtiectuaral Association Baden-Württemberg. It was the first time that the Team present their concept design to the general public. About 150 invited guests came to the event. Amongst others the State Secretary of Baden-Württemberg, (potential) sponsors, media, and a celebrated scientist (Prof. Matthias Schuler). The evening ended in interesting discussions and exchange of ideas with Baden-Württemberg wine and tapas from Spain. The event attracted a lot

attention in the region of Stuttgart, one of the most active economic areas in Germany. (articles in newspapers, positive feedback).

PRESENTATION DEUTSCHE BANK

Together with Deutsche Bank we organized a project presentation at the DB Office in Stuttgart. The DB invited business clients in due consideration of our target group "potential buyers". On invitation by the Deutsche Bank Stuttgart, students of Team Stuttgart presented the competition Solar Decathlon Europe 2010 on 25 November. The aim of the event was to inform the participants about energy efficient construction and future-oriented energy sources. The focus was of course the competition design of home+. The participants were very interested, especially in the high living comfort and the discussed energy-efficient technologies. During the following snack-time, team members could discuss questions in more detail. With the aid of a questionnaire, we analysed the opinion of the target group regarding our building.

Due to the great success further events are planed, together with DEUTSCHE BANK at the building lot.

PRESENTATION BMW₁ BERLIN

On September 23th, we presented our project at the Federal Ministry of Economics and Technology in Berlin. The goal is to create social awareness at federal level.

Conferences & Symposia:

To increase the public outreach of the project we will give lectures on relevant conferences. For the presentations we use posters and hand out flyers and brochures. We also aim to discuss the project with subject-related groups at universities and research facilities.

Public Relations:

For all press releases, see Appendix 3, at the end of Project Manual

Fairs

Date	Name
2324.06.2009	Consense Stuttgart
1216.01.2010	DeuBau Essen
1620.02.2010	Bautec Berlin
2527.02.2010	CEP Stuttgart

Conferences & Symposia

Date	Name		
31.08.2009 -03.09.2009	Sustainable Energy Technologies 2009 Aachen		
2728.10.2009	Europeans Symposium ,90 Jahre Bauhaus – Neue Herausforderungen durch die europäische Energiepolitik', "90 years Bauhaus - New challenges of the european energy politics", Bad Langensalza		
1416.10.2009	Solar Summits 2009 Freiburg		
1112.11.2009	Bauhaus.SOLAR Erfurt		
14.11.2009	Presentation at the Long Night of Museums in Sindelfingen		
16.11.2009	Building Physics Meeting		
2425.11.2009	Annual Conference ForschungsVerbund Erneuerbare Energien (FVEE) 2009		
27.11.2009	Project presentation at the ,BMWi' - Feneral Ministry of Economics and Technology in Berlin together with all German teams		
02.03.2010	2.Anwenderforum Gebäudeintegrierte Photovoltaik, Kloster Banz		
17.04.2010	Presentation at Haus Holz Energie, Messe Stuttgart		
1517.09.2010	Polycity Conference, Stuttgart		
2021.09.2010	International Conference on Buiolding Performance (icbp)		

Worldwide Events

Date	Name	
01.0531.10.2010	EXPO 2010 in Shanghai, Filmpresentation of home ⁺ in the stand of Baden-Württemberg (Germany)	
1719.11.2010	Greenbuild, Chicago, Illinois, United States of America	

Other external Events

Date	Name
26.06.2009	Solar Decathlon Studentenevent at the HFT Stuttgart
13.07.2009	VIP-Event at the Architectural Association Baden-Württemberg
09.02.2010	Presentation at the TU München
19.02.2010	Presentation at the TU Delft
20.04.2010	Roofing Ceremony at the HFT Stuttgart and Guided Tour
23.04.2010	Guided Tour "in situ" for Solarenergiekreis Leonberg
30.04.2010	Open Day and Guided Tour for interested groups
16.04.2010	Presentation at the FH Technikum Vienna
25.09.2010	Energietage Baden-Württemberg, Stuttgart
12.05.2010	Presentation at the architectural faculty of RWTH Aachen

Roofing Ceremony



Presentation at TU Delft



Newspapers and Magazines

Several articles have been published in online media (e.g. www.baukalender.de or www.umweltjournal.de) and some in print media (e.g. db Deutsche Bauzeitung 01/2009), announcing the participation and the concept of our team.

Articles in the regional press attract attention in the region of Stuttgart (e.g. Stuttgarter Zeitung 07/2009). This helps the Team to find sponsors on the one hand and give sponsors a platform to show their commitment. Beyond that, another intention is to raise the awareness of people for energy efficient construction issues.

Articles in national/international professional journals inform the professional audience about the progress of our work and the concepts we want to realise. Together with the professional journal "XIA" (intelligent building technologies) we developed a schedule for publishing information about the SDE 2010 competition and the houses of the four german teams. It started with an article about the competition and the workshop in Madrid in No. 67, which was published on May 18th. In No. 68 the design

and concepts of the four teams were presented. In No. 69-71 we will focus on different topics, like the building envelope or cooling strategies. In No. 72 the results of the competition will be published. The coordination for all four teams will be done by our team. In the present volume of the "Ingenieurblatt", a professional journal for engineers, we have published an article of 8-10 pages about the SDE 2010 competition, our design and concept. It will also contain information about the contributions of the involved degree courses.

We have also coordinated the cooperation with the professional journal "greenbuilding" for all four German teams. An article about the contributions of the teams was published in August.

Collaboration with SDE Organization:

The SDE Organization offered us possibilities to show the project to the international press. This is the case of El Pais Semanal, Arquitectura Viva and NAN, where all participating teams were invited to explain their projects. Of course we have made our contribution here. For the GENERA conference in May, the Team of FH Rosenheim will represent all four German teams and give an overview of the four

Press Releases For all press releases, see Appendix 3, at the end of Project Manual

Newspapers	Release-Date	Title
aud!max ING	01.01.2009	Solares Kräftemessen
Stuttgarter Wochenblatt	12.02.2009	Solarer Zehnkampf
Gerlinger Wochenblatt	12.02.2009	Solarer Zehnkampf
Stuttgarter Wochenblatt	22.01.2009	Sonne nutzen
Staatsanzeiger Baden-Württemberg	20.02.2009	Studenten planen das solare Wohnen der Zukunft
Bundesbaublatt	02.03.2009	Solar Decathlon Europe 2010 - Erste Entwürfe
Stallgeflüster	15.03.2009	Wir sehen uns 2010 in Madrid!
Staatsanzeiger Baden-Württemberg	12.06.2009	Studierende präsentieren für den Solar Decathlon
Stuttgarter Wochenblatt	25.06.2009	Wie wohnt man in der Zukunft?
Stuttgarter Zeitung	15.07.2009	Ein Haus als Öko-Kraftwerk
Staatsanzeiger	17.07.2009	Eine Hochschule im Wettbewerbsfieber
Heldenheft	05.09.2009	Wohnungsbau der Zukunft mit home+
Stallgeflüster	15.09.2009	home⁺ - Unser Beitrag zum Solar Decathlon Europe 2010
Lift	01.01.2010	Wie könnte Wohnungsbau in Zukunft aussehen?
Staatsanzeiter Baden-Württemberg	29.01.2010	Studierende der Hochschule für Technik planen und bauen Solarhaus der Zukunft
Stallgeflüster	15.03.2010	Wir haben mit dem Bau von home+ begonnen!
Stuttgarter Nachrichten	30.03.2010	Feuchtetücher im Windturm sollen die Raumtemperatur angenehm und kostenlos kühlen
Stuttgarter Zeitung	30.03.2010	Hightechhaus hat Energie im Überschuss
Staatsanzeiger Baden-Wütt- emberg	16.04.2010	Hochschule sucht Standort für das WEttbewerb des Solar Decathlon
Stuttgarter Zeitung	21.04.2010	Solarhaus geht in den Zehnkampf. Richtfest: Architekturstudenten der Hochschule haben ein Energiesparhaus der Extraklasse ausgetüftelt
Leonberger Kreiszeitung	21.04.2010	Haus mit Solarenergie
Heldenheft	1/2010	Solar Decathlon Juni 2010
Heldenheft	2/2010	article submitted, for June pending
Heldenheft	3/2010	article submitted, for October pending
Campushunter	to be published	
Welt am Sonntag	to be published	
179 Standortmagazin der Wirtschaftsförderung Region Stuttgart	to be published	

different concepts. Besides, in may Presentation in Madrid 2009 with architectural models.

Collaboration with all German teams:

From the very beginning the Team Stuttgart came up with the idea of a cooperation with the four German teams and so initiated it. We saw clearly in this action a big chance to maximize the public and media outreach so that we have coordinated and

pushed it for most tasks. For readers of journals, visitors of fairs or even for experts at conferences, it is very interesting to compare the concepts of the four teams and to get a broader view of the ideas and possibilinties in energy efficient building. In the regional press, we act independently. Besides of that, as you see, we have planned several presentations at different universities, to reach young engineers, designers, architects, planners and interested

home+

alumni, not only at our universities but in Germany and Europe. Our communication activities made the project well known in Stuttgart, Baden-Württemberg and, due to the cooperation with the other German teams, all over Germany. As a result, some public relation partners and sponsors take the initiative and approach our team with their own ideas of how to support the project. The team sees here also

a chance to reach the federal layer spreading the ideas and aims of this competition, taking this duty very seriously. We can say, we are best supported in this manner. We won a big sponsor with the German Federal Ministry of Economics and Technology, in Berlin, and we are already being supported at the regional and local layer.

Interactive marketing

For all press releases, see Appendix 3, at the end of Project Manual

Professional journals	Release -Date	Titel
horizonte	20.01.2009	Solar Decathlon Europe 2010
Deutsche Bauzeitung	20.01.2009	Solar Decathlon Europe 2010
Bauwelt	23.01.2009	Klobige Thermoskannen
Moderne Gebäudetechnik	01.04.2009	Solar Decathlon Europe 2010
Intelligente Architektur (XIA)	04-06.2009	Solar Decathlon Europe 2010
Sonne Wind & Wärme	22.07.2009	Solar Decathlon 2010 erstmals in Europa
Baumeister	01.08.2009	Solar Decathlon ab 18. August
greenbuilding	07-08.2009	Der Sonne entgegen
Intelligente Architektur (XIA)	07-09.2009	Solar Decathlon Europe 2010
Ingenieurblatt für BW	07-08.2009	Hochschule für Technik Stuttgart - Solar Decathlon Europe 2010
horizonte	01.09.2009	Wohnen von morgen schon heute - home+
Intelligente Architektur (XIA)	10-12.2009	Solar Decathlon Europe 2010
Energie Kompakt	15.02.2010	7. Süddeutsches Energieberaterforum in Feuchtwangen - Der Branchentreff mit Aha-Effekt
Gebäude Energieberater	01.03.2010	Reise zum Solar Decathlon Europe
horizonte	01.03.2010	Decathlon Wettbewerb - Das team der Hochschule für Technik Stuttgart kommt voran
Intelligente Architektur (XIA)	04-05.2010	Solar Decathlon Europe 2010
Deutsches Architektenblatt(DAB)	21.04.2010	Solarhaus geht in den Zehnkampf. Richtfest:Architekturstudenten der Technikhoch- schule haben ein Energiesparhaus der Extraklasse ausgetüftelt
Sonnenenergie	22.04.2010	Teil1: Solar Decathlon Europe 2010
Sonnenenergie	23.04.2010	Teil2: Solar Decathlon Europe 2010
greenbuilding		
Intelligent Glass Solutions	1/2010	Solar Decathlon goes European
Special edition "Innovative Fassadentechnik"		article submitted, pending
Architectural Record		article submitted, pending
German association of energy consultancy "Gebäude Energie Berater"	03/2010	Reise zum Solar Decathlon Europe

Other communication materials	Release -Date	Titel
OTTOChemie magazin	to be published	
STEICO Instruction Material	to be published	

Newsletters and press from HFT	Release -Date	Titel
Newsletter HFT	01.02.2010	Newsletter der Fakultät Architektur und Gestaltung: 2010 N° 2
Newsletter SDE home⁺	01.12.2009	Newsletter 12/09 - Team HFT Stuttgart
Newsletter SDE home⁺	01.03.2010	Newsletter 03/10 - Team HFT Stuttgart
Newsletter greenbuilding	07.08.2009	eMail Newsletter with link to article, has been added
HFT press	01.11.2008	Solar Decathlon Europe 2010: Wer baut das beste solar betriebene Haus?
HFT press	01.02.2009	Die ersten Entwürfe sind abgegeben
HFT press	19.06.2009	Wohnungsbau der Zukunft mit home+
HFT press	01.03.2010	Wettbewerbshaus home+ kommt nach Stuttgart

For all press releases, see Appendix 3, at the end of Project Manual

Online Releases

Internet	Date	Link
region-stuttgart.de	19.02.2008	http://www.region-stuttgart.de/sixcms/detail. php/268877
hft-stuttgart.de	12.11.2008	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2008/SolarDecathlon/de
innovations-report.de	24.11.2008	http://www.innovations-report.de/html/berichte/architektur_bauwesen/solar_decathlon_europe_2010_baut_beste_solar_122982.html
baukalender.de	25.11.2008	http://www.baukalender.de/nachrichten_detail2. php?nr=2770
umweltjournal.de	25.11.2008	http://www.umweltjournal.de/AfA_bauenwohnengarten/14962.php
ibau.de	25.11.2008	http://www.ibau.de/wirtschaftsnachrichten.php
hft-stuttgart.de	27.11.2008	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2008/SolarDecathlon1/de
solarserver.de	29.11.2008	http://www.solarserver.de/news/newsa2008m11.html
energie-portal.info	01.12.2008	http://www.energie-portal.info/cms/front_content. php?idcat=119&idart=1558
iwr.de	10.02.2009	http://www.iwr.de/news.php?id=13808
solarserver.de	10.02.2009	http://www.solarserver.de/news/news-10189.html
idw-online.de	10.02.2009	http://idw-online.de/pages/de/news300216
innovations-report.de	10.02.2009	http://www.innovations-report.de/html/berichte/prei- se_foerderungen/solar_decathlon_europe_2010_ers- ten_entwuerfe_126991.html
solarserver.de	10.02.2009	http://www.solarserver.de/news/news-10189.html
fona.de	11.02.2009	http://www.fona.de/de/7323
dbz.de	15.02.2009	http://www.dbz.de/artikel/dbz_Solar_Decath-lon_Europe_2010_Die_ersten_Entwuerfe_sind_abgegeben_84070.html
energie-portal.info	18.02.2009	http://www.energie-portal.info/cms/front_content. php?idcat=119&idart=1703
baunetzwissen.de	19.02.2009	http://www.baunetzwissen.de/standardartikel/Solar-Solar-Decathlon_726033.html
arcguide.de	19.02.2009	link no more available/ realease added
hft-stuttgart.de	04.03.2009	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2009/ SolarDecathlon/de
uni-protokolle.de	19.06.2009	http://www.uni-protokolle.de/nachrichten/id/179420/
idw-online.de	19.06.2009	http://idw-online.de/pages/de/news321555

umweltjournal.de	20.06.2009	http://www.umweltjournal.de/fp/archiv/AfA_bauenwohnengarten/15769.php
ibau.de	22.06.2009	http://www.ibau.de/kunden/meldung. php?nld=10004114
solaranlagen-portal.de	23.06.2009	http://www.solaranlagen-portal.de/wordpress/internationaler-wettbewerb-solar-decathlon-europe-2010
detailx.de	24.06.2009	http://www.detailx.de/hft-stuttgart/blog/wohnungsbau- der-zukunft-mit-home/
solarserver.de	12.07.2009	http://www.solarserver.de/solarmagazin/new-sa2009m02.html
solarserver.de	12.07.2009	http://www.solarserver.de/news/news-10991.html
detail.de	14.07.2009	http://www.detail.de/artikel_solar-decathlon-europa-madrid_24122_De.htm
stuttgarter-zeitung.de	15.07.2009	http://www.stuttgarter-zeitung.de/stz/ page/2126311_0_9223energietechnik-ein-haus-als oeko-kraftwerk.html
german-architects.com	15.07.2009	http://www.magazin-world-architects.com/de_09_29_onlinemagazin_sd_de.html
dbz.de	15.07.2009	http://www.dbz.de/artikel/dbz_Wir_wollen_ge- winnnen_HFT_Stuttgart_beim_Architekturwettbe- werb_Solar_157672.html
hft-stuttgart.de	16.07.2009	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2009/ SolarDecathlon06_09/de
fensterplatz.de	24.07.2009	http://www.fensterplatz.de/fenster/fenster.nsf/MainPage?OpenFrameset&Frame=Mainframe&Src=/fenster.fenster.nsf/0/606A78D78923F1A9C12575F500425182?OpenDocument
fensterplatz.de	24.07.2009	http://www.fensterplatz.de/fenster/fenster.nsf/MainPage?OpenFrameset&Frame=Mainframe&Src=/fenster.fenster.nsf/0/606A78D78923F1A9C12575F500425182?OpenDocument
arcguide.de	05.08.2009	link is not more available/ online realease added
hft-stuttgart.de	23.09.2009	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2009/ SolarDecathlon0709/de
hft-stuttgart.de	27.10.2009	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2009/ SDEurope_Raumprobe/de
baunetzwissen.de	16.11.2009	http://www.baunetzwissen.de/standardartikel/ Solar-Solar-Dacathlon-Europe-2010_811733. html?source=nl
bmwi.de	04.12.2009	http://www.bmwi.de/BMWi/Navigation/Presse/pressemitteilungen,did=322536.html
enob.info	04.12.2009	http://www.enob.info/de/news/news/details/solar-decathlon-europe-startschuss-fuer-madrid/
gizmag.com	04.02.2010	http://www.gizmag.com/solar-decathlon- europe/14081/
handwerkermarkt.de	06.12.2009	http://www.handwerkermarkt.de/nachrichten/themen- fur-handwerker/handwerk-in-politik-offentlichkeit/ solar-decathlon-europe-2010-fuer-architekten-und- ingenieure/
baulinks.de	06.12.2009	http://www.baulinks.de/webplugin/2009/2082.php4?n
europaticker.de	07.12.2009	link not available, release added
pressbot.net	07.12.2009	http://www.pressbot.net/article_I,1,i,93711.html
presseanzeiger.de	07.12.2009	http://www.presseanzeiger.de/meldungen/umwelt-energie/311967.php
fair-news.de	07.12.2009	http://www.fair-news.de/news/Teilnehmer+des+Solar- Decathlon+Europe+zum+Gespr%C3%A4ch+beim+B MWi/40845.html
prcenter.de	07.12.2009	http://www.prcenter.de/Teilnehmer-des-Solar-Decath-lon-Europe-zum-Gespraech-beim-BMWi.97506.html
pressbot.de	07.12.2009	link not avalaible, release added

sonnenseite.de	30.11.2009	link not available, release added
greendiary.com	08.02. 2010	http://www.greendiary.com/entry/sustainable-houses- for-the-solar-decathlon-europe-2010/
sonnenseite.de	17.02.2009	link not available, release added
focus.de	18.02.2010	http://www.focus.de/immobilien/energiesparen/tid-17273/solarwettbewerb-stuttgart-vom-winde-gekueh-lt_aid_481064.html
focus.de	18.02.2010	http://www.focus.de/immobilien/energiesparen/tid-17273/solarwettbewerb-das-wohnhaus-als-kraftwerk_aid_481052.html
hft-stuttgart.de	24.02.2010	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2010/ SolarDecathlon1_2010/de
bine.info	02.03.2010	http://www.bine.info/hauptnavigation/publikationen/news/news/solar-decathlon-europe/?artikel=1522
energieportal.de	03.03.2010	link not avalable, release added
detail.de	26.03.2010 (accessed)	http://www.detail.de/artikel_solar-decathlon-europa-madrid_24122_De.htm
baunetz.de	29.03.2010	http://www.baunetz.de/termine/Solar_Decathlon_ home987269.html
stuttgarter-nachrichten.de	30.03.2010	http://www.stuttgarter-nachrichten.de/inhalt.schoener-wohnen-im-kraftwerk.4d70eada-558e-45c2-9ad6-2357259a55d9.html
hft-stuttgart.de	01.04.2010	http://www.hft-stuttgart.de/Aktuell/Rueckblick/2010/ SolarDecathlonSS10-1/de
ais-online.de	12.04.2010	http://www.ais-online.de/solar-decathlon-wird-erst-mals-in-europa-ausgelobt-21497/neuheit.html
dailynet.de	12.04.2010	http://www.dailynet.de/BauHandwerkWohnen/71664. php
pr-inside.de	12.04.2010	http://www.pr-inside.de/de/print1824885.htm
firmenpresse.de	13.04.2010	http://www.firmenpresse.de/print-pressinfo188082.htm
inar.de	13.04.2010	link not available, release added
energie-experten.org	20.04.2010	http://www.energie-experten.org/experte/meldung- anzeigen/news/team-stuttgart-nimmt-mit-plusenergie- haus-und-energieturm-am-solar-decathlon-europe- 2010-teil-523.html
stuttgarter-zeitung.de	21.04.2010	http://www.stuttgarter-zeitung.de/stz/ page/2461187_0_2147solarhaus-geht-in-den- zehnkampf.html
energate.com	21.04.2010	www.energate.com/index.php?id=56&no_ cache=1&tx_ttnews[tt_news]=83&tx_ttnews[backPid] =23&cHash=2a702bcda1
swr.de	22.04.2010	http://www.swr.de/landesschau-bw/-/id=122182/did=6288436/pv=video/nid=122182/jn44rx/index.html
sonnenenergie.de	22.04.2010	http://baustelle.sonnenenergie.de/index. php?id=30&no_cache=1&tx_ttnews[tt_news]=9
sonnenenergie.de	23.04.2010	http://baustelle.sonnenenergie.de/index. php?id=30&no_cache=1&tx_ttnews[tt_news]=23
dbz.de	27.04.2010	http://dbz.de/artikel/dbz_HOMEEnergiehaus_der_ HFT_Stuttgart_Beim_Wettbewerb_fuer_898768.html
hft-stuttgart.de	28.04.2010	http://www.hft-stuttgart.de/News/solardecathlon-richtfest/de
openpr.de	29.04.2010	http://www.openpr.de/news/423425/Wettbewerbs- haus-home-der-HFT-Stuttgart-mit-ENERGATE-Fens- tern-von-Haeussler-feiert-Richtfest.html
detail.de	02.05.2010 (accessed)	http://www.detail.de/artikel_solar-decathlon-madrid_25136_De.htm
dbz.de	02.05.2010 (accessed)	http://www.dbz.de/artikel/dbz_HOMEEnergiehaus_der_HFT_Stuttgart_Beim_Wettbewerb_fuer_898768.html

home+

vi.sualize.us	02.05.2010 (accessed)	http://vi.sualize.us/eco_oficina/solar%20 houses/?page=2	
detailx.de	02.05.2010 (accessed)	http://www.detailx.de/hochschulen/hochschulnews/archiv/fortschritt-der-projekte-zum-solar-decathlon/	
kopenhagen.diplo.de	02.05.2010 (accessed)	http://www.kopenhagen.diplo.de/Vertretung/kopenhagen/de/05/EnergieKlima/seitesolardecathloneuropemadrid2010.html	
magazin-world-architects.com	02.05.2010 (accessed)	http://www.magazin-world-architects.com/de_09_29_onlinemagazin_sd_de.html	
greenbuilding-planning.de	02.05.2010 (accessed)	http://greenbuilding-planning.schiele-schoen.de/a14424/Solar_Decathlon_Europe_2010.html	
heinze.de	02.05.2010 (accessed)	http://www.heinze.de/hbo/typID_882/obID_8722954/module_1170/modulePageID_1/context_1/solar-decathlon-wird-erstmals-in-europa-ausgelobt.html	
licht-und-architektur.de	02.05.2010 (accessed)	http://www.licht-und-architektur.de/news/lat_Wohnungsbau_der_Zukunft_mit_HOME144610.html	
solardecathlon.tu-darmstadt. de	02.05.2010 (accessed)	http://www.solardecathlon.tu-darmstadt.de/solardecathlon09070909/sdeurope/landingpagesdeurope.de.jsp	
welt.de	02.05.2010	http://www.welt.de/die-welt/wirtschaft/article7429078/ Die-naechste-Solar-Generation-tritt-an.html	
akbw.de	02.05.2010 (accessed)	http://www.akbw.de/service/wohnungsbau-der-zu-kunft/artikel_5062.htm	
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For all press releases, see Appendix 3, at the end of Project Manual

Website:

Our main interactive portal is our team website http://www.sdeurope.de . Here, we add news about the process of the project and coming events of the team at fairs, symposia, presentations, etc, where the people can get informed about the competition and the project itself. This includes a download area of selected publications and further information, an online survey and also a live web-cam where people can follow-up on the building activities of home+ on site. Since we have our website domain, we have had 20 accesses per day. Since we added in our website the Live Stream Cam, we have daily 100 to 400 acceses (Google Analytics, Stand: 02.05.2010). Many of our sponsors have linked us on their own websites, for example our material sponsor häussermann (http://www.haeussermann.de/). Furthermore, we have been followed during the whole process by a film production company editing until the final project execution in Madrid itself. It can be reached also directly from the homepage of the official website of the HFT Stuttgart. But also from another big portals, like Wikipedia, and in each press realease (online or printed), the website adress is given.

Website description- Code:

The website is based on dynamic framework, which combines PHP programming and HTML content and allows easy-to-adjust repeating as well as changing components (menus, footer, titles, etc). The content files are separated from the code and are implemented into certain templates. In addition JavaScript and CSS are used to make website interactive and thus more attractive.

Design:

Lightweight"black-on-white" design uses only one colour (red) to accent or highlight some parts of the layout. Horizontal lines separate main area from header and footer. Main area is fixed in height and

introduces information always as text supported by graphics or video, therefore divided into two blocks. Main navigation (menu) is situated in the upper part and stays always visible. Sub-menus of next levels appear according to selected main menu.

Content:

The homepage indicates its purpose and creator/ owner with always visible team's logo (in header) and name of the competition (in footer). Further key information about competition, team, its project and university it presents can be found in the main menu. Website provides information in text form always combined with a related graphics and/or video. Initial page shows block with latest news. Previous news articles can be reached directly from this page. Website presents also press articles newly released, information on upcoming events and fundraising related material.

Video materials are usually put together with some news article, but are also to be found in the download area. These materials are interviews, reports about attended events or project describing films. Contact is to be made over contact form, which allows sending message on certain department of the project.

All content is updated regularly.

Questionnaire

To analyse the impact of our building, the Team designed a standardized questionnaire. The questionnaire is available on our homepage and is also distributed through Deutsche Bank to get in touch with the target group "potential buyers". The questionnaires do not require as much effort from the questioner as verbal or telephone surveys, and have standardized answers that make it simple to compile data. The evaluation is presently in progress.

Another Portals:

home+

The team owns also profiles and portals at XING, Lokalisten, Facebook, Studivz (German Facebook), Flickr, YouTube, and Twitter, Blogger. These communities reach several circles, there are some specific communities like XING, where professionals form the community and get to know more about these green and alternative technologies. Together with the other German teams, a German article was written for Wikipedia, the most known information platform on the web.

We are happy to have the leading position in a survey on www.suelosolar.es (http://www.suelosolar.es/decathlon/index.asp, Stand: 02.05.2010)

5.3. Future Communication Activities

The Team will organize two further events before
June 2010 with partners, sponsors and the public.
The aim is to raise awareness, to show the house
at the building lot and gain further financial support/
sponsors for the competition and the subsequent
use. We will also present our house on fairs and promote the competition, release articles together with

partners and the press and also promote the project at the HFT, with another event in March. Following the competition, the Team will exhibit the house at the most prominent place in Stuttgart.

It will be also exhibited together with major sponsors at different places in Germany.

When the house returns from Madrid, a great event is planed, together with the major of Stuttgart.

Furthermore, our house will be used in afterlife as an object for intensive research for new solar technologies, where studies and tests can be done making use of the monitoring technologies already implanted in the house.

Beyond that, during the competition in Madrid the following actions are foreseen:

We are planning some entertaining actions that refer to our buildings characteristics (games) while people will waiting in the queue before the building. We will also distribute flyers, brochures and posters and offer everything that makes the queue time as comfortable as possible. The information material is presently designed. We will use newest photo material from the building therefore there is only a

Future Actions

Date	Name			
28.0901.10.2010	Symposium EuroSun 2010, Graz (Austria), abtract accepted			
2224.09.2010	2. Symposium Aktiv Solarhaus, Luzern(Switzerland), abtract submitted			
2224.11.2010	Symposium IRES 2010, Berlin (Germany), abstract submitted			
2425.11.2010	Symposium Bauhaus.SOLAR, Weimar (Ger many), abstract submitted			
23.12.2010	Symposium Solar Building Skins, December 2010, Bressanone (Italy), abstract submitted			
1722.01.2011	Trade Fair Bau 2011 München (Posters appearance)			

concept flyer above.

6. Sponsorship progress

The major steps in our fundraising activities are taken and we already signed contracts with 64 sponsors and foundations, private donators or supporters which will support our project financially and with materials.

According to the capability of our (potential) sponsors, we offer several sponsoring-packages. For this purpose the FR-Team created a document with an overview of the three different Sponsoring-Levels and the priced services the HFT can provide.

In addition to the research projects, we have experienced that the project is a good star-ting point for developing new projects with companies supporting our team. This confirms our strategy from the beginning that we want to use the SDE as an opportunity to start long lasting relationships with partner companies for a mutual benefit. Together with Energate we are planning to develop a compendium for the planning of windows in energy efficient buil¬ding design. Together with Häussermann, the wood-processing company who sponsors the wooden flooring in our house and on our terrace, we are thinking about developing new inno-vative products. In cooperation with our main sponsor, müllerblaustein, we have future plans of making a serial production of the prototype. Furthermore several companies producing ab-sorbers and heat exchangers showed great interest in developing further our concept of PV-T radiant cooling. Since we, as a University of Applied Sciences, are concentrating on applied research and development, the contact and cooperation with companies is very important. The SDE project fits in very well and supports these activities

6.1 Sponsors & Foundations

MÜLLER BAU GMBH

MB is one of the leading timber-building enterprises in Germany. They are very highly experienced in the production of innovative woodwork and hardware components.

MBM KONSTRUKTIONEN

MBM is active worldwide in the construction of steel, light metal, stainless steel and glass structures.

Today MBM is setting benchmarks with these construction materials - be it in the development and production of facade structures, in the area of curtain walling, or for complicated special constructs.

TRANSSOLAR

Transsolar is a climate engineering firm whose scope is to ensure the highest possible comfort in the built environment with the lowest possible impact on the environment. This is accomplished by developing and validating climate and energy concepts through the recognition that environmental conditions are influenced by all aspects and stages of design.

ERTL GLAS AG - ERTEX SOLAR

The ERTL GLAS AG is one of the leading producers of laminated safety glass. This LSG technology in conjunction with the large area of the ERTEX-SOLAR photovoltaic modules opens up completely new horizons regarding architectonic façade design. ertex-solar is conceived as a partner for all architects searching to uniting both aesthetics and solar energy generation perfectly.

SUNWAYS AG

Sunways develops and produces the high-quality components for photovoltaic systems that play a major role for our building. They concentrate on solar cells and inverters, and cover the main areas

of photovoltaics.

VA-Q-TEC AG

va-Q-tec offers a range of Vacuum Insulation Panels (VIPs). VIPs are high performance thermal insulation panels with up to 10 times better insulation values than conventionally available materials.

Based in Würzburg, Germany, near Frankfurt, va-Q-tec AG has won several awards for its new technology, and owns more than 40 active patents and patent applications world wide.

LUDWIG HÄUßLER GMBH

The Ludiwg Häußler GmbH produces windows and doors. It provides us with future-oriented windows whose level of insulation is much higher than conventional windows. It has been designed not only to ensure minimal heat loss, but also to lower heating costs and guarantee greater living comfort.

AUGUSTA SOLAR GMBH

Augusta Solar produces high efficient and ecofriendly vacuum tube collectors.

BAUMGARTNER GMBH

Since 1990 the Baumgartner GmbH is engaged in photovoltaic business, planning of large-scale plants, planning of architectural challenging photovoltaic plants/ front-integrated photovoltaic plants and analysing malfunctions at plants that already exist.

SIKA DEUTSCHLAND GMBH

Sika AG, located in Baar, Switzerland, is a globally integrated company supplying speciality chemicals markets. It is a leader in processing materials used in sealing, bonding, damping, reinforcing and protecting load-bearing structures in construction and industry.

HILTI AG

Hilti AG also known as Hilti Group develops, manu-

factures, and markets products for the construction and building maintenance industries, primarily to the professional end-user. It concentrates primarily on hammer drills, firestops, and installation systems, but manufactures and markets an array of tools. Hilti supports us with tools for the competition week in Madrid.

STEICO AG

Steico is European market leader in environmentally-friendly insulation materials manufactured from natural wood fibres. The company produces high quality products manufactured from wood and hemp fibres as well as a range of I-joist construction products. Technological advancements combined with sound know-how and staff expertise make it possible to offer products and building materials that are innovative, environmentally friendly and economical.

TEAMWERK - FILMPRODUKTION

Teamwerk is the film production company that accompany the Team over the period of the entire Solar Decathlon. Amongst others they produce film sequences for our website and a documentation of the competition in Madrid.

LAUX, KAISER + PARTNER

LKP is a completely vendor-neutral consulting company. It gives us adive which actually building equipment is needed and what installation and operation of energy, climate, ventilation and sanitary technical equipment, etc. will ultimately cost.

NEMETSCHEK AG

Nemetschek AG is a company which produces CAD/CAE-software featuring Allplan, VectorWorks, Archi-CAD and Scia Engineer. The company was founded 1963 by Prof. Georg Nemetschek and listed on the Munich stock exchange in 1999. It is headquartered in Munich, Germany. The company provides financi-

al support for our team.

HÄUSSERMANN GMBH

The Häussermann wood works is today amongst the largest wood production and finishing works in Germany. Founded as a sawmill in 1899 at Sulzbach an der Murr in Württemberg, Häussermann now operates over 10,000 m2 of production facilities, with 50,000 m2 of warehouse space.

BECKHOFF AUTOMATION GMBH

Beckhoff implements open automation systems based on PC Control technology. The product range covers Industrial PCs, I/O and Fieldbus Components, Drive Technology and automation software. Products that can be used as separate components or integrated into a complete and seamless control system are available for all industries.

WACKER INGENIEURE

Wacker Consulting Wind Engineers offer technicalscientific well-founded services within the scope of applied building aerodynamics and building climate to private clients as well as public organizations. Besides the consulting activity, the financial independent team carries out expert opinions, analyses, prognoses, calculations and measurements - in cooperation with the clients.

KNÖDLER-DECKER-STIFTUNG

The KDS is a non-profit institution dedicated to the promotion of education at the university.

STUDIERENDENAUSSCHUSS

The AStA is the student representation within the University.

ARCHITEKTENKAMMER BADEN-WÜRTTEMBERG

The Architectural Association Baden-Württemberg

provided the facilities for our VIP-Event

Public Institutions

BUNDESMINISTERIUM FÜR WIRTSCHAFT UND TECHNOLOGIE

Together with the three other participants from Germany we get financial support from the German Federal Ministry of Economics and Technology for the competition and monitoring the houses after the competition. Additionally the project is under the patronage of the German Minister of Economic Affairs, Dr. Karl-Theodor zu Guttenberg.

STAATSMINISTERIUM BADEN-WÜRTTEMBERG
We also succeeded in securing the patronage of
the minister of the state Baden- Württemberg, Dr.
Günther Oettinger. The State Secretary of BW held
a speech at our first public event at the Architectural
Association Baden-Württemberg

CITY OF STUTTGART

The mayor of Stuttgart, Mr. Schuster has also taken the patronage for our project. He asked us to present our house to the public after the competition in Madrid. We are planning to present it at the most prominent place in Stuttgart.

6.2 Competition in Madrid

During the competition in Madrid, the team will make some guided tours, the so called House Tours, for the general public. Here, the team will explain the building, in an architectural perception but also taking consideration the technical and environmental side. We are making also an explaining video as a helping tool for the House Tour in Madrid and further uses in future communication activities. More important, the decathlete will make an emphasis on these new green technologies, giving more conscience

Supporters and Sponsors

The German Federal Ministry of Economics and Technology supports the Team financially. Additionally the project is under the patronage of the German Ministry of Economic Affairs.

Supported by:



on the basis of a decision by the German Bundestag

Sponsors





































































Patronage of public institutions:





The contribution is supported under the auspices of Minister President of Baden-Württemberg and the major of the capitol of Baden-Württemberg Stuttgart.

Other supporters

Margarete Müller-Bull Stiftung_Knödler-Decker Stiftung_Freunde der Hochschule für Technik e.V._AStA/Allgemeiner Studierendenausschuss_Architektenkammer Baden-Württemberg_Wacker Ingenieure_Hopf Kunststofftechnik GmbH_Linzmeier Bauelemente GmbH_Miele & Cie.KG_Hermann Paule GmbH & Co.KG_Liebherr-International Deutschland GmbH_Rotex Heating Systems GmbH_Simpson Strong-Tie GmbH_Teamwerk Filmproduktion_Silvertex GmbH_Danfoss GmbH_Speisemeisterei GmbH_Messe Essen_Messe Berlin_Deutsche Bank-Collaborators_Hermann Otto GmbH_Keramag AG_HG Berufsbekleidung Lochmann GmbH_Dörken GmbH & Co.KG_ MEWA Textil-Service AG & Co._Paul Serafini GmbH & Co. KG_Andrea Palm_Bau- und Heimstättenverein_Steng Licht_Festool_Steico AG_Interglas Technologies GmbH_Graf Hören und Sehen e.K._Franz Schneider Brakel GmbH + Co. KG_Warema Renkhoff SE

about the natural resources and its implementation to the public, a hand-out will be given during the tour informing the visitor and at the same time, spreading a general awareness in the public. Since the public in the competition will be wide and very varied, we want to exploit this chance and add a survey in the information flyer for the public to see how big is the acceptance of the house and look for possibilities of improving the house qualities. In the same way, our sponsors work toge¬ther with us to give some advising orientation in the sponsors area about these ideas and its implementation in daily life.

6.2.1 Sponsor Recognition

About the event and team sponsor recognition during the contest: The design, materials and dimension of the communication materials, which we are going to supply to the visitors during the competition, is still being discussed. For the development of these materials, we are going to take into consideration rules 10.2, 10.3 and 10.6. As soon as we have defined the specific and definitive characteristics of the communications materials, they will be submitted, in base on the new style guide of april 2010.

2 posters in front of the terrace, for position, see Public Exhibition Plan

Dimensions: 841cm*1100cm

Material: Supratex 1115

Layout:



Figure 1: home+ posters

1 flag, for position, see Public Exhibition Plan

Dimensions: 80cm*200cm

Material: Fabric

Proposal - Layout:

Front



Figure 2: home+ flag and flagpole

1 flyer available in english, spanish, german and italian, with a survey for tearing (See Public Exhibition Plan)

Dimensions: 3xDIN A5, 210mm*446mm, folded DIN

A5 format

Material: Paper

Layout:



Figure 3: home+ flyer front

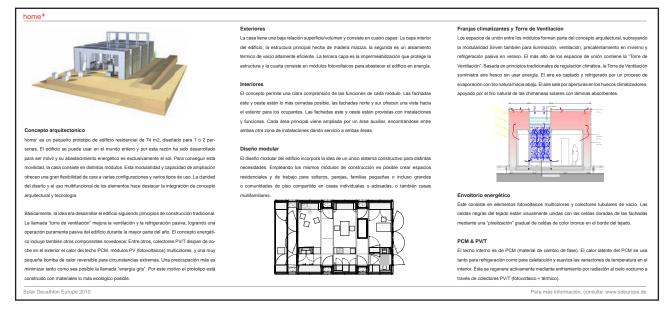


Figure 4: home+ flyer back

6.3 Upcoming Fundraising Activities

In addition, we conduct negotiations with approx. 10 other well known enterprises (construction, banking, energy etc.) and foundations. Many enterprises promised us support. At the moment the legal department of the HFT develops the contracts for these sponsorship partnerships. Besides the German Federal Ministry of Economics and Technology, that supports us with approx. 400.000€ we are presently in touch with the Ministry of Sciene, Research and Art in the state of Baden-Württemberg. The Team hold promising discussions with the Ministry and it is convinced to get financial support, too.

Besides this, the team expects another financial support through the Roofing Ceremony and the

Farewell-Party.

Another point are approx. 3 donations in kind that will be all wrapped up the following months.

7. Cost estimation

The total costs estimated for the entire project have increased to 1.400.000 €

The reasons for the increase included higher payroll and transport costs. Currently about 1.332.000 € in funds, material and services have been secured. This means that currently over 95 % of the project costs have been secured. Approximately 43 % (~600.000 €) are sponsored as material and services and approximately 57 % (~800.000 €) are funds.

The open cost positions are being negotiated with several companies, institutes and ministries, so that the Team will be able to secure these in a timely fashion. If there is a difference at the end, it will be covered by the HFT.

Until now funds have been spent mainly on salaries, consultancies, printing (plans, brochures), model

building, travel costs and experimental mock-ups. Since the assembly of the building began in December 2009, running costs for material (wood and technical equipment) have been incurred.

At the beginning of the SDE, the communication and fundraising cost were estimated. The Team calculated with about 60,000€ (including web design, brochures, flyer, invitation cards, travel costs, business cards, entertainment expenses, exhibition booth construction, costs for symposia, technical literature and a book and film documentation) + personal costs for communication and fundraising. Due to the high estimated expenses for the film and book documentation (20.000€ + 20.000€) the budget was raised to about 70.000€.

8. Evaluation & Lessons learnt

All in all, the Team can conclude that it build good relationships with companies and get in touch with the selected target groups. Through the realization of several internal and external activities we distributed coordinated information about the project and increase attractiveness for potential sponsors. The key to our success was the creation of high credibility. Especially the external personal communication (two or more persons communicate face-to-face, person-to-audience, over the telephone, or through e-mail) worked very well for fundraising and communication activities. Up to now the Team has collected over 400 new contacts in the database (enterprises, foundations, university staff, public institution, potential buyers and interested people).

With our internal communication we provided a basis for upcoming university research. Many students are interested in our project and are keen on writing Bachelor and Master theses. The team created the necessary awareness and contributed to the disse-

mination of the project and its technologies. Besides this, with the lobby established within the university, the team was able to justify the high project investment. We are very glad, that some students from other universities joined our team, helping us with some tasks just like making the audiovisuals for the exhibit in Madrid in 2009. This shows us the good acceptance of the competition and the project among the students.

The communication via mail and telephone was also very import to inform strategic partners and to keep good relationships. This was the main reason for medium sized enterprises to support our project. The efforts to get in touch with big enterprises were less effective. The willingness to support our project was very low. Mostly, these enterprises attached little value to the benefit of the project.

The external nonpersonal communications directed to more than one person and included in our case media, events and public relations were successfull. With the booth at the Deubau in Essen, the Team attracted a lot attention and received positive feedback. Unfortunately, the quantitative data collected through the questionnaire or survey is not deciding. Therefore, the impact on the target audience can not be measured ultimately, but the qualitative outcomes and revenues resulting from the fundraising and communication investments are more than satisfying. For a more expansive analysis of the impact of the house, we intend to distribute a survey in the information flyer, so that a bigger feedback can be obtained.

The most successfull action was our own event at the Architectural Association. It was an excellent opportunity to promote the competition and the project. To attract awareness we used transformational appeals. These appeals elaborated on a nonproduct related benefit. Thus, we wanted to stir up emotions and attract attention. As mentioned in the Communications Strategy we used the appeal: "The Solar Construction World Championship - Stuttgart wants to win".

The media presence in corresponding newspapers was high and the Team received many sponsorship commitments. The media coverage via radio and television is not assessable. The TV contribution will be broadcasted after the competition in Madrid.

The used communication materials the Team created for fundraising and information also received a positive feedback and are very informative.

The coverage of our communication activities was



Booths of the German teams at the DeuBau fair in Essen

predominantly local and regional, but national coverage through some architectural magazines was reached. Also, some publications and scientific papers were successfully launched internationally. Through the interactive coverage in form of our website and means like YouTube, different communities, online articles, we have been able to get to a wider public. On the other hand, joining forces with the other three German teams for national and international communication actions has turned out to be indeed a great advantage to maximize the public and media outreach.

home+			

12.9 Preliminary Industrialization and

Market Viability Report - Contents

- A. Market viability of the product
- a. Market analysis and trends
- b. Marketing strategy
- c. Distribution strategy

B. Technical Economic feasibility

- a Marketbility of innovative components
- b. Cost estimate
- c. Production scenario
- d. Production level
- e. Economic benefits and ecological benefits

C. Industrialization degree

- a. Constructive system
- b. Modular system
- c. Transport and assembly process

D. Possibilities for grouping

- a. Module
- b. Modification
- c. Typology
- d. Adaption to the potential users



Preliminary Industrialization and Market Viability Report

A. Market viability of the product

a. Market analysis and trends

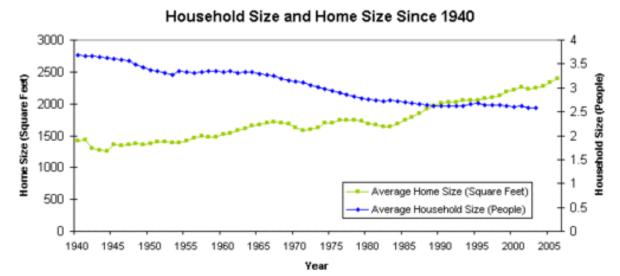
The housing tradition is going through a big change at the moment. This is due to the demographic change on the one hand, and on the other hand the change in the working and living environment. In former times, a further meaning was ascribed to the idea of "living". Mostly people lived as a small family, which existed of a parental pair and children in a household. The flat was seen as a place of recreation and spare time, as the opposite of work. It was a place of privacy and was accordingly introverted. However, the social structure of the population has strongly changed since the 70s. 60% of all households are single households, apartment-sharing communities, childless pairs and single parents. Only 10-15% of families live together. Basically one can say in general, that the majority of city-dwellers live alone. For this there are different reasons, among other things the fact that the time of "becoming adult" (the period of life after leaving the parental home until starting family planning) becomes longer and longer, as well as this phase for the parents, or also the changing role of the woman. Through these developments, there is a demographic change in the society, meaning

we have more and older people and singles, and parallel to this there is the migration from rural areas into cities. This leads to the problem that people often live in isolation and grow lonely. The average living space consumption per head in Germany amounted in 1950 to only 15 square metres, today it is more than 40 square metres. The trend is in the other worldwide urban countries like the same as in europe (look Graph household size).

But lifestyle has also changed. Today most people live in a very work and career oriented way, one can achieve this better without children and partners. The domestic duties are minimised and taken over by high tech devices.

As a result one can say, the development is in the direction of the city centre as the preferred living and residential location and the trend is toward more living space per person. "He who does not have a big household, has to live in a big city which replaces this for him," (Walter Siebel in archplus). The prerequisite for this is more prosperity. The flats should offer flexibility and neutral plans, which are adaptable to the changes of the resident's wishes and behaviour patterns of the inhabitants.

One can see especially in Germany a development since the 80s where continuously more people want



1.1 Graph: household size

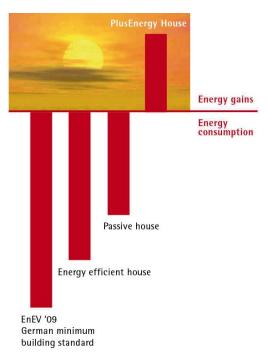
to own the home they live in. This has brought forth a new residential building industry. The turn-key industry has made it possible for people to live in their own houses "in the countryside". In the past few years the market share of this sector has constantly increased. In south Germany one in four houses are lightweight turn-key constructions. The main reasons are the lower costs compared to solid construction (e.g. brick/ stone/ concrete) and the security of a guaranteed price. The demands on energy efficiency have increased in Europe as a result of the toughened energy-saving regulations and through the intensified environmental sensitivity of the residents.

The global housing market is moving towards plus-energy homes (see Image Primary energy consumption) which offer a maximum flexibility of use. The goals of our project are to support the awareness for energy efficient construction and to contribute to reducing CO2 emissions:

- by using the full potential of passive solar means
 (e.g. natural lighting, ventilation, cooling, heating etc)
 through optimizing all aspects of solar architecture
 by the use of renewable energies, i.e. making
- by the use of renewable energies, i.e. making most use of active solar technologies (PV/electricity,

thermal for heating domestic hot water and cooling)

- by a very low energy-demand and the feed-in of excess energy into the public electricity grid
- by offering recycling options on all levels of consideration: modules, components, elements, materials
- by full consideration of LCA aspects for the choice of materials
- by providing high end construction, detailing quality and visual design quality to allow for a maximum lifetime of the building



1.2 Image: Primary energy consumption

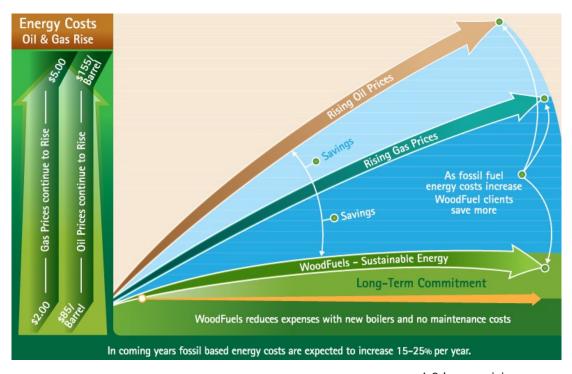
- by claiming that the high level of energy efficiency we have achieved is due to optimising both sides: reducing energy demand and improving architectural quality in its full broad range.

Target market germany

With our home+, we want cover the future demands of residents and to contribute to the saving of resources. The construction industry must react to the demographic changes also. That means residential houses need to be more flexible to be able to adapt to the changing residential structures and household forms, and they must be more energy efficient as fossil fuels are limited. With home+ we want to react to these developments. Our main competitors are the vendors in the turnkey industry. Potential further competitors could be building companies, architects, prefab suppliers and wood construction companies. Currently there are 3428 prefab home and part suppliers, 1000 prefab construction companies and 212 prefabricators. The possibility to adapt our product and the spectrum of additional services enables us to cover a large share of the market. The splitting of the product into its

components:

- 1. standard building system,
- 2. modular expansion,
- 3. energy system) allows us to offer these are subsystems on the prefab market and in this way to improve the marketability. With the appropriate products we can penetrate niche markets. On our target market of plus-energy homes, we can position our product as a singular premium-product that is made up of variable components. By developing a product that combines modern technology from a standardized component system and can be expanded modularly, we can offer all components to customers as a single supplier. In combination with extra services, a customer receives their complete home from us, from property consultation, to financing, to building take-over. Our competitive advantage is the plus in energy in combination with the highest level of architectural and building quality. In optimum circumstances, home+ produces more than double the energy it uses. By our high aesthetic standard and strict implementation of our concept, we have developed a residential home that can react to future trends. That is why one has to first get



1.3 Image: rising energy costs

used to the unusual appearance, which is founded on a strong concept.

Based on our core competence of developing, optimising and researching an energy concept, we can develop a Unique Sales Proposition (USP) compared to the market leader and other competitors and successfully enter the sector. We have a competitive advantage in our service offering and our turn-key house that adopts to the needs of the customer and combines high architectural quality with an optimized climatic concept. In this way home+ is placed on the energy-efficient prefab home market. Until now, plus-energy homes have occupied at most a niche market of the peripheral group of "environment lovers". As a result of coming demographic changes and dramatic increases in energy prices, in future the niche market will grow and our enterprise should be able to grow with it.

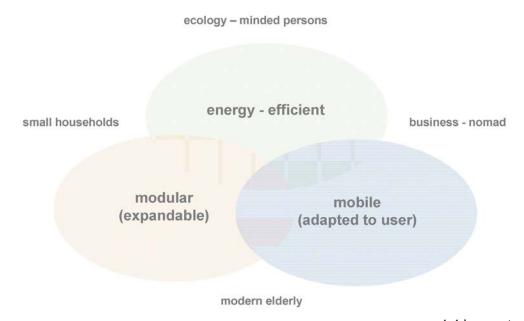
Target customer and opinion survey

In order to be able to survive on the highly competitive prefab market, one must be oriented on future trends and have a good marketing strategy. First of all, one needs however a deep understanding of the desires and needs of

customers. To accomplish this we implemented an online survey and conducted a detailed analysis

The needs of the customers are additionally influenced by external factors:

- age structure and population (see forecast for demographic changes – as a result of declining birth rates and longer life expectancy, there is an increase in the number of the elderly)
- household formation (since the 50s and 60s there has been a decrease in the number of family households and increase in single-person households as a result of the sociological development in Germany);
- demand of residential area (there is a constant migration from the countryside into the city, a north to south migration, and since the German reunification a east to west migration in this way there is a migration of residential area demand with increasing vacancy in the east and a shortage in south Germany; the per person demand is also increasing, so that there is no net decrease as a result of the decreasing household size)
- development of the home building sector (through the stricter energy-conservation regulation, there



1.4 Image: target customer

Age

space

extras

Target	
group	ecology minded
Job Family Hobbys	housewife and mother married, two children go riding

Living energy efficient
- location
- housing
- required

3 x sleeping

separate garden

32 years



modern elderly

pensioner married, four children theatre, museum 70/74 years

age-based
central city
apartment building
1 x living, 1 x dining
1 x sleeping
good household



business nomad

transportation designer unmarried, partnership traveling, meet friends 34 years

mobile
different citys
redensification
1 x living, 1 x dining
1 x sleeping
home delivery to
new workplace



small household

IT-Manager unmarried, single badminton, soccer 41 years

modular
central city
detached house
2 x living, 1 x dining
1 x sleeping
home office

1.5 Image: potential user

has been significant movement in the market from passive to zero to plus energy homes)

The interest in homes can thus be roughly divided into three market segments, each aimed at a target audience (see Image potential customer). Of course an overlap is possible in individual interests or in the audience itself, so that more or all aspects apply. In order to develop a targeted marketing strategy, one must focus on the segment with the most potential (see Image potential user).

Fundamentally, it was assumed that the group "energy efficiency" has the most potential. The main customers for our home+ have the following characteristics:

- environment awareness
- receptive to future trends
- modern lifestyle
- awareness for aesthetics

To check the assumption of the target audience and to gather more information about different target audiences, we put together a questionnaire for use on different platforms: visitors to our home page, customers of our sponsors, students, lecture and exhibition visitors, targeted magazine readers etc. To structure the questionnaire, we asked ourselves

what kind of information we want from interviewees: own living characteristics, current situation, financing, costs, investment readiness, product acceptance, demographics (see Image survey). The focus group is relatively precisely defined. Out of 268 respondent 36,7 %-the main partadjudge in the age group between 25-45 years. 27,4 % -the second largest part- of the respondent adjudge under the age of 25 years. The age group between 46-65 years accomplished a share part of 20,4% then again the age group over 65 years could reach a contingent of 15,5%. Therefore the questioning reached in the run-up to the defined focus group. The assumptions also turned out to be optimistic about the open mindedness of the respondent concerning of the basic concept of home plus. 90,9 % of the respondent are interested in living in a house which produces more energy than it consumed. In the same way 38,2% of the respondent showed a propensity to invest between 200.000-330.00 Euro, 28,1% between 330.000-460.000 in accordance with the calculated target costs of home plus. It also showed a positive tendency about the creation of home+. Over 50% of the respondent adjudge positive interests. (see image "provisional results of survey")

Your also invited to vote in our survey under:

http://www.sdeurope.de



Wir, die Hochschule für Technik in Stuttgart, nehmen an dem internationalen Hochschulwettbewerb Solar Decathlon Europe 2010 teil. Mit unserem Wohnhaus home⁺ haben wir uns bereits unter den 20 besten Teilnehmern qualifiziert. Um unsere Qualifizierung weiter ausbauen zu können, benötigen wir ihre Meinung zu unserem Projekt. Schenken Sie uns bitte fünf Minuten ihrer Zeit, um die nachstehenden Fragen möglichst vollständig zu beanworten. Der Fragebogen ist vollkommen anonym; ihre Angaben werden seibst verständlich vertrauße behandelt. Ein: Ihre Mitarbeit und Unterstitzung bedanken vir uns geht berülich.

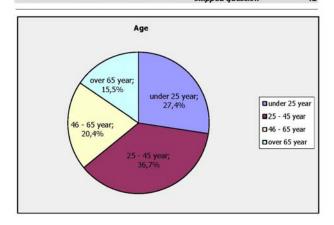
	9						
glio	hst vollständig zu b	eantworten. Der Frageboger	n ist vollke	ommen	anonym; Ih	re Angaben w	erden selbs
tā	ndlich vertraulich be	ehandelt. Für Ihre Mitarbeit u	nd Unters	stützun	g bedanken	wir uns recht l	herzlich.
	Sind Sie interessi	iert in einem Haus zu		Ja			
	wohnen, das meh	nr Energie produziert als		Nein			
	Sie verbrauchen?	7					
	Welche Aspekte	des Wohnens sind Ihnen	sehr			nicht	gar nich
	wichtig?		wichtig		wichtig	wichtig	wichtig
		kostengünstig					
		ökologisch					
		komfortabel					
		barrierefrei					
	Sind sie im Besitz	z eines Eigenheimes?		Ja			
				Nein			
	Besteht in Zukunf	t persönliches Interesse an		Ja			
	einem Hausbau?			Nein			
	Welche Form des	s Hausbaus kommt für Sie		Einfar	nilienhaus		
	zukünftig in Betra	echt?		Doppe	l-/Reihenha	us	
				Mehrf	amilienhaus		
				Erweit	erung des b	estehenden H	lauses
	Wieviel Wohnfläc	he haben Sie momentan		m ²			
	zur Verfügung?						

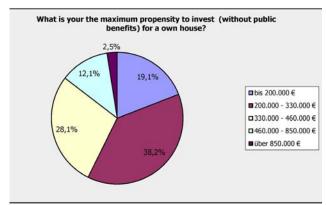
Weitere	Informationen	unter:	www.	sdeuro	pe.de

	Wieviel bezahlen Sie monatlich für Miet- und		Miete/	Nebe	enkosten
	Nebenkosten bzw. wie hoch ist die monat-		Belastung	(Hei	zung, Strom)
	liche Belastung (zusätzlich Nebenkosten) für	n	bis 250 €	□ bis 7	5€
	Ihr Eigenheim?		250 - 500 €	□ 75-	130 €
		п	500 - 1.000 €	□ 130	- 250 €
		п	über 1.000 €	□ über	250 €
	Wie hoch ist Ihre maximale Investitions-	П	bis 200,000 €		
	bereitschaft (außerhalb der staatlichen	п	200,000 - 330.00	00€	
	Unterstützung) für ein Wohnhaus?		330.000 - 460.00	00€	
		п	460.000 - 850.00	00€	
		D	über 850,000 €		
	Sind Sie bereit/interessiert durch Leistung	п	Ja		
	einer höheren Erstinvestition die Energie-	п	Nein		
	kosten über die komplette Wohndauer				
	einzusparen?				
3.	Entspricht das Haus home ⁺ Ihren An-	voll-			überhau
	sprüchen?	komme	n teilweise	weniger	nicht
	Gestaltung Innenraum		п	Π	П
	Gestaltung Fassade	п	п	п	п
	Transparenz	п	п	п	П
	Möbelkonzept		п	П	П
	Garten/Terrasse	П	П	П	П
4.	Wohnort:		Postleitzahl .		
	Alter:	п	unter 25 Jahre	п	45 - 65 Jahr
		п	25 - 45 Jahre	П	über 65 Jahr
	Berufszweig:	п	Akademiker	П	Techniker
		П	Bürokraft	п	Dienstleist.
		П	Landwirtschaft	П	Handwerk
		П	Gestalter		
Und h	nier haben wir noch Platz für Sie vorgesehen, fall	s Sie weit	ere Anregungen f	für uns habei	n.
- 	anken Ihnen für Ihre Mithilfe und Ihren Zeitaufwa				hr Team home

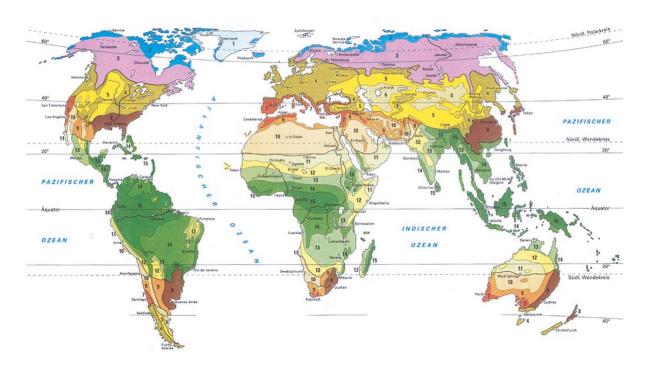
1.6 Image: survey

SDE survey home+ Age: Response Percent Response Count under 25 year 27,4% 62 25 - 45 year 36,7% 83 46 - 65 year 20,4% 46 over 65 year 15,5% 35 answered question skipped question 226





1.7 Image: provisional results of survey



moderate zone moderate, warm + dry moderate, cold + dry subtropical clime

tropical clime

modification

heatbuffer - tower

ventilation tower

heat accumulator tower

ventilation tower

exhaust tower and air drying

1.8 Image: climate zones

Adaptability in other climate zones

Already in the design process we have focused on adapting our concept to other climate zones. Since the building type is assembled variably, there are different possibilities for modification and adaptations to climatic conditions. The prototype has been developed and optimized for the location in Madrid. home+ is especially suited to the hot and dry climate prevalent there. The most important factors involved in the climate zone are the adaption of the building envelope (ratio of openings for solar gains, orientation etc) and the received sunlight required for the energy production, but also humidity required for the functioning of the cooling tower. Through the exchange and replacement of different components,

the building can be adapted to different climates and topographies.

Temperate climates are characterised by different sun conditions, which can vary from location to location, but nevertheless yielding a high amount of diffuse radiation. The exact calibration of the solar assembly takes this into consideration. An important aspect for the variation of the tower is the required heating and cooling periods.

In a hot/dry climate, the tower will be used for cooling through evaporation as is realised in the report (for more details to the function see the energy analysis report).

In areas near coastlines (e.g. north France, Ireland,



urban area









wind - energy

1.9 Image: location

also results in higher air temperatures. The climate tower is used here for cooling and increased ventilation. By added moisture in low to mid-humid situations, the evaporative cooling effects of the tower are used. The original idea came from subtopic vernacular example such as in India and Morocco (for more details to the function see the energy analysis report).

In the humid tropics, the ventilation tower can not cool the interior using evaporative effects, but it is possible to add a form of a Venturi wing to use the thermal lift to ventilate the warm, humid air.

home+

However, the building as designed now is not optimised for this climate.

The building orientation in the northern hemisphere is the same is in the prototype, in the southern hemisphere it is mirrored. In the subtropics a wide loggia is recommended to catch the sunlight before it can enter the building. Therefore, with small modifications we are able to adapt the home+ to almost all climates.

Life in the city offers many advantages through efficient use of infrastructure and transport energy. As a result we see a densification of the city as the main priority.

As described the prototype is self-sufficient in terms of a positive yearls net-energy balance. Therefore it can be used for re-densification in empty lots between major city buildings. Another easy possibility of placing the building is on the flat roof of inner city buildings. Merely the bearing capacity of the existing building and the availability of the needed house service connections have to be assured. The "parasite" on the roof could be used in various ways and would counteract the housing shortage in some cities. Besides, the inhabitant would have the possibility to take his building quite flexibly to different locations and cities. (see image location)

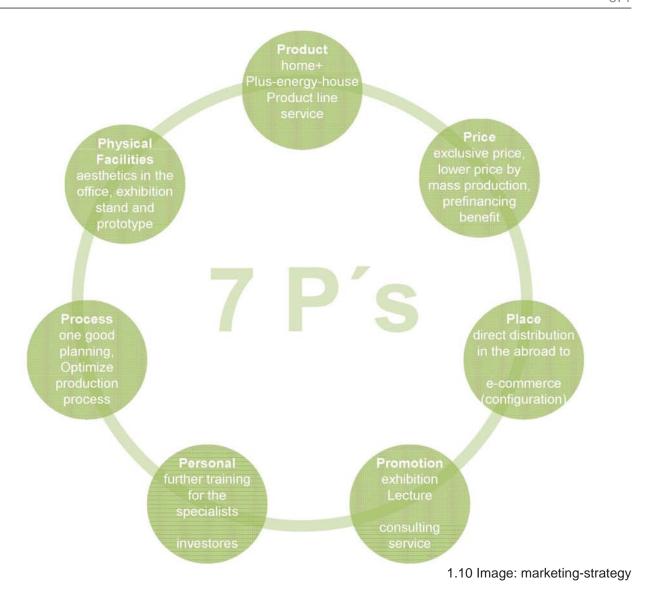
These modifications include: adding vertical or horizontal circulation modules, adjusting the sun protection devices, adjusting the PV surfaces, changing the height and efficiency of the energy tower, updating to vacuum tube collectors and larger heated water storage.

A row system requires more adaptation and certain considerations during prefabrication, however there are distinct advantages for this configuration, such as less surface area to volume and sharing certain technology installations, energy and costs.

A further study would look at the financial and

political situation depending on location to determine where construction would not be possible, examining

- financial situation of the residents
- financial support for solar power
- existing building typology and residential structures
- reception to new technologies
- potential for densification
- potential for suburban and holiday home developments



b. Marketing strategy

Product

Home+ is an exclusive brand product with a high rate of innovative technology. It shouldn't be offered as a conventional, individual plus-energy home but rather should have a vertical product range, meaning a product line with:

- 1. a standard building system
- 2. modular expansion
- 3. energy system

Price

The price of the house appears to be placed in the premium segment but this is based on the use of high-quality materials and modern technology. Furthermore it finances itself through the high energy generation which will allow to sell a certain percentage throughout the lifetime of the building. Serial production would spread the planning afford and machine costs over several houses, thus reducing the costs (see B – Economic feasibility study)

To attract the highest possible number of customers, there is a differentiated pricing strategy:

- a standard building system the entry product (lowest price)
- 2. modular expansion for individualists (price depends on configuration)
- energy system as an extra product adapted to climate (price depends on complexity)

Place

home+

Normally, residential buildings depend on direct marketing, which requires consultation and causes high costs. Therefore we are looking into marketing through the internet. E-commerce is to become the sales strategy of the future: the customer can configure their house at home using a simple program to assemble modules and choose between product possibilities and immediately see the calculation and try different financing possibilities. In this way the house can be sold cheaper as potentially less personal consulting time with the client will be needed. A further strategy is to market the house abroad by reconfiguring it. For foreign production and sales a further analysis of the market is necessary. If the market is open to home+, cooperation with local companies is possible to enter the market. The sales could also be outsourced to a specialised company. Additionally, a model of licensing / royalty fee scheme could be considered.

Using an up-to-date online presence allows us to present news, to inform existing customers and to look for new customers. Regular newsletters are sent to all customers and partners. For different events, we have already prepared project flyers, sponsor brochures and project portfolios.

Until now we have been very successful in our communication strategy. For the first realisation we have found many sponsors with whom a further cooperation is very likely.

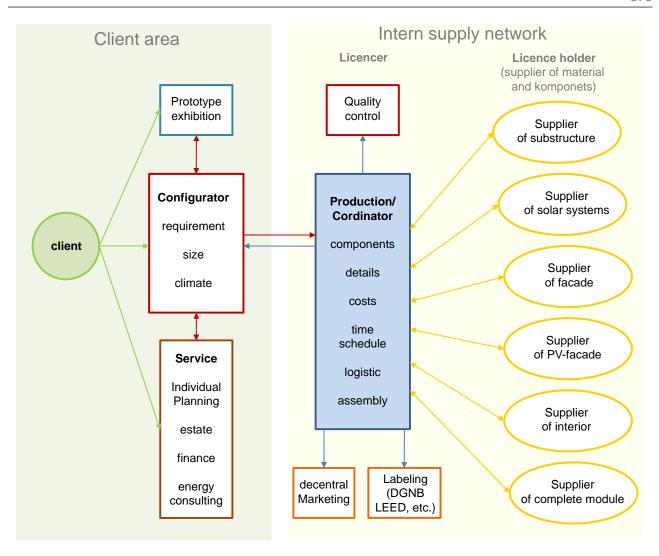
A road show is planned with the prototype after the competition to exhibit and present the house in several cities. In this way potential customers can see the home+ at full scale.

Promotion

In order to attract attention to our product, it is important to present it on different trade fairs to communicate not only with specialists of energy efficient construction but also interested novices. At an aesthetically designed booth, we are already presenting our vision of future living.

Our competence in energy systems is marketed at many technical conferences and presentations at companies, the architectural association, universities, etc. We promote our ideas through a big range of different publications and chanels (print, internet, even subway commercials etc) to all kind of audience (science, industry, administration, daily press etc).

Further presentations are planned for example at schools continuing education to demonstrate sustainable and ecological building to the youth. Excursions for schools and the handicapped are planned for the construction phases.

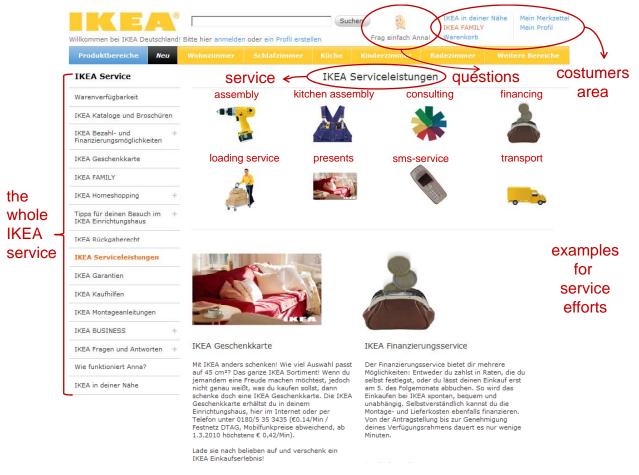


1.11 Image: distribution-strategy

c. Distribution - Strategy

The idea and market positioning statement provide a network for all project-partners. The product distribution concept of home+ is especially adapted to the customer's needs. This includes fast and direct channels of distribution on the basis of a modern e-commerce network as well as an easy con-cept of distribution instruments in form of considerable service offers and fulfillment. The pioneer of this practice is IKEA until today. The marketing activities take aim exactly at the needs of the clients and satisfy these, as the yearly trade accounts proofs. The success of the IKEA marketing is the advertising strategy which is specially adapted

to the final consumer. (see iamge IKEA-service)
The potential customers, that you can see circumstantial on page 241 to 242, are young, determined and ecologically sensitive. The clients are primary employed singles or young couples, with kids as well as without. They are at the beginning of their professional career or they are on the way to an own family what both means that they have to deal with a financial restricted or limited situation. Nevertheless they are interested in sustainability and have an ecologically oriented lifestyle. The target customers are very different; even so they have some common needs:

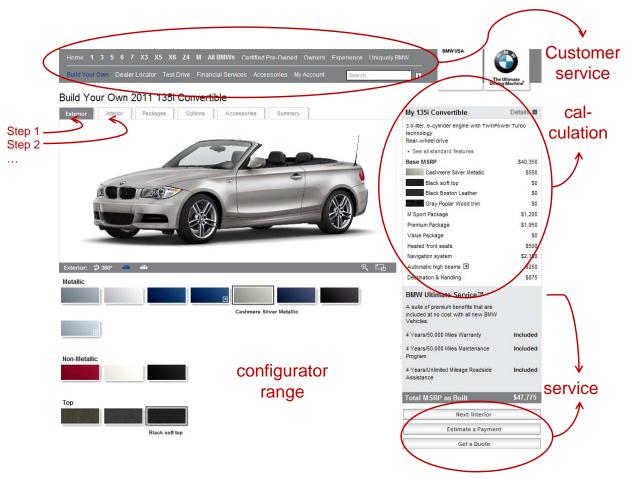


1.12 Image: IKEA-service

- They would like a quick and easy consulting
- They appreciate to have the feeling that they can make decisions at all times
- They like an individual home
- They like to control costs as well as the time schedule

This dynamic target group requires a home according to their current needs and financial situation. The needs of the clients can be quite different, therefore home+ is adjustable to the own necessity. The sophisticated space requirements we can assure by using a modular system. Costs can be controlled by character and scale of the equipment components and the service features. To support the clients during the process of composing their own house and the decision making, costumers also have the option to configure their dream house

online. (see image distribution-strategy) By the help of so called planning tools it is possible to ascertain the requirements concerning size, climate and equipment components. For modern persons service features get more and more important. That is the reason for us to focus also on these requirements and to offer smart solutions therefore according to the various needs of the clients. Additional services offered range from financing-, energy consulting-, estate consulting-, building-application-service up to maintenance- and gardener services. All the individual decisions made by the costumers affect the extent and the price. At the end of the individual configuration clients get a rendering from their house and a statement estimated costs. If the costumers want to see an object of comparison or want to make a use of a personal consulting service by experts, they can visit a local prototype village. For this



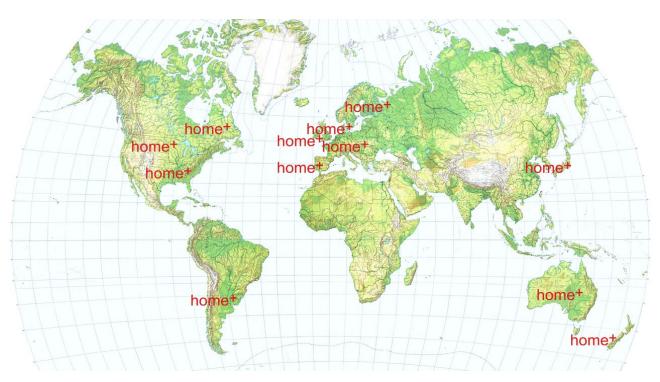
1.13 Image: BMW-konfigurator

purpose the website displays the closest location within reach.

In the background of home+ operates a big internal supply network consisting of planers, producers and suppliers. This offers business opportunities to all kind of companies that can supply on all kind of levels (from pure material to components to even complete modules). Also, central departments are linked here, like Quality Control (i.e. certificating body) or central marketing. The basic business model could rely on a royalty or licensing scheme. Therewith client's fulfillment service is warranted. A point of intersection comprises the home+ office, which plans and coordinates the production, the external contractors and the supply network. The external contractors also execute the quality control and they are responsible for the marketing. The

home+ office team is responsible for the detailed planning, cost estimations, sche-dule review, logistics and the assembling. In the same time the office is licenser for the supply network. The license holders get the commission about a shared platform. Following commissions are assured without business competition. On the other side they are obliged to a defined contingent to home+.

The contact person and the payment are carried out by home+ not by the different clients. The license holder profits by the advertising campaign from the whole home+ organization. Developments and new additional components are very welcome. After their fully integration in the planning process they will get integrated as optional elements in the planning tools of the configuration application. As an example this could be new components for PV-Designs or a cost reduced façade cover panels. By the time costumers



1.14 Image: international market

get therewith more options to build an individual house by the help of comprehensive component kits. One sample therefore is the automotive industry which has many years' experience with increasing costumers' individuality by component parts and complete packages without overstraining the clients. (see image BMW-configurator)

The marketing method of home+ is a modified franchise-model using the e-commerce channel. The advantages for home+ are the same to the clients as well as the license holders - the fulfillment ser-vice. The distribution abroad is mentioned on other sites, for example to adapt to the clime components. A further advantage is that the market entry in the foreign countries can be occurred step-by-step. As an example: It is possible to analyse the potential market in Finland and look for potential local sup-pliers. Until the details are arranged with the subsidiary company the product coordination will still be coordinated in Germany from home+. The aim is to establish a complete project structure

including client network, production coordinator, the whole service feature network and all the connected external companies - for example in Finland. Some products, for example the technical components can be produced by suppliers in Germany, in case that there are no adequate suppliers on site. For more detailed information see Industrialization and Market Viability Report or Sustainability Report.

B. Technical Economic feasibility

a Marketability of innovative components

Our home+ shows some key innovative developments in solar technologies systems and cooling systems.

At first we need an appropriate company that supports us by the production of systems. The idea is that we set up an own company that gives licenses for the production of our systems.

If we have a partner then we can begin to cooperate to produce several systems. (see capitel Distribution - Strategy).

If we have a partner then we can begin to cooperate to produce several systems.

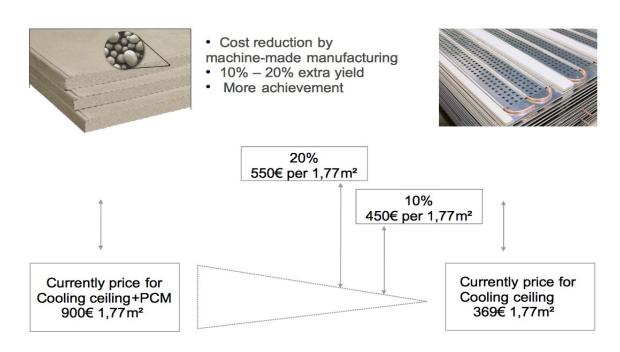
A further step will be to create a base for the commercialization of the systems. The idea is to offer the separate systems in home+ on the worldwide market. At first we will have to know which countries are interesting for the further commercialization. Therefore, in a first step we will concentrate on European countries as

Germany, Austria, France, Italy and Spain. Those have the most potential for the first steps of commercialization.

The developed systems are just being in a process of deployment which do not allow to produce a big number of systems. Our prototypes are hand made, for the further manufacturing of the systems, we want to replace this process by machine-made manufacturing and then later by industrialized production. This will bring down production time and cost significantly.

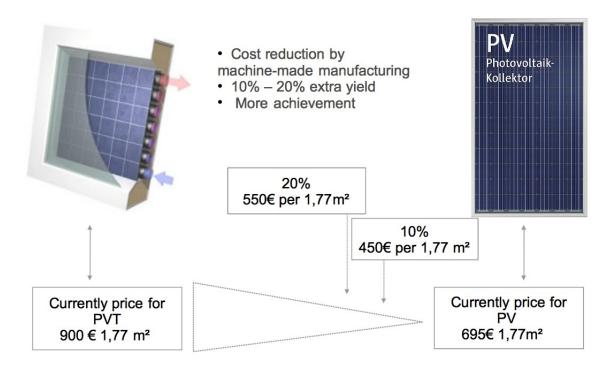
The developed cooling ceiling in connection with PCM is one of the key innovations of home+. The qualities of PCM (phase change material) improve cooling ceilings too. The advantage of PCM is that it can store heat or cold that will be released later. The target is to achieve that the current price of a cooling-ceiling with PCM is tantamount to a conventional cooling ceilings. Despite the

Process of marketing for cooling ceiling with installed PCM



1.1 Image: arrengement for cost reduction of PCM

Process of marketing for PVT-collectoren



1.2 Image: arrengement for cost reduction of PVT

reduction of production costs we assume that we shall have an extra yield of 10% – 20% in the first years of commercialization. That depends on the development in few sectors of the energetic research and the currently state of technologies. The same process will be used for the PVT-collector manufacturing. The system of PVT-collectors The more yield of 10% - 20% based on the fact that we shall have an efficient output of our PVT-collector as a normal PV-collector.

Cost reductions depends on:

- · improved manufacturing processes; and
- · new advanced materials

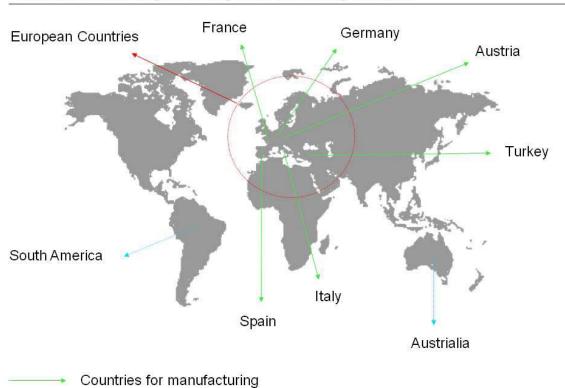
Furthermore, cost reduction potential can be seen in increasing productivity by the mass production of standardized (kit) systems, which reduce the need for on-site

installation and maintenance works.

The following innovation of cooling tower won't market on the same way as the other innovation. The marketing strategies is to bring the hole product on market because we see in the hole system a closed system, that his function has only together. The cooling tower based on evaporative cooling and the home+ will attend to so passive.

Through the process of evaporative cooling will attend to the rooms of home+ with passive cooling. The cooling tower was planed by the special condition for the competition of Solar Decathlon Europe and so for the climatic conditions in madrid. The further manufacturing foresee that the cooling tower will configure so that it is possible to apply it in other countries with different climatic condition. (an Report Turm)

In these analysis will be presented the following



Process of marketing for cooling tower in following countries

Potential countries for manufacturing

1.3 Image: arrengement for cost reduction of PVT

countries: Germany, Austria, France, Italy and Spain Through the planed expandable of qualities are increase the catchment area of potential markets. Further steps in the marketing strategies will be to open up a other markets.

b. Cost estimate

Solar Decathlon 2010_home⁺ Industrialization Costs (Base Cost Estimate from 22.March 2010)

home* Prototype]	home ⁺ Industrialized house	
module	comprise	total net price prototype	cost type fix/alternative	alternativ	total net price alternativ
Building-cons	struction works	308.854,00 €		Building-construction works	162.956,00 €
floor	Shallow foundation (without terrace)	8.330,00 €	Alternativ:	strip foundation (30m)	452,00 €
	Subsoil and base slabs	60.882,00 €	Fix	Subsoil and base slabs (without VIP)	29.278,00 €
	Boardings (without terrace)	6.355,00 €	Fix	Boardings (without terrace, without VIP)	4.300,00 €
wall	Cladding units (incl. PV)	113.626,00 €	Alternative:	Cladding units (economic PV, without VIP)	60.000,00 €
	Loadbearing external walls	56.090,00 €	Alternative:	Loadbearing external walls (other construction)	20.540,00 €
	Non-loadbearing internal walls	9.446,00 €	Fix	Non-loadbearing internal walls	9.446,00 €
ceiling	Roof structures (incl. PVT)	39.725,00 €	Fix	Roof structures (incl. PVT, without VIP)	28.940,00 €
	Ceiling surfaces	14.400,00 €	Alternative:	Ceiling surfaces (machine-made-manufacturing)	10.000,00 €
Gaps and Glaz	zing	85.956,00 €]	Gaps and Glazing	72.000,00 €
	Exteral door and windows	85.956,00 €	Alternative:	Exteral door and windows (economic glazing)	72.000,00 €
Ventilation to	wer	11.085,00 €		Ventilation tower	11.085,00 €
	Ventilation tower	11.085,00 €	Fix	Ventilation tower	11.085,00 €
Structure-serv	vices	86.017,00 €		Structure-services	47.701,00 €
	Sewerage systems	1.600,00 €	Fix	Sewerage systems	1.600,00 €
	Water supply systems	5.555,00 €	Fix	Water supply systems (without tanks)	5.555,00 €
	Space heating systems	34.258,00 €	Fix	Space heating	34.258,00 €
	Ventilation systems	3.938,00 €	Fix	Ventilation systems	3.938,00 €
	Air conditioning system	1.000,00 €	Fix	Air conditioning system	1.000,00 €
	Low voltage switch gear	1.350,00 €	Fix	Low voltage switch gear	1.350,00 €
	Telecommunications systems	500,00 €	Alternative:	not embo	odied in the costs
	Television and aerial systems	4.826,00 €	Alternative:	not embo	odied in the costs
	Automationssysteme	2.000,00 €	Alternative:	not embo	odied in the costs
	Management and operator facilities	30.990,00 €	Alternative:	not embo	odied in the costs
Function-relat	ted equipment and fitments	55.400,00 €	ı	Function-related equipment and fitments	1.200,00 €
	Prefabricated wall units	450,00 €	Alternative:	not embo	odied in the costs
	General purpose fittings	10.000,00 €	Alternative:	not embo	odied in the costs
	Kitchen fittings	9.825,00 €	Alternative:	not embo	odied in the costs
	Laundry and dry cleaning equipment	2.292,00 €	Alternative:	not embo	odied in the costs
	Baths equipment	1.843,00 €	Fix	Baths equipment (economic fitting)	1.200,00 €
	Management and operator facilities	30.990,00 €	Alternative:	not embo	odied in the costs
Other constru	ction related activities	38.129,00 €	1	Other construction related activities	5.000,00 €
	Site equipment	20.129,00 €	Fix	Site equipment	5.000,00 €
	Transport	18.000,00 €	Alternative:	not embo	odied in the costs
Total net price	e (building costs KG300+400)	593.369,00 €	j	Total net price (building costs KG300+400)	299.942,00 €
Planingcosts		69.800,00 €	ı	Planingcosts	50.000,00 €
	Architektenleistung	26.000,00 €		Planing (one-time)	45.000,00 €
	Ingenieurleistung Elektroplanung	10.000,00 € 11.000,00 €	-	Planing (individual assimilation)	5.000,00 €
	HLS-Planung Messsteuerregelungstechnik	10.800,00 € 12.000,00 €	1		
Total net price	e - Prototype -	663.169,00 €	1	Total net price - Industrialized house -	349.942,00 €
	**		•		. , , ,

calculation ("What does the house cost?")	prototype	1-2 houses/year	100 houses/year	1000 houses/year
material costs (fixed)	=	240.000 €	240.000 €	240.000 €
- discount (variable)	-	30.000 €	63.000€	108.000 €
= material - prime costs	210.000 €	210.000 €	177.000 €	132.000 €
+ production costs	-	40.000 €	40.000 €	40.000 €
+ planing (one-time)	-	45.000 €	450 €	45 €
+ planing (individual assimilation)	-	5.000 €	5.000 €	5.000 €
= building costs	593.000 €	300.000 €	222.450 €	177.045 €
+ benefit	-	15.000 €	46.000 €	62.000 €
= price of sale clear	-	315.000 €	268.450 €	239.045 €
Target Costing ("What may the house cost?")				
budgeted sales clear	-	315.000 €	268.450 €	239.045 €
- benefit	-	15.000 €	46.000 €	62.000 €
= building costs	-	300.000 €	222.450 €	177.045 €
- material costs	-	210.000 €	177.000 €	132.000 €
- production costs	=	40.000 €	40.000 €	40.000 €
- planing costs (one-time)	=	45.000 €	450 €	45 €
- planning costs (individual)	-	5.000 €	5.000€	5.000 €

2.1 Chart: industrialization-calculation

c. Production scenario

In order to profitably market a product, it is necessary to adjust the production capacity per year to the type of production. With more than two houses per year, a serial production makes sense, with different levels: low production level = 1-2 houses/ year, medium production level = 100 houses/year and high production level = 1000 houses/year. In parallel the production process is optimised. Since home+ is a modular residential system using light wood construction, a production level of up to two houses per year is carried using small machines without any automation. With our design a very high degree of prefabrication is possible due to the standardised wood construction and the entire structural construction can be completed in a factory (including all integrated services and fit-out) and then transported by truck on site. Only the final assembly is carried out on site.

If a production level of 100 houses/year is achieved, the production can be optimised with special machinery (joinery machine with CAD interface, assembly system) to reduce production costs and also reduce potential errors to a higher level of production experience.

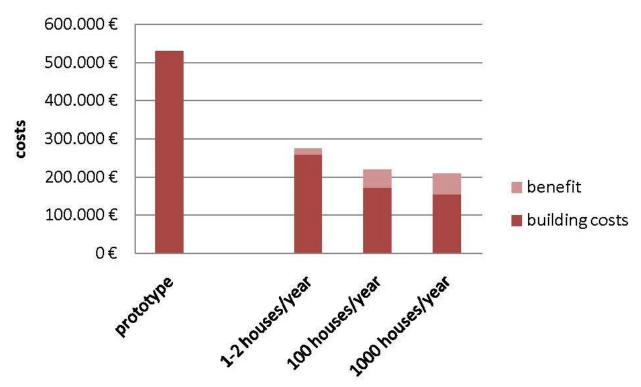
A mass production of 1000 houses/year makes an assembly line with hydraulic machines profitable for continuous production. The investment for an assembly line are high but are tax deductible and the production can be optimised for longer times.

By increasing the production volume, many variable costs can be reduced: material purchasing benefits from quantity discounts, planning costs can be spread over more units. (see chart industrialization-calculation)

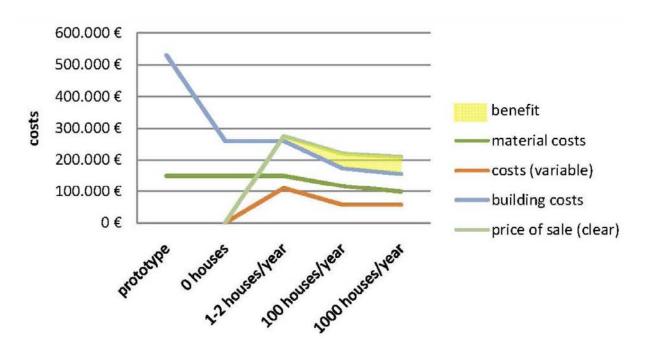
To maximise profits, the sales price is cost oriented with a break even analysis. Falling production costs and stable sales prices allows for a higher margin. In this way the sales force has more flexibility in pricing (see Graph break-even-point and Graph industrialization benefit).

d. Production level

To analyse the effects of an increase in production volume, we examined three different product scenarios. This basis is a rough cost estimate, with small differences to the prototype. To get realistic costs we considered only the material and production costs of a standard home+ without furniture and kitchen appliances. For mass



2.2 Graph: industrialization benefit



2.3 Graph: break-even-point

production, the complex subconstruction can be replaced with a cheaper stripe foundation. The prototype uses highly efficient vacuum insulation that is currently very expensive and is used for space-saving reasons for the contest. A marketable home+ version could also use a more standard, ecological insulation. The ceiling and floor can also

be insulated using rafter insulation, which keeps the U value so that the efficiency is conserved.

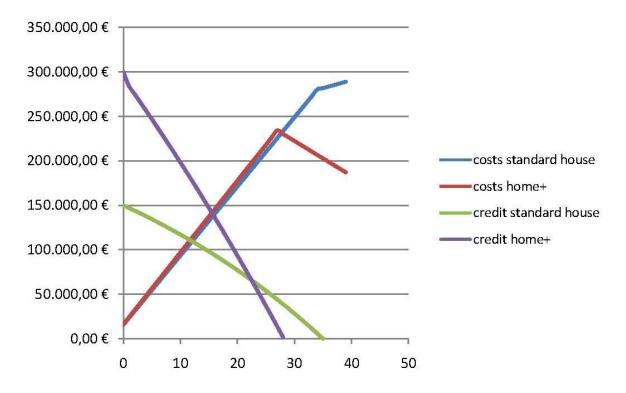
All installation equipment required for our climatic concept as well as the installed furniture and bath are included in the cost calculation.

e. Economic benefits and ecological benefits

Economic benefits

In comparison with a standard product using the same characteristics, it becomes clear for the end consumer how lucrative the product home+ really is. This example shows how the sample products perform under financial and sustainable factors taking into account the most important factors. The high cost of initial investment for the home+ can be explained with the current value of the technological installation. The both objects of comparison objects are based on 70 m2 residential area. The investment costs (including value added tax and discounts) are 300,000 € for home+ and 150,000 € for the comparison object. In the comparison only costs were considered that deviate, while costs that are the same for both were ignored. This example also assumes that both objects will be financed without a down payment. For comparison the pay back varies: the comparison object has an

The annual costs for home+ are 12,000 € (1% interest, the rest is pay back). The consumption costs are 0 €, but in order to retain comparability, the sum of the pay back is added. The home+ is energy optimised and generates a surplus. The surplus is calculated from the amount fed into the public electricity network at a current price of 0.43 € / kWh. Our annual surplus of 5,000 kWh is a total 2,150 €. The annual costs are therefore 8,074 €. The German government subsidises regenerative energy systems, currently 6,930.50 € for home+. The calculation determines in how many years each object would be credit-free and when a breakeven point would be reached when the costs of the comparison object meet the generated profit of



1.13 Graph: profitability

home+ (see Graph profitability).

The comparison object has been paid off in 20 years, whereas the financing period for home+ is only 25 years. After 26 years, the home+ has lower costs than the conventional building, which leads to net profit. The main factors here are the lack of

Graph profitability-calculation)

Cost comparison from home+ and standard houses

consumption costs and the surplus energy. (see

Cost comparison from home+ and standar	ra nouses		── - Financing per year ¹:
House	home+	standard	the calculation shows only the
Size	70 m ²	70 m²	first year, though the interest wi
Cost	300.000,00 €	150.000,00 €	,
			change in the following years.
Non-recurring Subsidies			
Heat pump	2.000,00 €	none	Intonest 2
Solar / PV	3.487,50 €	none	- Interest ² :
Combination bonus	750,00 €	none	KfW Privatkundenbank offer for
Collectors	693,00 €	none	energy efficient building a credti
Total	6.930,50 €	none	
Seed capital	15%	20%	form with a interest of 3,05%
Euro	45.000,00 €	30.000,00 €	<u> </u>
Total	248.069,50 €	120.000,00 €	- Feed into public network ³ : the
· · · · · · · · · · · · · · · · · ·			allowance for solar electricity
Financing per year ¹	25	20	<u> </u>
Duration of the credit	25 years	20 years	is calculated by Germans
Interest ²	3,05%	4,50%	renewable energy law (status
Annual redemption payment Interest in the first year	9.922,78 €	6.000,00 €	2010)
•	7.566,12 € 17.488,90 €	5.400,00 € 11.400,00 €	2010)
Cash drain in first year Monthly dues in the first year	1.457,41 €	950,00 €	
Total dues in the hole years of payback	346.429,76 €	176.700,00 €	- Electricity 4:
, , , , , , , , , , , , , , , , , , ,	- · · · · · · · · · · · · · · · · · · ·		•
Feed into public network ³			energy efficient appliances will
kWh per year fed into Grid	7500 kWh	none	help to reduce the electricity
€ per kWh	0,4301	none	demand. Compared to the
Annual surplus	3.225,75 €	none	•
			prototype in Madrid home+ will
Running costs per year			be supplied by domestic or sola
additional costs per year	1.200,00 €	1.200,00 €	•
electricity ⁴	3500 kWh	4500 kWh	thermal heating.
costs for electricity ⁵	616,00 €	792,00 €	
heating	none	1.150,00 €	Costs for electricity F:
Total	1.816,00 €	3.142,00 €	- Costs for electricity 5:
Fixed seeks war year			Generated electricity (PV) will
Fixed costs per year	1.016.00.6	2 142 00 0	be fully fed into grid (sold).
Running costs per year	1.816,00 €	3.142,00 €	
Feed into public network	-3.225,75 € 17.488,90 €	none	Electricity demand will be fully
Financing per year Total annual cash drain	, ,	11.400,00 € 14.542,00 €	bought at 0,176 EUR/kWh.
i otai alliludi Casii ul dili	16.079,15 €	14.542,00 €	

1.14 Graph: Cost comparison

	List of Mate	rials					
Summary				Production	End of L	.ife	Total
material	mass [kg] or area [m2]	primary energy demand [MJ, fossil/kg]	primary energy demand [MJ, ren./kg]	primary energy demand - total [in GJ]	EOL treatment	primary energy demand - total [in GJ]	primary energy demand - total [in GJ]
main construction materials							
construction wood (FSH)	7.301	13,74	28,36	307,38	thermal usage	-101,07	206,31
OSB board	5.218	7,86	24,58	169,23	thermal usage	-72,24	97,00
aluminium	676	146,25	49,18	132,09	recycling	-90,48	41,61
insulation glass	3.918	17,44	0,23	69,22	landfill	0,18	69,40
perlite	7.267	6,42	0,03	46,87	recycling	0,00	46,87
steel	920	23,56	0,78	22,38	recycling	-12,89	9,50
solid structural timber (KVH)	463	9,60	18,25	12,89	thermal usage	-6,41	6,48
PE-film	130	71,47	0,73	9,36	thermal usage	-0,79	8,57
polyolefin film	93	89,56	2,05	8,51	thermal usage	-0,57	7,95
other construction parts (see below)	2.535			72,75			72,75
linoleum	628	31,31	19,73		thermal usage	-3,83	-3,83
copper	79	28,70	1,43		recycling	-1,92	-1,92
seal	5	115,71	1,08		thermal usage	-0,03	-0,03
mineral wool	18	19,75	0,71		landfill	0,00	0,00
gluten	54	1,74	0,16		landfill	0,00	0,00
single glass	161	17,44	0,23		landfill	0,01	0,01
cellulose insulation	502	3,77	0,75		thermal usage	-6,96	-6,96
wood fiber	168	21,15	9,23		thermal usage	-2,33	-2,33
polyuretan foam	30	86,38	7,47		thermal usage	-0,42	-0,42
cotton fiber	1	13,45	20,40		thermal usage	0,00	0,00
Salthydrate (PCM)	603	10,20	0,12		landfill	0,03	0,03
sheep wool	283	63,	00		thermal usage	-1,72	-1,72
glas vlies	2	69,91	0,98		landfill	0,00	0,00
building systems engineering							
vacuum collector (m2)	7	1.550,71	172,19	11,37	recycling	-3,29	8,08
reversible heat pump							
photovoltaic modules (m2)	99	277	9,5	274,61		0,00	274,61
Buffer (30 %)				227,33		0,00	227,33
Sum construction	28.519,43			1.364,01		-304,71	1.059,30
Sum / m² (75 m²)	380,26			18,19		-4,06	14,12

1.11 Chart: bioclimatic

Ecologic benefit

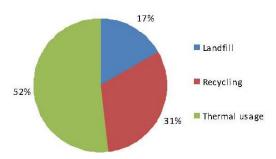
The bioclimatic strategy for comfort was defined based on analysis and the four elements. The bioclimatic chart shows that the comfort levels will be maintained over the time period:

- Climatic analysis based on regional architectural vocabulary and cooling techniques
- 2. Fire, orientation to the sun, shading strategy and optimal use of sunlight
- 3. Earth, building materials and construction: optimised building envelope to save energy and to generate the necessary energy using mainly ecological materials, integration of green areas within the plan to improve the comfort levels
- 4. Wind, natural ventilation and air conditioning using wind, adapting traditional measures
- 5. Water, natural air conditioning using water and new technologies
- 6. Psychometric chart

The primary energy for home+ is can be summarized by the key indicators: 395 kg mass per m² gross area and $9.43 \text{ MJ} / \text{m}^2$.

We considered a buffer of 10 % because not all materials are within in calculation. We applied the methodology of the LCA from the DGNB certification. When the main parts are calculated over the surface area, the systems engineering and connectors can be assumed with 10 %.

End of Life of Constructed Materials



1.12 Graph: end of life of constructed materials

home+

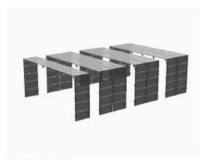
When looking in detail into the materials (see chart bioclimatic) it can be seen that we do not consider primary energy for the sheep insulation. This is due to the reason, that the primary energy needed for the sheep production so far is allocated to the sheep products milk and meat. Therefore no primary energy is allocated towards the sheep wool. When considering the end of life stage it can be seen, that the timber materials and those with a high calorific value will thermally disposed (44 %). In this process fossil energy needed for electricity and heat production is compensated. The results are ecological credits. This also applies to recyclable materials such as aluminum, copper and steel (44 %). Only a small percentage of products (12 %) have to be land filled (see graph end of life of constructed materials).

Assembly - Elements









photovoltaic



furnishing



3.1 Image: assembly-elemts

C. Industrialization degree

a. Constructive system

The building gets a substructure to carry the load punctually into the ground. The substructure contains on the one hand of steel bases (8 bases/module) and timber frames (3 frames/module). All steel bases are adjustable in height. The fusion between the modules and the substructure is composed of a hard wood element and the steel frustum. By this easy klick-system an exactly assembly is guaranteed.

Because of the required mobility, the building is made of different modules, including the living areas, secondary rooms as well as the climatically activated building joints. The main structure of the modules is made of wood. To have the heat loss as slightly as possible the modules are high insulated.

The glass joints and the ventilation tower which are hung up afterwards are made out of steel, glass and aluminium, so that the transparency is so largely as possible.

The photovoltaic-modules form the external facade. They appear filigree, hover above the main structure.

home+

The furniture for the interior are remounted for the most part already in the modules. The finish is mounting the multifunctional furniture. (see Graph Isometrie Steico ultralam)

Standardized pieces

The walls and the roof of the building are composed of several layers of material with different distinct functions.

The interior layer consists of 75 mm of veneer plywood; it is part of the load bearing structure. Moreover it provides thermal mass to stabilize the indoor climate.

On their outside, the plywood elements are covered with Vacuum Insulation Panels (VIP) which serve as thermal insulation. Another layer shields the sensitive VIPs from mechanical damage. While this layer was originally meant to be made of wood fiber boards, it was changed during the design process to the more robust Oriented Strand Boards (OSB). Thus smaller parts of the substructure carrying the photovoltaics can be attached to it.

Photovoltaic cells laminated onto large panes of

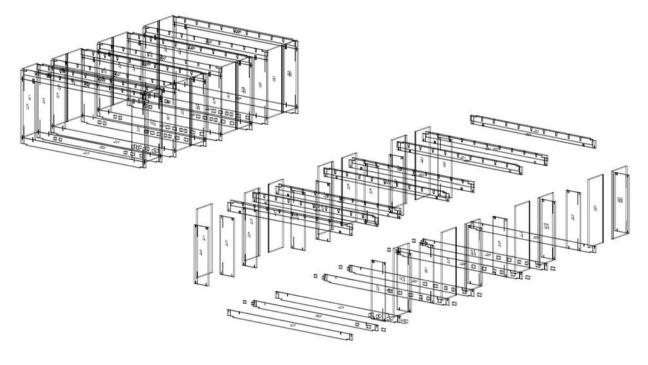
glass are the final "active" layer. It is mounted on a substructure made of metal rails which creates some distance to the underlying wall construction. In this way the PV envelope seems to levitate weightless over the building.

The modules will be built as timber structures. In the following, the loading assumption will be determined according to the German Industrial Standard DIN 1055, Part 1-5.

The module will be proven as a single, selfsupporting load-bearing structure, not being connected to the neighbouring modules. The load of the glass-joints will be distributed in equal parts to the neighbouring modules.

The bracing in the longitudinal axis or in the frame respectively will be ensured by two rigid, all side supported frames that will be built from veneer plywood "STEICO ultralam".

In the lateral axis or perpendicular to the frame respectively, the structure is braced by the shear walls at the fronts. Those shear walls are manufactured from veneer plywood "STEICO ultralam". By symmetrical arrangement of the walls,



3.2 Image: Isometrie Steico ultralam

twisting is not to be expected for the structure. The roof loads (superstructure, snow) are transmitted to auxiliary girders, here cross girders, made of structured solid timber. These pass the loads on to the principal girders, here frames from Kerto-S. On the bottom of the modules, cross girders (STEICO construction) are used to accept the loads from dead weight (superstructure, floor covering, etc.) and the imposed load. Those loads are likewise transmitted to the frame.

To obtain a clear load transmission into the soil, the loads are concentrated to four steel footings per frame. Since the modules will be erected on different locations regarding the competition, the dimensions of the foundation should be adapted the respective soil characteristics. (for more informations about the material look at the end of the manual at apendex 1)

Industrialized components

The home+ is prefabricated as practicably possible, meaning built from standardized components and compositions. The whole house consists of four

wooden modules and three glass and steel-modules, plus further sub construction. (see also b. modular system) The wooden modules were built by a timberwork company and the corner joints are made with the usual manual methods.

The gaps were produced in a special company as the construction is glass and steel requiring special machines. The production of furnishings was done in a joiner's workshop (see also c. transport and assembly process). All used materials and components are common and the production is in each case in industrialized companies and delivered justin-time to the building site.

Innovative components and system

The construction system used reduces costs and makes the assembly easy. The only modification for mass production is the wall construction (see image wall construction)

A further innovative system is the plug-in system for plumbing connections. (see image Plug-In-System)



STEICOultralamTM is made of multiple 3 mm layers of graded laminated spruce veneers. This disperses knots and irregular growth, producing a practically homogeneous cross section. This construction means that STEICOultralamTM is highly rigid and dimensionally stable.



Producing the product in this method also allows larger variety of formats to be produced thanks to the production of a blank sheet up to 20.5 m long and 1,25 m wide.

Ct-certified in an initial teap, the Stuttgart Materials Testing insensitute of the University of Stuttgart (Germany) howe certified STEIC-culturalism (**), with lateral veneer layers. The certification of STEIC-culturalism ***, with crowive veneer layers is currently being prepared and is expected to be available soon.

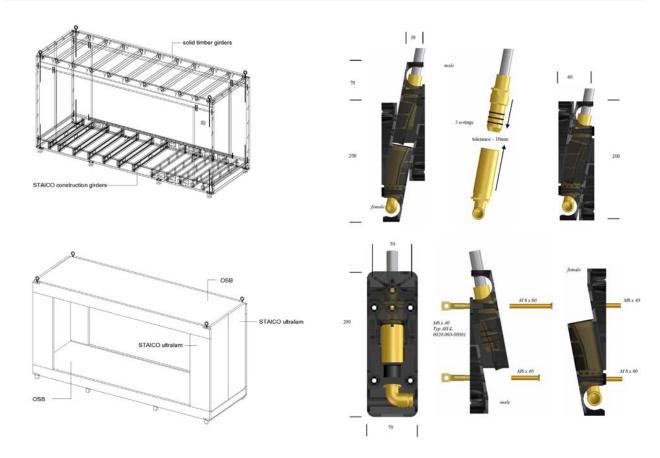
3.3 Image: data Steico ultralam

Reduction of thermal bridging		Туре	Flange b*h [mm]	Depth H [mm]	Weight [kg/m]
* C	°C TOC	33	45*45	200	2.9
		STEICOioist	45*45	220	3.1
			45*45	240	3.2
		SJ 45	45*45	300	3.7
Easy installation			45*45	360	4.2
of services	///		60±45	200	3.5
Of Services	600		60*45	220	3.8
	1///	STEICOjoist	60*45	240	3.9
		2J 60	60±45	300	4.3
			60*45	360	4.8
tweight. Easy to			60*45	400	5.0
andle and install	600		90 *45	200	4.8
arrule ariu iristari	A 100		90 *45	220	5.1
		ST EICOjoist	90 *45	240	5.1
	-	SJ 90	90 *45	300	5.6
			90 *45	360	6.2
ligh dimensional			90 *45	400	6.4
stability through		-			
trolled moisture		0.9	45*45	160	2.4
content		STEICOwa// *	45 * 45	200	2.7
COIKEIK			45*45	240	2.9
		SW45	45*45	300	3.3
Available pre-			45 *45	360	3.7
insulated to	pates.		60 *45	160	3.0
orm a solid cross	23		60 *45	200	3.3
ction for ease of	22	STEICOwell *	60 *45	240	3.5
installation		SW60	60 *45	300	3.9
			60 *45	360	4.3
igh load bearing	-		60 *45	400	4.5
capacity	kg	*	90 *45	240	4.8
capacity	L-I	STEICOwa// *	90*45	300	5.2
		SW90	90 *45	360	5.7
			90 *45	400	5.8
Easy to machine	are of other states	Available in length	Lengths of up to 16 meters, depths from 160 - 400 mm and the		Oconstruction stem meets the
ct manufacturing		=	option for pre-insulation combine to make the STEICOconstruction		ding Regulations

3.4 Image: data Steico joist

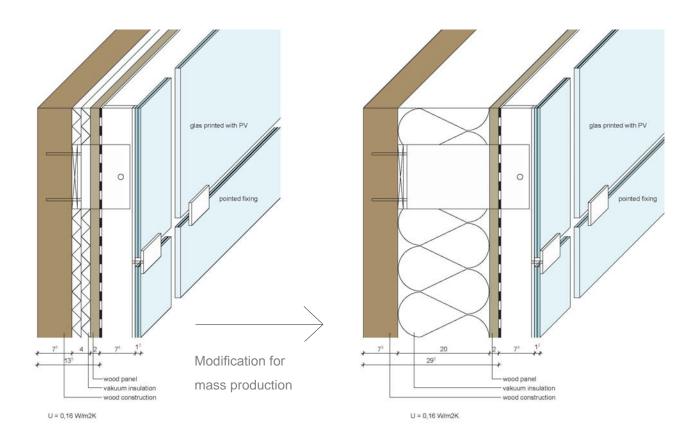
* ZURICH Insurance * Robust Details Ltd

range a fully integrated



3.5 Image: structure and materials

3.6 Image: plug-in-stystem



3.7 Image: wall construction

b. Modular system

Our main aims for the site activities, the assembly system and the lot are:

- · quick activities
- · easy system
- safe working conditions

The layout gives us the advantage of a high level of pre-fabrication and therefore an efficient and easy assembly. Four modules are built as frames – the fifth is the prefabricated part of the tower. Between the modules 1-4 there are glazing gaps (1-3), which separate the frames optically. In this way, a rhythmic separation of the modules is achieved.

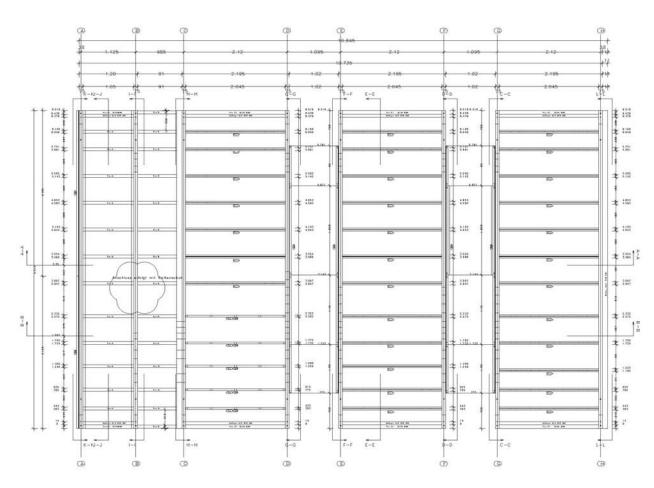
The dimensions of the modules are:

Module I	6,80 x 2,50 x 3,60 m
Module II	6,80 x 2,50 x 3,60 m
Module III	6,80 x 2,50 x 3,60 m
Module IV	6,80 x 1,20 x 3,60 m
Module V (tower)	1,95 x 0,80 x 4,62 m

The submodules are:

- 1. substructure
- 2. gap 1
- 3. gap 2
- 4. gap 3
- 5. PV
- 6. tanks
- 7. terrace
- 8. interiors

(for more details see the Operations Chart)



3.8 Drawing: engineering structure



3.9 Image: module

c.Transport and assembly process - Assembly and transport means

To transport our house to Madrid, 9 truck trailers are required:

4 flat-bed trailers:

dimensions:

10,00 x 2,50 x 3,00 m (0,40 m load height)

weight:

20,00 tons/trailer (without load)

- load:
 - 1. module 1 3 tons
 - 2. module 2 7 tons
 - 3. module 3 6 tons
 - 4. module 4 7 tons

5 standard (2 axial) trucks:

dimensions:

08,00 x 2,50 x 3,00 m (1,20 m load height)

· weight:

10,00 tons/trailer (without load)

- load:
 - 1. substructure of the building, floors of the



3.10 Image: module

gaps - 8 tons

2. glazing, photovoltaics: 4 tons

3. terrace materials: 4 tons

4. ventilation tower: 5 tons

5. equipment: 5 tons

Crane:

One tower crane capacity: tonnage 60 tons

Action reach: 15 m

Especial equipment:

moveable scaffolding electric forklift

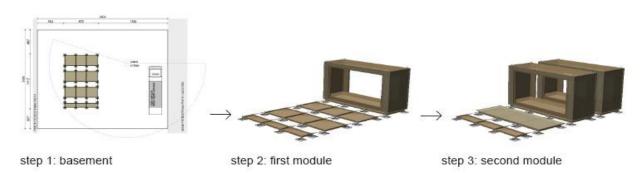
Assembly phases and time tables

As far as possible, home+ is build in the factory. The modules are on high precision and built to be weatherproof. When insulation and water proofing work is finished, the modules are transported with only few trucks on the building site where already everything is prepared for the assembly. A crane is put up and the substructure stands already on its final place.

Now the cranes lift module by module onto the substructure and receive thereby his exact position.

A keenly work is guaranteed by the prefabrication of

Assembly - Step by Step





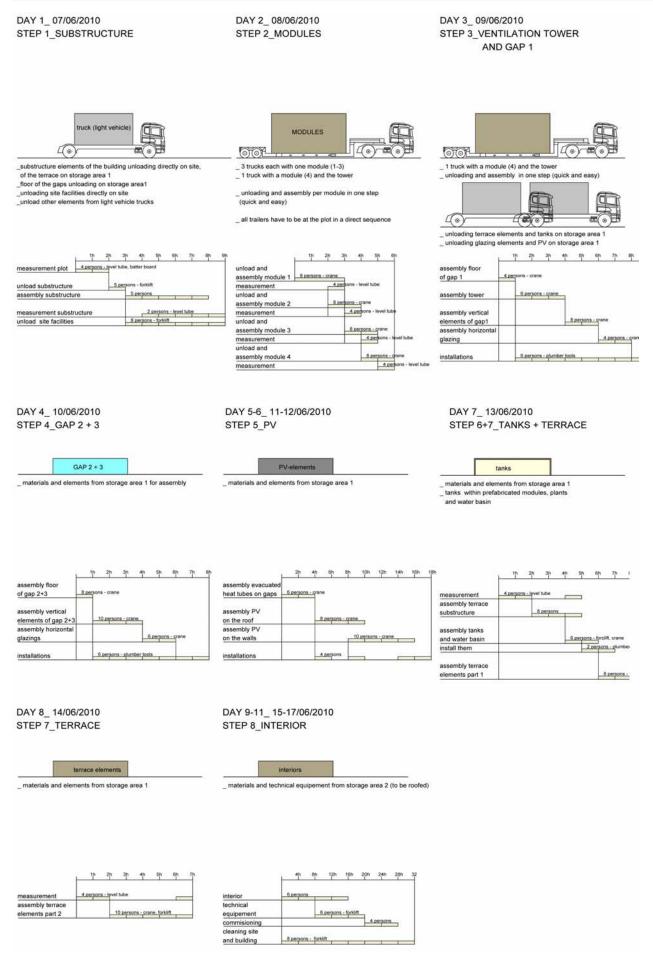


step 7: photovoltaic-elements

step 8: furnishing

step 8: exterior

3.11 Image: assembly phases



3.12 Image: assembly time-table

the modules as well as by the stable substructure. Thus the tower, which is completely prefabricated, is directly inserted into its suitable place.

Highest precision is also necessary, because the glass joints are hung up between the modules in the suitable device.

While manufacturing in the factory the substructure was already assembled for the PV facade. The photovoltaic elements are attached only by pointed fixing.

In the next step the multifunctional furniture is mounted. Adapted to the estate, becomes the exterior is formed by terrace layers, plants and water surfaces.

Project schedule

Client

The client dreams of a house owned by himself. He approaches us with this idea and then, in a personal conversation, we are designing his home+, which corresponds to his needs and visions. With the modular system and the modification of the single modules we adapt the house to the customer's wishes and the location.

Planning

The specialists from the home+ - planning team move the vision of the customer. The technical equipment, the interior fittings and the exterior area

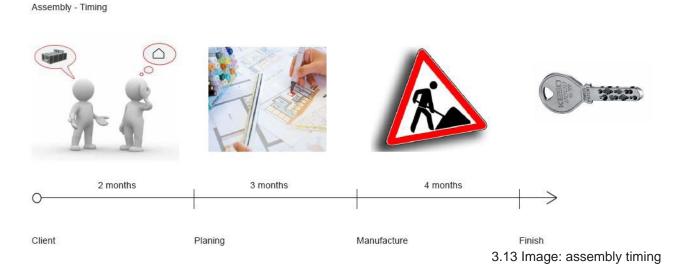
is adapted by the wishes of the customer. The final plans and detailed plans are provided and handed on to the manufacturing in the factory.

Manufacture

In the factory the modules are build by experts based on the plans and are prepared for the further handling. Here the installations, ducts and pipes are already inserted as well as the pieces of furniture in the cupboard zones on the side. The bath and the kitchen as well as all suitable surfaces and floor coverings are appropriated. The device for the joints and the substructure for the PV facade are mounted.

Finish

By truck the ready modules are delivered on the building site and unloaded with a crane to the right place. They are fixed on the substructure. After this the energy tower can be attached and after the glass joints can hang up. After this the PV modules are fastened. The finish in the interior space is the mounting of the multifunctional furniture and the connecting of the pipelines. After approx. nine months the house is ready and the customer receives the key to his home+.



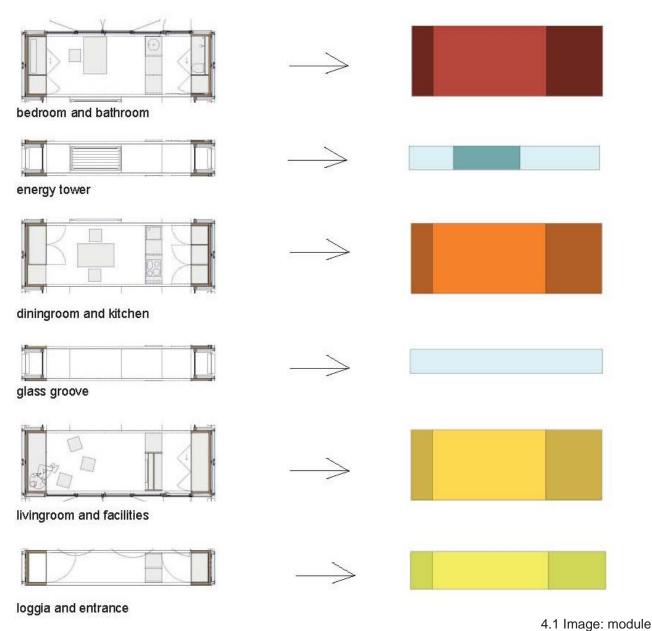
D. Possibilities for grouping

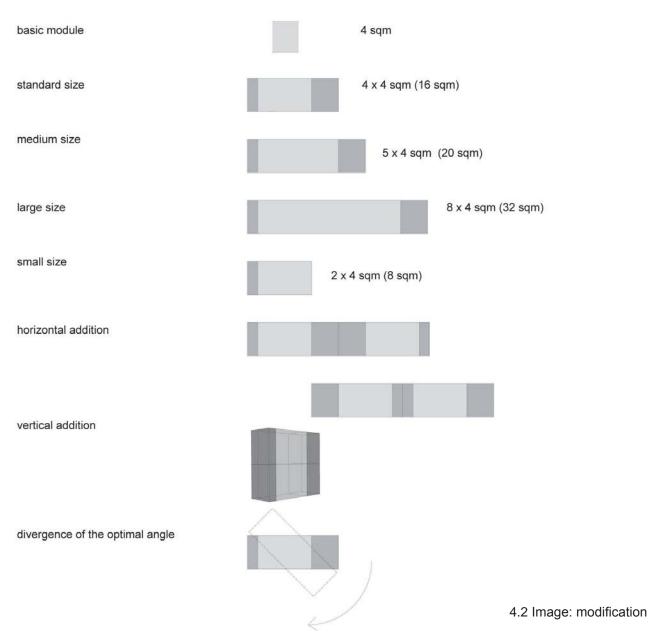
a. Module

The dwelling house is made up of single modules, which are connected in each case by glass joints with each other. Every module has a surface of approx. 16 square metres and can accommodate different uses, where in each case a storage zone and a secondary room is assigned. The following examples are schematically illustrated demonstrating the realisation.

The bedroom module accommodates a bedroom for two people. The storage zone can be used here as a wardrobe. As a secondary room, the bathroom

with shower, wash basin, lavatory and a technology space for washing machine / dryer is attached here. The glass joint, called "climate gap", separates bedroom from dining room and ensures a private retreat from public use, and it also defines the secondary rooms and contains the "energy tower" for natural illumination, cooling and ventilation. In the culinary module there is enough space for 4-6 people at the dining table, as well as a kitchen unit that is laid out to accommodate all technical devices. Between the module cooking and living is another "climate gap". The living room is also accommodated in a basic module. In the storage zone with the multimedia area and stools which are positioned in





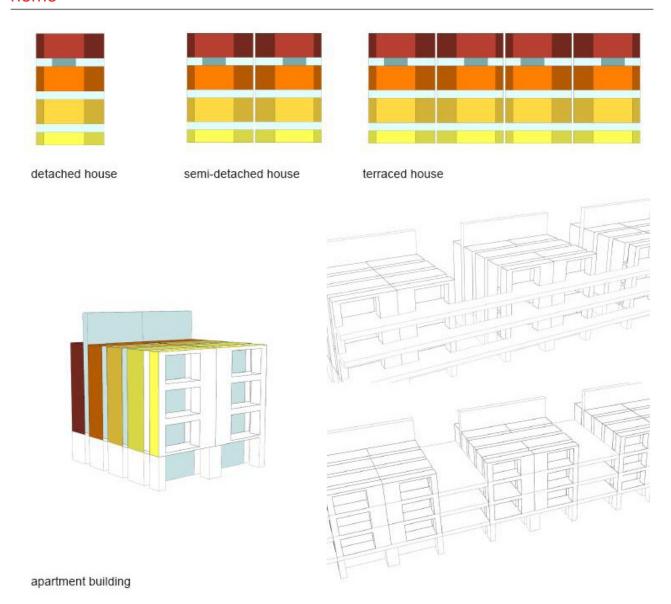
the middle furniture zone. The secondary room of this module contains the wardrobe and facilities. A frontal module, which is used as a sunblind, creates the entrance area and at the same time a welcoming terrace.

b. Modification

The concept allows the prospective inhabitant to compose a residential house according to their own requirements from a range of different modules, which are to be joined by glazing joints. The climate and bearing structure concept offers enough flexibility to be adapted to the individual customer's wishes and building forms (e.g. different typologies, add-

ons, stack).

The modules have a basic size of 16 square metres, they can, however, also are produced in bigger or smaller sizes. This offers individual adaptation to the requirements of accommodation changing if required by inhabitants. The maximum width amounts to 13 m to enable transport with a standard truck trailer (see "Assembly Report"). Variable addition is possible horizontally as well as vertically. An approximately north-south direction should be strived for in order to benefit best from the solar facade and the PV-collectors. Divergence from this orientation is naturally possible, the maximum solar yield, however, cannot be achieved.



4.3 Image: typology

c. Typology

The base unit illustrates which form the building can be arranged in. As a detached house it can be arranged optimally on a sufficiently sized estate. Its solar facades and the yields of the PV-collectors make the building self-sufficient, in principle, and independent of energy providers. A sequence of several buildings is possible, for example as a semidetached house or row house, however, the suitable fire prevention measures must be considered. The climate concept has to perhaps be adjusted to one of these building forms because of the loss of at least one of the solar facades.

Using the concept in an urban context is the preferred alternative, for example, as an apartment house with a commercial level on the ground floor. Three residential floors could be opened, for example, by a pergola or an inserted stairwell element. Air ventilation and lighting are provided by the lateral glazing joints. The "energy tower" offers extra light down to the lowest level as well as the mechanical ventilation. The exhaust air and the installation pipes are led through the inner joints up to the roof. The solar yields are dependent on the arrangement and position of the building.

d. Adaption to the potential usersTwo persons household

Young people at the beginning of their career mostly like to live in a modern and contemporary way. Big households are not needed living in an urban context. Services as well as the leisure time facilities and the cultural offers can be responded locally. Therefore the basic prototype contains one module to sleep in, with an attached bathroom, one module to live in and another one including the kitchen and the dining room. Each module is separated by a joint of glass, the "climate gap", which is used for air ventilation, natural light exposure and development of each room. Due to the solar facade and its air conditioning technology, the building is independent from

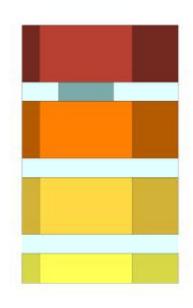
external influences to a large extend. The building could also be a part of a terraced housing estate, or stand in a suburb of a big city offering the couple a cheap way to build the first privately owned home. At the beginning the target audience finds its place in the urbane sphere. With the wish for offspring then, mostly the wish of the place of residence also changes. The building first constructed in the city is easily able to be disjoined, transported to calmer regions and to be rebuild and extended.

It also fits to elderly couples who have no kids, but

It also fits to elderly couples who have no kids, but like to live in a housing estate or like to enjoy the flexibility to the full.

Potential users - two persons household





example: young couple

Four persons household

The wish way to build the first privately owned home mostly is challenging to master. The dimensions of the building, the number of rooms and the resulting costs are the crucial factors. The possibility to extend the once build house easily as it is demanded in the situation, helps to achieve the wish of a private home. The basic module unit for two persons

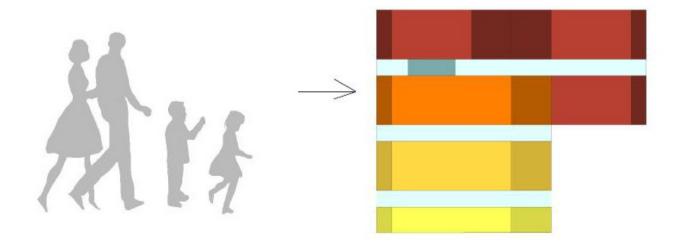
4.4 Image: two persons household

contains all you need to cook, to sleep, to live and of course sanitary facilities.

The prime costs of acquisition of the modules could be kept low. According to the circumstances of life and the need of more space, investments in the private home can be adjusted as needed.

The Modules are also able to be prefabricated indi-

Potential users - four persons household



exampel: family with two children

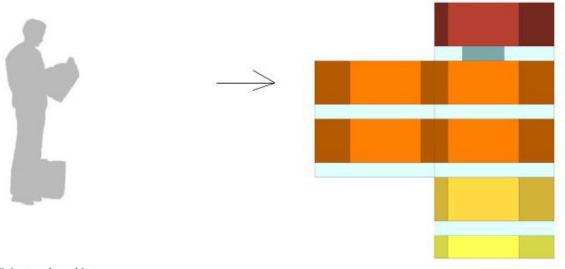
vidually. For example modules to work in, another living room or a nursery can be added to the basic modules. Even the enlargement of the building for private rooms of the grandparents would be conceivable. Moving out of the parents home, the children could possibly disassemble their previous attached rooms and take them to generate a new basic mo-

Potential users - one person household

dule.

4.5 Image: four persons household

Singles and career-oriented employed persons, who choose to live in an ecologically minded way without abstaining from living comfort, fit to this target audience. The basic module of a single persons therefore is build in an urban context, preferably on a higher location to guarantee the solar yields and therewith the energetic self-sufficiency of the building. This single person household involves modules containing all you need to cook, to sleep, to live, sanitary



example: living and working

4.6 Image: one person household

facilities and is extendable with more living modules or some to work in.

Because this target audience normally has numerous connections and a circle of friends, multifunctional use of the rooms is desirable. Thus, for example, the dining- and living area are able to be combined to offer space for a big table. Private rooms and the living area are separated strictly. The building is easily able to be disjoined, transported and to be rebuilt or even extended if needed. Nowadays a frequently change of the workplace is also to be taken in account. Due to the mobility of the home, the job search is disengaged of the residence. The easy assembly and transportability of the building are favoured by the determining factor of the climatic independence of the building. Thanks to this the prototype is applicable all around the globe.

apartment-sharing community can easily be amended by new inhabitants and their modules. Also the community area can be complemented around the other modules, which are used as a spare time area, workroom or party room. One can fancy an unimproved property as well as a redensification in the urban environment. Therefore the architectural structure becomes an agent of growing flexibility and will be the effigy of social networks.

king module rank among the together used one's.

Those form the centre of the living unity, where the

inhabitants can meet each other. Around the centre

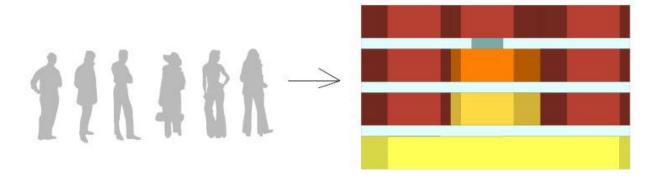
the private modules are arranged, which contain

in each case at least one sleeping module. The

Multiple persons household

The demographic development shows clearly that there are more and more single households. This target group mainly encloses people, who replace social contacts of the family by contacts between like-minded people. Current examples reach from hall of residence up to senior citizen's residences. The living type distinguishes between together used and private used modules. Living, eating and coo-

Potential users - multiple persons household



exampel: community

4.7 Image: multiple persons household

home+

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12.10 Sustainability Report - Contents

- 1 Concept of Sustainability
- 2 Bioclimatic Strategies
- 3 Water
- 4 Solid Waste
- 5 Materials
- 6 Solar Facilities
- 7 Appliances
- 8 Description of Technical System
- 9 Communication
- 10 Product data sheet overview



Sustainability Report

Compared to the last deliverable many modifications were considered and therefore this report is very different.

1 Concept of Sustainability

From the beginning the project was designed with a great ambition on sustainability. Since the topic is very complex and buildings can conduct differently to sustainable development, we applied several criterion of the German Sustainable Building Council (DGNB; www.dgnb.de/en). This certification system is a complex measurement method to find out the ecological, economical, social, technical and process quality of the building construction.

The ecological quality of the building is analyzed with the life cycle assessment (LCA) methodology. The LCA was carried out parallel to the design phase to reduce primary energy demand of the building. Variations of different roof, wall and floor constructions have been analyzed. As one result sheep wool is considered instead of cellulose (see Chapter 5).

The economical sustainability is assessed by a market feasibility study pointing out how home+ can be used in different bioclimatic areas (see Chapter 2). The social sustainability is measured by different DGNB criterion (see Chapter 1.1 ff). The technical grade is evaluated by the ease of deconstruction and recycling (see Chapter 4.3).

The integrated planning represents a key criterion for the process quality. Our interdisciplinary team consists of master students with specialization in architecture, interior design, building physics and sustainable energy management. External experts in ecological building design were integrated in the planning. Therefore all participating experts involved in a construction project were working together closely from the beginning.

The architectural concept consists of three focal points:

- Natural conditioning for heating and cooling (through wind tower and glass façade)
- Durable, natural construction materials with low environmental impacts
- 3. Utilization of renewable energies

1.1 Comfort Conditions

The comfort conditions were evaluated according to the criterion of the German Council for Sustainable Buildings. Because there is no system for residential buildings, the office building standards were applied and adopted. In the following several socio-functional criteria are described and evaluated.

1.1.1 Hydrothermal comfort

Thermal quality as perceived by a person is closely connected to their living satisfaction. This is affected on one hand by the total comfort level and on the other by local factors of thermal uncomfortableness. In this way a person can feel generally comfortable, yet perceive a draft on a body part as uncomfortable. The summer situation is based on the German norm DIN 4108-2. The winter situation considers the installation requirements of the heating system as well as general data for air egress.

The comfort levels were predefined by the organizers. The temperature is defined between 23 and 25 °C and the humidity is between 40 and 50 %. With these values a comfort zone can be drawn in a psychrometic chart. We simulated the hottest week to be expected for Madrid in this chart to proof that we mostly comply with the desired comfort criterion inside the building (see Figure 18).

1.1.2 Humidity control

Since the weather conditions in Madrid are relatively dry, we do not use any dehumidifying process with sorption material. Nevertheless, in order to avoid bringing to much humidity inside the house when the ambient temperature is too high, we have the possibility to dehumidify the supply air with the cooling coil. In this case, after the heat exchanger the supply air is cooled below the dew point and the excess humidity is removed from the air by condensation. The condensed water is evacuated with the condensate drain of the cooling coil.

1.1.3 Air quality

The aim for the control of interior air quality is to avoid negative influences on the comfort levels of

the user. In the planning phase, we focused on materials and building products with low odour and emission to create an interior with low emission concentrations and volatile, smell-activating chemicals. The considered sheep wool in the construction was chosen because of the low U-value, to raise awareness of sheep wool within the construction sector and because the wool absorbs toxic substances (e.g. formaldehyde) or protein reactive substances (e.g. ozone from copiers) and binds these. In this way we consider the contamination by the users (biological transpiration) and also contamination through emissions by the building materials. Ventilation is controlled by the technical installations and can be influenced by the users with operable ventilation openings (windows).

1.1.4 Acoustical Comfort

We aim for low disruptive and noise levels as well as high acoustic qualities in our building to not impair the health and wellbeing of the users. The lower the noise and echo levels are, the lower the impairment. Better listening conditions and high echo absorption are advantageous. For the evaluation, several prerequisite figures are required. The echo time was determined through calculation. The installed furniture was factored in, as it is a part of the architectural building concept. Without furniture we have a result of T500 = 0.8 s at 500 Hz. To reduce this value, the design of the furniture will incorporate acoustic measures.

1.1.5 Artificial lighting

The artificial illumination will achieve adequate general lighting as well as locally adjustable lighting without any disruptions such as direct or reflex glare. Important for the user satisfaction is the view outside revealing the time of day, location and weather. Further criteria are the lack of glare, and light spread and colour in the rooms. These demands ap-

ply to both daylight and artificial illumination. By integrating day light planning and illumination early into the planning process, we were able to create high-quality, but energy and cooling efficient light levels. Through the simulations with the software daylight, dialux and radiance we reduced the artificial lightning further during the planning process. Finally our lighting system contains mostly low energy consuming LED lights (see Figure 1).



Figure 1: Simulation with Dialux of the artificial light without gaps lighting

1.1.6 User Influence

In home+ a complex hydraulic system is installed which need a sophisticated building automation. Therefore a central automation system collects ambient data by our meteorological station outside. Data for the inside is monitored by sensors located in the cupboard zone. After the analysis of different values (temperature, humidity, air quality, etc.) the system chooses an adequate mode for heating or cooling and ventilation. The corresponding devices are turned on or off automatically, mass flow and outlet temperature of the heat pump are appointed, valves and mixing valves are set according to the requirements. However, to guarantee maximum user comfort the following devices also may be regulated manually:

- 1. Ventilation
- 2. Sun protection
- 3. Glare protection
- 4. Temperature during the heating period

- Temperature outside the heating period
- 6. Control of daylight and artificial illumination

1.2 Industrialization

Spatial control and adaptation strategies

At the beginning of the design phase, we considered possibilities to erect the building in other locations. Cooling and heating strategies resulted from traditional examples and so it was important for us to adapt the building to other climates by adjusting the modules. The prototype has been developed for Madrid since the contest is taking place there, but also for climate regions with hot and dry conditions. Possible adaptations of the tower to different climate conditions:

Hot & dry: tower for cooling through evaporation

The passive ventilation power realized as a prototype in Madrid supplies fresh air to the house without mechanical effort when ambient conditions are favourable. When the wind speed is high enough, the ambient air is caught by the tower, cooled through downdraught evaporative process and supplied to the building. The air is exhausted through openings on the gaps with the help of solar chimneys (absorber plates). This can be seen from the preliminary simulation results in Figure 2.

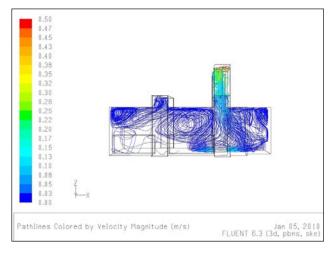


Figure 2: Simulation of wind velocity through the ventilation tower

Additionally, passive cross ventilation can cool down the house during the night through the gaps. We are aware that the ventilation tower which is a key design feature of home+ is a very specific measure for a climate like Madrid (hot and dry).

When setting up home+ in different climatic zones, it can be replaced by components customized for the respective climatic conditions.

Coastal regions: upgrade with wind turbines

As a result of the other typologies, necessary technologies can be installed to use wind energy. Turbines can be added to the gaps or on top of the tower (Figure 3).

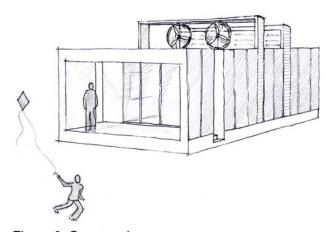


Figure 3: Coast region

Cold areas: tower as chimney or heat buffer with water

Other possibilities are northern climates, e.g. Sweden or Finland. Here heating load has the highest priority and not cooling as in Madrid. In these conditions the tower would be used as a heating element and not as cooling wind tower. Also possible is the use of a heat buffer with water.

Hot & Humid: Tower as a Venturi foil for cooling

In the subtropics with prevailing humid conditions, the Ventilation Tower cannot cool the interior adequately with evaporation. However, there is the possibility of adaptation using a Venturi foil to ventilate the warm humid air using thermal lift.

The orientation in the northern hemisphere is northsouth as described in the architecture narrative. In the southern hemisphere, the building and interior are mirrored, with the porch facing north. The building envelope is activated with PV vertically in the direction east and west and horizontally on the roof, to be able to fulfil the energy demands, also in northern areas. The active components would remain as is, since the high energy surplus, as well as the highly insulated envelope, results in a reduced heating and cooling load. Therefore the design and climatic concepts need only to be adjusted in form of the energy tower, calibrating the absorber surfaces and upgrading with certain technical installation. The effort to adapt the design is low, since our concept is modular. The joints of the energy tower can be prefabricated in two to three variations, so that the building is configured as a building set adapted to a particular climate (see also Market Viability).

Urban environment proposal and redensification

Life in the city offers many advantages through efficient use of infrastructure and transport energy. As a result we see a densification of the city as the main priority.

As described the prototype is self-sufficient in terms of a positive annual net-energy balance. Therefore it can be used for redensification in empty lots within the city. Another easy possibility of placing the building is on the flat roof of a town house. Merely the bearing capacity of the existing building and the availability of the needed house service connections have to be assured. The "parasite" on the roof could be used in various ways and would counteract the housing shortage in some cities. Besides, the inhabitant would have the possibility to take his building quite flexibly to different locations and cities. However, stacking is possible horizontally as well as vertically, so there are more possibilities for dense resi-

dential development. Modifications required here: inserting vertical and horizontal circulation modules; adjusting the PV surfaces and height (and thus efficiency) of the energy tower; upgrading to vacuum tube collectors; and larger warm water storage. A row system requires more adaptation and certain considerations during prefabrication, however there are distinct advantages for this configuration, such as less surface area to volume and sharing certain technology installations, energy and costs.

2 Bioclimatic Strategies

The bioclimatic strategy for comfort was defined based on analysis and the four elements. The bioclimatic chart shows that the comfort levels will be maintained over the time period:

- Climatic analysis based on regional architectural vocabulary and cooling techniques
- Fire, orientation to the sun, shading strategy and optimal use of sunlight
- Earth, building materials and construction: optimised building envelope to save energy and to generate the necessary energy using mainly ecological materials, integration of green areas within the plan to improve the comfort levels

- Wind, natural ventilation and air conditioning using wind, adapting traditional measures
- Water, natural air conditioning using water and new technologies
- 6. Psychometric chart

2.1 Climatic analysis

At the beginning of the conceptual development, we considered the climate in Madrid and the prevailing wind conditions. Starting from a traditional architectural vocabulary used in hot and try climate to ensure comfort levels, a combination of traditional methods and new, efficient technologies was developed: modernity meets tradition. These traditional motives and methods include the wind tower, evaporative cooling, and thermal mass (Figure 4).



Figure 4: Ventilation Tower

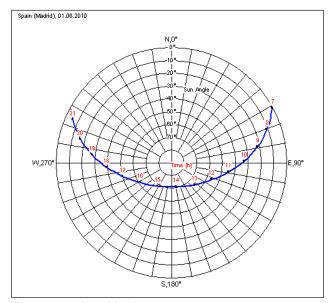


Figure 5: solar altitude summer

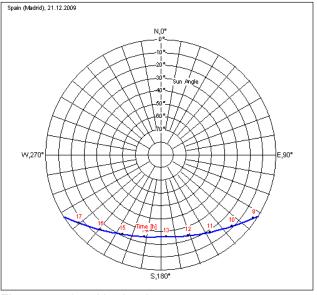


Figure 6: solar altitude winter

Further steps to ensure comfort levels were developed throughout the planning phase and are explained using the four elements and the bioclimatic charts.

2.2 Fire, orientation to the sun

Using sun data from Madrid, the building orientation was optimised. The main lighting and orientation is defined by two glazed elements to the north and south, where the energy from direct sunlight is the

lowest and the view can be extended into the landscape. In this way the low winter sun at an angle of approximately 25° is allowed into the interior, while the high summer sun at an angle of 72° cannot enter (see Figure 5 to 8).

The glazing is arranged so that the interior is warmed up in winter but not overheated in summer. The east and west facades are mainly closed. Through the modularity an alternating rhythm of

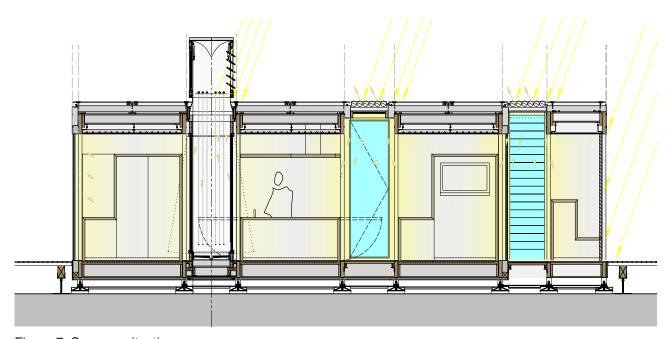


Figure 7: Summer situation

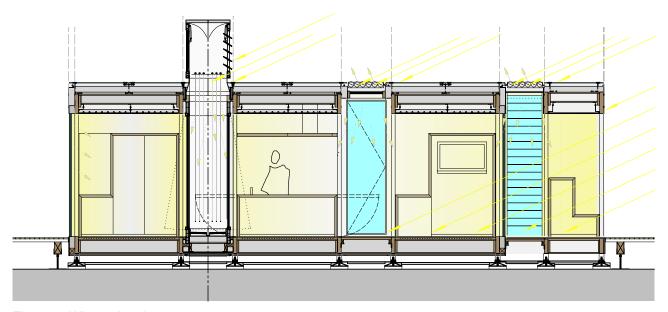


Figure 8: Winter situation

modules and gaps is formed, and these glazed gaps allow sun inside. In the morning, diffuse light enters through the west side, while the shading on the east keeps out direct light. This arrangement is reversed

in the evenings (see Figure 9 and 10). Additionally, the vertical shading on the patio keeps diffuse light out and the offset to the glazing at the gaps allows light in.

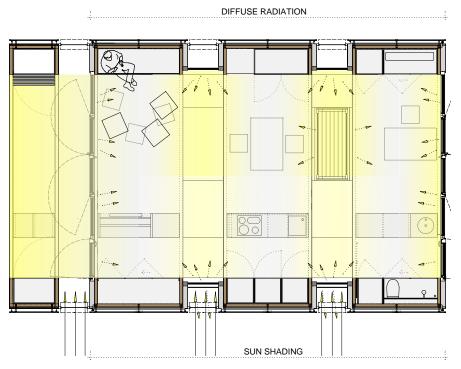


Figure 9: floor plan

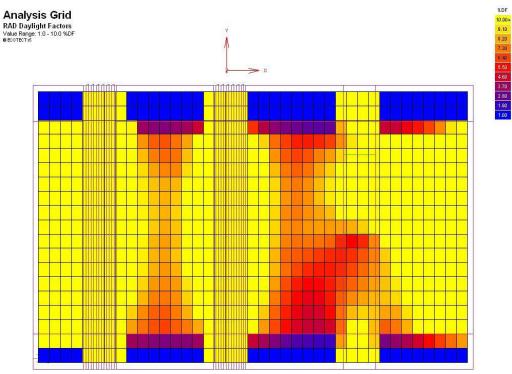


Figure 10: Simulation be cloudy sky

2.3 Earth, building materials and construction

In order to keep the heating and cooling loads low while maintaining high comfort levels, the building envelope consists of three main layers:

- The primary structural layer of solid wood construction creating a high thermal mass; this is not particularly high with wood but it does create a difference while augmenting the effects of Phase Change materials (PCM) used in the false ceiling
- High efficiency vacuum insulation that lowers the energy demand because of low heat transmission losses, so that sunlight and human heat is adequate for heating in the spring and fall
- PV façade which produces electricity for the active technical installations and required energy
- All materials used have also been checked for ecology and alternatives are compared (see Materials).

2.4 Wind, natural ventilation and air conditioning

The bioclimatic ventilation concept has 3 phases:

- 1. Cross ventilation: in normal days (Figure 11)
- Ventilation Tower: in moderate climate conditions (Figure 13 and 14)
- Air preheating: in the winter or cold regions (Figure 12)

During the day and/or at night the air flows through the totally opened gaps and thereby allowing a high air exchange through cross-ventilation. On hot summer days this is also used at night to cool down the mass of the building in a passive way.

The ventilation tower inside the building is used for natural air conditioning and ventilation of the interior. Wind is taken in from the south and north, guided into the interior through the meshes and cooled with evaporation. At base of the tower, the air enters the interior already cooled. In Figure 15 it can be seen that the main wind direction in summer is from the south-west, resulting in the placement of the tower. The solar chimney ventilates the interior through thermal lift. Furthermore the thermal mass is used during the night for natural cross ventilation (see Energy Analysis).

Especially on sunny winter days the air will heat up in a passive way. The air, streaming through the lamella glazing at the base, will be heated up in the glazed gaps using solar power. While the outer windows (the lamella glazing) in the climate gaps are closed, the heated air can stream through the opened inner windows. The plants in these gaps humidify the air by evapo-transpiration which improves the air quality.

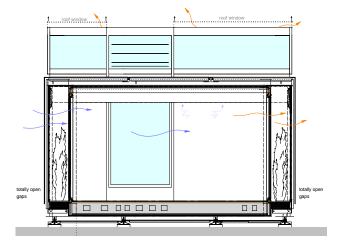


Figure 11: Cross ventilation

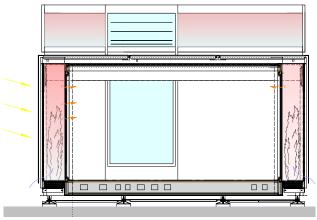


Figure 12: Air preheating

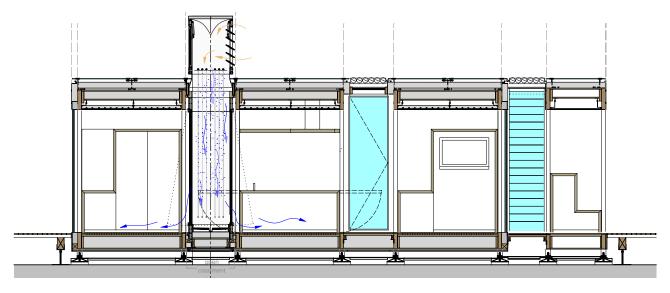


Figure 13: Ventilation Tower Section 1

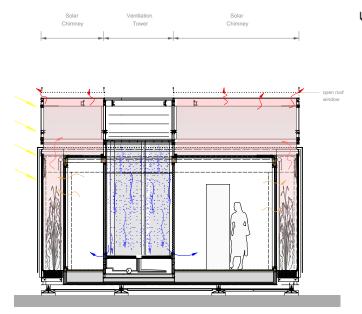


Figure 14: Ventilation Tower Section 2

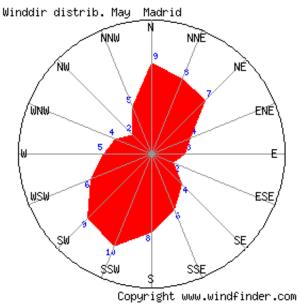


Figure 15: Wind direction during May

2.5 Water, natural air conditioning

During the day the vacuum tubes on the roof the warm water supply while the PV modules are used at night to produce cold water through radiation transmission to the night sky. This cold water is used

to unload the PCM and to cool the floor. In this way, an efficient cycle is used taking advantage of natural processes. Water reuse is described under Water Treatment (see Figure 16 and 17).

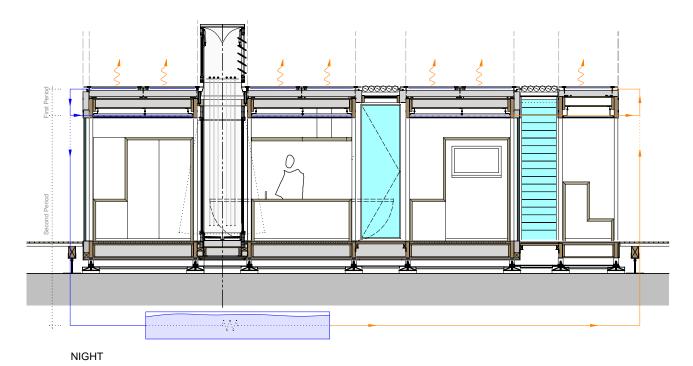


Figure 16: Night sky radiation and discharging of the PCM ceiling

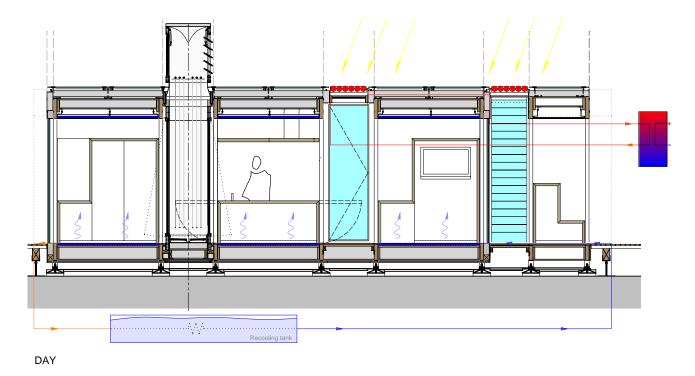


Figure 17: Solar thermal system and Low energy cooling system

2.6 Psychrometric chart

The bioclimatic influences are described using the psychometric chart. The following chart (Figure 18) shows the simulated room temperatures and humidity ratios. The yellow zone defined of the psychromet-

ric chart corresponds to the comfort zone defined by the organisation. For this chart we selected the values from the hottest day, but we are also the most of time within the comfort zone.

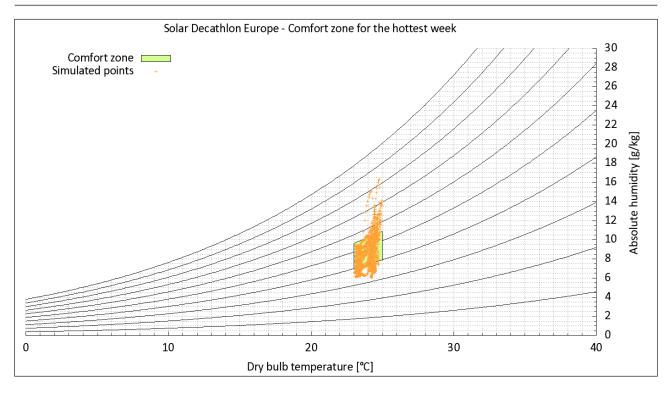


Figure 18: Psychrometric chart

3 Water

Germany is with Belgium amongst the industrial countries with the lowest fresh water consumption. This information can be obtained from the German Cooperation on energy and water management (BDEW)¹. Since water is a valuable and restricted resource great efforts have been put on a low fresh water demand. This can be reached through water efficient devices as well as the utilization of rain and grey water. With these efforts also the total sewage can be reduced.

At home+ we tried to deal with all of the water reducing aspects. Therefore the fresh water demand is lower compared to a normal household. This can be obtained from Figure 19. Each water consuming area will be described in this Chapter.

The utilization of rain and grey water is not being realized for the prototype shown in Madrid because the average rainfall and the corresponding usable water amount are too low. No sewage system is considered because the sewage generation is too low for the considered techniques.

3.1 Consumption reduction

The typical water demand for one person in Germany is 123 liters per day. Showering and bathing activities cause the highest water demand with 46 liter per day². The usual water flow rate of shower devices lies between 13 and 20 liter per minute. We chose a solution by Hans Grohe (Crometta 85 1jet) with a flow rate of 6 liter per second. Additionally we have a rain water shower on the ceiling with a flow rate of 9 liters. This was considered for bathing quality and has a lower consumption than regular "rain fall showers" with 25 to 40 liters. The inhabitants of home + can chose if they want to save water and use Crometta or have a comfortable shower experience.

¹ German Cooperation on energy and water management (BDEW), 2009, http://www.bdew.de/bdew.nsf/id/ DE_7DBKG6_Kennzahlen?open -> Wasserfakten im Überblick

² German Cooperation on energy and water management (BDEW), 2009, http://www.bdew.de/bdew.nsf/id/ DE_7DBKG6_Kennzahlen?open -> Wasserfakten im Überblick

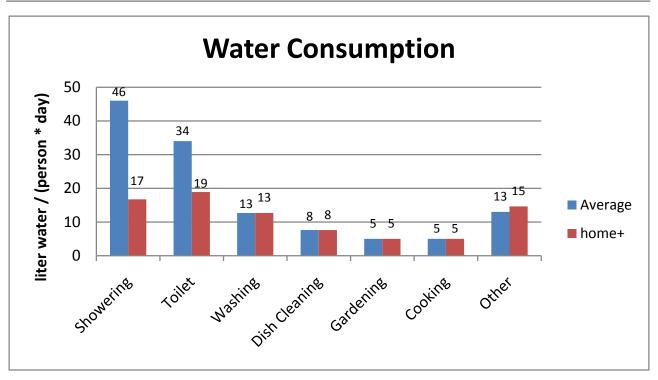


Figure 19: Water Consumption of home+ compared to German average household

Flashing the toilet causes 34 liter per day. While normal flushing tanks need 9 liters per operation, the considered toilet from Keramag needs just 4 liters. We considered a vacuum toilet which would further reduce our fresh water demand. Due to high maintenance efforts this system is deprecated.

The demand for gardening, cooking and other are assumed to be the same as no detailed information about each criterion could be found. The water demand for the cooling tower is estimated with 1200 liters per year. This equals about 3.3 liters per day. Assuming two people are living in the household, the rate is divided by two which equals 1.6 liters per day and person. But the energetic benefits of evaporation dominate the higher water demand by far.

Washing and dish cleaning ads up to 20 liters per day. Since we put the focus on electricity efficient devices, the water demand of these devices is similar to the ones of modern average devices. However, the washing machine and the dishing machine have hot water connection supplies. This means, that they

are operated through our regenerative heating system (solar thermal modules).

In total we need 78.9 liters per person and day, Which means a reduction to an average household of almost 40%.

3.2 Water treatment

Sewage treatment may not be realized in Madrid because of the lack of space and the restriction of utilizing the outside area. Currently we are still researching a solution also suitable for a one family house such as home+.

Definitely we want to consider sewage treatment for the final destination of home+. By sterilizing waste water from the washing machine and the showers we can reduce our fresh water consumption for the toilet and gardening (see figure 19 from above) further. So far the following techniques have been examined.

The first considered technique is the submerged trickling filter, where the sewage runs through four

filtering basins, where it will be sterilized through UV radiation. But because the low sewage quantity reached by home+ this system was deprecated. When home+ is installed with at least five modules this technique can be applied. Secondly a natural cleaning system was examined, in which grey water is directed into a basin where the coarse dust will be separated. After that the water gets pumped outside into the garden on a reed bed where it sinks and gets filtered by the natural rooting. The area demand is about one square meter per person. Due to the regulations this system will not be used in Madrid but is on discussion for the final destination of home+.

4 Solid Waste

Compared to other countries the German waste regulations are much advanced. Under European regulations the priorities with waste management are the following five which will be explained afterwards more in detail:

- 1. Reduction of waste generation
- Closed loop recycling: This means for example that emptied and cleaned glass bottles can be reused in the same manner
- Recycling of materials which can be used with a lower quality or pureness. For example the utilization of recycled windows for glass bottle production
- Other additional treatment such as incineration. Through this process electricity and thermal energy can be produced which substitutes the electricity grid mix mainly consisting of fossil fuels
- 5. Landfill

Though there is still a waste generation of about 350 million tons annually several initiatives led to a reduction of waste and a better separation.

The "Green Dot System" has been one of the most

successful initiatives as it reduced the yearly waste generation with about 1 million ton per year. Manufacturers and retailers have to pay for the amount of packaging they need for their products. More weight causes higher fees. This clever system has led to less paper, thinner glass and less metal being used, thus creating less garbage to be recycled. The recycling process also advanced because consumers are demanded to separate products with the Green Dot separately. German regulation also requires the consumer to be part as a separator in the recycling cycle. Waste collectors take care that only these products are put into the transparent recycling bags and refuse to collect bags with different waste materials.

The preselection of waste by the consumer also includes separation of paper, glass, products with the "Green Dot", organic waste and other waste. Out of the other waste there are separate collection places for toxical substances such as old batteries, electronic waste, glues and paintings.

In the advanced German recycling management system currently 88% of used paper, 87% of glass, 72% of metals and 67% of plastics are recycled3. During the last years these recycling quotes have gained drastically as can be seen in Figure 20. 600.000 tons of second hand clothing are recycled each year. According to the German Council on Statistics 12.4 million tons of biological waste have been generated in Germany in 20064 which mostly are used in incineration plants to cool the systems. Many incineration plants have are running on higher temperatures than originally planned because the separation done by consumers is better than originally expected. According to the new legislation in 2007⁵ the biological waste should be used in biogas plants to generate electricity and heat.

- 3 German cooperation on recycling, water and material (BDE), 2008
- 4 DeStatis (2006)
- 5 German Federal Environmental Agency (2007), http://www.bmu.de/files/pdfs/allgemein/application/pdf/hausmuelldeponien_2007.pdf

Because of waste reduction and better recycling quotes the amount of landfilled waste fell drastically from about 560 million tons in 1993 to 160 million tons in 2007. The same development takes place in the construction sector. The working group on recycling management (ARGE KWTB) is a voluntary organization and consists of the member of different construction associations. The voluntary goal to half the landfilled construction materials from 1996 to 2005 was overachieved. Nowadays only 10 % of the construction materials are landfilled in comparison to 50% in 1997.

At home+ we tried to consider the aspects described above to reduce waste generation and focus

on recycling materials respectively materials with high percentage of renewable primary energy. The amount of solid waste from the construction is explained in Chapter 4.4.

4.1 Solid waste during construction

In order to reduce waste during the production of the wood modules, board and length dimensions were used most efficiently. The required veneer plywood was cut from the raw boards of 1.25 x 12.00 x 0.075 m minimising cutting scrap. The double girders and beams of construction timber were ordered to exact dimensions. The connections for the beams of solid construction timber in the ceiling were done in dovetail joints eliminating the need for joist hangers. The

(in Percent from 1991 until 2007) 100 90 80 70 60 50 40 Glas Auminium 30 While sheet Plastics Paper, Pulp and Carton Fluid Carton 20 Total recycling quote 10

Development of Recycling Quotes of Packaging Materials

Figure 20: Development of Recycling Quotes of Packaging Materials

2001

1997

Quelle: Gesellschaft für Verpackungsmarktforschung mbH (GVM), 2009

total cutting scrap was thus reduced to 16%. The stiffness of the frame construction was used optimally so that the required steel bars could be integrated, reducing the required steel further and it was ordered to exact dimensions.

1991

Most of the construction is designed on a high prefabricated level. Therefore the time of construction is comparably low. Also the amount of solid waste is reduced because cutting scrap is kept in the production factory and not on site. Transport materials will be stored and reused once the building will be deconstructed. All other materials used for the construction are separated in glass, paper, wood, plastics, metals and other materials.

2005 2006 2007

4.2 Office Solid waste

The Solar Decathlon office reduces paper waste by reusing unneeded printouts as sketch paper. All data is stored on a network so that information can be transported electronically. Waste separation is carried out based on German standards, which will also be used during the contest in Madrid.

4.3 Home Solid Waste

During the operation of home+ as well as during the competition, home solid waste will be separated according to the German recycling regulations. Since home+ will be placed in Stuttgart in the end, the home solid waste system is based on the German waste regulations. The waste box in the kitchen has four parts for the different waste types: We will separate organic waste, paper, plastics as collected through the "Green Dot system" and other residual waste. Glass will be stored separately. Therefore we have the devices to separate waste and we will adopt it to the local requirements.

4.4 Disposal solid waste

Since 50% of the solid waste in Germany is produced by the building industry, we focused on reusability and recycling aspects when choosing materials. A detailed overview of the waste potentials can be found in chapter 5.3.

As most of the construction is meant to be recyclable, the VIPs are not bonded to the plywood elements. Instead they are integrated between battens which are fixed to the wall so they can be easily removed when the building is disassembled. Moreover, VIPs that are damaged during construction works can be replaced with little effort as long as the final layers are not applied. Our focus was future-oriented materials, especially materials that can be homogeneously disassembled for recycling.

The result is quite positive as most of the materials can be recycled or incinerated. The treatment of

every material can be obtained from Chapter 5.4. In total almost 9 tons of materials can be recycled after disassembling at the end of life stage. Most of the materials can be incinerated and only 17% have to be landfilled. Since we used the methodology of the DGNB the insulation glass is landfilled at the end of life scenario. The insulation glass account for 14% of the 17% landfilled materials. Because insulation glass will probably be recycled and used for glass bottles, this might also be a scenario once home+has come to its end of life. Therefore the percentage of landfilled materials may decrease to only 3%.

[%]	[Ton]
17%	4,76
31%	8,95
52%	14,79
	17% 31%

Table 1: Relative and absolute masses of home+ materials at End of Life Scenario

5 Materials

Compared to the last deliverable we corrected several masses of the building and included also the systems engineering such as the vacuum tube collectors and the PV modules into the calculation.

5.1 Material selection

During the planning stage many different variations of the roof, wall and floor constructions have been analyzed to determine a construction with low environmental impact. As one of the results, the load carrying structure and other board are made out of timber. 50% of the embedded primary energy of the considered construction materials is renewable. All timber used in the building is PEFC certified and therefore obtained from sustainable wood harvest areas.

Another result of the LCA is the consideration of

polyolefin foil for the waterproofing of the building. Compared to polyethylene foil and other alternative waterproofing materials the environmental impacts are much lower. Since the use phase dominates the life cycle as described above, the emphasis on the LCA was put on materials contributing to lower energy consumption during the use phase. This has lead to the consideration of less environmentally friendly materials which on the other hand contribute to lower energy consumption during the use phase and thus gain a better life cycle result.

As insulation material we consider sheep wool instead of the cellulose insulation which was firstly planned. Since sheep wool is a good example of how we considered sustainability on a broader view it will be described in detail.

Firstly sheep wool has a better heat transfer coefficient and reduces the heating losses through the cladding area. Secondly this material was chosen, because there is a worldwide lack of distribution the offer of sheep wool succeeds the demand - for sheep wool which might affect the nature especially in developing countries. In Germany farmers mix wool into their farming area because there is no consumer for it. In Mongolia the German organization for development service (GTZ) designs new selling channels for sheep wool. Herdsman and small farmers do not get adequate revenues from sheep wool. Because of this dilemma, many farmers change their animal stock to goats. This has a great impact on nature as goats are ungulates and cut rootage with their hooves. This causes ground degradation. While constructing sheep wool in home+ we want to raise awareness of a very good utilization possibility of sheep wool. This is also one of the ways of how we try to communication sustainability opportunities.

5.2 Character of enclosure

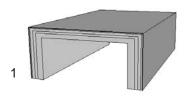
The design is based on architectural and energetic considerations. The starting point is a compact, high-

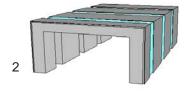
ly insulated volume, with a small surface to volume ratio. This volume consists of four layers (see part 1 of Figure 21). The inner layer of the building, the main structure, is made of solid timber. The material is ideal for two reasons: it provides a light weight structure and it is a very ecological material due to its CO₂ –neutrality.

The second layer is a highly efficient evacuated insulation (vacuum insulation). It provides a very low U-value within a slim wall. This reduces heat losses in winter and thermal gains in summer and creates a high level of comfort.

The third layer is waterproofing to protect the structure. The chosen waterproofing membrane provides a maximum of solar reflectance to also reduce solar thermal loads in summer.

The fourth layer consists of glass/glass photovoltaic modules. This power envelope supplies the building with electrical energy. It is attached with a small gap to the other layers. The active solar photovoltaic layer appears delicate, it hovers above the main structure.





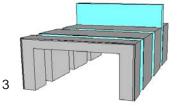


Figure 21: Different Layers of home+

This volume, consisting of the four mentioned layers, contains and frames the interior and is segmented into four building modules (see part 2 of Figure 21). Each building module accommodates another use. The first module contains a loggia, the second a living room, the third a dining room and the last one the bedroom. Secondary rooms are included adjacent to the main areas. For example, the dining-room-module contains a kitchen or the bedroom-module a bathroom.

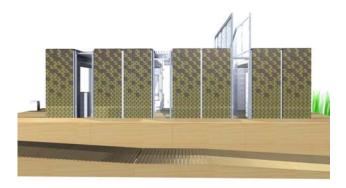


Figure 22: Side view of home+

The modules are positioned with interspaces between them. These gaps are part of the design concept to emphasize the modularity. But the gaps are much more than only design. They are used for lighting, ventilation, pre-heating in winter and passive cooling in summer. They also allow for a visual connection to the outside and offer very different view axes within the building and to the outside by nicely framing the exterior. One of these gaps is higher than the others, containing the "ventilation tower" (see part 3 of Figure 21). Based on traditional principles of climate control, the ventilation tower is a key element for the energy concept as well as for the outer appearance of the building and the interior space.

The modules and the gaps are bound together by the building's power envelope, which consists of photovoltaic elements and thermal vacuum tube collectors. The elements are made of photovoltaic cells of three different colours: gold, bronze and black. The black cells are on the roof for maximum energy benefit. The gold cells are on the facade. These cells are bound together by a gradient-like "pixelation" of bronze cells over the roof-edge.

The enclosure materials were chosen based on their functionality and their ecological footprint. Ecological products in form of renewable materials, materi-

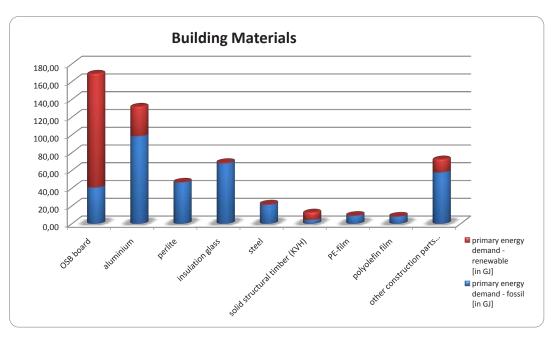


Figure 23: Building Materials with relative primary energy demand [in MJ]

als with higher comfort impact or less ecological impact have been preferred. As one result it can be seen that the materials with the highest mass contribution have a higher renewable primary energy demand and a low than the fossil primary energy demand (see figure 23). Also we do not have any toxic products within the building.

5.3 Maintenance plan

One aspect of sustainability is a long duration of products. The construction materials have a comparably high lifetime. The considered lifecycle of office buildings by the DGNB is 50 years. The following table shows the frequency and the materials that have to be renewed according to the current status. The lifetime of each material is obtained from the German Guideline for Sustainable Buildings published by the Federal Ministry of Transport, Building and Housing⁶. It is a consensus within the building industry and reflects the average lifetime of materials. In reality the materials might have a longer lifetime. The result is one maintenance cycle after 25 years. At that stage the windows should be renewed as well as the insulation (vacuum insulation and sheep wool) and the OSB boards. The maintenance efforts have not been considered in the calculations as it is not sure, how the real lifetime of the prototype of home+ will be. The demand to the construction materials due to the frequent transportation (e.g. fairs and exhibitions) is not comparable to regular material demand and may lead to a lower lifetime.

5.4 List of Materials and Incorporated Energy

A description of the constructed materials can be obtained from the product data sheet overview in the appendix of this report. More inforamation from all datasheets can be found in the Appendix 1: Construction Specifications.

For the calculation of the incorporated energy we

6 Guidline for Sustainable Building by Federal Ministry of Transport, Building and Housing (2002) considered these materials. Since we could not gather environmental information on all constructed materials we considered only the materials with available data in our life cycle assessment calculation and added a security buffer. However, the majority of materials habe been considered as can be obtained from Table 2.

We calculated the incorporated energy in two ways. Firstly according through the faciliated option of the DGNB. In this calculation of the LCA only the construction and the end of life of the constructed materials are considered and the heating unit, in our case the vacuum collectors. Since there is no dataset available for our reversible heating pump, we did not consider the primary energy needed for this device. According to DGNB, when the main parts are calculated over the surface area, the systems engineering and connectors can be assumed with 10 %. Other technical devices can be neglected. The results with this calculation are a total primary energy of the construction of 18.19 GJ/m². Secondly we calculated the value for the construction including also the systems engineering, where data was available (photovoltaics). Since data on tanks, pumps and other devices yet has not been calculated, we added a 30 % buffer to our primary energy demand. The result is 14.12 GJ / m² (see Table 2).

When considering the end of life stage it can be seen, that the timber materials and those with a high calorific value will be thermally disposed (52 %). In this process fossil energy needed for electricity and heat production is substituted. The results are ecological credits. For 1 kWh of produced electricity through thermal incineration the production of 1 kWh is credited. This also applies to recyclable materials such as aluminum, copper and steel. These recycled materials account for 31% of our construction materials. At the end of life scenario the recycling of these materials mostly result in the substitution of primary produced materials. Therefore the materials re-

ceive an end of life credit, because they can be reused and thus substitute primary metal, which does not have to be mined or preproduced. In case of aluminium, which needs a lot of energy during the production process, the end of life credits may be very relevant. In some ways, for example during the production of reinforced steel, only secondary steel is used for the metal product. Therefore at the end of life this reinforced steel would not receive any credits as the input metal was already recycled material. Only a small percentage of products (17 %) have to be land filled (see figure 24). This also shows how much care we took on the ecological qualities of our materials.

List of Materials

Summary				Production	End of L	.ife	Total
material	mass [kg] or area [m2]	primary energy demand [MJ, fossil/kg]	primary energy demand [MJ, ren./kg]	primary energy demand - total [in GJ]	EOL treatment	primary energy demand - total [in GJ]	primary energy demand - total [in GJ]
main construction materials	•	•					
construction wood (FSH)	7.301	13,74	28,36	307,38	thermal usage	-101,07	206,31
OSB board	5.218	7,86	24,58	169,23	thermal usage	-72,24	97,00
aluminium	676	146,25	49,18	132,09	recycling	-90,48	41,61
insulation glass	3.918	17,44	0,23	69,22	landfill	0,18	69,40
perlite	7.267	6,42	0,03	46,87	recycling	0,00	46,87
steel	920	23,56	0,78	22,38	recycling	-12,89	9,50
solid structural timber (KVH)	463	9,60	18,25	12,89	thermal usage	-6,41	6,48
PE-film	130	71,47	0,73	9,36	thermal usage	-0,79	8,57
polyolefin film	93	89,56	2,05	8,51	thermal usage	-0,57	7,95
other construction parts (see below)	2.535			72,75			72,75
linoleum	628	31,31	19,73		thermal usage	-3,83	-3,83
copper	79	28,70	1,43		recycling	-1,92	-1,92
seal	5	115,71	1,08		thermal usage	-0,03	-0,03
mineral wool	18	19,75	0,71		landfill	0,00	0,00
gluten	54	1,74	0,16		landfill	0,00	0,00
single glass	161	17,44	0,23		landfill	0,01	0,01
cellulose insulation	502	3,77	0,75		thermal usage	-6,96	-6,96
wood fiber	168	21,15	9,23		thermal usage	-2,33	-2,33
polyuretan foam	30	86,38	7,47		thermal usage	-0,42	-0,42
cotton fiber	1	13,45	20,40		thermal usage	0,00	0,00
Salthydrate (PCM)	603	10,20	0,12		landfill	0,03	0,03
sheep wool	283	63,00)		thermal usage	-1,72	-1,72
glas vlies	2	69,91	0,98		landfill	0,00	0,00
building systems engineering							
vacuum collector (m2)	7	1.550,71	172,19	11,37	recycling	-3,29	8,08
reversible heat pump							
photovoltaic modules (m2)	99	2779,	5	274,61		0,00	274,61
Buffer (30 %)				227,33		0,00	227,33
Sum construction	<u>28.519,43</u>			<u>1.364,01</u>		<u>-304,71</u>	1.059,30
Sum / m² (75 m²)	380,26			<u>18,19</u>		-4,06	14,12

Table 2: Primary energy demand of materials and home+ during the life cycle stages

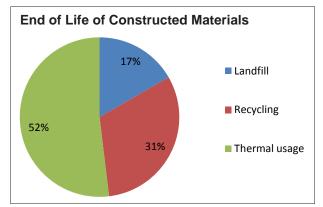


Figure 24: End of Life Scenario for the Mass of Construction Materials

5.5 Energy Payback Time Construction

In Chapter 6 the energy payback time from the photovoltaic devices is calculated and described in detail. We related the energetic yields of the photovoltaic devices to the fossil primary energy needed for the construction. The total fossil primary energy embedded in the construction materials including solar devices is about 612 GJ. This value is divided by the yearly gains multiplied by the electricity grid mix of Germany and Spain respectively. The results are very positive resulting in about 26 years for Stuttgart and 7 years for Madrid.

Energy Production Stuttgart	7445	kWh
Energy Consumption Stuttgart	5323	kWh
Difference	2122	kWh
Difference	23618	MJ
Total Energy Construction	612487	MJ
Energy Payback Time	26	years
Energy Production Madrid	11415	kWh
Energy Consumption Madrid	3819	kWh
Difference	7596	kWh
Difference Supplied Energy Mix	85303	MJ
Total Energy Construction	612487	MJ
Energy Payback Time	7	years

Table 3: Energy Payback Time

6 Solar Facilities

In the design of home+ we aimed for potential multi-usage of components which are an important aspect of a successful architectural integration of solar systems (see Figure 25). The PV System is not only an essential system for such a solar house; it also gives distinction to the face of the building. The manufacturer of the PV-Cells is Sunways AG in Konstanz (Germany). The Manufacturer of the PV glass pieces is ERTEX-Solar (Austria).

The monocrystalline PV modules on the roof have the added function of providing cooling energy at night. The evacuated tube collectors act as the key

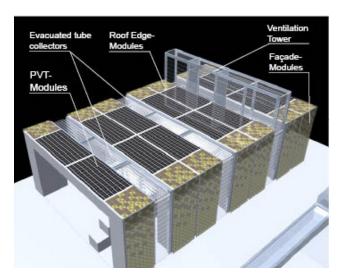


Figure 25: Solar Devices of home+

shading device for the light gaps between the modules. These are manufactured by Augusta solar from Augsburg (Germany). The ventilation tower with the two solar chimneys on both sides of the solar driven adiabatic cooling slot also is a key design feature for the interior of the house.

6.1 Solar Thermal Devices

A solar thermal system of 6 m² of vacuum tubes collector is installed on the roof. The solar heat is stored in a 300 liters tank (solar tank) via an internal heat exchanger. Additionally, in winter when it is necessary, the solar heat can heat a second tank (heat sink tank) in order to prevent freezing (see section on reversible heat pump). The solar tank is equipped with a back-up electrical heater in order to deliver heat during periods with insufficient sun radiation in winter. The dimensioning of the solar thermal system has been done in order to be able to feed the heat sink store in winter when the heat pump is working in heating mode and takes heat out of the heat sink store. The solar thermal devices cover the domestic hot water demand for the location Madrid almost throughout the year (see figure 26).

The annual solar fraction is with 94 % very high.

Only in the winter month between November and

February electrical energy is needed to cover the do-

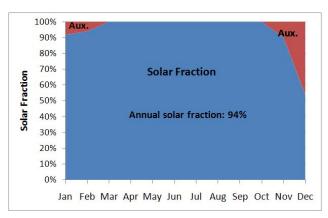


Figure 26: Solar Fraction for Madrid

mestic hot water demand. The annual specific yield of the solar system is 263 kWh/m².

When home+ is installed in Stuttgart, the situation is different, since the solar system has to feed a lot more heat into the heat sink store for the heat pump operation. The annual solar fraction is only 79 %. As it can be obtained from figure 27, auxiliary energy in form of electricity is needed almost throughout the whole year. The solar specific yield of the solar system is similar to the one of Madrid (257 kWh/m²a) since the solar system runs much more in winter at low temperature for feeding the heat sink store.

6.1.1 Energy and Carbon Dioxide recovery time for Madrid

The recovery time is based on our yearly yields from solar thermal modules. Our simulations show a yearly energy yield of 263 kWh/m² for the location Madrid. According to the data sets of the GaBi

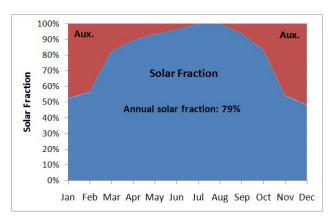


Figure 27: Solar Fraction of Solar Thermal System over one year for Stuttgart

4 Software 0.27 kg Co2-Equivalents (Co2-e) are emitted during the generation of 1 kWh thermal heat from natural gas. The data set used is an average data set for the heat generation from natural gas in Spain. Natural gas is considered as the main combustible for heat production in Spain. The fossil primary energy demand for the generation of 1 kWh thermal heat is 4.32 MJ. The specific thermal energy yield is multiplied the primary energy and Co₂-Equivalents factor described to get the specific yearly savings from the solarthermal devices..

The primary energy and carbon dioxide equivalents needed for the production were estimated, because no detailed data could be given from the manufacturer. The main materials such as floatglas, copper, aluminium and insulation were put into a GaBi model and related to 1 m² of collector area. The results in form of primary energy demand and carbon dioxide equivalents can be obtained from Table 4.

Amount	Unit	Description	Source
263	[kWh/m² a]	Specific Yield	Internal Energy Simulation
0,27	[kg Co2e / kwh]	Co2e Emissions from thermal heat from natural gas	GaBi 4 Database
4,32	[MJ Primary Energy / kwh]	Primary Energy demand for thermal heat natural gas	GaBi 4 Database
70	[kg Co2e / m²]	Savings per year	Calculation: Specific yield * Specific Co2 Factor
1136	[MJ Primary Energy / m²]	Savings per year	Calculation: Specific yield * Specific Primary Energy Factor
110	[kg Co2e / m²]	Co2e demand production solar thermal system	Estimation with GaBi 4 Model
1545	[MJ Primary Energy / m²]	Primary energy demand production solar thermal system	Estimation with GaBi 4 Model
1,57	[years]	Carbon Dioxide Payback Time	Calculation
1,36	[years]	Energy Payback Time	Calculation

Table 4: Energy and Carbon Dioxid Payback Calculation for Madrid

Finally the values calculated for the production are divided by the yearly savings to get the energy recovery time, which is 1.36 years for primary energy and 1.57 years for Co_2 -e.

6.1.2 Maintenance description

The solar thermal modules have to be cleaned once a year with fresh water. The lifetime of the modules is estimated with 25 years, the pumps and the control technique have an expected lifetime of 10 years. The gazed gaps below the collectors can be cleaned normal as all other windows. The only detail is that the wiper has to contain a long rod, due to clean the horizontal windows under the collectors from east and west. All components are easily accessible: the tank is only beyond cubicle door as the pump, the collectors can be demounted from above without change anything only the pipes have to be disconnected.

6.2 Photovoltaic

For electricity generation, a large PV installation of 12.5 kWp is installed on the roof and both west and east facades. Each facade is completely covered with polycrystalline PV modules (3 kWp each). On the roof, two different types of modules are installed.

Small polycrystalline PV modules (1.5 kWp) are located on the east and west sides and large monocrystalline PVT modules (5 kWp) in the middle of the roof. The conversion from DC current to AC current is done with 4 inverters (one for each facade and 2 for the roof). The manufacturer of the PV-Cells and

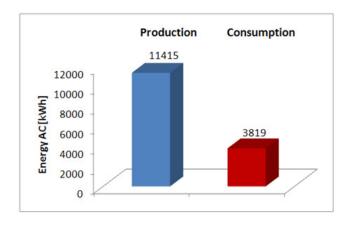


Figure 28:Annual Electrical Balance for Madrid

inverters is Sunways AG in Konstanz (Germany). The manufacturer of the PV glass pieces is ERTEX-Solar (Austria).

6.3 Electrical Energy Balance

The electrical energy balance (see figure 28) is calculated on every minute for the location of Madrid and shows that home+ is an energy plus house. The

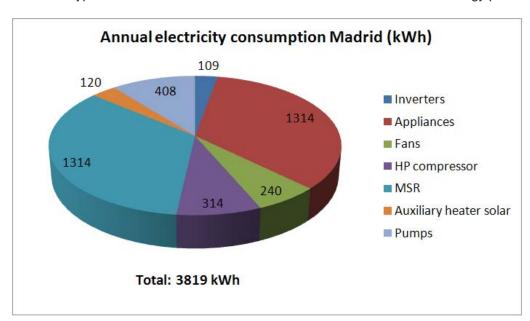


Figure 29: Monthly Comparison of Electric Yield and Consumption for Madrid

yearly electricity yield is about three times higher than the yearly consumption. On the electrical consumer side the appliances and the steering control system (MSR) have the greatest impact with about 35 %. The devices for air conditioning, the pumps and compressors show a relatively low contribution. The electrical devices for the solar systems (inverter and auxiliary heater solar) have a very low impact on the electrical consumption.

Since there is an asymmetry between the PV generation and the we are working on an intelligent way to synchronize the electronic devices with the electrical generation. The goal is to run these devices when we have high PV generation. The washing machine for example starts when the control system recognized high electric generation or low general electricity demand.

6.3.1 Energy and Carbon Dioxide Recovery Time

The methodology for the calculation of the Energy and Carbon Dioxide Recovery time for the PV modules is obtained from the Crystal Clear project and the data that is published by the Energy research

Centre of the Netherlands. The most current information was presented by Mariska de Wild Scholten⁷. Therefore the calculation method and the data from her last presentation is used as the calculation basis and adapted to the home+ installation and the location of Madrid (see Table 5).

The primary energy demand for mono- and polycrystalline modules is 2.860 MJ/m² respectively 2.699 MJ/m². Since we have a thicker glass in our Ertex modules we estimated our modules to be 6 mm thicker than the ones calculated by de Wild Scholten. Data from GaBi 4 Software was used for estimating the primary energy demand of the thicker glass. We calculated with a density of 2500 kg / m³ which lead to 15 kg / m². With a specific primary energy demand of about 17 MJ / kg this adds up to about 270 MJ / m². The data for the module and the additional glass considered is summed up and related to our yearly specific gains.

According to our energy simulations the specific

7 De Wild Scholten, Mariska; Energierücklaufzeiten für PV-Module und Systeme Energy payback times of PV modules and systems; 6. Workshop Photovoltaik-Modultechnik, 26-27 November 2009, Cologne

Description	Unit	Mono	Poly	Source of data
				Mariska de Wild-Scholten, 6. Workshop Photovoltaik-Modultechnik, 26-27 November 2009, Köln; http://www.apollon-eu.org/Assets/20091218- Energier%C3%BCcklaufzeiten%20f%C3%BCr%20PV-
Primary Energy Demand for Production of PV module	[MJ/m²]	2.860		Module%20und%20Systeme%20-%20deWild%20-%20final.pdf GaBi 4 dataset on glass inkluding End of Life (see "Summary of considered
				materials" in the sustainability report), Asumption: Thickness of glass 0.006
Additional primary energy considered for thicker glasses	[MJ/m ²]	270	270	m * density 2.500 kg/m3 = 15 kg/m2
Total Primary Energy Demand for Production of PV module	[MJ/m ²]	3.130	2.969	Addition of the first two numbers
Energy Output per Year	(kWh/(m²*yr)	163	92	energy simulation (see energy report)
Primary Energy Factor Power Grid Mix Spain	MJ/kWh	11,4	11,4	GaBi 4 data set (www.gabi-software.com)
Avoided Primary Energy Demand by PV generated energy	[GJ/year]	1.863		Primary Energy Factor Power Grid Mix Spain * Installed Capacity at home+
Energy Payback Time (Primary Energy Demand)	years	1,68	2,83	Primary Energy Production / Avoided Primary Energy Demand PV

Description	Unit	Mono	Poly	Source of data
				Wild-Scholten,M., presented at 2nd EPIA International
Specific CO2 eq. Emissions for PV produced electricity	g Co2 eq./kWh	29,00	28,00	Thin Film Conference on Nov 12, 2009
				Wild-Scholten,M., presented at 2nd EPIA International
				Thin Film Conference on Nov 12, 2009;
				Assumptions: 1700 kWh/m² a * 75% system performance ratio * 30 years
Generated kWh during lifetime of PV modules	kWh/m²	5.355	5.049	lifetime * 0,14 (mono) respectively 0,132 (poly) efficiency
Total CO2-eq. Emissions for Production of PV modules	kg/m²	155	141	Specific CO2 eq. Emissions * Generated power during lifetime PV
Energy Output per Year	(kWh/(m²*yr)	163	92	energy simulation (see energy report)
Carbon Dioxide Eq. Factor Power Grid Mix Spain	kg Co2 eq./kWh	0,64	0,64	GaBi 4 data set (www.gabi-software.com)
Avoided CO2eq. Emissions by PV generated energy	[GJ/m²]	104	59	Energy Output per year and m ² * specific CO2 Emissions Grid Mix Spain
Payback Time (CO2-eq. Emissions)	years	1,49	2,41	CO2eq. Emissions Production PV / Avoided CO2 Emissions by PV

Table 5: Primary Energy and CO2E Payback Calculation

yields are 163 kWh/(m²*yr) and 92 kWh/(m²*yr) for mono- respectively polycrystalline modules. The energy yields are inducted into the Spanish national grid. The national grid mix for Spain is 11.43 MJ / kWh. Therefore 1 kWh inducted energy from our PV devices substituted 11.43 MJ. The energy payback time can be found by relating the energy gains to the primary energy used during the production phase. The division leads to 1.68 years for mono and 2.83 years for the polycrystalline PV modules.

The carbon dioxide payback time is calculated differently, but also obtained from a presentation of Mariska de Wild Scholten⁸. Firstly the specific carbon emissions per kWh are used to calculate the total carbon emissions that are emitted through the production of a 1 m² module. The specific CO₂-e

8 De Wild Scholten, Mariska; presented at 2nd EPIA International Thin Film Conference on Nov 12, 2009, Munich

Emissions of one produced kWh are 29 g CO2 e for mono and 28 g CO2 e for polycrystalline modules. With the assumptions of de Wild Scholten of a PV lifetime of 30 years, system performance ratio of 0.75, solar irradiation of 1700 kWh/m²a and system efficiency of 0.14 (mono) and 0.132 (poly) the total amount of produced energy during the lifecycle can be calculated. When related to the specific GWP Emissions, the total GWP potential of the production of 1 m² PV can be concluded.

These emissions are related to the yearly electricity yield of the modules. In Spain 0.64 kg $\rm CO_2$ eq. are emitted during the generation of 1 kWh (GaBi 4 data set). The results in table 3 shows that the $\rm CO_2$ payback time for mono crystalline modules (1.49 years) and poly crystalline modules (2.41 years) is very low. Restrictions.

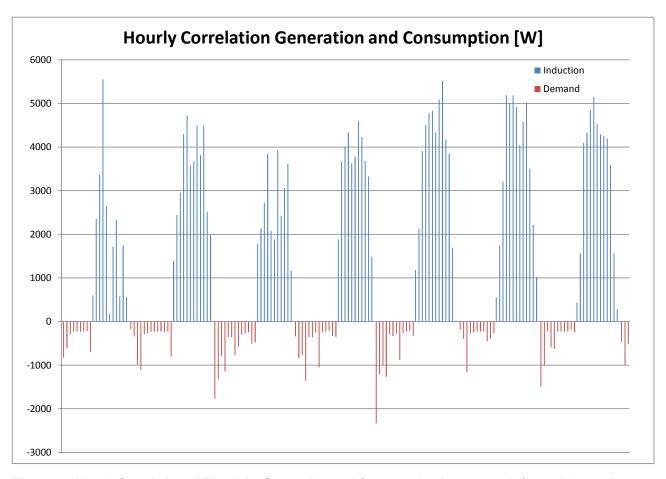


Figure 30: Hourly Correlation of Electricity Generation and Consumption for one week (favorable case)

The results can only be seen as estimation. Different studies use various system boarders for the calculation. In the Crystal Clear study the clean room and the technical building devices have not been considered which also have an impact on the results. If an end of life scenario is also taken into consideration, the payback time is lower. We calculated the correlation for one week in Madrid for an unfavorable case and a favorable case (see Figure 30). While the induction in both cases outnumbers the grid demand it can be seen, that in both cases the hourly comparison between induction and demand is similar.

6.3.2 Temporary Generation-Consumption Correlation

While it is important to know the factor of the total generation against the total consumption of our electrical devices, the temporary correlation between generation and consumption is also interesting to know. As it can be obtained from Figure 31, home+ has an electricity surplus during the day and a demand during the night. However, the electricity induction into the grid mix during the day is very high compared to the electricity demand from the grid at night.

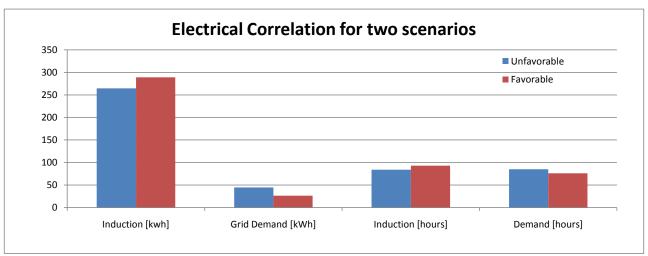


Figure 31: Electrical Correlation for favorable and unfavorable week in Madrid

6.3.3 Maintenance description

The PV modules have to be cleaned once a year with fresh water. The lifetime of the modules is estimated with 25 years. The inverters and the other electrical components should be checked frequently and possibly renewed after 10 years.

7 Appliances

Household appliances

The aesthetic requirement of visible devices as a result of the one room concept of our prototype is also an aspect which affected the choice of the appliances. For more detail see technical data sheets chapter 10.

Freezer/ Refrigerator

Liebherr - ICBP 3166 Premium Plus BioFresh 222 kWh/year / A+ / 120 W

The Volume of the freezer is 207 litres and a temperature of 0°C can be achieved. The refrigerator has a capacity of 57 litres. The BioFresh technology allows keeping the food on best temperature for it, so that some types of food can stay three times longer (according to the manufacturer) than a traditional refrigerator. This is achieved by keeping the interior at

0°C and an ideal humidity. The drawers can be used as safes with high humidity for vegetables and with a low humidity for other food. The interior lighting of the freezer is LED technology. For the contest we can adjust the level to hold the temperature between 1° and 4, 5°C.

Dishwasher

Miele - G1562 SCVI

wattage 0.80 kWh, water 9I / A / 2200 W

The dishwasher has a volume for 9 place settings and is enough for a two person household. The ThermoSpar program reduces energy consumption. Furthermore the energy and water consumption can be balanced out by the loading detection and by supporting the warm water need from the thermal energy system. Every washing program is thus automatically controlled. As a result of the one-room concept of the prototype, we choose appliances which are very quiet; this dishwasher is rated at 44 dB.

Oven

Miele - H5681 BL

1,02 kWh (normal) & 0,95 kWh (hot-air) / A / 3700 W The oven has a capacity of 66 I with a hot-air function and is approximately 10% more efficient than the energy rating class A.

Cooker

Miele - KM5944 7400 W

Energy saved by the inductions system so that only the contact area between the hotplate and the bottom of the pot is activated with the heat. This form of cooking has the advantage that the meal can prepared very quickly because of the good heat transmission of the special pots.

Coffee Machine

Miele - CVA3660 / 2300 W

We know about that this machine is not required

and we know also about the consumption. And maybe this coffee machine is also luxury device but is a part of the basic household equipment for us. So our guest can enjoy an excellent coffee or cappuccino after their dinner. The connected load is only the consumption in case of use, 2-4 times in a normal day. In all other times the stand-by modus is active and the machine has no consumption.

Washing machine

Miele - Softtronic W5841 WPS EcoComfort 55 I Water, 1.05 kWh / A / 2300 W

The special feature this washing machine has is the connection to the warm water circulation, the consumption of a normal washing program is around 0.50 kWh. This is a reduction of the wattage of more than a half by normal use as compared when the machine has to warm up the water with the integrated system. The machine has also an automatic loading detection so that water and deployed energy is balanced. The energy efficiency class is indeed A but by using the solar water, the efficiency is far better.

Clothes dryer

Miele - Softtronic T 8627 WP EcoComfort/ A /1140 W 1,55 kWh at 1400 revolution per minute

The Dryer is a condensation dryer with a heat pump.

By this less than half of the energy required can be used than with traditional dryers. The sensor in the tumble dryer controls everything from moisture levels to drying temperatures making adjustments as needed.

TV

Apple - LED Cinema Display 24" / 212 W
The LED background illumination of the digital LCD display creates a brighter picture and consumes 40% less electricity than standard LCD TVs or plasma displays.

Computer

Apple - Mac Book Pro 17" / 20.7 W

The laptop reacts to different modes and adjusts consumption accordingly:

Mode	100V	115V	230V
Power adapter, no-load	0.21W	0.22W	0.27W
Off	0.69W	0.70W	0.75W
Sleep	1.40W	1.41W	1.47W
Idle-Display off	13.0W	13.0W	13.2W
Idle-Display on	19.5W	19.9W	20.7W
Power adapter efficience	y 88.1%	88.2%	88.4%

Furthermore Apple aims to reduce energy use and waste production through the compact design and a minimum of packaging material. Other comparable products have a consumption of approximately 100 W.

Lighting

For the lighting control system we have use the En-Ocean system. Thereby the lights are switched on through a signal of the wireless switches. The selfpowered wireless sensors without batteries makes the design more flexible and has no unneeded wiring routs which means a lot of material, cost and no unrecyclable waste after his deconstruction. All lighting installations are listed in the following:

- 1x Pendant Lamp, 27 W, energy-efficient lamp
- 1x Floor lamp (Livingroom), 15 W, LED
- 1x Kitchen, 29 W, LED
- 1x Wall-washer (corridor) 1, 54 W, fluorescent
- 1x Wall-washer (corridor) 2, 54 W, fluorescent
- 1x Wall-washer (corridor) 3, 54 W, fluorescent
- 1x Spotlight basin, 15 W, LED
- 6x Light (gaps), 17,5 WI,LED
- 1x Line-shaped light (Ventilation T), 50 W, LED
- 1x Wall-washer (Loggia), 28 W, fluorescent
- 13x Exterior light, 2,5 W, LED

Project Manual, 22 September 2010

8 Description of Technical System

In order to satisfy the domestic hot water, heating and cooling demand several active components have to be added to the basic concept of maximizing passive solar effects. In the following the active systems are described separately even if they function only in cooperation with each other. The PV/T modules are one of the key elements adjacent to the ventilation tower. In the PV/T water is cooled during the night and used for three systems: to re-generate the PCM-ceiling, directly for the radiant floor (free cooling mode) and to lower the temperature in the re-cooling storage tank for the heat pump. The location interface is the heat sink tank, which stores the water for use. Also the domestic hot water preparation is integrated in two systems: for the hot water preparation with a connection to the storage tank, as said, and to heat up the heat sink tank in winter when needed. In the part "Air handling unit with evaporative cooling (RLT)" the connection with the heat pump for fast heating or cooling is described. All these systems are connected together by the building control devices.

8.1 Building Control and Automatization

To control the complex hydraulic system described above a sophisticated building automization is essential. It takes into account weather data gathered outside by our meteorological station and the indoor climate which is monitored by sensors located in the cupboard zone. After the analysis of different values (temperatures: inside, ambient, in various tanks; relative humidity, air quality and others) it chooses an adequate mode for heating or cooling and ventilation. The corresponding devices are turned on or off automatically, mass flow and outlet temperature of the heat pump are appointed, valves and mixing valves are set according to the requirements. For the cooling scenario, this reaction occurs always in the following priorities:

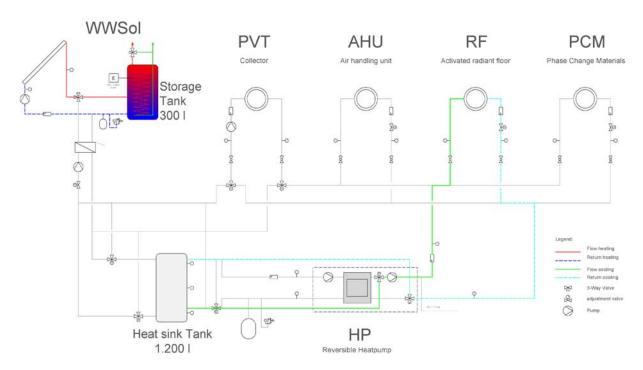


Figure 32: simplified hydraulic scheme; in free cooling mode. (see drawings ME-211 till 225)

- 1. PCM ceiling
- 2. Ventilation tower
- 3. Cross ventilation
- 4. Active ventilation heat recovery
- 5. Low energy cooling system (free cooling mode)
- 6. Indirect evaporative cooling
- 7. Reversible heat pump/ radiant floor

Passive technologies are prioritized and then the technologies that require low parasitical energy. But not only the conditioning systems can be controlled, but also the sun shading elements and the lamella glazing. The windows in the gaps and the openings of the ventilation tower are connected to the building automation system, but have to be operated by hand. The building automation gives a specific visual signal to the inhabitants when the conditions allow the use of the ventilation tower and the inhabitants can decide if they want to use it. The inhabitants can control all these actions also by the touch panel.

8.2 Domestic hot water preparation (WWSoI)

A solar thermal system of 6.60 m² of evacuated

tubes collectors is installed on the roof. The solar heat is stored in a 300 liter storage tank (solar tank) via an internal heat exchanger. Moreover these collectors are used to supply the thermal storage that serves as heat source for the heat pump in winter. During successional cold and cloudy days, the collectors will not be able to both heat up the heat sink tank and provide domestic hot water. In this quite rare case hot water has to be prepared by an electric heating rod.

8.3 Reversible Heat Pump (HP)

A reversible water/water heat pump provides heating in winter and cooling in summer to the house through an activated radiant floor (RF). On the source side, the heat pump is coupled with the so-called heat sink tank (1200 liters). In winter, the HP takes heat out of the heat sink tank and releases it into the house through the radiant floor. As described above, the heat sink tank is powered by the evacuated tube collectors.

In summer, the HP extracts heat from the building (via the radiant floor) and releases it into the heat

sink tank. The HP with its capacity of 2.4 kW is another new development of the home+ SDE-team and a specialized company, intended to be developed further on after the competition.

8.4 Activated radiant floor (RF)

The activated radiant floor (30 m²) distributes the energy from the heat pump in winter and summer. It can also be activated in "free cooling" mode in summer. In this case, cold water is taken directly out of the heat sink tank and pumped to the radiant floor. This free cooling mode is only possible when the temperature in the tank is above 18-19°C. This tank has to be cooled down by radiative cooling through the PV/T modules.

8.5 PV/T Modules (PV/T)

The hybrid photovoltaic and thermal modules have two mains functions: generate electricity (all year long during the day) and cool both heat sink tank and PCM ceiling during the night (summer) by radiative cooling to the clear night sky. Radiative cooling is based on the heat loss over long-wave radiation emission from one body towards another body of lower temperature, which of acts as a heat sink. As there are currently no appropriate PV/T modules on the market which are optimized for this very special use we had to develop them for the SDE. The development went through different 1:1 mock-ups and has been tested to be working very well. Therefore, our new PV/T collector technology is also on the list of components that we will further work on after the competition.

8.6 Phase Change Materials - integrated ceiling (PCM)

The house is equipped with 20 m² PCM ceiling (1 cm thick). The PCM used is a mix of salt hydrate and graphite (85/15%). The graphite increases the thermal conductivity of the material in order to enhance

the heat transfer from the room to the PCM. With a melting temperature of about 22°C, the latent heat of the PCM is used for both cooling and heating purposes and smoothes the temperature variation in the room. A density of around 1500 kg/m³ allows also an increase of the thermal mass in the building (sensible heat). In summer, the PCM ceiling is actively regenerated by radiative cooling through the PVT collectors. This ceiling is another innovative component of our house and is based on research and development work conducted by the HFT for some years already. As the performance of the ceiling solution promises a very high market potential it will also be developed further after the competition.

8.7 Ventilation tower and cross ventilation – passive component

The passive ventilation tower supplies fresh air to the house without mechanical effort when ambient conditions are favorable. When the wind speed is high enough, the ambient air is caught by the tower, cooled through downdraught evaporative process and supplied to the building. The air is exhausted through openings on the gaps with the help of solar chimneys (absorber plates). Additionally, passive cross ventilation can cool down the house during the night through the gaps. We are aware that the ventilation tower which is a key design feature of home+ is a very specific measure for a climate like Madrid (hot and dry). When setting up home+ in different climatic zones, it can be replaced by components customized for the respective climatic conditions.

8.8 Air handling unit with evaporative cooling (AHU)

Whenever it is either too hot or too cold to get fresh air by just opening the windows or the ventilation tower, the mechanical ventilation system is activated. An integrated heat recovery system reduces heat losses in winter and unwanted heat gains

in summer. In summer, additional cooling is provided through indirect evaporative cooling. The exhaust air is moistened as much as possible (>100%) and therefore cooled down before exchanging its heat with the ambient air through the heat exchanger. In extreme conditions, the reversible heat pump can supply cooling or heating to the air system via an additional water/air heat exchanger. This allows a quicker response to the peak loads than the radiant floor.

9 Communication

During the whole planning process high emphasis has been put on the communication of this sustainable construction project. According to the saying "Do good and talk about it" we published our project work through many channels. A very innovative form of advertisement was to show an article about the competition and our contribution at the Metro-TV at the metro stations in Stuttgart. To gain the attention of young people, we made an interview on university radio, which is listened at all universities nearby. We also intend to publish a film and a documentation in many languages together with the other German teams. Also after the competition in Madrid the house is intended to raise awareness to sustainable construction. Further trade fairs together with all four German houses in collaboration with the Federal Ministry of Economics and Technology are planned; one of the key acts of this is the international trade fair "Bau 2011" in Munich. Our house will be used in afterlife as an object for intensive research for new solar technologies, where studies and tests can be done making use of the monitoring technologies already implemented in the house.

10 Product data sheet overview

See following ages:

No.	Product	Description	Producer	Data sheet
05	Metals curtain rail	3114_ curtain rail	www.helmo.de	yes, just german
06	Wood, plastics and composites Roof OSB (oriented strand board) panel	OSB is an engineered wood product formed by layering strands of wood in specific orientations. In appearance it may have a rough and variegated surface with the individual strips lying unevenly across each other.	www.kronoply.de	yes, just german
	Wood construction	STEICOjoists fulfil the demands from house builders for greater clear spans and better dimensional stability, whilst not increasing the size of the cross section of the construction elements.	www.steico.com	yes, german /english
	Wall Wood construction (FSH)	STEICOultralam is a laminated veneer lumber for the highest demands. Is made of multiple 3 mm layers of graded laminated spruce veneers. This disperses knots and irregular growth, producing a practically homogeneous cross section. This construction means that STEICOultralam is highly rigid and dimensionally stable. Powerful engineered timber product for rectangular cross sections. With STEICOultralamR™ elements all veneer layers are glued together longitudinally. Cross laminated STEICOultralamX™ means that one-fifth of the veneers are glued crosswise − improving the lateral bending strength and stiffness of the board.	www.steico.com	yes, german /english
	Floor Parquet floor	Solid wood planks are milled from one solid piece of wood. This is the main difference between them and all types of engineered flooring. Engineered floors are made of three to seven layers of thin wood that are stacked together and then glued. Solid wood planks are milled with tongue and groove on all four sides. This makes possible a time- and cost-saving continuous installation. Slightly bevelled edges on all four sides rule out variations in board height, often referred to as "overwoods", and guarantee an even surface. An exact fitting of the planks is achieved by slightly bevelled and backcut tongues and grooves. Stress grooves on the bottom side of the planks prevent them from cupping or buckling.	www.berthold-holz.de	yes, german /english
	Parquet terrace			yes, just german

No.	Product	Description	Producer	Data sheet
07	Thermal and moisture protection Roof			
	Vacuum-Insulation-Panel (perlite filling)	va-Q-vip B is an evacuated thermal insulating panel with a very low thermal conductivity.	www.va-q-tec.de	yes, german /english
	Waterproofing	This Sarnafil plastic liner (TS 77-20) is a high- quality flexible polyolefin alloy membrane containing advanced polymers, stabilizers, fiberglass and polyester reinforcement.	www.sika.de	yes, just german
		Sarnafil_Dunstrohreinfassung	www.sika.de	yes, just german
		Sarnafil_Verbundblechtafeln	www.sika.de	yes, just german
	Lamb's wool		www.klimalan.com	yes,
	Recycling structural panel	Linirec	www.linzmeier.de	just german yes, just german
	Wall Vacuum-Insulation-Panel (silica filling)	va-Q-vip B is an evacuated thermal insulating panel with a very low thermal conductivity.	www.va-q-tec.de	yes, german /english
	Waterproofing	This Sarnafil plastic liner (TS 77-20) is a high- quality flexible polyolefin alloy membrane containing advanced polymers, stabilizers, fiberglass and polyester reinforcement.	www.sika.de	yes, just german
	Recycling structural panel	Linirec	www.linzmeier.de	yes, just german
	Floor Vacuum-Insulation-Panel (silica filling)	description see wall	www.va-q-tec.de	yes, german /english
	Recycling structural panel	Linirec	www.linzmeier.de	yes, just german
08	Openings / windows (glass)			
	Wall HAHN lamella (ventilation tower)	HAHN S9 Louvre window is applied for optimal adjustable ventilation.	www.glasbau-hahn.de	yes, german /english
	VSG	It consist of at least two single panes of glass with are joined togehter by a strong, tear-resistant polyvinylbutyral film (PVB).	www.bgt-brette.de	yes, german /english
	Insulated glass		www.glastroesch.de	yes, just german

No.	Product	Description	Producer	Data sheet		
11	Equipment Cooker	Miele KM 5944	www.miele.de	yes,		
	Oven	Miele - H5681 BL	www.miele.de	just german yes, just german		
	Cooker Hood	Miele - DA420 V mit Umluftbetrieb	www.miele.de	yes,		
	Coffee Machine	Miele - CVA3660	www.miele.de	just german yes, just german		
	Freezer / Refrigerator	Liebherr ICBP 3166 Premium Plus BioFresh	www.liebherr.com	yes, german /english		
	Dishwasher	Miele G1562 SCVI (integrable)	www.miele.de	yes, just german		
	Washing machine	Miele Softtronic W 5841 WPS EcoComfort	www.miele.de	yes,		
	Clothes dryer	Miele Softtronic T 8627 WP EcoComfort	www.miele.de	just german yes, just german		
	LCD-TV	Connect 32 Media Full-HD+100	www.loewe.de	yes, german /english		
	Soundboard	Soundboard 300 - 40PW The purSonic Soundboards satisfy all individual desires. Soundboards are available in a wide variety of different lines to suit the different applications and uses. So you can design your building programme just as you please.	www.pursonic.com	yes, just german		
	Speaker system	Speaker system for stereo or surround sound. Perfect functionality in combination with Auro audio system.	www.loewe.de	yes, german /english		
	Apple	17-inch MacBook Pro	www.apple.de	yes, just german		
	Wireless	Netgear DG834GB Wireless ADSL Firewall Router	www.kmelektronik.de	yes,		
	TV Live Media Player	WD TV Lieve Mediaplayer LAN/HDMI	www.kmelektronik.de	just german yes,		
	Network Direct Attached Storage	1000GB IOCELL NetDisk NAS USB	www.kmelektronik.de	just german yes, just german		
12	Portable generators	PRAMAC E 5000	www.pramac.com	yes, german /english		
12	Furnishings Oak (work plate kitchen, table, bed)	Oak wood is hard and heavy, but nonetheless elastic. The heartwood is very resilient, and durable even under water.	www.musterkiste.com	yes, german /english		
	Stainless steel foot	Stainless steel is considered one of the most classic and noble materials for use in creating ageless furniture design. Especially elegant is the combination of stainless steel with selected solid wood	www.haseform.de	yes, german /english		
	Curtain	Mira x Plain 6882 Col. 61	www.mira-x.ch	yes, just		
	Felt	Woolfelt_Flame retardant (B1 DIN 4102), an eco-friendly natural product	www.daimer-filze.com	german		
21	Fire suppression	Minimaxol-fire drencher_WS 6 nG	www.minimax.de	yes, just german		

22	Diametria -			
22	Plumbing Pumping equipment	SOLOLIFT + CWC 3	www.grundfos.de	yes, just german
	Drinking water supply	Grundfos Hydrojet	www.grundfos.de	yes, just german
	Delivery pump	Grundfos ALPHA 2 25-60 180	www.grundfos.de	yes, just german
	PVT collector	Grundfos MAGNA 25-60	www.grundfos.de	yes, just german
22	Water storage tank	The ROTEX Sanicube is a combination of hot water storage tank and instantaneous water heater. This means that the actual heat is not stored in the domestic water itself, but in the storage tank water which is clearly separated from it. The volume of the stored domestic water is relatively small and is 19-29 litres, depending upon the type of storage tank. On the other hand, the total storage tank volume is 300 and 500 litres. This amount of heat that can be stored and also removed is accordingly large.	www.rotex.de	yes, german /english
	Electric heating element		www.rotex.de	yes, just german
	Duct	AFR 150 _ Flexible singel-grooved aluminium duct DIN 150, to be used as connection to the main duct	www.maico.de	yes, german /english
	Flush switch	Sigma50	www.geberit.de	yes, just german
	Toilet brush set	VOLA T33	www.vola.com	yes, just german
	Toilet roll holder	VOLA T12, T13	www.vola.com	yes, just german
	One-handle mixer	VOLA 500T1 and 590	www.vola.com	yes, german /english
	Basin	ZEROX 450	www.blanco.de	yes, just german
	Three-hole mixer (kitchen)	VOLA KV4	www.vola.com	yes, german /english
<u> </u>	1			

No.	Product	Description	Producer	Data sheet
23	HVAC (heating, ventilation			
	and air conditioning)			
	Air conditioning appliance		www.polybloc.ch	yes, just german
	Cooling ceiling	Varicool UNI	www.zent-frenger.de	yes, just german
	Heat pump	Heat pump Typ WK 3	www.schwaemmle-gmbh.de	yes, just german
	Brine-air heat exchanger	EW-K 200 _Brine-air heat exchanger for brine earth heat exchanger, DN 200. Application examples: Single family-unit houses in combination with room air systems with heat recovery, Low energy and passive energy houses up to 200 m ² .	www.maico.de	yes, german /english
	Expansion vessels for heating, cooling and solar applications	reflex N _for heating and chilled water applications reflex S_for solar, heating and chilled water applications	www.reflex.de	yes, german /english
	Floor Floor heating	SpeedUp Eco	www.danfoss.de	yes, just german
	Sensor Cable Temperature Sensor	TF25 (PT1000-1/3DIN)_Cable sensor for temperature measurement in gaseous media of heating, cooling or airconditioning systems (e.g. fresh air/ exhaust air ducts). Designed for locking on to control and display systems. In conjunction with an immersion pocket, also suitable for temperature measurement in liquid fluids(e.g. pipeline systems).	www.thermokon.de	yes, german /english
	Contact Temperature Sensor	AF25 (PT1000-1/3DIN)_Designed for locking on to control and display systems. For measuring temperature on pipes and arched surfaces. Contact temperature sensor VFG54 includes connection housing and clamp.	www.thermokon.de	yes, german /english
	Pendulumsensor for relative humidity	FTP VV_Pendulum sensor for sectional measurement of relative humidity (model FP), respectively for sectional measurement of relative humidity and temperature (model FTP) in large rooms (e.g. openplan offices, galleries, production plants etc.) Designed for lockingon control and display systems.	www.thermokon.de	yes, german /english
	Room Pendulum Temperatur Sensor	RPF 100 (PT1000-1/3DIN)_Pendulum sensor for sectional temperature measurement in large rooms (e.g. openplan offices, galleries, production plants etc.). Designed for locking on to control and display systems. Model RPF40 is specially designedas a radiation sensor withlongtime constant for radiant heaters.	www.thermokon.de	yes, german /english
	Combined room sensor CO2/Temperature	WRF04 CO2 VV LCD_The sensor is designed for the detection of carbon dioxide (CO2), temperature and relative humidity (optionally) in living spaces. Wherever people are staying in rooms, the CO2 concentration is an evident indicator for the room quality.	www.thermokon.de	yes, german /english

No.	Product	Description	Producer	Data sheet
	Centrifugal fans, single inlet	The scroll housing of single inlet centrifugal fans is open on one side. The characteristic features of this ebm-papst product series are high efficiency, a low noise level, relatively small air flow with a high increase in static pressure, robust design and space-saving application.	www.ebmpapst.com	yes, german /english
25	Wind Direction Sensor compact Windsensor compact	Wind Direction Sensor Compact 4.319.00.161 0-10 V_ Measuring value transmitter for the measurement of the horizontal wind direction, with analogue output signals. Windsensor Compact 4.35190.00.161 0-10 V_ Measuring value transmitter for the measurement of the horizontal wind velocity with digital output signal.	www.thiesclima.com	yes, german /english
		Hygro-Thermogeber compact_Instrument designed for measurement of temperature and air humidity. The data are output as electrical analogue signals. The transmitters consist of a capacitive humidity element and a Pt 100 resistance thermometer. For outside mounting we recommend the use of the weather- and thermal radiation shield.	www.thiesclima.com	yes, german /english
		Pyranometer GSM 10.7_ Electrical measuring instrument to measure the global radiation. The measurement is coscorrected.	www.thiesclima.com	yes, german /english
	Precipitation Monitor	Precipitation Monitor_The instrument serves for detecting start and end of precipitation. It can be used as status indicator or as signal transmitter for the controlling of security devices against precipitation such as windows, venetian blinds, awnings.	www.thiesclima.com	yes, german /english
	Wireless Ceiling Multi Sensor 360°	SR-MDS_The battery and wireless ceiling multi sensor is designed for movement detection in room or office spaces. In addition, the sensor detects the ambient brightness in rooms. Radio telegrams according to EnOcean standard. With integrated solar energy storage for maintenacefree operation.	www.thermokon.de	yes, german /english
	Light Sensor	L104/L165_Sensor for light measurement in rooms and offices (model L104, specially for wallmounting) or in outdoor areas (model L165). Designed for lockingon control anddisplay systems. The sensors have an integrated colour filter (green filter) which isadapted to the sensitivity of human eyes.	www.thermokon.de	yes, german /english
	Wireless Key Card Activeated Switch	SR-KCS _The SRKCS is a wireless, selfpowered transmitter which is designed to accept room or security card keys.	www.thermokon.de	yes, german /english

No.	Product	Description	Producer	Data sheet
	Photovoltaic collectors			
31-00				
26	Bath and kitchen	Slim-Line _ The new 3-chip-led bar with adjustable colour temperature and Ra 95	www.richter-lt.de	yes, german /english
	Ventilation Tower	X-BAR-HIP68-DC-500-RGB_LED Lighting	www.richter-lt.de	yes, german /english
	Living room	High-Voltage Pendant Lights_ Pendant light can be positioned practically anywhere on the ceilling.	www.steng.de	yes, german /english
	Floor lamp, sleeping, living	High-voltage free-standing lamps_ A free-standing light with a moveable shade that allows light to be pointed in various directions.	www.steng.de	yes, german /english
	Exteriors	ORILED_LED wall-embelt	www.zumtobel.com	yes, just german
	Gap	MINIPLANO_3 accent LED 3200K 230V 3,6W	www.zumtobel.com	yes,
	Corridor	MIREL_ Wallwasher	www.zumtobel.com	just german yes, just german
	Roof Solar Cells	The monocrystalline Sunways Solar Cell is now provided with three energy feeder units (busbars) instead of two. This reduces the losses during the power generation in the solar module. This new contact design, in combination with the constant increase in the efficiency of the Sunways Solar Cells, results in extremely powerful and surface-effective solar modules.	www.sunways.de	yes, german /english
	Well	Coloured design cells from Sunways combine power generation and aesthetics. The cells are available in emerald, gold, bronze and silver and therefore enable unique, customised PV system designs.	www.sunways.de	yes, german /english
	Wall Solar Cells	Coloured design cells from Sunways combine power generation and aesthetics. The cells are available in emerald, gold, bronze and silver and therefore enable unique, customised PV system designs.	www.sunways.de	yes, german /english
	Inverter	Sunways Solar Inverter AT 5000, AT 4500, AT 3600, AT 2700_ Thanks to HERIC® topology with innovative FP switching, the new AT Solar Inverters from Sunways achieve a constant yield at changing irradiation levels and temperatures. And that even across technological limits.	www.sunways.de	yes, german /english
		Certificate of compliance	www.sunways.de	yes, german /english

home+			

12.11 Public Tour - Contents

- 1. Stations of the Public Exhibition Tour
- 2. Team Uniforms

Public Tour

The site is divided into two levels. There is a waiting level and there is a higher level, where the house is actually placed. In the waiting level, the visitor gets some basic information (flyer, available in Spanish, English, German and Italian) about the house, and there are some sitting possibilities. A special feature of this flyer is that there's a survey added, which can

be filled in during the waiting. Some shadings in this waiting area are planned, but it is still in discussion about form and placement.

The house tour is planned for 6 persons per tour.

The tour will be offered in spanish, english and german all the time. Therefore, we will need 3 Spanish native speaker, provided by the SDE Organization.

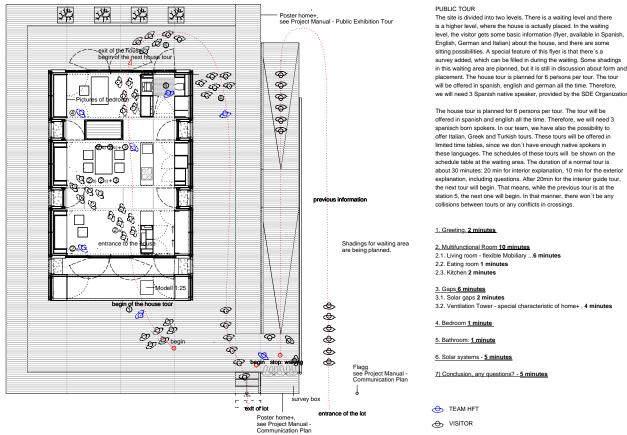


Figure 1: Masterplan of the Public Exhibition Plan

In our team, we have also the possibility to offer Italian, Greek and Turkish tours. These tours will be offered in limited time tables, since we don't have enough native spokers in these languages. The schedules of these tours will be shown on the schedule table at the waiting area. The duration of a normal tour is about 30 minutes: 20 min for interior explanation, 10 min for the exterior explanation, including questions. After 20min for the interior guide tour, the next tour will begin. That means, while the previous tour is at the station 5, the next one will begin. In that manner, there won't be any collisions between tours or any conflicts in crossings. See

Stations of the Public Exhibition Tour

1. Greeting - 2 minutes

Figure 1: Public Exhibition Plan.

The student presents himself, and explains in short sentences the main idea of the house, its purpose and its main characteristics like modularity and the glass-covered gaps. He also asks the visitors to wait until the end of the tour for making questions. A model is available for blind in the exterior furniture

in scale 1:25, so that they can imagine the house through the tactile sense. Next, he asks the visitors to enter with him into the house.

2. Multifunctional Room - 10 minutes

The student enters the house through the door of the terrace with the group. The multifunctional room is a room for eating, reading, cooking, living and another similar activities. The student explains generally the idea and design concept of the multifunctional room.

2.1. Living room - flexible Mobiliary - 6 minutes

2.1.1. He turns the TV on.The student plays a short video on (available in English, German and Spanish). The video shows shots of the planning and construction phase of the house until its execution in Madrid. Any linguistic explanation in the video will be avoided, so that the video doesn't distract the visitors. 2 minutes

2.1.2. The seating can also be arranged as the user wishes. The stoles are hidden under the couch in the first module, and they are moveable and can be used in all the house interior and exterior. 1 minute

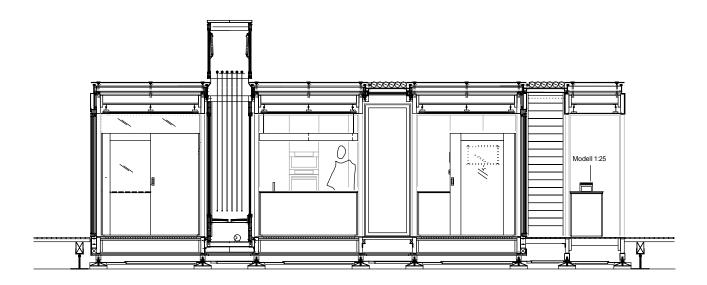


Figure 2: Exhibition Elevation, model for blind

2.1.3. For the different light simulations of the different activities, the house is provided with a touch panel, where the lights of the whole house are controlled. The user doesn't only get an easy system for the diming the lighting in the house, he also gets the information of outside temperature, energy gain of the house and how much he earns with the energy feed into the grid. 3 minutes

2.2. Eating room - 1 minutes

In the eating room, the eating table will be set for 4 people. The extension table will be placed in the bedroom, as a work office during the day.

2.3. Kitchen - 2 minutes

The student explains some energy efficient devices used in the kitchen. He explains also that the house can be arranged in different ways, so that the price of the house varies depending on the equipment.

3. Gaps - 6 minutes

3.1. Solar gaps - 2 minutes

Moving along, the student stands in front of the Ventilation Tower shows the public the glass covered gaps. He explains their function, system and measures for the technical appliances (such as sun protection).

3.2. Ventilation Tower - special characteristic of home⁺ - 4 minutes

The special gap developed for the climate in Madrid, the Ventilation Tower, functions differently than the other solar gaps. The system consists of two different points, the Ventilation Tower itself and the solar chimneys. Both principles will be explained to the public with easy examples of the daily life, where these mechanisms can be found. The different uses of the Ventilation Tower will be also explained, like its modification for coastal regions.

The Ventilation Tower also provides illumination and it is also used as an architectural element for the division between multifunctional room and private room-bedroom. The student asks the public to stay or come back at night because of the special lighting design of the house: All the gaps being illuminated and the Ventilation Tower simulates the changes of temperature, from cold to warm.

4. Bedroom 1 minute

Passing along the Ventilation Tower, is there is any

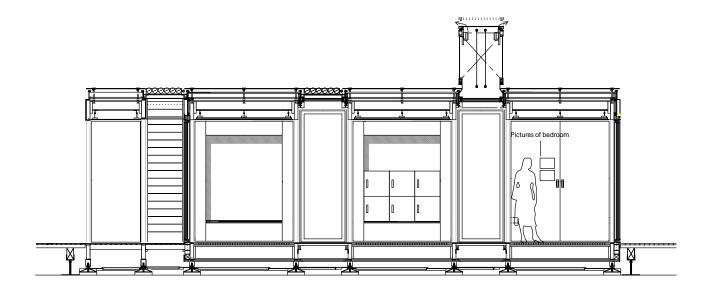


Figure 3: Exhibition Elevation, pictures showing the mechanism of the bed

handycapped or disabled person, the decathlete will give any help through this passing.

In the bedroom, the student shows the possible daily use of the bedroom as a personal office. The bed is stored at that moment in the board. He shows pictures, (see figure 3) of the night situation with the bed in the bedroom, with the possibility of rolling the bed outside and sleeping under the open summer sky.

For the Jury Tour, the bed will be taken out of the cupboard and placed in the bedroom, to demonstrate its mechanism.

5. Bathroom - 1 minute

The student goes outside and the next tour begins.

He opens the bathroom door from the outside and he enters to the bathroom, meanwhile the public stays outside and watches in the interior through the

glassing. The student shows the public the equipment of the bathroom such as the water saving consumers. When he finishes, he gets out of the house through the outside door and closes it.

6. Solar systems - 5 minutes

The solar systems will be shortly explained. As special feature here, the night sky radiation. The photovoltaic facade is a special eye-catcher of the project. For this facade, the team decided to use a new technology of photovoltaic with a patterned optic, to make the facade more dynamic.

7. Conclusion, any questions? - 5 minutes

A summary of the most important points of the project is exposed. The student asks the public for questions and answers them. If there are further questions, the student will indicate the interested visitors that his collegues at the waiting area can answer any other concerns.

As said, the visitor got an information flyer with a survey at the waiting area. At the end of the tour, this survey can be turned back to the decathlete or be deposit in the survey-box or the mailbox. In this manner, the team hopes to find out more on how big is the acceptance of the house, and win some impressions and so improve the qualities of the house for the serial production in the future.

Team Uniforms

Taking into consideration our corporate design, we wanted to take the same or similar colours for the uniforms, so our brand can be distinguish even in our outfits. We wanted a fresh and clean look that stay in balance with the house. Our clothings are soft, and breathy, a little touch of cassual and modern. A summer look in bright colours, but still having in mind a city outfit, taking into consideration that the team have to be well enough dressed for a presentation just like the house tour is.

1. Construction uniforms:

This uniform will be used during the construction phase and it has special requirements in contrast to the contest uniform. Besides of the following description, it will also consists of a helmet, steel shoes and construction gloves.

- Men's construction uniform: t-shirt with long sleeves or chemise, with overalls or trousers.
- Women's construction uniform: t-shirt with long sleeves or chemise, with overalls or trousers.

2. Contest uniforms:

It will be different from the construction uniform, since it has other requirements than the construction uniforms. We think the design of the contest uniform should reflect our concept of ecological and future living to the visitors.

- Men's contest uniform: t-shirte, of cotton. The trousers are made of linen, in grey colour, additionally a cap as sun protection
- Women's contest uniform: top (or t-shirt, optional) of cotton. The trousers are made of linen, red colour, adittionally a cap as sun protection





T-shirt front T-shirt back

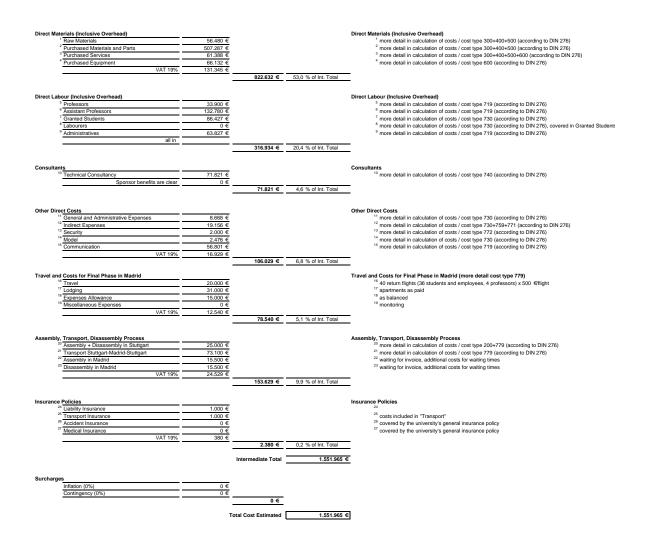
home+			

13. Cost Estimate and Project Financial Summary

- 1. Cost Estimate
- 2. Project Financial Summary

Cost Estimate and Project Financial Summary

1. Cost Estimate



2. Project Financial Summary

st type	sub- essembly	description	Costs estimated schedule Madrid	mass	device	unit price in € per abundance	total net price in €	Cost Netto %	total price in € incl. 19% tax (as appropriated, sponsor benefits are clear)	Cost Brutto
0		site / property						0,00 €		0,
	111	Site value Land value					0,00		0,00	
		Costs for reuse Stuttgart							ļ	
		Incidental site costs					0,00		0,00	
	121	Surveying Charges Costs for realization Stuttgart								
		Reuse Stuttgart								
	122 123	Court Fees Notary's fees								
		Reuse Stuttgart								
	124 125	Estate agents commissions Property transfer tax								
		Reuse Stuttgart							ļ	
	126 127	Valuations and site inspections Permit fees			ļ					
		Realization Stuttgart Reuse Stuttgart								
	128	Soil regulation and boundary settlement								
	129	Incidental site costs, other items			ļ					
l		Discencumbrance					0,00		0,00	
	131 132	Compensation Redemption for real rights		1	ļ					
	139	Disempursement		ļ	L					ļ
0		Preparation and Infrastructure						8.403,36 €		10.000
ı		Clearance for replication to competition					4201,68		5000,00	
	211	Protective measures								
	212 213	Demolition Environmental remediance								
	214	Site surface clearance Realization Stuttgart								
		Replication		1,00	pausch.	4201,68	4201,68		5000,00	
	219	Clearance, other items								
		Public Development for replication to competition			1		4201,68		5000,00	
	221	Drainage and sewerage systems Replication Stuttgart		1,00	pausch.	1680,84	1680,84		2000,20	
		Realization Stuttgart							-	
	222	Water supply Reuse Stuttgart		1,00	pausch.	1680,84	1680,84		2000,20	
		Realization Stuttgart								
	225	Electricity supply Reuse Stuttgart		1,00	pausch.	420,00	420,00		499,80	
	226	Telecommunication Reuse Stuttgart		1,00	pausch.	420,00	420,00		499,80	
		Realization Stuttgart								
	228 229	Garbage removal Public development, other items								
		Private Development					0,00		0,00	
		Compensations					0,00		0,00	
		Replacement for parking spaces/tree population					-,			
		Change arragements					0,00		0,00	
	251	Contingencies					0,00		0,00	
	252	Outsourcing		ļ						
)		Building-construction works						460.779,59€		502.383
		Foundations					88638,63		90990,97	
	321	Soil improvement								
	322	Shallow foundation Stud link bearing 6/24 SteicoJoist 2,045m		33.00	Call.	0.40	200.04		224.22	
		Partial sponsorship on beam	1	33,00 33,00	Stk Stk	8,18 8,92	269,94 294,36		321,23 294,36	benefit (clear)
		Stud link bearing 6/24 SteicoJoist 1,05m Partial sponsorship on beam	1	11,00 11,00	Stk Stk	4,20 4,58	46,20 50,38		54,98 50,38	benefit (clear)
		Joist hanger and nails for stud link bearing	1	1,00	pausch	558,22	558,22		558,22	benefit (clear)
		Wooden beam substructure for terrace	1	13,00	m²	400,00	5200,00		6188,00	
		Height adjustable column base - terrace	2	55,00	Stk	30,00	1650,00		1963,50	
		Height adjustable column base - building	2	1350,00	kg	2,20	2970,00		3534,30	
	324	Subsoil and base slabs Cellulose insulation between bearing replaced lamb's wool	1	14,40	m³	25,00	360,00		428,40	1
		Partial sponsorship on insulation OSB panel (1x3,0cm)	1 1	14,40 54,00	m³ m²	35,00 9,80	504,00 529,20		504,00 629,75	benefit (clear)
		OSB panel (1x3,8cm) - bottom gap OSB panel (1x2,2cm)	1 1	20,00 65,00	m² m²	30,00 6,85	600,00 445,25		714,00 529,85	
	neu neu	Subcarrier base KVH 8/24 Subcarrier base KVH 6/10	1 1	0,52 0,20	m³	485,00 280,00	254,14 56,00		302,43 66,64	<u> </u>
		Vacuum insulation (VIP) with silika-filling (1x2,4cm) Production of the wooden structure	2 2	55,00 75,00	m² m²	90,00 615,79	4950,00 46184,25		4950,00 46184,25	benefit (clear) benefit (clear)
		Material for production of the wooden structure	2	1,00	pausch	7000,00	7000,00		7000,00	benefit (clear)
	325	Boardings Terrace covering (oak)	1	188,00	m²	47,14	8861,79		8861,79	benefit (clear)
		Terrace clamps and bolts Parquet flooring (oak)	1 1	1,00 49,00	pausch m ²	1500,00 50,10	1500,00 2454,90		1500,00 2454,90	benefit (clear) benefit (clear)
		Personnel cost for floor cover Fa. Häußermann	3	1,00	pausch	3900,00	3900,00		3900,00	benefit (clear)
	326 327	Waterproofing of structure Drainage								

	\$ incl. 1976 tax (or proportion) country to the cou
Lamasia demo burthe Diseaschants Pagle 2-5 pag. 1	2155,6,3 benefit (clear) 4123,35 3011,88 benefit (clear) 44952,67 benefit (clear) 3493,27 benefit (clear) 3493,25 benefit (clear) 20059,12 1580,3,55 benefit (clear) 704,00 benefit (clear) 2077,93 16550,00 benefit (clear) 1585,00 benefit (clear) 825,00 benefit (clear) 825,00 benefit (clear)
Participatementary to read 1	2155,6,3 benefit (clear) 4123,35 3011,88 benefit (clear) 44952,67 benefit (clear) 3493,27 benefit (clear) 3493,25 benefit (clear) 20059,12 1580,3,55 benefit (clear) 704,00 benefit (clear) 2077,93 16550,00 benefit (clear) 1585,00 benefit (clear) 825,00 benefit (clear) 825,00 benefit (clear)
Production of the weeds tractions 2 77,00 m² 63,79	44952,67 benefit (clear) 34793,22 20059,12 20059,12 1580,55 benefit (clear) 704,00 benefit (clear) 2077,93 16650,00 benefit (clear) 8850,00 benefit (clear) 1344,46 1349,46
130	20059,12 15803,55 3444,45 benefit (clear) 704,00 benefit (clear) 207,93 10550,00 benefit (clear) 10550,00 benefit (clear) 10550,00 benefit (clear) 10550,00 benefit (clear) 10540,00 benefit (clear) 10540,00 benefit (clear)
The parting (bear) 19	20059,12 15803,55 3444,45 benefit (clear) 704,00 benefit (clear) 207,93 10550,00 benefit (clear) 10550,00 benefit (clear) 10550,00 benefit (clear) 10550,00 benefit (clear) 10540,00 benefit (clear) 10540,00 benefit (clear)
Seption State Septiment Control Section 19	1580.55 benefit (clear) 3446.45 benefit (clear) 704.00 benefit (clear) 2077,93 16650,00 benefit (clear) 5166.00 benefit (clear) 81650,00 benefit (clear) 1346.46 139.74
Window advantable, weighted learn 3	704,00 benefit (clear) 2077,93 16550,00 benefit (clear) 5156,00 benefit (clear) 8856,00 benefit (clear) 932,00 1349,46 719,71
Westproducy State 1744,155	1655,0,00 benefit (clear) 5166,00 benefit (clear) 8856,00 benefit (clear) 928,2,0 1349,46 719,71
Membrate country (solidor) contributed 2 1,475 art 190,00 1544,00	5166,00 benefit (clear) 8856,00 benefit (clear) 928,20 1349,46 719,71
### Plant String the secure installation de Chrom is Lineareuric Use: ### Plant String the secure installation de Chrom is Lineareuric Use: ### Plant String the secure installation de Chrom is Lineareuric Use: ### Plant String the secure installation de Chrom is Lineareuric Use: ### Plant String the secure installation de Chrom is Lineareuric Use: ### Plant String the secure installation of Chrom is Lineareuric Use: ### Plant String the String String Use: ### Plant Strin	928,20 1349,46 719,71
### Process State Process	719,71 578,34
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188	
See access (1981)	
Internal Walfs	4733,82 4733,82
141	
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Giss will workholde, bed and behaviors 2 5,25 m² 700,00 6300,00	400 00
242 Internal Column 244 Class offices and elements 24	465,89 7497,00 5355,00 benefit (clear)
### Internal doors and windows Class skilling doors (storked glass)	3700,00 benefit (clear)
346 Perplaint cited wall units for bathroom 2 1.00 51k 300,00 300,00 150,00	
Integrated wall units for warfroben	1785,00
Floor and cellings	357,00 178,50
351 Floor structures	
S52 Floor surfaces	17136,00
PCM (plaste change material colling 2 36,00 m² 300,00 3600,00	
Roofs S1676,68 S	4284,00 12852,00
Signature Sign	12032,00
Waterprofiling SIAA 2 57,43 m² 33,58 3292,50 Insulation with 38 slope 2 57,43 m² 120,00 6891,60 6891	55379,31
Insulation with 3's slope 2 57,43 m² 120,00 6891,60 Vacoum insulation (VPI) with perilise-filling (122cm) 2 55,00 m² 50,00 2750,00	2294,91
Cellucie insulation between bearing replaced lamb's wool 1 9,60 m³ 25,00 240,00 Partial sponsority por insulation 1 9,60 m³ 25,00 336,00 OSB panel (24,2cm) 1 66,25 m² 6,85 451,81 OSB panel (22,2cm) 1 55,00 m² 15,00 835,00 Production of the woods structure 2 42,00 m² 15,00 835,00 Production of the woods structure 2 42,00 m² 15,00 2850,18 362 Rodflight, ref genering 2 11,00 m² 200,00 2240,00 Glass ceiling, gap 2 11,00 m² 200,00 2240,00 Glass ceiling, gap 2 10,00 m² 1300,00 8712,00 Closed roof panel 2 2,00 m² 500,00 1000,00 361 Rodflight, softer items 2 2,00 m² 500,00 1000,00 362 Rodflight, other items 369 Rodflight, other items 369 Rodflight, other items 371 General purpose fittings 4 1,00 51k 10000,00 371 General purpose fittings 3 372 Special purpose fittings 3 372 Special purpose fittings 3 373 Structural fittings other items 3 374 375	8201,00 2750,00 benefit (clear)
Partial sponsorchip on insulation 1 9,60 m² 35,00 336,00	469,15 50,40 285,60
Production of the wooden structure	336,00 benefit (clear) 540,04
362 Rooflights, roof openings 2 11,20 m² 200,00 2240,00 2340	981,75 25863,18 benefit (clear)
Class celling, gap 2 6,60 m² 120,00 871,00 Closed root panel 2 2,00 m² 150,00 1000,00 361 Root coverings 2 2,00 m² 500,00 1000,00 364 Root finning 2 2,00 m² 2,00 m² 2,00 369 Root, other items 2 2,00 m² 2,00 371 Structural fitments 2 2,00 2,00 372 General purpose fittings 2 2,00 2,00 373 Special purpose fittings 3 2,00 2,00 374 Special purpose fittings 3 3,00 3,00 375 Structural fittings other items 3 3,00 3,00 376 Structural fittings other items 3 3,00 4 3,00 377 Structural fittings other items 3 3,00 4 3,00 388 Structural fittings can bladded activities 3 3,00 4 3,00 2,00 389 Structural fittings can bladded activities 3 3,00 4 3,00 2,00 380 Structural fittings can bladded activities 3 3,00 4 3,00 2,00 381 Structural fittings can bladded activities 3 3,00 4 3,00 2,00 3,00 381 Structural fittings can bladded activities 3 3,00 4 3,00 3,00 382 Structural fittings can bladded activities 3 3,00 4 3,00 3,00 383 Structural fittings can bladded activities 3 3,00 4 3,00 3,00 384 Structural fittings can bladded activities 3 3,00 4 3,00 3,00 385 Structural fittings can bladded activities 3 3,00 4 3,00 3,00 386 Structural fittings can bladded activities 3 3,00 4 3,00 3,00 387 Structural fittings can bladded activities 3 3,00 4 3,00 3,00 388 Structural fittings can bladded activities 3 3,00 4 3,00 389 Structural fittings can bladded activities 3 3,00 4 3,00 380 Structural fittings can bladded activities 3 3,00 4 3,00 380 Structural fittings can bladded activities 3 3,00 4 3,00 380 Structural fittings can bladded activities 3 3,00 4 3,00 380 Structural fittings can bladded activities 3 3,00 4 3,00 380 S	2240,00 benefit (clear)
363 Roof coverings	10367,28 1000,00 benefit (clear)
Structural fitments	
371 General purpose fittings	
Integrated double bed, fold-sway, with integrated desk	11900,00
379	11900,00
379	
391 Site equipment Heavy equipment like building crane (Madrid) 3 120,00 h 170,00 20400,00	
391 Site equipment Heavy equipment like building crane (Madrid) 3 120,00 h 170,00 20400,00	129820,61
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11-000 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00 3000,00	24276,00 3570,00
Assembly/Cisassembly crane Stutgart, realisation 3 150,00 h 125,00 18750,00 Assembly crane Stutgart, resise 3 25,00 h 125,00 3125,00 Construction sign 2 1,00 Stk. 200,00 200,00	22312,50 3718,75 238,00
Site power supply with distribution (power supply generator) 3 1,00 Stk. 500,00 500,00	595,00
Temporary roof 128,00 m² 25,00 3200,00 Building illumination Suttgart - Madrid 3 1,00 pasuch 2000,00 2000,00	942,48
Other equipment and machinery 3 1,00 pausch 5000,00 5000,00 392 Scoffolding	942,48 3808,00 2380,00
	942,48 3808,00
393 Sofety measures Hoarding Stuttgart 3 150,00 m 14,00 2100,00	942,48 3808,00 2380,00
395 Repairwork 3 1,00 plausch 35000,00 35000,00	942,48 3808,00 2380,00
396 Material disposal 397 Additional work	942,48 3808,00 2380,00 5000,00 benefit (clear)
338 Interim solutions 339 Other construction related activities,	912,88 3368,00 2380,00 5000,00 benefit (clear)
Loading on transport vehicle in Blaustein 21 1,00 pausch 3000,00 3000,00 Transport cost Fa. Steel on Blaustein 3 1,00 pausch 150,00 150,00	912,48 3360,00 2880,00 5000,00 benefit (dear) 2499,00 41650,00
Minimal mass multiplication Fa. Steico 2 1,00 pausch 100,70 100,70 Assembly MBM in Stuttgart+Madrid 2 1,00 pausch 6820,55 15332,55	912,88 3368,00 2380,00 5000,00 benefit (clear)

ost type	sub- essembly	description	Costs estimated schedule	mass	device	unit price in € per abundance	total net price in €	Cost Netto %	total price in € incl. 19% tax (as appropriated, sponsor	Cost Brutto
00		Structure-services	Madrid					239.444,69€	benefits are clear)	278.354,7
0		Sewage , water and gas					7495,00		8919,05	
	411	Sewerage systems Eavesdrop, downpipe inside-outside Inspection equipment	2 2	1,00	pausch pausch	1200,00 400,00	1200,00 400,00	-	1428,00 476,00	
	412	Water supply systems								
		Potable water tank 1700l Waste water tank 1700l Recooling water tank 1000l	2 2	1,00 1,00 1,00	Stk Stk Stk	1240,00 1430,00 1385,00	1240,00 1430,00 1385,00		1475,60 1701,70 1648,15	
		Piping for cold water Piping for hot water	2 2 2	1,00 1,00	pausch pausch	500,00 500,00	500,00 500,00 500,00		595,00 595,00	
	413	Water pump Gas supply systems		1,00	Stk	500,00	300,00		595,00	
	413	Fire extinguishing equipment Extinguisher	2	2,00	Stk	170,00	340,00		404,60	
10	419	Sewerage, water, and gas system, other items Heat supply systems					61132,85		68462,65	
	421	Heat generators		6.60	2	340.00				
		Vacuum tube collectors, Fa. Augusta Solar Partial sponsorship on collectors Hybrid Collector Fa. Ertex/HIT	2 2	6,60 6,60 27,00	m² m² m²	349,09 585,00	2303,99 5376,00 15795,00		2741,75 5376,00 18796,05	benefit (clear)
	423	Circulation pump for collectors Fa. Danfoss, Grundfos Alpha Space heating	2	2,00	Stk	1700,00	3400,00		4046,00	
		Floor heating Fa. Danfoss (36m²heated+16m² under furniture)	1	52,00	m²	55,00	2860,00		3403,40	
	429	Heat supply systems, other items Heat pump reversible Fa. Schwämmle Typ WK3 Partial sponsorship Fa. Schwämmle	2 2	1,00	Stk	8300,00	8300,00 15925.00		9877,00 15925.00	benefit (clear)
		Circulation pump tower (Oase Neptun 6000)	2	1,00	Stk	242,86	242,86		289,00	111-00309P mmb
		Textile in pump sump energy tower Fa. Silvertex Textile (Energy tower)	2	0,70 40,00	m m²	540,00 120,00	378,00 4800,00		378,00 5712,00	benefit (clear)
		Thermal stratified storage tank, Fa. Rotex SCS 328/14/0 Art.Nr. 165010-49) 50% Sponsorship Healths element to memory Fa. Rotex	2	1,00 1,00 1,00	Stk Stk Stk	620,00 620,00 256,00	620,00 620,00		737,80 620,00 304,64	benefit (clear)
		Heating element to memory, Fa. Rotex 50% Sponsorship	2	1,00	Stk Stk	256,00 256,00	256,00 256,00		256,00	benefit (clear)
	431	Air treatment system Ventilation systems					39937,82		47526,01	
	431	Air intake Air egress	1 1	1,00 1,00	pausch pausch	600,00 1000,00	600,00 1000,00		714,00 1190,00	
		Air conditioning appliance (Polybloc)-heat exchanger Adiabat Heat exchanger for an experimental building	4	1,00	pausch Stk	2000,00 337,82	2000,00 337,82		2380,00 402,01	111-00309P mmb
	432 433	Partial air conditioning system Air conditioning system								
	434	Ventilation duct elements Refrigerating plant	1	1,00	pausch	1000,00	1000,00		1190,00	
	439	Air treatment systems, other items additional costs for high complexity technique niche	2	1,00	pausch	35000,00	35000,00		41650,00	
10		Power installations					81399,00		94964,81	
	441 442	High and medium voltage plants Independent power supply installations Glass printed with thin layer CIS photovoltaics, Fa. Ertex(facade)	,	26,00	Stk	695,00	18070,00		21503,30	
		Solar module, thin layer photovoltaics, Fa. Ertex (roof) Substructure PV	2 2	14,00 1,00	Stk pausch	1731,00 10000,00	24234,00 10000,00		28838,46 10000,00	benefit (clear)
		Invertor part of PV Sunways Cells from Fa. Sunways House service connection for PV	2 2	2,00 1,00 1,00	Stk pausch Stk	1700,00 20000,00 2000,00	3400,00 20000,00 2000,00		4046,00 23800,00 2380,00	
		Distribution board/ fuse	2	1,00	Stk	500,00	500,00		595,00	
	443 444	Low voltage switch gear Low voltage installation equipment Line/ circuit	1	1,00	pausch	300,00	300,00		357,00	
		Low voltage line Cable Switch	1 1 2	1,00 1,00 15,00	pausch pausch Stk	300,00 300,00 15,00	300,00 300,00 225,00		357,00 357,00 267,75	
		Socket	2	15,00	Stk	15,00	225,00		267,75	
	445	Lighting systems Lights Downlights	4	1,00 5,00	Stk Stk	300,00 261,00	300,00 1305,00		357,00 1552,95	
	446	Lightning protection and earthing systems								
	449	Lightning protection Heavy current systems, others		80,00	m²	3,00	240,00		285,60	
0		Telecommunications and other communications systems					4529,00		5389,51	
	451	Telecommunications systems Telephone wall jack	1	1,00	pausch	500,00	500,00		595,00	
	452 453	Search and signalling equipment Time metering systems Drive technology and control technology								
	454	Electroacoustic equipment								
	455	Television and aerial systems LCD-televison Receiving antenna	4	1,00	Stk	1200,00	1200,00		1428,00	
	456	Laptop Security systems	4	1,00	Stk	2229,00	2229,00		2652,51	
		Heat-smoke- and fire detector as main or secondary detector	2	2,00	Stk	300,00	600,00		714,00	
	457 459	Transmission networks Telecommunications and other communications systems,								
_		other items								
	465	Transport systems Cranes					0,00		0,00	
10	469	Transport systems, other items Function-related equipment and fitments					13961.02		16214.61	
	471	Kitchen fittings								
		Freezer/refrigerator Fa. Liebherr-ICBP 3166 premium plus Dishwasher Fa. Miele-G1562 SCVI Sink	4 4 4	1,00 1,00 1,00	Stk Stk Stk	2100,00 1217,65 300,00	2100,00 1217,65 300,00		2100,00 1449,00 357,00	benefit (clear)
		Built-in oven Fa. Miele-H5681 BL Ceramic stove top Fa. Miele-KM5944	4	1,00 1,00	Stk Stk	2247,90 1553,78	2247,90 1553,78		2675,00 1849,00	
		Exhaust hood Fa. Miele-DA 420V Coffee machine Fa. Miele-CVA 3660 Water boiler	4 4	1,00 1,00 1,00	Stk Stk Stk	377,31 1473,95 55,00	377,31 1473,95 55,00		449,00 1754,00 65,45	
	472	Integrated lamp in built-in-kitchen	4	10,00	Stk	50,00	500,00		595,00	
	+/4	Laundry and dry cleaning equipment Washing machine Fa. Miele-Softtronic W5841WPS EcoComfort Clothes dryer Fa. Miele-Softtronic T8627WP EcoComfort	4	1,00 1,00	Stk Stk	1234,45 1057,98	1234,45 1057,98		1469,00 1259,00	
	473 476	Media systems Swimming boths equipment								
		Basin Mountings	4	1,00 1,00	Stk Stk	369,00 373,00	369,00 373,00		439,11 443,87	
		Toilet Toilet seat Toilet brush	4 4	1,00 1,00 1,00	Stk Stk Stk	483,00 78,43 3,54	483,00 78,43 3,54		574,77 93,33 4,21	
					Stk	47,03	47,03	1		1
		Toilet brush holder, stainless steel Shower	4	1,00 1,00	Stk	489,00	489,00		55,97 581,91	

			Costs						total price in €	
t type	sub- essembly	description	estimated schedule Madrid	mass	device	unit price in € per abundance	total net price in €	Cost Netto %	incl. 19% tax (as appropriated, sponsor benefits are clear)	Cost Brutto
		Building Automation					30990,00		36878,10	
	481 482	Automated systems Switchboards		<u> </u>						
		Cutout box	2	1,00	Stk	2000,00	2000,00		2380,00	
	483	Management and operator facilities Measurement control engineering	2				28990,00		34498,10	
	484	Room automation systems		ļ	ļ					ļ
	485 489	Transmission grid Building automation, other items								
		Other services related works					0,00		0,00	
	491	Site equipment								
	492 493	Scaffolding Safety measures								
	495 496	Repair work Material disposal								ļ
	497	Additional work								
	498 499	Interim technical equipment Other services related works,								
		Other items								
0		External works						18.003,05 €		21.42
		Ground surfaces					0,00		0,00	
	511	Landscaping		 					<u> </u>	
	512 519	Preparation of soil Ground surfaces, other items		<u> </u>	<u> </u>				<u> </u>	
		Hard Surfaces					0,00		0,00	
	521	Paths								
	522 523	Roads Squares, courtyards			-					
		Parking spaces		1	!				 	
	524 525	Sports grounds			ļ					ļ
	526 527	Playgrounds Track systems								
	529	Hard Surfaces, other items								
		External Construction works			1		12273,00	_	14604,87	
	531 532	Enclosures Protective structures							-	
	533 534	Walls Ramps, stairs, stands								
		Ramp	1	20,00 1,00	m² pausch	300,00 1302,00	6000,00 1302,00		7140,00 1549,38	ļ
		Stair Handrail	1	33,14	Ifm	150,00	4971,00		5915,49	
	535	Roof coverings								
	536 537	Bridges, footpaths Conduit and shaft systems								
	538	Hydraulic installations			ļ				 	
	539	Outdoor construction works, other items								
		External services					0,00		0,00	
	541	Sewerage systems Wastewater lines								
	542									ļ
		Water supply systems								
	543 544 545	Gas supply systems Heat supply systems								
	546	Air treatment systems Power installations								<u> </u>
	547 548	Telecommunications and other communications systems Function-related equipment and fitments								ļ
	549	External services, other items								
		External fitments					240,00		285,60	
	551	General purpose fittings	2	2,00	Stk	20,00	40,00		47,60	ļ
		Waste bin Labeling and signs, pictogram, destination signs	2	20,00	Stk	10,00	200,00		238,00	
	552	Special purpose fittings								
	559	External fittings, other items								
		Water areas			1		0,00		0,00	
	561 562	Liner Special purpose fittings								
	569	Water areas, other items								
		Planting and lawn areas		1			5490,05		6533,16	
	571	Landscaping Propagation of sail for planting		ļ	!				†	ļ
	572	Preparation of soil for planting Gap	1	6,00	Stk m³	70,00	420,00		499,80 154,76	<u> </u>
		Terrace	1	2,89	m³	45,00	130,05		154,76	
	573 574	Backup construction Planting			<u> </u>					<u> </u>
		Plants in gap Plant on terrace	4 4	6,00 32,00	Stk Stk	130,00 130,00	780,00 4160,00		928,20 4950,40	
	575	Lawn		-	F					
	576 579	Plantings over buried structures		ļ				ļ		ļ
		Planting and lawn areas, other items		1			0,00		0,00	
		Other external works		1			U,00		υ,00	
					1	1	1	1	1	1
	591 592	Site equipment Scaffolding								
	591 592 593 595	Scaffolding Safety measures								
	592 593 595 596	Scoffoldinq Safety measures Repair work Recycling, interim disposal and final disposal								
	592 593 595	Scoffolding Safety measures Repair work								

	sub- essembly	description	Costs estimated schedule	mass	device	unit price in € per abundance	total net price	Cost Netto %	total price in € incl. 19% tax (as appropriated, sponsor	Cost Brutto
00		Furnishings and artistic appointments	Madrid					41.859,00 €	benefits are clear)	49.812,2
								41.835,00 €		45.012,2
		Furnishings					38609,00		45944,71	
	611	General furnishings Table	4	1,00	Stk	3000,00	3000,00		3570,00	
		Chair Couch	4	12,00 1,00	Stk	350,00 1649,00	4200,00 1649,00		4998,00 1962,31	
		Coffee table Built-in kitchen	4	1,00	Stk Stk Stk	300,00 10000,00	300,00 10000,00		357,00 11900,00	
		Integrated wall units for bedroom	4	1,00	Stk	2500,00	2500,00		2975,00	
		Integrated wall units for living Integrated wall units for dinig room	4 4	1,00 1,00	Stk Stk	2500,00 2500,00	2500,00 2500,00		2975,00 2975,00	
		Shelves Mirror	4	1,00	Stk	160,00	160,00		190,40	
		Towel rail Shower partition								
		Pillow + Blanket Bed Table and Bed linen								
		Tableware	4	12,00	pausch	150,00	1800,00		2142,00	
		diverse furnishings	4	1,00	pausch	10000,00	10000,00		11900,00	
	612 619	Special furnishings Furnishings, other items								
							3250,00		3867,50	
		Artistic appointments					3250,00		3867,50	
	621 622	Art works Ornamental features								
	623	Light outside facilities, Fa. Simes-Eos 24148013 External ornamental features	4	13,00	Stk	250,00	3250,00		3867,50	
	629	Art works, other items								
0		Incidental building costs		15-22%				642.954,61€		690.005,
		Clients responsibilities					290954,76		303358,48	
	711	Project administration								
	712 713	Contingency planning								
	719	Project Management Clients responsibilities, other items								
		Internet presence (Fa. Red cube - jangeld nerves) Project flyer:	15 15	1,00	pausch pausch	420,00 8000,00	420,00 8000,00		499,80 9520,00	
		Brochures Postcards, Invitation cards	15 15	1,00 1,00	Stk pausch	51,61 516,34	51,61 516,34		61,42 614,44	
		Marketing	15	1,00	pausch	2393,76	2393,76		2848,57	
		Poster Posting EnOB: Lernnetz	15 15	1,00	pausch pausch	1000,00 2625,00	1000,00 2625,00		1190,00 3123,75	
		Symposium/Fair:	15	1,00	pausch	5000,00	5000,00		5950,00	
		Darmstadt Fulda	15	1,00 1,00	Stk Stk	36,76 1027,48	36,76 1027,48		43,74 1222,70	
		SET Aachen Consense Stuttgart	15 15 15	1,00 1,00	Stk Stk	336,13 184,87	336,13 184,87		399,99 220,00	
		Travel S. Fiedler	15	1,00	pausch	265,13	265,13		315,50	
		Booth Rental	12	1,00	Stk	4000,00	4000,00		4760,00	
		Slides and accessories booth	12	1,00	Stk	620,00	620,00		737,80	
		Acquisition literature	12	1,00	pausch	376,89	376,89		403,27	(7% tax)
		Professional publications Book publications	15 15	1,00 1,00	pausch pausch	2625,00 16806,73	2625,00 16806,73		3123,75 20000,01	
		Chart/Film documentation	15	1,00	pausch	17000,00	17000,00		20230,00	
		Entertainment expenses	12	1,00	Stk	41,89	41,89		49,85	
		Entertainment expenses	12	1,00	pausch	1680,67	1680,67		2000,00	
		Business carts for the project	15	1,00	pausch	12,50	12,50		14,88	
		External translations	12	1,00	Stk	500,00	500,00		595,00	
		Salaries employee:	5	6.00		2260,00	13560.00		13560,00	all in? Steuer?
		Project management Controlling	6	6,00	mon	2260,00	13560,00		13560,00	all in? Steuer?
		Building physics Building physics	6	2,00 6,00	mon mon	3390,00 1130,00	6780,00 6780,00		6780,00 6780,00	all in? Steuer? all in? Steuer?
		Project management Transfer to daylight project	5	4,00	mon	-2260,00	-9040,00		-9040,00	all in? Steuer?
		Project management Controlling	5	12,00 9,00	mon	2260,00 2260,00	27120,00 20340.00		27120,00 20340,00	all in? Steuer? all in? Steuer?
		Building physics	6	6,00	mon	3390,00	20340,00		20340,00	all in? Steuer?
		Building physics	6	9,00	mon	1130,00	10170,00		10170,00	all in? Steuer?
		Project management Building physics	5	1,00 0,00	mon mon	2260,00 3390,00	2260,00 0,00		2260,00 0,00	all in? Steuer? all in? Steuer?
		Salaries employee								
		Measurement control engineering Measurement control engineering	6	3,50	mon	2100,00 2100,00	7350,00 25200,00		7350,00 25200,00	all in? Steuer? all in? Steuer?
		Measurement control engineering Communication	6	12,00 1,00	mon	2100,00	2100,00		2100,00	all in? Steuer?
			6	3,00	mon	420,00	1260,00		1260,00	all in? Steuer?
		Salaries Fundraising:	9	1,00	pausch	5596,19	5596,19 6914,68		5596,19	all in? Steuer?
		Fundraising		1,00	pausch	6914,68	6914,68 16403,81	L	6914,68	all in? Steuer?
		Fundraising Fundraising Fundraising	9	1,00	pausch	16403,81	10403,81		16403,81	all in? Steuer?
		Fundraising Fundraising Fundraising Fundraising Fundraising	9 9	1,00 1,00	pausch	21085,32	21085,32		21085,32	all in? Steuer?
		Fundraising Fundraising Fundraising	9	1,00		16403,81 21085,32 2304,50 2304,50	21085,32 13827,00 13827,00		16403,81 21085,32 13827,00 13827,00	
		Fundraising Fundraising Fundraising Fundraising Fundraising Fundraising Fundraising Fundraising	9 9 9 9	1,00 1,00 6,00	pausch mon	21085,32 2304,50	21085,32 13827,00 13827,00		21085,32 13827,00 13827,00	all in? Steuer? all in? Steuer?
		Fundraising Fundraising Fundraising Fundraising Fundraising Fundraising Fundraising	9 9 9 9	1,00 1,00 6,00	pausch mon	21085,32 2304,50	21085,32 13827,00		21085,32 13827,00	all in? Steuer? all in? Steuer?
	721	Fundraising Freilminary project planning Investigations	9 9 9 9	1,00 1,00 6,00	pausch mon	21085,32 2304,50	21085,32 13827,00 13827,00		21085,32 13827,00 13827,00	all in? Steuer? all in? Steuer?
	722 723	Fundraising United Fundraising Freilminary project planning Investigations Valuations United Revelopment services	9 9 9 9	1,00 1,00 6,00	pausch mon	21085,32 2304,50	21085,32 13827,00 13827,00		21085,32 13827,00 13827,00	all in? Steuer? all in? Steuer?
	722	Fundraising	9 9 9 9	1,00 1,00 6,00	pausch mon	21085,32 2304,50	21085,32 13827,00 13827,00		21085,32 13827,00 13827,00	all in? Steuer? all in? Steuer?



cost type	sub- essembly	description	Costs estimated schedule Madrid	mass	device	unit price in € per abundance	total net price in €	Cost Netto %	total price in € incl. 19% tax (as appropriated, sponsor	Cost Brutto
30		Services of architects and engineers	Madrid				134427,51		benefits are clear) 136209,62	
	731	Buildings planing								
		Design planning and implementation planning: Salaries eployee								
		Granted Students Granted Students	7	1,00	pausch pausch	22500,00 25500,00	22500,00 25500,00		22500,00 25500,00	all in? Steuer? all in? Steuer?
		Granted Students Contingency for over time	7	1,00	pausch pausch	1000,00 33500,00	1000,00 33500,00		1000,00 33500,00	all in? Steuer? all in? Steuer?
		Building Physics	7	1,00	pausch	505,40	505,40		505,40	all in? Steuer?
		Building Physics	7	1,00	pausch	3421,82	3421,82		3421,82	all in? Steuer?
	732 733	Open areas Configuration of interiors								
	774	contained in 731								
	734 735	Civil engineering works and traffic systems Planning of structural framing								
	736	Supply and disposal systems								
		Planning building services-electrical Fa. Raible Planning building services Fa. Raible	10 10	1,00 1,00	pausch pausch	11098,43 10822,32	11098,43 10822,32		11098,43 10822,32	benefit ->clear benefit ->clear
		Planning building services Fa. Siebert statics for glass	10	1,00	pausch	10000,00	10000,00		10000,00	benefit ->clear
		Experimental set-up ventilation tower Micha Schneider Experimental set-up ventilation tower humidistat	12 12	1,00	pausch pausch	296,47 3020,77	296,47 3020,77		352,80 3594,72	
		Experimental set-up ventilation tower Experimental set-up PVT Simon	12 12	1,00 1,00	pausch pausch	1127,47 162,54	1127,47 162,54		1341,69 193,42	
		Experimental set-up PVT Simon, Heating element	12	1,00	stk	329,00	329,00		391,51	
	739	Services of architects and engineers, other items								
		Copy and plot costs Copy and plot costs	11 11	1,00 1,00	Stk pausch	53,53 1500,00	53,53 1500,00		63,70 1785,00	
		Mailing expenses, Porto	11	1,00	Stk	81,03	81,03		96,43	
		Mailing expenses, Porto Cost Model	11 14	1,00 1,00	pausch pausch	333,00 1175,18	333,00 1175,18		396,27 1398,46	
		Cost Model Transport costs model to Madrid	14	1,00 1,00	pausch Stk	200,55 1100,00	200,55 1100,00		238,65 1309,00	
		GaBi Software for Building Physics	11	1,00	Stk	6700,00	6700,00		6700,00	benefit ->clear
		Assessments and consultations					39900,00		41800,00	
	741	Thermal physics of structures	10	1,00	pausch	15000,00	15000,00		15000,00	benefit ->clear
	742 743	Noise control and acoustics Soil mechanics, ground and foundation engineering								
	744 745	Surveying	10	1,00	nausch	5000,00	5000,00		5000,00	benefit ->clear
	746	Lighting and daylight engineering Fire protection	10	1,00	pausch	5000,00	5000,00		5000,00	benefit ->clear
	747 748	Health protection Environment protection								
	749	Assessments and consultations, other items								
		Simulation and calculation wind tunnel Consulting service fundraising H. Schwegler	10 10	1,00 1,00	pausch pausch	9900,00 5882,35	9900,00 5882,35		9900,00 7000,00	benefit ->clear
		Consulting service fundraising H. Schwegler	10	1,00	pausch	4117,65	4117,65		4900,00	
		Art services					500,00		595,00	
	751 752	Art competitions								
	759	Fees Art services, other items								
		Objectdesign Financing	12	1,00	pausch	500,00	500,00		595,00	
	761	Financing Financing costs					0,00		0,00	
	762	Interest prior to commissioning of structure								
	769	Financing costs, other items General incidental building costs					177172,34		208042,08	
	771	Tests, approvals, acceptance inspections					17/172,34		200042,00	
	//1	Building licence	12	1	pausch	2000,00	2000,00		2380,00	
	772	Site management costs								
		Rent, security service	13	1	pausch	2000,00	2000,00		2380,00	
	773 774	Sample costs Running costs during construction period								
	775	Insurances Insurances Stuttgart	24	1	pausch	1000,00	1000,00		1190,00	
		Insurances Madrid	25	1	pausch	1000,00	1000,00		1190,00	
	779	General incidental building costs, other items Documentation	12	1	pausch	4500,00	4500,00		5355,00	
		Monitoring Travel cost (University-Madrid/ Madrid-University)	2 16	1 40	pausch Stk	20250,00 500,00	20250,00 20000,00		24097,50 23800,00	
		Travel cost (University-Madrid/ Madrid-University) Lodging students, employees, professors	16 17	1 1	Stk pausch	2557,63 31000,00	2557,63 31000,00		3043,58 36890,00	
		Lodging students, professors Workshop Expenses allowance	17 18	1 490	Stk pers/days	1064,71 30.00	1064,71 14700.00		1267,00 14700.00	all in
		Transport Müller Blaustein to University	21	1,00	pausch	6300,00	6300,00		7497,00	
		Transport University - Madrid, Madrid - University additionl costs for waiting time in Madrid	21 21	1,00 1,00	pausch pausch	63800,00 7000,00	63800,00 7000,00		75922,00 8330,00	
1		Other incidental building costs		,		1	,		,	
ischensumme Gesamt	kosten (netto)	Subtotal						1.411.444,31 €		1.551.979
chlag für Unvorherges	ehenes	Addition miscellaneous (0%)		0,00			0,00	0,00 €		1.331.979
SAMTKOSTEN (net	to)	<u>Total costs</u>					0,00	1.411.444,31 €		1.551.979
		Builling costs KG 300 + 400						700.224,29 €		780.73
	lac l									10.40
	75	€/m² BGF €/m³ BRI			-			9.336,32 € 3.334,40 €	-	3.71

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14. Dinner Party Menue - Contents

- 1. Recipes for a classical swabian menu
- 2. Pancake soup (Flädlesuppe)
- 3. Maultaschen (swabian pasta squares filled with meat and spinach)*
- 4. Schwäbischer Kartoffelsalat (swabian potato salad)
- 5. Schwäbischer Träubleskuchen (redcurrant cake)
- 6. Drinks and hors d'ouvres

Dinner Party Menue

1. Recipes for a classical swabian menu

Courses:

hors d'oeuvre

Surprise of the swabian kitchen – "Überraschung schwäbischer Art"

Soup

Pancake-soup - Flädlesuppe

Main course

Maultaschen with swabian potato salad – "Maultaschen an schwäb. Kartoffelsalat"

Dessert

Redcurrant cake - "Schwäbischer Träubleskuchen"

A detailed list of beverages and hors d'oeuvres, which will be offered during the evening (before and also after the dinner) and will be submitted later.

2. Pancake soup (Flädlesuppe)

For 8 portions Time approx. 20 min

Resting time approx. 1 h

Ingredients:

1000 g beef

(beef brisket, short rib, leg of beef,

thick rib or flank)

1000 g beef bones

2 onion(s)2 clove(s)

2 bay leaves

2 tea spoons salt

2 bunch greens2 carrots

4l water
1l milk

400g wheat flour

6 eggs

2 knife point salt

shortening

4 tablespoons chives

Bouillon:

Preparation:

Rinse the pieces of meat under floating cold water. Peel the onions and put the cloves in them. Stir the pieces of meat, bones, onions with the cloves, bay leaf, salt and water. Bring this mixture to a boil over high heat, then reduce the heat to medium-low, cover, and simmer around 2,5 hours.

Take away at regular intervals the protein froth with a skimmer. While cooking a part of the fluid should evaporate. Wash the greens and the carrots, peel them and cut them in small (cubes) pieces. Stir them with the other ingredients half an hour before the end of the simmer time is over.



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Pass the bouillon through a sieve and use the plain bouillon for the pancake soup. The cooked meat and the vegetables can be used elsewhere.

Pancake stripes:

Stir the milk and the eggs by the help of a mixer and add slowly the wheat flour and a little salt. Leave the mixtures swell for around half an hour and mix it quickly time by time.

Depending on the sort of the flour it is to recommend adding some milk to get a thin fluid dough.

Heat in a coated pan some vegetable oil over medium high heat. Add some small portions of the dough with a dipper until the ground of the pan is completely covered. Bake the dough golden brownish and turn it to the other side.

Take the pan cake out of the pan and roll it whilst it is still hot. Repeat this procedure until the dough is finished. Just as a hint, the pan cakes can be a bit thicker than the classical Crêpes. After all the rolled pancakes cooled down cut them in thin stripes

To prepare finally the pancake soup you should put the pancake stripes in some preheated soup plates and souse them with the hot bouillon. To prettify the soup it is always nice to dredge it with some hackled chives. It is recommended to wait a few moments before serving the soup until the pancake stripes also got hot.

3. Maultaschen (swabian pasta squares filled with meat and spinach)*

For 10 portions For the filling:

Ingredients: streaky bacon

onions

750 g flour garlic clove

6 eggs spinach (frozen)

Some salt coarse sausage meat (chopped veal)

Some water breadcrumps

chopped parsley

nutmeg

black pepper

egg white

strong meat stock



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Time: approx. 45 min Resting time approx. 30 min

Preparation:

Make a soft noodle dough with the flour, eggs and salt. Cover it and allow it to stand in a bowl for 30 minutes. Cut the bacon into cubes and heat it so the fat melts. Add the onions and garlic and fry them until they are clear. Add the frozen spinach and cook it until there is no more liquid remaining. Allow the mixture to cool slightly and mix in the sausage meat, breadcrumbs and parsley. Season with salt, pepper and nutmeg. Roll out the dough in two portions to a thickness of 3 mm on a thinly floured kitchen towel. On one of the pieces of dough, mark out squares of roughly 8 cm and place a tablespoon of filling in the centre of each of these squares. Brush the areas between the filling with egg white. Place the second piece of dough over the first and press it down in the areas between the filling. Cut out the squares. Bring the meat stock to the boil in a large pot, add the Maultaschen and cook them for about 10 minutes in lightly boiling water. For the garnish, heat some butter and fry onion rings until they are brown. Remove the Maultaschen from the pot using a slotted spoon, place them on a warm plate and pour a little stock over them. Finally, spread the onion rings over the Maultaschen and serve the dish.

*Note: In Germany it is common to buy readymade "Maultaschen", to cook them or fry them. These "Maultaschen" we are using for our menu are ready made by our team in Germany, by reason of a lack of time. After confecting them they will be evacuated for the transport to Spain. A video documentation (May 2010) will be prepared to proof the own hand made preparation and will be publicized on our website www. sdeurope.de!

4. Schwäbischer Kartoffelsalat (swabian potato salad)

For 8 portions

Ingredients:

2kg small salad potatoesonions cut into cubes4 tablespoons wine vinegar 10%

2 cups bouillon 2 tablespoons salt

2 danchpepper

6 tablespoons sunflower oil

Time approx. 45 min Resting time approx. 2 h

Preparation:

Peel the cooked and still slightly warm potatoes and then chip them. Cut also the onion(s) in small cubes and stir them in the hot bouillon. Season the potatoes with salt and pepper. Afterwards souse them with the bouillon and onions and add wine vinegar and oil. Mix everything carefully in the way that the potatoes won't turn into puree. Allow it to stand for a while to infuse the ingredients. Add again some oil before serving.

5. Schwäbischer Träubleskuchen (redcurrant cake)

For 1 portion

Ingredients: Mix flour, butter, sugar, eggs, salt and milk and

Basic shortcrust: min in the fridge. Meanwhile peel the currants from

the panicle.

250g flour

125g butter

65g sugar

1 egg

1danch salt

1 tablespoon milk

For the fruit cover:

500g redcurrants

1 handful breadcrumbs or kibbled nuts

4 eggs 200g sugar

125g minced almonds

1 package vanilla sugar

Preparation:

Time approx. 30 min

Resting time approx. 50 min

Formularende

bowls. First of all divide the eggs egg white and egg yolk. In one bowl stir the egg yolk with a tablespoon of sugar until it gets creamy. That followed you whisk stiff the egg white in the other bowl, including also sugar, vanilla sugar and the minced almonds. Afterwards you put 2/3 of this mixture in the bowl

For the fruit cover it is recommended to use two

knead a shortcrust. Allow it to stand for approx. 30

with the egg yolk and stir it softly. Add the currants

and fold them into the mass.

Roll out the shortcrust and put in a baking pan

(diameter 26 cm). Puncture the shortcrust with a fork

in several places and strew some breadcrumbs or

some kibbled nuts all over. Then put in all the mass

with the currants. When you evenly spread the mass

in the backing pan then cover it with the rest of the

stiff egg white.

The cake needs around 50 minutes in a 180 degree

preheated oven.



6. Drinks and hors d'ouvres

For the evening, we plan to have alcoholic and non alcoholic drinks.

We start the dinner at 9:00 pm, we will have hors d'ouvres at the terrace, while some are setting the table. For hors d'ouvres we will have fingerfood: tomate with cuke, tomato with cheese, or sausage, all with some bread. We will offer some sparkling wine from the region Baden-Württemberg, where Stuttgart is located and we will get it from the selfmade winegrowing of an home+ team member. This can be mixed with orange juice if it's wished. Optional for non drinkers are apple juice, or water.





At the dinner, we will offer non sparkling wine. Optional are apple juice, or water from sealed bottles (sparkling, non sparkling).



At the end of the dinner, we will sit outside of the house, in the southern terrace and offer any kind of drinks, that were offered in the evening.

An exact assortment of the wine will decided during our proof of dinner party menue cooking this month.





home+			

15. Site Operations - Contents

- 1. Precedents and aim
- 2. General Data
- 3. Site Operations Team Coordinator and Team Members
- 4. Outside Logistic Villa Solar
- 5. Inside Logistic Approximation
- 6. Load and Unload
- 7. Assembly/Disassembly

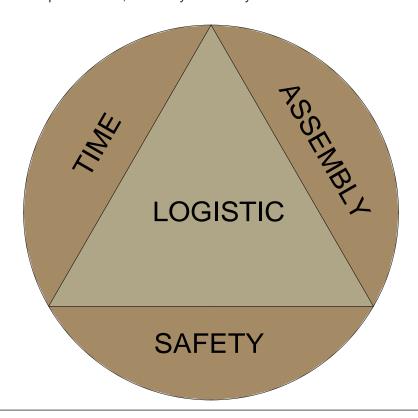
Site Operations

1. Precedents and aim

Our main aims for the site activities, the assembly system and the lot are: quick activities easy system safe working conditions

To achieve these aims and to avoid possible nonconformities an accurate strategy of the logistic is necessary, and therefore our emphasis on the Site Operations Plan is prevention.

The following topics are important: time, assembly and safety



2. General Data

2.1 Logistics

The layout gives us the advantage of a high level of pre-fabrication and therefore an efficient and easy assembly.

Four modules are built as frames – the fifth is the prefabricated part of the tower. Between the modules 1-4 there are glazing gaps (1-3), which separate the frames optically. In this way, a rhythmic separation of the modules is achieved.

The dimensions of the modules are:

 Module I
 6,80 x 1,20 x 3,60 m

 Module II
 6,80 x 2,415 x 3,60 m

 Module III
 6,80 x 2,415 x 3,60 m

 Module IV
 6,80 x 2,415 x 3,60 m

 Module V (tower)
 1,95 x 0,80 x 4,42 m

The submodules are:

- 1. substructure
- 2. gap 1 prefabricated glazing elements
- 3. gap 2 prefabricated glazing elements
- 4. gap 3 prefabricated glazing elements
- 5. PV+ evacuated tube collectors
- 6. tanks -inside terrace furniture element
- 7. terrace elements
- 8. interiors

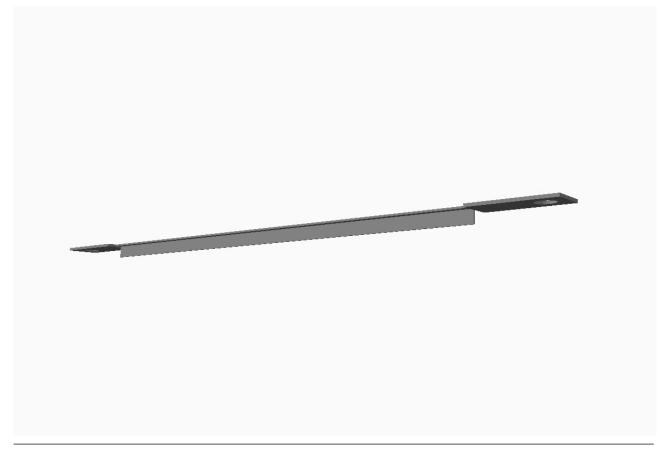
The building has an overall weight of approx. 40,5 tons / with terrace 53,0 tons (for more details see SO-401b Operations Chart).

2.2 Time / Assembly

To achieve our main aim of quick and easy assembly, we have developed a special assembly system (see pictures). Therefore we save time and effort, which has an effect on our timetable for the unloading and assembling process.

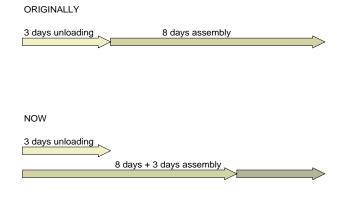


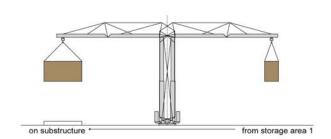


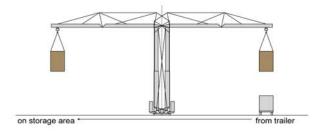


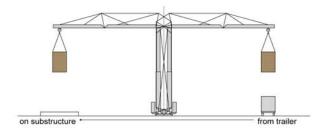
Because of the short default timetable, an efficient use of time and resources is essential for the planning. So the time for unloading (3 days) and for assembly (8 days), which are originally planned to be subsequent are now concurrently organised.

Another positive aspect is the reduction of time needed for the crane. Instead of two steps for the crane use for each module (from trailer to storage area 1; from storage area 1 to substructure), we have one step of crane use for one module (from trailer directly to substructure).









3. Site Operations Team Coordinator:

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Construction Manager

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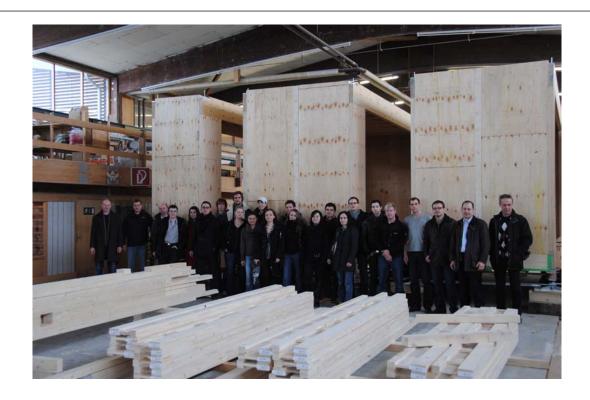
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4. Outside Logistic Villa Solar

4.1 Transport logistic phases:

Day 1: 07.06.2010 access team bus

(see SO-401b operations chart)

Day 2: 08.06.2010 access trailers 1-3

(see SO-401b operations chart)

Day 2-3: 08-09.06.2010 access trailers 3-6

(see SO-401b operations chart)

Day 3-4: 09-10.06.2010 access trailers 6-8

(see SO-401b operations chart)

see rule 36:

"Access and circulation of heavy vehicles:

Heavy vehicles will arrive and will be parked in a Meeting Point near the Villa Solar. From there, they will be called in one after the other to guarantee the orderly entry into the villa, always through established paths and following the organization's schedule. The organization, in accordance with Site Operations Plan of the Villa and each particular team Site Operations Plan, will determine the moment in which each team will move their truck in a strict order of entry, to proceed unloading. The entry of heavy vehicles will only be allowed during the three established days. Out of these days only light vehicles will be able to access the villa and they must be in complete communication and coordination with the organization.

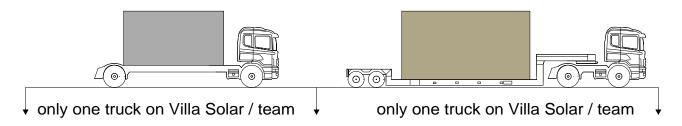
Several internal circulations will be laid out for vehicles that the teams will have to respect. Only one truck by team will be permitted at a time in the villa, so the rest of them will have to wait for the previous truck to leave. This process will be coordinated between the persons in charge of the Site Operations Plan of the Villa and those in charge in each team...."

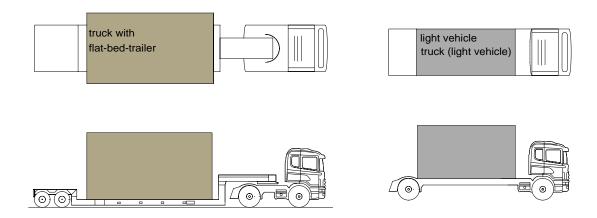
4.2 Transport vehicles planned:

For the transport is the safety of our elements very important. As mentioned we have a high prefabrication level, which causes big modules. They are prefabricated with all layers and interiors (with the exception of the PV). So they have to be packaged carefully, also the glazing elements. From the small elements, we transport, we planned with spare parts only for the worst case of a broken one.

To transport our house to Madrid, 9 truck trailers are required:

- 4 flat-bed trailers:
 - 1. 18,50x2,55x4,25 m and 38 tons
 3 axis traction engine, 2 axis flatbedtrailer
 6,0/6,0/7,5/7,5/5,5/5,5 tons per axis
 330/135/1010/136 cm axis distances
 - 2. 20,00x2,55x4,35 m and 40 tons 3 axis traction engine, 3 axis flatbedtrailer 6,0/6,0/7,25/7,25/3x4,5 tons per axis 320/135/10,57/136/136 cm axis distances
- 18,50x2,55x4,35 m and 38 tons
 2 axis traction engine, 2 axis flatbedtrailer
 7,5/11,0/10,0/10,0 tons per axis
 380/1050/136 cm axis distances
- 4. 20,50x2,55x4,35 m and 45 tons 3 axis traction engine, 3 axis flatbedtrailer 6,0/8,0/8,0/3x7,5 tons per axis 330/135/1050/136/136 cm axis distances





load: 1. module 1

- 2. module 2
- 3. module 3
- 4. module 4

4 standard (2 axial) trucks:

dimensions:

08,00 x 2,50 x 3,00 m (1,20 m load height)

weight: 10,00 tons/trailer (without load)

load: 1. container, horizontal glazing elements

2. substructure of the building and terrace, gap floors

- 3. terrace materials part 1
- 4. terrace materials part 2, PV+evacuated tube collectors

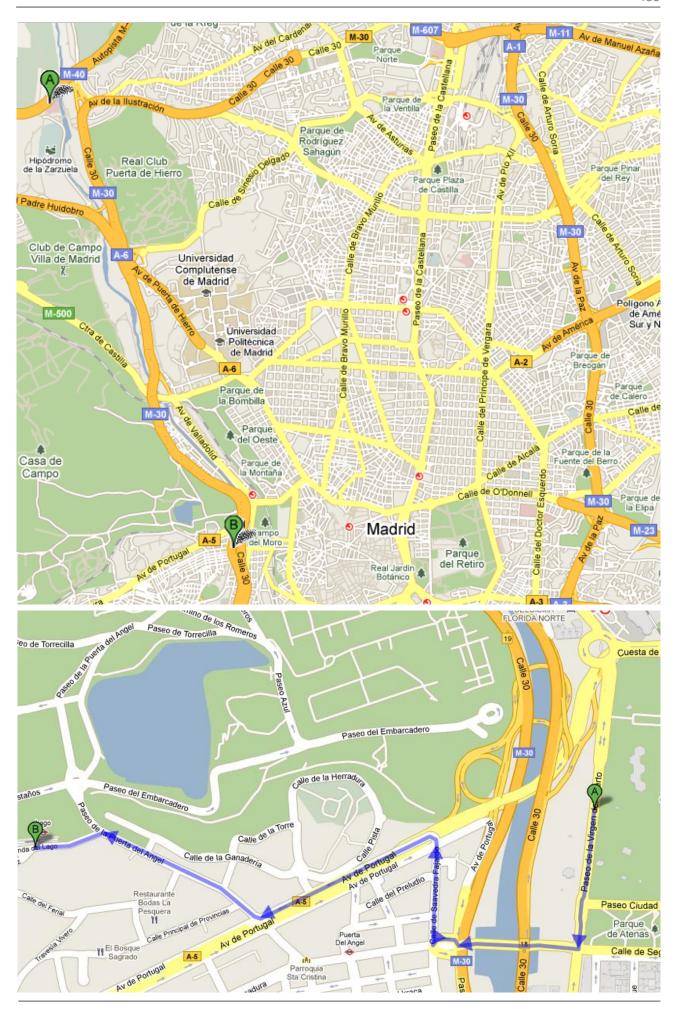
The module sizes are laid out on the truck sizes and the positive result is to get simple conditions of transport without an expensive, abnormal load.

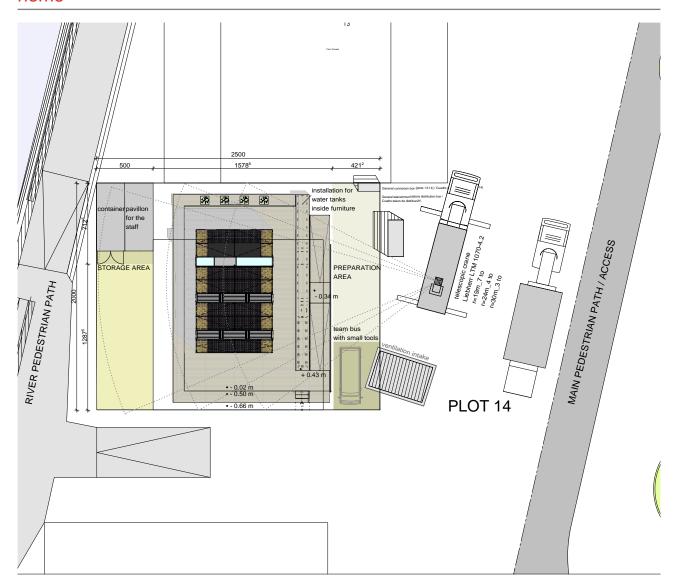
(for more details see SO-401b Operations Chart)

4.3 Vehicles Circulation



The route between Stuttgart and Madrid is approximately 1.900 km lond. The trailers drove 4 days (incl. breaks). All special licences for the three countries Germany, France and Spain were existing. They all wait on the waitingarea near the Villa Solar and the distance was only 10 min. to drive.





5. Inside Logistic Approximation

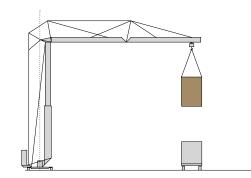
The lot is divided into areas with different functions: unloading/preparation area_ storage area _ container_ lounge area for the stuff_ area for the team bus

5.1 Phases description

(for more details see SO-401b Operations Chart and SO-201e-208e and SO-402b Logistic planning)

equipment machinery:

trailers (see transport)
crane (we are thinking about the use of a
crane for ourselves only, we decided this
when the exacl prizes are known)



forklift



tools:

batter board level tube cordless screwdriver hammer

material for unloading:

ladder
moveable scaffolding
autonomous equipment
electricity generator
(it comply with rule 4.5 + 4.6, more
details in the construction
specifications)
ground spike emitters

(for detailed data see operations chart)

5.2 Determining Factors

see operations chart

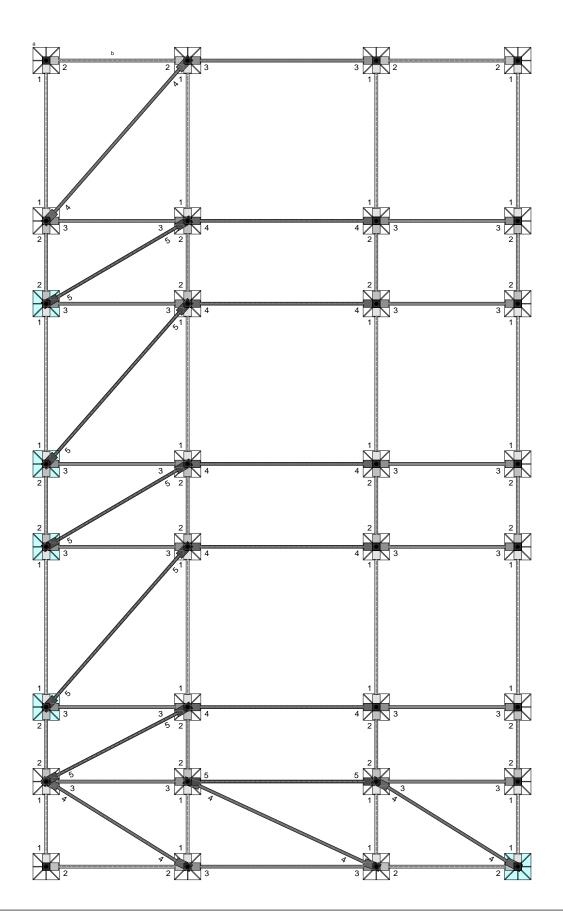






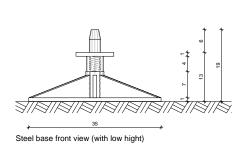
5.3 Infrastructures:

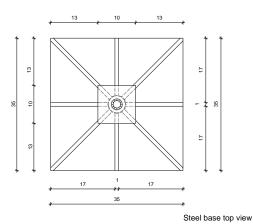
see ST-001/002a foundation, ST-311a, ST-312a, ST-313a and SO-401b

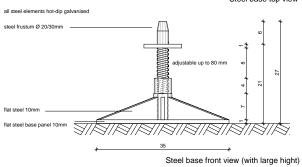


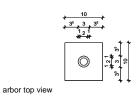
Steel base (adjustable in hight)

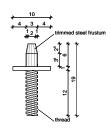






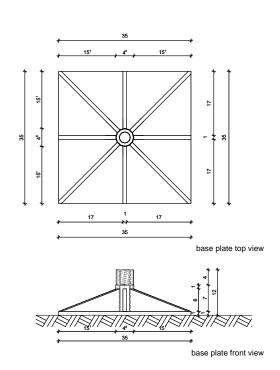


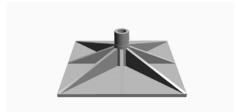


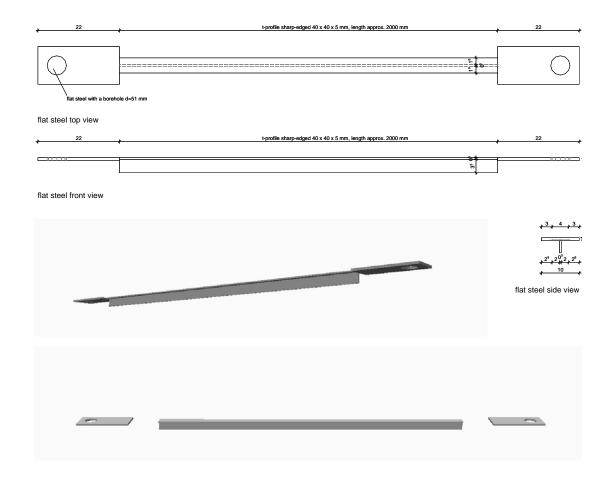
















5.3 Waste Management

see operations chart

Most of the construction is designed for a high pre-fabricated integration. Therefore the time of construction is comparably low. Also the amount of solid waste is reduced because cutting scrap is kept in the production factory and not on site. Transport materials will be stored and reused once the building is dissembled. All other materials used for the construction are separated into glass, paper, wood, plastics, metals and other materials.

6. Load and Unload

The first step is to unload all the site facilities and technical equipment, then the measurement of the lot can start. At the beginning the foundation in the form of steel bases will be located and leveled (details see 5.3).

(for more details see SO-401b and SO-201e-208e, SO-211b-214b and SO-402b)

7. Assembly/Disassembly

The first day is therefore the prearrangement for the second day. There we need the access the first fledbed-trailer and two standard trucks, to unload them on the storage area. The assembly of the building foundation can start and the provement of it by the organization can be done at the same day. After this approval the next three flatbedtrailers have to access in a short sequence after each other. They will be unloaded and assembled in one step including a quick and easy system. The bonding between them is actually fabricated.



The next day is reservated for the gaps and the tower. the floor of the gaps are the first assembled elements. The tower and the vertical parts of the gaps are prefabricated too and have to be assembled with the use of a crane. Special attention is necessary because of the high use of glazing.

The terrace is prefabricated in elements,too. And we try to involve all the possible heights (45cm). So there stay many actions, which we will adapt on the site (for example the verticall fronts of the platform, the ramp and stairs to seat. Important is the outside furniture, that contains the tanks. After the terrace arround the building this furniture has to be assembled and the installations continue. From this moment the filling of the tanks can start and the other elements of the terrace can be assembled.

The same point is important for the assembly of the evacuated tube collectors for the roof of the gaps and the PV, staring also on the roof of the building and then proceeding on the facades in east and west direction.

All the installations for the tower, the bonding of the module pipes in the gaps, the PV etc. are th following actions, that can proceed parallel to thoutside elements.

The interiors and the finishings are the fine tuning of our home +.

(for more details see SO-401b and SO-201e-208e, SO-211b-214b)



home+			

16. Health and Safety Report - Contents

Summary of Changes

- 1. Health & Safety Precedents and Aim
- 2. General data of the project
- 3. Health & Safety plan Objectives
- 4. Conditions of the site where construction will take place, and interesting data related to the prevention of labour risks during the construction process
- 5. Work units for labour risks prevention
- 6. Critical work phases for labour risks prevention
- 7. Risks identification and efficacy evaluation of the adopted protections
- 8. Collective Protection to use
- 9. Individual protection resources to use
- 10. Safe working procedures of every employer: It is enough mentioning it will be the procedures to be included in the Health & Safety plans of the activity of the construction employers.
- 11. Machinery and auxiliary resources: It is enough mentioning that the application of the safe working procedures made by the manufacturer will be demonstrated.
- 12. Welfare prevention in case of labour accident
- 13. Risks identification for possible later works; risks related with the cleaning and maintenance of the prototype will be indicated.
- 14. Useful plans and information for possible later works: prevention and Health & Safety solutions for this type of works will be indicated. For example: installed protection, or applicable safe method for the cleaning of the PV panels.
- 15. Adopted system for the level of health and safety control during works
- 16. Formation and information about health and safety
- 17. Building emergency evacuation plan
- Annex 1 Identification of risks with SENMUT EXPERTO
- **Annex 2 Safety Equipment List**
- Annex 3 Construction Site Ordinance home+
- **Annex 4 University Declarations**
- **Annex 5 Medical Certificate**
- **Annex 6 Employer Certification**
- Annex 7 external skid resistance test –the material was certified by the IFA-institute
- Annex 8 fire reaction type of construction elements
- **Annex 9 fragile elements**
- **Annex 10 Inspection Card**

Summary of changes – Health and Safety Report

The changes relay on delivery 7

to 6. Critical work phases for labour risks prevention

Film team added

to 8. Collective protection to use

advanced

to 14. Useful plans and information for possible later works

- description of cleaning the roof, the photovoltaics and the photovoltaic facade completed

Annex 1 Identification of risks with SENMUT EXPERTO

- advanced
- note added

Annex 6 Employer Certification

- CSO added
- completed

Annex 11 Construction Site Ordinances of the Team

added

Annex 12 Medical Certificate of the Team

added

Drawings

HS-106 – ASSEMBLY 06 replaced by HS-106a – ASSEMBLY 06

Summary of changes – Health and Safety Report

The changes relay on delivery 5

to 2. General data of the project

- Address added
- Change in responsibilities
- Closed building hull full assembled Most used materials added

to 4. Conditions of the site where construction will take place, and interesting data related to the prevention of labour risks during the construction process

- to a): constructive process assembly and disassembly process added
- to b): type and characteristics of the materials and elements used materials added
- to c) : site description measurements of the site and important common measures on construction site added
- to e): access and paths for vehicles description added
- to f): determining for the house placing factors added
- to g): overlaps with the affected services and other circumstances or activities of the environment, able to cause labour risks during the construction the special attention to the other teams, to the traffic and during the crane works added
- to h): planned work units the planned work units, unit 1 to unit 16 added
- to k): machinery planned for the construction site complete machinery added
- to I): construction site installations complete site installations added, procedure with the waste added
- to m): characteristics table for the stocks description of the stocks added

to 5. Work units for labour risks prevention

- to a) : construction plan: determination of work effective timing work plan and description of the shift working added
- to b) : overlaps and incompatilibilities in the construction overlaps and their description for avoiding risks added
- to c) : number of workers taking part in the construction calculation number of workers and their composition added
- to d): contracting planned planned contracting and contact details added

to 6. Critical work phases for labour risks prevention

 Critical work phases and the measurements against the risks accruing at the load/unload, the electrical installation, installation of the interior, absorbers and solar chimney interior added

to 7. Risks identification and efficacy evaluation of the adopted protection

- to a): location and identification of the areas where the works involving special risks will be developed preparation zone added, risks resulting from the location of the construction site and their solutions added
- to b): risks identification and efficiency evaluation of the adopted protection risks and the measurements for avoiding them added

to 8. Collective protection to use

- Collective protection like scaffold, ladders, hoarding, boards, membrane illumination, pavilion, handrails, fire extinguishers and their descriptions added
- Preventive protection added

to 9. Individual protection resources to use

- to a) : signposting of the labour risks signs at the hoarding, information signs advising of the health and safety equipment and signs for dangerous work units added
- to 10. Safe working procedures of every employer
- Importance of cleanness added

to 12. Welfare prevention in case of labour accident

- to a): first aids Spanish sentence for calling emergency added, important telephone numbers will be added as soon as possible
- to c): preventive medicine a few components added
- to d): accident victims evacuation procedure, when there are victims, added
- to 13. Risks identification for possible later works
- Later works added

to 14. Useful plans and information for possible later works

- The description of the later works, their risks and how to avoid them, added

to 15. Adopted system for the level of the health and safety control during the works

Complete system added

to 16. Formation and information about health and safety

Tutorial added

to 17. Building emergency evacuation plan

Escape ways added, evacuation plans added

Annex 1 Identification of risks with SENMUT EXPERTO

advanced

Annex 2 Safety Equipment List

advanced

Annex 4 University Declarations

added

Annex 5 Medical Certificate

added

Annex 6 Employer Certification

added

Annex 7 external skid resistance test - the material was certified by the IFA-Institute

added

Annex 8 fire reaction type of construction elements

added

Annex 9 fragile elements

added

Annex 10 Inspection Card

added

Health & Safety Report

1. Health & Safety Precedents and Aim

Preamble - Health & Safety Report

Our Health & Safety Report is a general description of all our hazards and risks and how we can avoid them in all aspects.

Every team member had to sign the construction site ordinance which you can find in the Annex. In this document everyone agrees with the possible danger, risks, rules and the personal safety precautions we thought of for the whole building phase of the project, whether in Madrid or in Germany. Additional some basic information about the insurances are inserted and the document was printed, shown and signed to/from every team member.

Prescribed safety precautions like hard hats, safety glasses, shirt with sleeves, long pants and safety boots with ankle supports – should be used by each team member and crew. Additional PPE (personal protective equipment) will be used in individual cases and as much as possible.

To respect and protect our team from risks it is our duty that we aim to reduce risks and if a hazardous condition is identified, it is not a problem to stop all working immediately. Health & Safety is the area of policy and legislation covering employee wellbeing. Health and safety within an organization is often coordinated by a particular person, but it is the responsibility of all employees. Maintaining a safe working environment and safe working practices and ensuring that employees' health is not detrimentally affected by their work, is a statutory duty of organizations. Regardless of size, all businesses have a legal responsibility to protect the health and safety of their employees and visitors to their workplaces and to the competition site.

2. General data of the project

General address / Construction Site in Germany

Stuttgart University of Applied Sciences

(Hochschule für Technik Stuttgart)

Schellingstraße 24

70174 Stuttgart - Germany

Telefax: ++49 711 8926-2666

www.sdeurope.de www.hft-stuttgart.de

Emergency telephone codes - Germany

Emergency/Police: 110

Ambulance/Fire Department: 112

Emergency telephone codes - Spain

Emergencies: 112 Local Police: 092

National Police: 091

Police 24 hours crime reporting: 902 102 112

Fire Department: 080

Ambulance: 061

Construction Site in Madrid

Villa Solar – Ground 14

Puente de Segovia

(from Paseo Bajo Virgen del Puerto)

SDE 2010 (organization) Contact on site

To be defined by the SDE organization.

Addresses from the police, hospital and other

institutions that could be important for a smooth

event will be defined by the SDE organization. We

will get this information during the register at the

beginning of the competition in Madrid.

Responsible Persons:

project management / faculty advisor

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fire watch captain

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structural engineer

Heiner Hartmann – professor

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Closed building hull - full assembled:

length: 10,85 m width: 6,78

height without tower: 3,59 overall height with tower: 4,76

Most used materials: wood, glass, steel, aluminum,

plastics

3. Health & Safety plan Objectives

The objective of the plan is to guarantee as much safety on the working site as possible. Therefore every work step is planned always to have the health & safety of the workers in mind.

Safety in all relevant areas is necessary for a successful competition

4. Conditions of the site where construction will take place, and interesting data related to the prevention of labour risks during the construction process

Ground:

The working site is located in a valley next to the Royal Palace Gardens. The lot is situated directly at the pedestrian bridge. The ground seems to be relatively hard and consists of dry sand or concrete because of the tunnel-system (highway) under the whole competition area (with a ventilation shaft near the site.) Boards will allocate the weight of heavy loads to assure a safe ground.

Surrounding:

Beside the competition site is a new built river. All groupmembers are required to keep distance to the riverside.

a) Constructive process

Assembly:

- 1. unload and assembly of site facilities (Day 1)
- 2. assembly of the building foundation (Day 2)
- 3. unload and assembly of modules (Night 2)
- 4. assembly of the tower and gaps (Day 3-4)
- 5. unload and assembly of the terrace (Day 3, 5-6)
- 6. assembly of the solar envelope (Day 7-8)
- 7. interiors (Day 5-9)
- 8. disassembling site facilities and cleaning (Day 10)

Disassembly:

- 9. unload and assembly of site facilities (Day 1)
- 10. interior (Day 1-3)
- 11. disassembly of the solar envelope (Day 1-2)
- 12. disassembly and load of the terrace (Day 2-3)
- 13. disassembly of the tower and gaps (Day 3-4)
- 14. disassembly and load of modules (Day 4)
- 15. assembly of the building foundation (Day 5)
- 16. disassembling site facilities and cleaning (Day 5)

b) Type and characteristics of the materials and elements

Most used materials: wood, glass, steel, aluminum and plastics.

Furthermore we will use oversize-chip-boards, screws, mask-band, compositions, lamb's wool and different metal. We also need elements, which are already stuck together.

Gasoline will be stored for generator and forklift.

This is highly combustable and therefore it will be stored in a safe petrol can and in small quantity. It will be placed in the container, thus it is shaded and secured. Out of this we won't use any dangerous substances.

c) Site description

On construction site there will be a preparation area and an area for loading and unloading. Moreover we have a storage area on the western side. Next to the construction site is a river.

Measurement: 20 m to 24 m

Boards will be constructed on the storage area in order to allocate the load of the fork lift. In addition to that, there will be boards on the ground of the storage area which will allocate the loads of these building elements.

On the preparation area we will construct a membrane which will absorb small pieces of waste. This membrane will be removed after assembling so that we can make sure, that we have a clean and safe ground during the competition.

d) Climatology description

The climate of Madrid is typically continental Mediterranean, dry and warm. Its high altitude and proximity to mountains causes some wide variations in winter and summer temperatures.

In summer the midday heat can be intense (can easily reach 40°C), but the evenings are often cool. Winters are frigid across the region (average below 8°C) and there

are frequent frosts and occasional snowfalls. Rain in Madrid is a rarity, with a short rainy season in late October and some showers in spring.

The Meaning for the competition in June:
Average temperature is about 21 degrees and there are 10 hours of sunshine a day. Preventive

arrangements are listed in the Safety Equipment

List.

e) Access and paths for vehicles

The access point is located at the Puente de Segovia. Approach to the site is expected to be from the side of the building at the beginning of the hillside, through a big street (eventually from Paseo Bajo Virgen del Puerto)

Furthermore our site is located next to the pedestrian bridge for non-vehicle access.

After loading or unloading the trucks have to leave the area by using the north entrance.

f) Determining factors for the house placing

Because of the overhang of the crane and the decline of the construction site towards the western side, the building has to be placed at the eastern side of the site.

g) Overlaps with the affected services and other circumstances or activities of the environment, able to cause labour risks during the construction

We have to pay attention to the other teams' assembling, their buildings and to the traffic. In the north we have to pay special attention to our neighbours. In the east there will be the road which is adjunctive with some special safety measures. During crane works we will lock an area of the pedestrian path in order to restrain pedestrians from entering into the area and causing mischief.

h) Planned work units

Unit 1 - unload and assembly the site facilities

First, the spotlights will be installed and the storage area will be covered with boards. Then, unload site facilities, foundation, gap elements, ventilation tower and 1st Module on the storage area by crane. While this is done, the site will be safeguarded by the team and only four team-members will assist the crane in the danger zone. Afterwards the site will be fenced by hoarding and the pavilion and site facilities will be assembled.

Unit 2 - assembly of the building foundation

At first the side will be measured. Then we will assemble and adjust the building foundation. These consist of steel elements of portable weight and therefore can be done by hand. This will be supervised by Albert Stöcker. After this it will be approved by the SDE organization.

Unit 3 - unload and assembly of modules

The third Unit includes the modules, which will be unloaded and assembled in one step so that a quick and easy assembly is avouched. All modules are prefabricated with the structure and all layers except the PV. The interiors are also inside the modules. The assembly starts with module one, which is smaller than the others and includes the terrace. The modules 2-4 are to follow. All modules are sealed and had been unloaded and assembled with the packaging from the transport. While this is done, the street will be safeguarded by the team and only four team-members will assist the crane in the danger zone. Gaps between the modules will be covered by boards. This is happening during the night so the site will be illuminated by spotlights.

Unit 4 - assembly of the tower and gaps

The fourth unit is divided in many sub steps and it includes the tower and the gap elements. Except for the tower the steps for the gap elements are the same and can be done in parallel sequence. The first step of the gap assembly is the floor of gap 1-3. Then the tower assembly follows in gap 3. The next points are the vertical gap elements in all gaps. Then the horizontal glazing will be assembled. All parts of the gaps are prefabricated elements of steel and glazing. A scaffolding secures the people on the roof. It is important that everybody except the crane-assistance, leave the danger zone while the crane is operating.

Unit 5 - unload and assembly of the terrace

The Terrace, PV modules and evacuated tube collectors will be unloaded during the night and stored on the storage area. Therefore the loading and unloading will be safeguarded by the team. The terrace is prefabricated in 6 elements. The element 2 is the first assembled part, followed by 3, 1, 4, 5, 6 and 7. The stair elements 9, 10, 13 will be assembled as soon as possible to prevent the danger of fall. Also the floor will be attached as soon as the structure is assembled to avoid dangerous gaps. All elements have steel bases and bearing wooden beams and prefabricated terrace elements on it. Most of the elements will be lifted by fork lift or crane. All team members have to leave the danger zone while these machines are operating. Finally the side cover can be fixed.

Unit 6 - assembly of the PV Modules and evacuated tube collectors

The next position is the assembly of the PV and evacuated tube collectors. We start with the PV

on the roof and the evacuated tube collectors. They will be connected and the pressure tightness will be checked by Mr. Neumüller, a professional heating engineer. Then the PV on the walls can be assembled and installed. Also glass of the louver windows will be assembled. A scaffolding secures the people on the roof. While the crane is operating the other team members have to leave the danger zone.

Installation of the PV

The installation and grounding of the PV will be done by Sigfried Baumgartner as a professional and authorized person. During the work the power has to be off and secured.

Unit 7 - interior

The interior fittings can be done simultaneously to Unit 4 and 5. At first the electrical installation and plumbing's will be connected in the floor of the gaps. Another person will secure the gaps. Then the floor of the gaps can be assembled. The ceiling will be plastered and painted. Beyond this, there are several minor works which can be done in parallel sequence like the installation of the ventilation tower, the assembly of the moveable furniture, cleaning etc.

Electrical installation of the modules

All modules are prefabricated within the electricity lines and plumbing. To connect the electricity lines of each module there are revision openings in the floor of the gaps. During the installation the holes have to be secured by signs to prevent fall. All the power in the house has to be disconnected and secured while somebody is working at the electrical grid. The installation and grounding of the electrical system will be done by Sigfried Baumgartner as a professional and authorized person.

Ventilation Tower interior

To install the interior of the ventilation tower, two team members will hold the hung window open while another person is assembling the water system and membranes. First a Board on the floor will be installed to allocate the load. A ladder will be used for fixing the membrane and water tubes in the top. Therefore a fourth person is securing the ladder. Then the ladder and floor board will be disassembled to remove the basin. The waterproofed lighting and the water- and wastewater disposal line will be assembled and the electrical water pump connected. Finally the basin will be adopted. During the work the power has to be off and secured.

Installation of the solar chimney interior
Because of the narrow and difficult place, the
assembling of the solar chimney interior has to be
done with a lot of care. First the scaffolding will be
placed in front of the solar chimney.
To install the absorbers, a board will be placed
between the side window and the lower security
glass. This has to be fixed against shift. One person
will enter the solar chimney while another person
will assist from the scaffolding. The absorbers will
be fixed by steel wires. All fixings will be prepared in
advance to assure an easy installation.

Unit 8 - disassembling site facilities and cleaning

After the façade of the building and the side is cleaned, the building facilities will be dismantled and stored in the container. The waste will be emptied. Finally the container will be moved on a truck by crane. To assure the public safety the danger zone will be sealed off by the team members.

Disassembly

The disassembly will take place in the same units but in opposite order. Special attention is essential since the disassembly will be done in a shorter period.

Unit 9 - Unload and assembly of site facilities

First, the spotlights will be installed and the storage area will be covered with boards. Then, unload site facilities on the storage area by crane. While this is done, the site will be safeguarded by the team and only four team-members will assist the crane in the danger zone. After this is done the site will be fenced and the pavilion and site facilities will be assembled. The tanks will be emptied on the designated place. Unit 10 - interior

The interior fittings can be done simultaneously to Unit 11 and 12. There are several minor works which can be done in parallel sequence like the disassembly of the ventilation tower and gaps interior, fixing of moveable furniture etc. At last the electrical installation and plumbings will be disconnected in the floor of the gaps. All the power in the house has to be disconnected and secured while somebody is working at the electrical grid.

Unit 11 - disassembly of the PV Modules and evacuated tube collectors

The unit 11 can be done simultaneously to unit 10. First the PV modules of the façade, then the PV modules and the evacuated tube collectors of the roof will be disassembled and stored in the packaging for transport. This is done by crane therefore only four group members will assist in the danger zone. A scaffolding secures the people on the roof. Then the glass of the louver windows will be removed by hand.

Unit 12 - disassembly and load of the terrace

The terrace will be removed element by element in the following order: 7, 6, 13, 5, 4, 1, 9, 3, 2, and 10. Each element consists of steel bases and bearing wooden beams and prefabricated terrace elements on it. Most of the elements will be lifted by fork lift or crane. All team members have to leave the danger zone while these machines are operating. During the night the terrace will be loaded onto trucks. Therefore the loading and unloading will be safeguarded by the team.

Unit 13 - disassembly of the tower and gaps

In the first step of the gap disassembly, the horizontal glazing will be removed and stored in the storage area. The next points are the vertical gap elements in all gaps. Then the ventilation tower disassembly follows in gap 3. After that the floor of the gaps will be disassembled and stored in storage area. During the night the module 1 will be directly lifted on a flatbed trailer. The horizontal glazing, the ventilation tower and vertical elements will be lifted from the storage area onto a standard truck. It is important that everybody except the craneassistance has to leave the danger zone while the crane is operating.

Unit 14 - disassembly and upload of modules

The third Unit includes the modules, which will be disassembled and loaded in one. All modules are prefabricated with the structure and all layers except the PV. The interiors are also inside the modules. First the modules will be protected by the transport tarp. Then modules 2-4 will be disassembled and loaded directly on flatbed trailers. While this is done, the street will be safeguarded by the team and only four team-members will assist the crane in the

danger zone. This will be happening during the night so the site will be illuminated by spotlights.

- vacuum cleaner (exhauster)
- fell saw
- jigsaw
- grinding machine

Unit 15 - assembly of the building foundation

The foundation will be dismantled and stored in the storage area.

All machinery have CE branding

Unit 16 - disassembling site facilities and cleaning

The building facilities will be dismantled and stored in the container. The waste will be emptied and the site cleaned. Finally the container and the elements from the storage area will be moved on a truck by crane. To assure the public safety the danger zone will be sealed off by the team members.

i) Trades whose intervention is affected by the labour risks prevention

Preventive arrangements are all done between trades or deliveries or in defined breaks avoiding labour risks.

j) Auxiliary resources planned for the construction

For planned auxiliary resources, please see site operations plan.

k) Machinery planned for the construction

We will take along the following equipment:

- fork lift
- circular saw bench "Ulmia"
- standing power drill
- emergency backup generator
- 6 cordless screwdrivers
- 4 circular hand saws
- angle grinder small and big

I) Construction site installations

- rolling scaffold with fall protection
- hoarding/ barriers by bands, hard barriers
- ladder
- shading (pavilion)
- drinking (fresh water)
- telescope spot lights
- garbage box
- fire extinguisher (2x)
- fork lift

Garbage

The following waste will assail on construction site:

Cuttings of the boards, domestic litter,

We will have a garbage box on our construction site, which will be cleared at least once a day.

The packaging material will be stocked on construction site below the terrace. After the competition we will use it again and take it with us back to Germany.

m) Characteristics table for the stocks

We will have one large storage area in the west of the lot, where we store the construction parts. Smaller tools or parts will be stored in our team bus and container which is more secure.

OSB- boards will allocate the loads of the elements in the storage area. This is important because there are tunnel constructions under the building site.

5. Work units for labour risks prevention

For the Safety of our workers we have personal safety equipment like safety helmets, safety goggles, safety vests, ear mugs, safety gloves, safety shoes, girdles, working clothes.

For more details see annexed Safety Equipment List.

a) Construction plan: determination of work effective timing

We will work in 3 shifts. The workers are allowed to work 8 hours a day. With 15 minute breaks for breakfast and 1 hour for lunch. The labour time of each member will be registered. In order to do that, we will have lists on a laptop in form of a daily construction records. We will work in 3 shifts. The keeping of the breaks will be controlled.

b) Overlaps and incompatibilities in the construction

With our assembling-steps and the organization from Madrid, there are almost no incompatibilities of the construction because of the high prefabricated modules, that are mostly assembled in Germany. If there are minor overlap-works, we make sure that they will not interfere with each other through coordination:

While the terrace will be finished the interior will be in process as well. Out of that, there should be (is) no danger, because every single working step is practiced and planned.

Both the setup of the fugues and the accesses and some cleaning woks will be at the same time, but there won't occur dangers, because each worker know the operations.

c) Number of workers taking part in the construction calculation

We have about 29 students, 4 university staff and 4 skilled worker people working on the site during the construction of our building.

d) Contracting planned

Hermann Paule GmbH & Co. KG

Our transport partner is Paule. It will be the assistant at the assembly/disassembly.

Müller Holzbau GmbH

One of our Sponsors is "Müller Holzbau GmbH"

(wooden structure) on site assistance.

MBM Konstruktionen GmbH Another sponsor is "MBM Konstruktionen" (glass fronts).

Please see Annex for further details.

6. Critical work phases for labour risks prevention

Load/unload phase:

The high danger zone will be separated from the rest of the working site. The workers have to wear safety helmets, safety shoes and working clothes at any time. When the unload occurs with the crane, the pedestrian paths around the crane will be completely locked. The barriers will be composed of bands and team members, who are dependent to hold people off the locked area. Aim in this phase is to have as few persons as possible working around the danger zone.

Electrical installation of the modules

All modules are prefabricated within the electricity lines and plumbing. To connect the electricity lines of each module there are revision openings in the floor of the gaps. During the installation the holes have to be secured by signs to prevent fall. All the power in the house has to be disconnected and secured while somebody is working at the electrical grid. The installation and grounding of the electrical system will be done by Sigfried Baumgartner as a professional and authorized person.

Ventilation Tower interior

To install the interior of the ventilation tower, two team members will hold the hung window open while another person is assembling the water system and membranes. First a Board on the floor will be installed to allocate the load. A ladder will be used for fixing the membrane and water tubes in the top. Therefore a fourth person is securing the ladder. Then the ladder and floor board will be disassembled to remove the basin. The waterproofed lighting and the water- and wastewater disposal line will be assembled and the electrical water pump connected. Finally the basin will be adopted. During the work the power has to be off and secured.

Installation of the solar chimney interior
Because of the narrow and difficult place, the
assembling of the solar chimney interior has to be
done with high carefulness. First the scaffolding will
be placed in front of the solar chimney.
To install the absorbers, a board will be placed
between the side window and the lower security
glass. This has to be fixed against shift. One person
will enter the solar chimney while another person
will assist from the scaffolding. The absorbers will
be fixed by steel wires. All fixings will be prepared in
advance to assure an easy installation.

Low danger zone consist of the storage (inactive) area, most of the recreational area and the areas which do not touch the diameter of the crane during the unload/assembly-phase (or load/disassembly-phase).

The workers have already experiences in assembling and disassembling the building, because it will have been built up and dismantled in Stuttgart before and the same workers will be involved. Each grip will be well known and therefore the dangers are minimized. If there is a special action we let our neighbours know, too.

There will be a Film Team attending our building site. This demands a special concentration to prevent risks. Like every team member, the film team has to wear individual protection like safe boots, safety vest and helmet. They also have to sign the Construction Site Ordinance which describes the safety demands. To avoid confusion they will be introduced in the working procedures.

7. Risks identification and efficacy evaluation of the adopted protections

a) Location and identification of the areas where the works involving special risks will be developed

There will be a preparation zone on construction site, where there will be lots of dangers, because a lot of people will remain there. When the crane will rotate loads above this area, nobody is allowed to stay there. The area will be locked.

The risk of being near the river is, that someone might fall in this river. We have a hoarding around our construction site, so that the workers are not able to reach the river easily during the assembling/

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disassembling.

Another risk is the working site, which is located above an underground street tunnel, therefore we will have boards on the ground for load sharing when we transport some loads for example with the fork lift.

the the workers have to wear safety clothes

safety clothes

flying fragments or particles
 the workers have to wear helmets

- accidents caused by living beings

- trapped by or between objects

gaps will be covered by boards

- b) Risks identification and efficiency evaluation of the adopted protections
- -fall of persons at a different level there won't be any insecured building edges, gabs will be covered by boards
- trapped by turned over machines, tractors or vehicles
 signs will show, that you have to pay attention because of vehicles

- fall of persons at the same level always a cleaned construction site
- overexertion
 workers are just allowed to work 8 hours a day and have to make breaks

- fall of objects because of collapse the workers have to use helmets
- fall of objects because they come loose the workers have to wear helmets, if a helmet can't countervail against the falling objects, the area will be locked by a hoarding
- exposure to extreme environmental temperatures we will have enough fresh drinking water and sun scream on the construction site

- fall of objects because of manipulation
 externals not allowed to enter the construction site
- thermal contact
 should not happen because the system start working
 after it is installed, even if thermal contact should
 ocur every worker is instructed and has to wear
- stepping on objects
 the workers have to wear safety shoes and the construction site has to be cleaned permanently
- exposure to electric connections
 the electric sockets are completely installed, only the
 PV-installation will be done by professionals and the
 emergency generator will be run supervised by the
 site manager / health & safety officer
- to collide with still objects
 any worker has to care about his working place and has to be careful when working on site
- exposure to solar radiation
 There is enough sunscreen and water (refreshing elements) at the team bus / container on site
- to collide with objects in motion
 the workers have to wear a helmet, locked areas
- exposure to harmful substances
 there won't be any harmful substances on

knocked by objects or tools
 the workers have to wear helmets

construction site
contact with caustic or corrosive substances
there won't be any caustic and corrosive substances
on construction site

explosion
 there won't be any explosive substances on construction site

- fire

- we have fire- extinguishers and a rescue-plan, smoking is prohibited on construction site
- run over or hit by vehicles
 signs will help, that there are no accidents;
 the workers driving the vehicles have a lot of experiences
- non traumatic pathologies
 smaller injuries will be medicated until the worker
 can go on working without any restriction
- "in itinere"
 Warning signs will help, to reduce the risk of accidents
- complexity (at night)
 there will be 6 spotlights on construction site,
 in order of there being enough light all over the construction site
- cutting
 workers will have to wear gloves, if there is the
 danger of cutting, so the hands and fingers are kept
 safe
- narrow range
 people won't work alone, if they panic, the other
 ones could help

8. Collective Protection to use

First you need to know what you can do in case of an emergency >>> therefore see point 12 a.

You have to consider some questions to the working ground, the situation when the truck is unloaded/ loaded and the supply or disposal at the working site.

To keep in mind there is not only a hazard to the team-members but also to third persons or things. Furthermore hazards might be produced from beyond the working site for example by traffic infrastructure.

Therefore we have the following 6 aims:

- Protection of third persons during the work performance
- 2. Protection of the team-members from external risks
- Protection of the team-members from danger caused by the work performance on the site
- 4. Protection of the property of third persons
- 5. Protection of the own property and the building during the work performance
- Protection of the own property and the building from external risks for example burglary and vandalism

These aims we try to reach with the annexed Safety Equipment List.

Signs for the site during assembly/disassembly see 9.a - Signposting of the labour risks.

Scaffold:

A mobile scaffolding and ladders are needed, to protect the workers above the ground. Two rolling scaffolds will be installed on each side of the building. Connected by a fall protection it will secure the work on the roof of one module. Thereby the handrail height will be a min. of 1 m above the roof level. Workers on the roof are just allowed in this secured area. There will be an inner staircase

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to prevent fall. Both scaffolds have to be locked against rolling before use. The ground has to be firm and clean. Boards will allocate the load of the scaffolding. The scaffolding is proofed by the "Deutsches Institut für Bautechnik" and therefore comply with DIN 4422-1 (HD 1004:1992).

Ladder:

Folding ladders will be used for interior and maintenance work. Telescope ladders will be used to hinge the hook to the modules, and for the installation of the tower interior.

Therefore they have to be fixed to stabilize them. For work on the façade of the building this can be done to the substructure of the Photovoltaic's. In other situations the ladder has to be secured by another person. There will be also a Platform ladder with handrail for maintainance work. Just one worker is allowed on one ladder. The maximum weight is 150kg. The ground has to be firm and clean. The overlap over the staying or access points has to be at least 1m. The security lock has to click into place before use. All ladders will comply with EN 1147.

Hoarding:

Hoarding is used as security fencing around the building site. The hoarding consists of 2 m high steel and wire panels. It will be installed as soon as possible to avoid externals in danger zones.

The pedestrian paths around the crane will be completely locked during load and unload. The barriers will be composed of bands and team members, who are dependent to hold people off the locked area. Aim in this phase is to have as few persons as possible working around the danger zone.

Boards, which covering gaps:

OSB- boards will be used to cover the gaps between the modules. They have to be fixed against shift. This is to prevent fall of different levels.

Boards to allocate the weight:

OSB- boards will allocate the loads of the elements in the storage area. This is important because there are tunnel constructions under the building site. The forklift will also only be used on boards.

Membrane on the preparation area:

On the preparation area we will construct a membrane which will absorb small pieces of waste. This membrane will be removed after the assembling so that we can make sure, that we have a clean and safe ground during the competition.

Building site illumination:

There will be illumination of the construction site during the night. 4 spotlights will be installed on the site for the basic illumination (each corner one).

There will be more lights for specific working places.

Staffs pavilion:

A pavilion will provide shade for the team members. There will be enough drinking water, and sunscreen as well.

Handrails:

There will be handrails on both sides of the ramp and at one site of the staircase, to prevent fall. The edges of the Terrace will be secured by stair element to the north, west and southern side. A furniture element gives fall protection to the east. All these protections will be assembled as soon as possible to prevent unsecured edges during the construction site.

Designation of level differences:

A visual and tactile differentiation will be made in the northern, western and southern side of the terrace. This is in order to prevent fall at different levels. There are two, "AB" fire extinguishers on the site For emergency calls there is a telephone located in the team bus.

There won't be any insecured building edges either. In a flexible rack we will store some smaller materials safely.

The workers are just allowed to work 8 hours a day, at least 3 workers – 2 of them have to hold the cover.

Smoking is absolutely prohibited on the whole construction site at any time.

It's not allowed to work alone on the site, this is essential for every team member. A Second person could help or call for help in case of an accident.

Preventive Protection:

We had a safety-at-work- tutorial for each team member. The topics were the correct behaviour on construction site as well as preventive and safety measures.

The workers have already experience in assembling and disassembling the building, because it will have been built up and dismantled in Stuttgart before and the same workers will be involved. Each movement will be well known and therefore the dangers are minimized. If there is a special action we let our neighbours know, too.

a) Signposting of the Labour risks

The following signs are posted at the hoarding

(fence) near the access:

Danger of falling objects

Caution fork lift trucks operating

Strictly no admittance (on each side of the site)

No smoking

Hard hat area

Protective footwear must be worn

High visibility jacket must be worn

Keep this area litter free

The following information signs advise of the health

& safety equipment:

Drinking water

First aid

Fire extinguisher

Emergency Telephone

The following signs will be placed during dangerous

work units:

Caution slippery surface

Danger overhead crane

Warning overhead loads

9. Individual protection resources to use

For individual protection please see Safety Equipment List.

Every team-member will wear safety shoes, a safety helmet, safety vest, safety gloves and working clothes. Some work will require safety glasses (goggles) and hearing protection as well as a girdle, dust covers or an exhauster







Caution fork-lift trucks operating Strictly no admittance



No e smoking













Keep this area litter free







Drinking water



Emergency telephone



Fire extinguisher







Caution slippery surface



Warning sudden drop



Warning overhead loads

10. Safe working procedures of every employer: It is enough mentioning it will be the procedures to be included in the Health & Safety plans of the activity of the construction employers.

We make sure, that every worker only executes the work he is applicable for. The workers coordinate their work before they start working.

The most important thing on construction site is tidiness. In the evenings the construction site will have to be cleaned up permanently and completely before there is a change of shift.

11. Machinery and auxiliary resources: It is enough mentioning that the application of the safe working procedures made by the manufacturer will be demonstrated.

The workers will be trained in appliance and safety with the tools and the used machinery - demonstrated by the manufacturer and will be experienced in assembling and disassembling the building in Stuttgart.

12. Welfare prevention in case of labour accident

 All accidents have to be noted and communicated to the relevant person at site AND the Solar Decathlon management team.

a) First aids

There will be several members, who are trained in first aid. Some of them are first-aiders. In each shift there is at least one first aider.

We will have a table on construction site, where the following information is written down. There will be a short briefing and each team-member knows, where the table is placed.

- The next police station (address and telephone number)
- The next fire department (address and telephone number)
- The next hospital (address and telephone number)
- The next doctor (address and telephone number)
- The contact of the officer
- Location of the sanitary facilities

Location of the next gas-station
 We will get these information at the beginning of the assembling.

Another useful sentence if something happens is this: "Hola estamos en el "Puente de Segovia" y un estudiante se acaba de herir (gravemente) en la construcción. Lo/Los estaremos esperando en la capilla "Iglesia de la Virgen del Puerto"."

It means: "Hello we are located at the "Puente de Segovia" and a student was (seriously) injured during building construction. We will wait at the Church of the Virgin of Puerto beside the chapel."

So everyone should know where we are located!

b) First aids bag

Considering the Spanish standards the first aid kits will have the following filling:

- first-aid manual
- sterile gauze
- adhesive tape
- adhesive bandages in several sizes
- elastic bandage
- antiseptic wipes
- soap
- antibiotic cream (triple-antibiotic ointment)
- antiseptic solution (like hydrogen peroxide)
- hydrocortisone cream (1%)
- acetaminophen and ibuprofen
- tweezers
- sharp scissors
- safety pins
- disposable instant cold packs
- calamine lotion
- alcohol wipes or ethyl alcohol
- thermometer
- plastic gloves (at least 2 pairs)
- blanket (stored nearby)

c) Preventive medicine

It is important for the health protection of interacting groups to have preventive medicine for smaller diseases like:

- a conventional cold: medicine drops for throat-pain, enough tissues, antipyretic medicine
- dry noses: herbal or seawater nasal spray
- sunburn/sunstroke: high-level sunscreen for all members during the competition, hats or caps, cold packs in a coolbag near or at the working site
- insect bites: if necessary a lotion against insects
- dehydration: enough bottled or drinking water
- sickness/stomach flu: medicine
- -Voltaren and other pain relievers
- disinfection spray, germicide
 Active immunisation references will be observed.

d) Accident victims evacuation

Victims, who are able to walk, will be brought to the central helping point accompanied by at least one other team-member.

Victims, who aren't able to walk anymore, will be brought to the tent on construction site or to the ambulance. During this transport, another person (for example the healt h & safety officer) has to call or contact the health service immediately.

13. Risks identification for possible later works; risks related with the cleaning and maintenance of the prototype will be indicated.

- Later problems with the technics
- Drying-out the tower flap-wings
- Checking the content of the tank
- Cleaning the roof and the photovoltaics
- Cleaning the façade
- Cleaning the floor in the house

14. Useful plans and information for possible later works: prevention and Health & Safety solutions for this type of works will be indicated. For example: installed protection, or applicable safe method for the cleaning of the PV panels.

If there are problems with the technics someone has to look below the floor, because the accesses are there. Therefore bottom flaps can be opened. For this at least two people are needed. One of them is responsible for shielding the gab in the floor, in order that nobody is falls down.

For drying-out the tower flap-wings can be opened sideways of the tower. This action will be carried out about three times a week. For this three people are needed. One of them will go into the tower, will pull the cork and eventually clean the tower inside. The others will hold the flap-wing during these works.

Once a week, we had to look into the tank and check its content. You have to screw the sitting covering off in order to check it's content.. The opening extents 1meter to 1 meter. Two people will be needed to do that in order to assure that no objects fall in the tank.

For cleaning the roof and the photovoltaic's, we will have a specific ladder with a platform. The platform with handrail decreases the risk of falling at different levels to a tolerable risk. One person will clean on the ladder with the telescope stick while another person will hold the ladder. Also the ladder has stabilizers. The ladder has to be slid for every single module.

The PV façade will be cleaned from the terrace by a telescope cleaner. Therefore a ladder is not necessary and there will be no risk of falling at different level.

The floor in the house will also have to be cleaned. Therefore we have to make sure, that nobody will slip because of the wet floor. The house will be locked during this time and we will put special signs in front of the doors.

15. Adopted system for the level of health and safety control during works

Every team member knows the rules.

There is a supervisor in each shift who controls the health & safety measures during the works. He is able to stop the working process if there are any unacceptable risks.

Please see the specific work steps in the construction site plan or in the H&S plans to find the safety arrangements during the work phases.

16. Formation and information about health and safety

Every team-member will be informed about the health & safety regulations and has to sign a special (annexed) "Construction Site Ordinance" before working on the Project (see below) which includes instruction, rules and information.

All the workers taking part during the construction process were instructed (in Germany) by a professional safety officer from an external safety agency.

17. Building emergency evacuation plan

In the case of an emergency during the assembly/ disassembly it will be easy to get out of the danger zone because every module (length: 6,78m/width: maximum 2,40m) is open on two sides. The linking elements consists of glass (length: 6,78/width: 0,80m) and are open on two sides, too. During the use of the full-assembled building, it must be possible to open the main entrance and the front door at any time, when people are in the house. A fire and rescue plan exists.

There are two escape ways, one in the south (exit 1) and one in the north (exit 2) of the house. Exit 1:You have to leave the house on the south side through the terrace entrance and go on southbound through the construction site and leave it through egress 2 on the south side of the construction site. Exit2: You have to leave the house on the north side through the main entrance and turn to the right side (to east), where you have to go around the corner southbound between the house and the wall. At the wall's end you have to turn left around the wall and go northbound. Leave the construction site through egress 1.

Evaluation of the possible risks during evacuation. People might run westbound at exit 2. That's the wrong way, because there is no exit of the construction site at the western side. Therefore a team member is in charge of preventing them from going in that direction during the evacuation.

Evacuation plan:

Situation considered for starting evacuation are fire, explosion, smoke generation and the danger of collapse.

Measures to be adopted once the evacuation starts:
-Inside the house: to ask people to leave the house, to show occupants the exits and the way out by guiding them, to make sure that the house is empty
- Outside the house: to ask people to move away from the house as fast as possible and come around the main roads.

There are two fire extinguishers on construction site. One of them inside of the house in the south module, and the other one outside in the south-east of the construction side.

Conclusion of our updated Health & Safety Report

Because of our highly prefabricated module construction and the early prototype construction progress of our building in these days, we describe not the operations in work phases but the different work, which is needed to assemble/disassemble the building, more specific. If the proposed safety equipment is used - the risk of injuries caused by falling objects will change to tolerable. The individual operations are currently revised, too. If there are overlapping works of two or more employers, the present site manager has to arrange and coordinate, so that the people use the same safety equipment and more important - they know which work is actually done at the moment. Before every installation/work phase there will be a meeting of the actual working shift (inclusive external employees) to review the following work and risks. On the other hand, the proceedings about additional insurances and the team uniform (safety clothes) are in progress, too.

Health & Safety is a highly important area for our team, therefore we reconsidered most of our points so that we can be sure, to be well-prepared when we start the building-phase. If some important points are still missing, please let us know and we will try to insert them as good as possible and as soon as possible.

Annex 1 Identification of risks with SENMUT EXPERTO

Identification of risks and evaluation of the efficiency of the adopted protections. For it, the document "Annexed SENMUT EXPERTO" will be used.

Name: Unloading						Eva	aluat	ion pl	ace:	in pla	ns				
Risks identification and its causes		babil ne ev	ity of		Deteri preca				sequ the r	ence		sk qua recau			
Date: 07.06.2010 Time: 6p.m.	R	P	IC	CI	Pi	S	PP	L		M	Т		M	I	In
Fall of persons at a different level:				Х	Х		Х		Х			Х			
Fall of persons at the same level:		Х			Х		Х	Х				Χ			
Fall of objects because of collapse:		Х					Х			Х	Χ				
Fall of objects because they come loose:	Х			Х	Х		Χ			Χ	Χ				
Fall of objects because of manipulation:	Х					Χ	Х			Х	Χ				
Stepping on objects:		Х			Х		Х	Х			Χ				
To collide with still objects:		Х					Х	Х			Χ				
To collide with objects in motion:		Х					Х		Х		Χ				
Knocked by objects or tools:	Х				Х		Х	Х				Χ			
Flying fragments or paticles:		Х			Х		Х	Х			Х				
Accidents caused by living beings:	Х				Х		Χ	Х			Χ				
Trapped by or between objects:		Х			Х		Χ		Χ			Χ			
Trapped by turned over machines, tractors or vehicles:		Х			Х		Χ			Χ	Χ				
Overexertion:			Х	Χ			Χ	Х				Χ			
Exposure to extreme environmental temperatures:	Х				Х		Χ		Χ		Χ				
Thermal contact:	Х				Х		Χ	Х			Χ				
Exposure to electric connections:	Х				Х		Χ			Χ	Χ				
Exposure to radiation:	Х				Χ		Χ			Χ	Χ				
Exposure to harmful substances:	Χ				Χ		Χ			Χ	Χ				
Contact with caustic or corrosive substances:	Χ						Χ	Χ			Χ				
Explosion:	Х				Χ		Χ			Χ	Χ				
Fire:	Х					Χ	Χ			Χ	Χ				
Run over or hit by vehicles:		Х				Χ	Χ			Χ					
Non traumatic pathologies:	Х				Х		Х			Χ					
"In itinere":	Х				Х		Χ			Х	Χ				

Collective protection:

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place) One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

externals are not allowed to enter the construction site

at least 1 first aider in each shift

we have a hoarding

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes

Signs:

individual protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited, attention - fork lift

Prevention procedure:

health and safety tutorial

the workers will have trained each work step before

machinery will be checked (CE)

Name: Unloading with a crane						Ev	aluati	on pl	ace:	in pla	ıns/re	eport			
Risks identification and its causes	Pro	babil	ity of		Deter	mine	ed	Con	sequ	ence	Ris	sk qu	alifica	ation	with
Risks identification and its causes	tł	ne ev	ent		preca	utio	n	of	the r	isk	р	recau	ıtion	apply	ed
Date: 07./08.06.2010 Time: 11 p.m.	R	Р	С	CI	Pi	S	PP	L	G	М	Т	То	М	I	In
Fall of persons at a different level:		Х		Χ	Х		Χ		Χ			Χ			
Fall of persons at the same level:		Х			Х		Χ	Χ				Χ			
Fall of objects because of collapse:		Χ					Χ			Χ	Χ				
Fall of objects because they come loose:			Х		Х		Χ			Χ	Χ				
Fall of objects because of manipulation:			Х			Х	Х			Х	Χ				
Stepping on objects:		Х			Х		Χ	Х			Χ				
To collide with still objects:	Х						Х	Х			Х				
To collide with objects in motion:		Х					Χ		Χ		Х				
Knocked by objects or tools:			Х		Х		Х	Х				Х			
Flying fragments or paticles:		Х			Х		Х	Χ			Х				
Accidents caused by living beings:	Х				Х		Х	Х			Х				
Trapped by or between objects:		Χ			Χ		Χ		Χ			Χ			L
Trapped by turned over machines, tractors or vehicles:		Х			Х		х			Х	Х				
Overexertion:			Χ	Χ			Χ	Χ				Χ			
Exposure to extreme environmental temperatures:	Х				Х		Х		Χ		Χ				
Thermal contact:	Х				Х		Х	Χ			Χ				
Exposure to electric connections:	Х				Х		Χ			Χ	Χ				
Exposure to radiation:	Х				Х		Х			Χ	Χ				
Exposure to harmful substances:	Х				Х		Χ			Χ	Χ				
Contact with caustic or corrosive substances:	Х						Х	Χ			Χ				
Explosion:	Х				Х		Х			Х	Χ				
Fire:	Х					Х	Х			Х	Х				
Run over or hit by vehicles:		Х				Χ	Χ			Χ					
Non traumatic pathologies:	Х				Х		Х			Х					
"In itinere":	Х				Х		Х			Х	Χ				

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place) One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

max. 4 formed team members have the admission to be in the area of the crane. They will assist the crane. While the crane is working, there will be the highest degree of danger. When the container will be unloaded, nobody is allowed to stay on construction site.

externals are not allowed to enter the construction site

at least 1 first aider in each shift

we have a hoarding

the loading and the unloading area will be sealed by bands and by teammembers

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes

Signs:

individual protection - obligation of wearing a helmet and safety shoes, floating loads, entrace prohibited, smoking prohibited, attention- fork lift

Prevention procedure:

health and safety tutorials

the workers will have trained each working step

machinery will be checked (CE)

Name: positioning the substructure						Eva	aluati	on pla	ace: i	in pla	ns/re	port			
Risks identification and its causes	Pro	babili	ty of		eterr	nine	ed	Con	sequ	ence	Ris	k qua	alifica	tion \	vith
Trisks identification and its causes	th	e eve	ent		oreca			of	the r	isk	рі	recau	tion a	apply	<u>ed</u>
Date: 08.06.2010 Time: 8 a.m.	R	Р	С	CI	Pi	S	PP	L	G	M	Т	То	M	I	In
Fall of persons at a different level:	Χ			Χ	Χ		Χ		Χ			Χ			<u> </u>
Fall of persons at the same level:		Χ			Χ		Χ	Χ				Χ			
Fall of objects because of collapse:		Χ					Χ			Χ	Χ				
Fall of objects because they come loose:	Χ			Χ			Χ			Χ	Χ				
Fall of objects because of manipulation:	Χ					Χ	Χ			Χ	Χ				
Stepping on objects:		Χ			Χ		Χ	Χ			Χ				
To collide with still objects:		Χ					Χ	Χ			Χ				
To collide with objects in motion:		Χ					Χ		Χ		Χ				
Knocked by objects or tools:			Χ		Χ		Χ	Χ				Χ			
Flying fragments or paticles:		Χ			Χ		Χ	Χ			Χ				
Accidents caused by living beings:	Χ				Χ		Χ	Χ			Χ				
Trapped by or between objects:		Χ			Χ		Χ		Χ			Χ			
							Х								
Trapped by turned over machines, tractors or vehicles:		Χ			Χ					Χ	Χ				
Overexertion:			Χ	Χ			Χ	Χ				Χ			
Exposure to extreme environmental temperatures:	Χ				Χ		Χ		Χ		Χ				
Thermal contact:	Χ				Χ		Χ	Χ			Χ				
Exposure to electric connections:	Χ				Χ		Χ			Χ	Χ				
Exposure to radiation:	Χ				Χ		Х			Χ	Χ				
Exposure to harmful substances:	Χ				Χ		Χ			Χ	Χ				
Contact with caustic or corrosive substances:	Χ						Χ	Χ			Χ				
Explosion:	Χ				Χ		Χ			Χ	Χ				
Fire:	Χ					Χ	Χ			Χ	Χ				
Run over or hit by vehicles:		Χ				Χ	Χ			Χ					
Non traumatic pathologies:	Χ				Χ		Χ			Χ					
"In itinere":	Χ				Χ		Χ			Χ	Χ				

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extuingishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

externals are not allowed to enter the construction site

at least 1 first aider in each shift

we have a hoarding

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes

Signs:

individual protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited, attention- fork lift

Prevention procedure:

health and safety tutorial

each working step will have to be trained by the workers in Stuttgart before

machinery will be checked (CE)

Name: fitting the modules (from 8 p.m. with a crane)						Εv	aluati	on pl	ace:	in pla					
Risks identification and its causes			ity of		Deter					ence				ation	
		ne ev	_		preca			_	the r		р			apply	
Date: 08./ 09.06.2010 Time: 6p.m 5 a.m.	R	Р	С	CI	Pi	S	PP	L	G	М	Т	То	М	I	In
Fall of persons at a different level:		Х		Χ	Х		Χ		Χ			Χ			
Fall of persons at the same level:		Х			Х		Χ	Χ				Χ			
Fall of objects because of collapse:		Х		Χ			Χ			Χ	Χ				
Fall of objects because they come loose:		Х		Χ			Χ			Χ	Χ				
Fall of objects because of manipulation:		Х		Χ			Χ			Χ	Χ				
Stepping on objects:			Χ		Χ		Χ	Χ			Χ				
To collide with still objects:		Χ				Х	Χ	Χ			Χ				
To collide with objects in motion:		Х				Х	Χ		Χ		Χ				
Knocked by objects or tools:			Х		Х		Χ	Χ				Х			
Flying fragments or paticles:		Х			Х		Х	Х			Χ				1
Accidents caused by living beings:	Х				Х		Х	Х			Χ				
Trapped by or between objects:		Х			Х		Χ		Χ			Х			
							,				,,				
Trapped by turned over machines, tractors or vehicles:		Х			Х		Х			Х	Χ				↓
Overexertion:			Х	Х			Х	Х				Х			↓
Exposure to extreme environmental temperatures:	Х				Х		Х		Х		Х				ــــــ
Thermal contact:	Х				Х		Χ	Χ			Х				<u> </u>
Exposure to electric connections:	Х				Х		Х			Х	Х				<u> </u>
Exposure to radiation:	Х				Х		Χ			Х	Χ				
Exposure to harmful substances:	Х				Χ		Χ			Х	Χ				
Contact with caustic or corrosive substances:	Х				Х		Χ	Χ			Χ				
Explosion:	Х						Χ			Х	Χ				
Fire:	Х				Χ		Χ			Χ	Χ				
Run over or hit by vehicles:		Х				Χ	Χ			Χ		Χ			
Non traumatic pathologies:	Х					Χ	Χ			Χ		Χ			
"In itinere":	Х				Х		Χ			Х	Χ				
adherence demand		Х			Х		Χ		Χ			Х			
dazzle		Х					Χ	Χ			Χ				
complexity		Х					Х	Х			Х				

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extuingishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible), they have to placed that way, that there is no dazzling One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

Just 4 persons on construction site, who are formed safety-related and constructive while the crane is working at least 1 first aider in each shift

ladders have always to be secured by another person - to fix the load onto the crane

the path will be secured by sadety line and team members

we have a hoarding

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes, goggles

Signs: individual Protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited, attention - fork lift

Prevention procedure:

health and safety tutorial

each working step will be trained by the workers in Stuttgart before

machinery will be checked

Name: Montage of the fugues (with crane)						Ev	aluati	on pl	ace:	in pla					
Risks identification and its causes	Pro	babil	lity of		Deteri	mine	ed	Con	sequ	ience	Ris	sk qu	alifica	ation	with
Nisks identification and its causes	tł	ne ev	ent		preca		n	of	the i	risk	р	recau	ution	apply	ed
Date: 09.06.2010	R	Р	С	CI	Pi	S	PP	L	G	М	Т	То	M	I	In
Fall of persons at a different level:		Х		Χ	Х		Χ		Χ			Χ			
Fall of persons at the same level:		Χ			Χ		Χ	Χ				Χ			
Fall of objects because of collapse:		Χ		Χ			Χ			Χ	Χ				
Fall of objects because they come loose:	Х			Χ			Х			Х	Χ				
Fall of objects because of manipulation:		Х		Х			Χ			Х	Χ				
Stepping on objects:		Х			Х		Χ	Χ			Χ				
To collide with still objects:		Х				Х	Х	Х			Х				
To collide with objects in motion:		Х				Χ	Χ		Х			Х			
Knocked by objects or tools:			Х		Х		Χ	Χ			Χ				
Flying fragments or paticles:		Х			Х		Χ	Χ			Χ				
Accidents caused by living beings:	Х				Х		Χ	Χ				Х			
Trapped by or between objects:		Χ			Χ		Χ		Χ		Χ				
Trapped by turned over machines, tractors or vehicles:		Х		х			х			X		Х			
Overexertion:			Х	Х			Х	Х			Х				
Exposure to extreme environmental temperatures:	Х				Х		Х		Х		Х				
Thermal contact:	Х				Х		Х	Х			Х				
Exposure to electric connections:	Х				Х		Х			Х	Х				
Exposure to radiation:	Х				Х		Х			Х	Χ				
Exposure to harmful substances:	Х				Х		Х			Х	х				
Contact with caustic or corrosive substances:	Х						Х	Х			Х				
Explosion:	Х				Х		Χ			Х	Х				
Fire:	Х					Х	Х			Х	Х				
Run over or hit by vehicles:		Х				Χ	Х			Х					
Non traumatic pathologies:	Х				Х		Х			Х					
"In itinere":	Х				Х		Х			Х	Χ				

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

at least 1 first aider in each shift

externals are not allowed to enter the construction site

scaffolding will secure the people on the roof

we have a hoarding

while the crane is working just a few workers will assist it- the other ones have to leave the zone

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes

Signs:

individual Protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited,

Prevention procedure:

health and safety tutorial

each working will have to be trained by the workers in Stuttgart before

workers have to licences according to their vehicles

machinery is checked (CE)

Name: Insertion of the sideelements						Ev	aluati	on pl	ace:	in pla	ıns/re	eport			
Risks identification and its causes	Pro	babil	ity of	1	Deteri	mine	ed	Con	sequ	ence	Ris	sk qu	alifica	ation	with
Nisks identification and its causes	tł	ne ev	ent		preca		n	of	the i	risk	р	recau	ution	apply	ed
Date: 09.06.2010	R	Р	С	CI	Pi	S	PP	L	G	М	Т	To	M	I	In
Fall of persons at a different level:		Х		Х	Х		Х		Χ			Χ			
Fall of persons at the same level:		Χ			Χ		Χ	Χ				Χ			
Fall of objects because of collapse:		Х					Χ			Χ	Χ				
Fall of objects because they come loose:	Х						Х			Х	Х				
Fall of objects because of manipulation:		Х					Х			Х	Х				
Stepping on objects:		Х			Х		Х	Χ			Х				
To collide with still objects:		Х					Х	Х			Х				
To collide with objects in motion:		Х					Х		Х		Χ				
Knocked by objects or tools:			Х		Х		Х	Х				Х			
Flying fragments or paticles:		Х			Х		Х	Х			Х				
Accidents caused by living beings:	Х				Х		Х	Х			Х				
Trapped by or between objects:		Х			Х		Χ		Χ			Х			
Trapped by turned over machines, tractors or vehicles:		x			x		Х			х	Х				
Overexertion:			Х	Х			Х	Х				Χ			
Exposure to extreme environmental temperatures:	Х				Х		Х		Х		Х				
Thermal contact:	Х				Х		Х	Х			Χ				
Exposure to electric connections:	Х				Х		Х			Х		Х			
Exposure to radiation:	Х				Х		Х			Х	Χ				
Exposure to harmful substances:	Х				Х		Х			Х	Х				
Contact with caustic or corrosive substances:	Х						Х	Х			Х				
Explosion:	Х				Х		Х			Х	Х				
Fire:	Х					Х	Х			Х	Х				
Run over or hit by vehicles:		Х				Х	Х			Х					
Non traumatic pathologies:	Х				Х		Х			Х	Ì				
"In itinere":	Х				Х		Х			Х	Χ				

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

externals are not allowed to enter the construction site

at least 1 first aider in each shift

scaffolding to secure the people on the roof

few people as possible in the danger zone

we have a hoarding

Individual protection equipment:

Safety helmet, safety gloves, woking clothes

Signs:

individual Protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited, attention - fork lift

Prevention procedure:

health and safety tutorial

each working step will have been trained by the workers in Stuttgart before

machinery will be checked (CE)

Name: Terrace (with crane)						Ev	aluati	on pl	ace:						
Risks identification and its causes	Pro	babil	ity of		Deter	mine	ed	Con	sequ	ence	Ris	sk qu	alifica	ation	with
Risks identification and its causes	th	ne ev	ent		preca	utio	n	of	the r	isk	р	recau	ution	apply	ed
Date: 09./10.06.2010	R	Р	С	CI	Pi	S	PP	L	G	М	Т	То	M	I	In
Fall of persons at a different level:		Χ		Х	Х		Χ		Χ			Х			
Fall of persons at the same level:		Х			Х		Χ	Χ			Χ				
Fall of objects because of collapse:		Χ		Χ			Χ			Х	Χ				
Fall of objects because they come loose:			Х	Х			Χ			Х	Χ				
Fall of objects because of manipulation:		Χ		Х			Χ			Х	Χ				
Stepping on objects:		Х			Х		Χ	Χ			Χ				
To collide with still objects:		Х					Χ	Х			Χ				1
To collide with objects in motion:		Χ					Χ		Χ			Х			
Knocked by objects or tools:			Х		Х		Χ	Х			Χ				
Flying fragments or paticles:		Х			Χ		Χ	Χ				Χ			
Accidents caused by living beings:	Х				Х		Χ	Χ			Χ				
Trapped by or between objects:		Χ			Х		Χ		Χ			Х			
Trapped by turned over machines, tractors or vehicles:		Х		Х			Χ			Χ	Χ				
Overexertion:			Х		Х		Χ	Χ				Χ			
Exposure to extreme environmental temperatures:	Х				Х		Χ		Χ		Χ				
Thermal contact:	Χ				Χ		Χ	Χ			Χ				
Exposure to electric connections:	Χ				Χ		Χ			Χ	Χ				
Exposure to radiation:	Х				Х		Χ			Χ	Χ				
Exposure to harmful substances:	Χ				Χ		Χ			Χ	Χ				
Contact with caustic or corrosive substances:	Х						Χ	Χ			Χ				
Explosion:	Х				Х		Χ			Χ	Χ				
Fire:	Х					Х	Χ			Χ	Χ				
Run over or hit by vehicles:		Χ				Χ	Χ			Χ					
Non traumatic pathologies:	Х				Х		Χ			Χ					
"In itinere":	Х				Х		Χ			Χ	Χ				

Just the western part of the substructure will be built up that day to avoid reciprocal blockages

to prevent danger some stair elements will be assembled as soon as possible

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

max. 4 formed team members have the admission to be in the area of the crane. They will assist the crane. While the crane is working, there will be the highest degree of danger.

we have a hoarding

externals are not allowed to enter the construction site

at least 1 first aider in each shift

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes, goggles

Signs:

individual protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited, attention - fork lift

Prevention procedure:

health and safety tutorial

each working step will be trained by the workers

machinery will be checked (CE)

Name: Terrace								on pl	ace:	in pla					
Risks identification and its causes	Pro	babil	lity of	[Deter	mine	ed	Con	sequ	ence	Ri	sk qu	alifica	ation	with
	_	ne ev	_		preca			of	the r	_	_	recau		apply	ed
Date: 11./1206.2010	R	Р	С	CI	Pi	S	PP	L	G	М	T	То	М	I	In
Fall of persons at a different level:		Χ		Χ	Χ		Χ		Χ			Χ			
Fall of persons at the same level:		Χ			Х		Χ	Χ				Х			
Fall of objects because of collapse:		Х		Χ			Χ			Χ	Χ				
Fall of objects because they come loose:	Х			Х			Χ			Χ	Χ				
Fall of objects because of manipulation:		Х				Х	Χ			Χ	Χ				
Stepping on objects:		Х			Χ		Χ	Χ			Χ				
To collide with still objects:		Χ				Х	Χ	Χ			Χ				
To collide with objects in motion:		Х				Х	Χ		Х		Χ				
Knocked by objects or tools:			Х		Х		Χ	Χ			Χ				
Flying fragments or paticles:		Х			Х		Χ	Χ				Х			
Accidents caused by living beings:	Х				Х		Χ	Х			Х				
Trapped by or between objects:		Х			Χ		Χ		Χ			Χ			
Trapped by turned over machines, tractors or vehicles:		X		Х			X			X	Х				
Overexertion:			Х	Х			Χ	Х				Х			
Exposure to extreme environmental temperatures:	Х				Х		Х		Х		Х				
Thermal contact:	Х				Х		Х	Χ			Х				
Exposure to electric connections:	Х				Х		Х			Х	Х				
Exposure to radiation:	Х				Х		Х			Х	Х				
Exposure to harmful substances:	Х				Х		Х			Х	Х				
Contact with caustic or corrosive substances:	Х				Х		Х	Х			Х				
Explosion:	Х				Х		Х			Х	Χ				
Fire:	Х					Χ	Х			Х	Χ				
Run over or hit by vehicles:		Х				Χ	Χ			Χ					
Non traumatic pathologies:	Х						Х			Х					
"In itinere":	Х				Х		Χ			Χ	Χ				
cutting		Х			Х		Х		Х						

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

while the crane is oppering just 4 formed team members will assist the crane. The zone has to be left by anyone else. externals are not allowed to enter

the stairs will be assembled as soon as possible to avoid someone falling down

at least 1 first aider in each shift

while the fork lift is operating, everybody has to leave the area of movement

boards will be used to allocate the the weight of the fork lift

we have a hoarding

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes, hearing protection, goggles

Signs:

individual Protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited, attention - fork lift

Prevention procedure:

The worker has to be formed to use the machine, which has a certification and will be checked (CE)

Health and safety tutorial

each working step will be trained by the workers before

Name: completion of the interior						Eva	aluati	on pl	ace:	in pla	ns/re	port			
Risks identification and its causes	Pro	babil	ity of		Deteri	mine	ed	Con	sequ	ence	Ris	sk qu	alifica	tion v	with
Nisks identification and its causes	th	e eve	ent	_	preca	utio	_	of	the r	isk	р	recau	ition a	apply	<u>ed</u>
Date: 11./12.06.2010	R	Р	С	CI	Pi	S	PP	L	G	M	Т	То	M	I	In
Fall of persons at a different level:	Х						Χ		Χ			Χ			
Fall of persons at the same level:		Х			Х		Χ	Χ				Х			
Fall of objects because of collapse:		Х		Χ			Χ			Χ	Χ				
Fall of objects because they come loose:	Х						Χ			Χ	Χ				
Fall of objects because of manipulation:	Χ			Χ			Χ			Χ	Χ				
Stepping on objects:		Х			Х		Χ	Χ			Χ				
To collide with still objects:		Χ				Х	Χ	Χ			Χ				
To collide with objects in motion:		Х				Х	Χ		Χ		Χ				
Knocked by objects or tools:			Х		Х		Χ	Χ				Χ			
Flying fragments or paticles:		Χ			Х		Χ	Χ			Χ				
Accidents caused by living beings:	Х				Х		Χ	Χ			Χ				
Trapped by or between objects:		Χ			Χ		Χ		Χ			Χ			
Trapped by turned over machines, tractors or vehicles:		X		X	X		X			Х	Χ				
Overexertion:			Х	Х			Х	Х				Χ			
Exposure to extreme environmental temperatures:	Х				Х		Х		Х		Χ				
Thermal contact:	Х				Х		Х	Х			Χ				
Exposure to electric connections:	Х				Х		Х			Х	Χ				
Exposure to radiation:	Х				Х		Х			Χ	Χ				
Exposure to harmful substances:	Χ				Х		Χ			Χ	Χ				
Contact with caustic or corrosive substances:	Х						Х	Χ			Χ				
Explosion:	Χ				Х		Χ			Χ	Χ				
Fire:	Χ						Χ			Χ	Χ				
Run over or hit by vehicles:	Χ					Χ	Χ			Χ					
Non traumatic pathologies:	Χ				Х		Х			Χ					
"In itinere":	Χ				Х		Χ			Χ	Χ				
cutting		Х			Х		Χ		Χ						

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

externals are not allowed to enter the construction site

at least 1 first aider in each shift

power has to be off and secured, while somebody is working in the elecrical system

we have a hoarding

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes, hearing protection, dust cover, goggles, exhauster

Signs:

individual protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited

Prevention procedure:

the worker is formed to use the machine, which is certificated.

Health and safety tutorial

each worker will be instructed in their individual work in Stuttgart before.

Machinery will be checked (CE)

the workers have

Name: Photovoltaics (with crane)						Eva	aluati	on pl	ace:i	n plar	ns/re	port			
Risks identification and its causes	Pro	babil	lity of		Deteri	mine	ed	Con	sequ	ence	Ris	sk qu	alifica	ation	with
Nisks identification and its causes	tł	ne ev	ent		preca		n	of	the r	isk	р	recau	ition :	apply	<u>ed</u>
Date: 13./14.06.2010	R	Р	С	CI	Pi	S	PP	L	G	M	Т	То	M	I	In
Fall of persons at a different level:		Х		Χ	Х		Χ		Χ			Χ			
Fall of persons at the same level:		Х			Χ		Χ	Χ				Χ			
Fall of objects because of collapse:		Х		Χ			Χ			Χ	Χ				
Fall of objects because they come loose:			Χ				Χ			Χ	Χ				
Fall of objects because of manipulation:		Х		Х			Χ			Х	Χ				
Stepping on objects:		Х			Х		Χ	Χ			Χ				
To collide with still objects:		Х				Х	Χ	Х			Χ				
To collide with objects in motion:		Х				Χ	Х		Χ		Χ				
Knocked by objects or tools:			Х		Х		Χ	Χ				Χ			
Flying fragments or paticles:		Х			Х		Χ	Χ			Χ				
Accidents caused by living beings:	Х				Х		Х	Χ			Χ				
Trapped by or between objects:		Χ			Χ		Χ		Χ			Χ			
Trapped by turned over machines, tractors or vehicles:		Х		х	X		х			Х	Х				
Overexertion:			Х	Х			Χ	Χ				Χ			
Exposure to extreme environmental temperatures:	Х				Х		Х		Х		Х				
Thermal contact:	Х				Х		Χ	Χ			Χ				
Exposure to electric connections:	Х				Х		Χ			Χ	Χ				
Exposure to radiation:	Х				Х		Χ			Χ	Χ				
Exposure to harmful substances:	Х				Х		Χ			Χ	Χ				
Contact with caustic or corrosive substances:	Х						Χ	Χ			Χ				
Explosion:	Х				Х		Χ			Х	Χ				
Fire:	Х					Х	Х			Х	Х				
Run over or hit by vehicles:		Х				Χ	Х			Х					
Non traumatic pathologies:	Х				Х		Χ			Х					
"In itinere":	Х				Х		Χ			Х	Χ				
•															

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

externals are not allowed to enter the construction site

at least 1 first aider in each shift

we have a hoarding

scaffold

PV installation and groundlich by authorized person

few people as possible in dangerzone of the crane

we have a hoarding

Individual protection equipment:

Safety helmet, girdle, safety gloves, woking clothes, goggles

Signs:

individual protection - obligation of wearing a helmet and safety shoes, floating loads, entrance prohibited, smoking prohibited

Prevention procedure:

health and safety tutorials

each working step will have been trained by the workers in Stuttgart before

machinery will be checked (CE)

the workers have licences according to their vehicles

note: There will be scaffolding used to secure the workers on the roof of only one module. Therefore there are two rolling scaffolds, one on each side of one module. These two are connected by two traverses, so that there is a falling protection on each side of this particular module. Workers on the roof will be just allowed in this secured area. For the next module the Scaffolding have to be moved to the next module.

Name: Setting of the tower (inside)						Εv	aluati	ion pl	ace:						
Risks identification and its causes	Pro	babil	ity of		Deter	mine	ed	Con	sequ	ence	Ris	sk qu	alifica	ation	with
Risks identification and its causes	th	ne ev	ent		preca	utio	n	of	the r	isk	р	recau	ution	apply	ed
Date: 14./15.06. 2010	R	Р	С	CI	Pi	S	PP	L	G	М	Т	То	М	I	ln
Fall of persons at a different level:		Χ					Χ		Χ			Χ			
Fall of persons at the same level:	Х				Х		Χ	Χ				Χ			
Fall of objects because of collapse:		Χ					Χ			Χ	Χ				
Fall of objects because they come loose:	Х						Х			Χ	Χ				
Fall of objects because of manipulation:	Х						Х			Χ	Χ				
Stepping on objects:		Х			Х		Х	Х			Χ				
To collide with still objects:		Х					Х	Х			Х				
To collide with objects in motion:		Х					Х		Χ		Χ				
Knocked by objects or tools:			Х		Х		Х	Х				Χ			
Flying fragments or paticles:		Х			Х		Х	Х			Χ				
Accidents caused by living beings:	Х				Х		Х	Х			Χ				
Trapped by or between objects:		Х			Х		Х		Χ			Χ			
Trapped by turned over machines, tractors or vehicles:		Х			Х		Х			Χ	Χ				
Overexertion:			Х		Х		Х	Х				Χ			
Exposure to extreme environmental temperatures:	Х				Х		Х		Χ		Χ				
Thermal contact:	Х				Х		Х	Х			Χ				
Exposure to electric connections:	Х				Х		Х			Χ	Χ				
Exposure to radiation:	Х				Х		Х			Х	Χ				
Exposure to harmful substances:	Х				Х		Х			Χ	Χ				
Contact with caustic or corrosive substances:	Х						Х	Х			Χ				
Explosion:	Х				Х		Х			Χ	Χ				
Fire:	Х					Χ	Х			Х	Χ				
Run over or hit by vehicles:		Х				Х	Х			Х					
Non traumatic pathologies:	Х				Х		Х			Х					
"In itinere":	Х				Х		Х			Х	Х				
panic because of the narrow range		Х		Х					Х			Χ			

at least 3 workers- 2 of them have to hold the cover

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

externals are not allowed to enter the construction site

at least 1 first aider in each shift

ladder will be secured by another person

we have a hoarding

power off and secured during the hole installation

Individual protection equipment:

Safety helmet, safety gloves, woking clothes, safety shoes, goggles

Signs:

individual protection - obligation of wearing a helmet and safety shoes, entrance prohibited, smoking prohibited

Prevention procedure:

Each working step will be trained before in Stuttgart by the workers

health and safety tutorials

machinery will be checked

Name: Finishing						Ev	aluati	on pl	ace:	in pla	ıns/re	eport			
Risks identification and its causes	Pro	babil	ity of		Deteri	mine	ed	Con	sequ	ence	Ris	sk qu	alifica	ation	with
Nisks identification and its causes	tł	ne ev	ent		preca		n	of	the r	risk	р	recau	ution	apply	ed
Date: 15./16.06.2010	R	Р	С	CI	Pi	S	PP	L	G	М	Т	To	M	I	In
Fall of persons at a different level:		Х					Χ		Х			Χ			
Fall of persons at the same level:	Χ				Χ		Χ	Χ				Χ			
Fall of objects because of collapse:	Х			Χ			Χ			Χ	Χ				
Fall of objects because they come loose:	Х			Χ			Χ			Χ	Χ				
Fall of objects because of manipulation:		Х		Х			Χ			Х	Χ				
Stepping on objects:		Х			Х		Χ	Χ			Χ				
To collide with still objects:		Х				Х	Х	Х			Х				
To collide with objects in motion:		Х				Χ	Χ		Х		Х				
Knocked by objects or tools:			Х		Х		Χ	Χ				Х			
Flying fragments or paticles:		Х			Х		Х	Х			Χ				
Accidents caused by living beings:	Х				Х		Χ	Χ			Х				
Trapped by or between objects:		Х			Χ		Χ		Χ			Χ			
Trapped by turned over machines, tractors or vehicles:		Х			X		х			Х	х				
Overexertion:			Х	Х			Χ	Χ				Х			T
Exposure to extreme environmental temperatures:	Х				Х		Х			Х	Х				
Thermal contact:	Х				Х		Х			Χ	Χ				
Exposure to electric connections:	Х				Х		Χ			Х	Х				
Exposure to radiation:	Х				Х		Х	Х			Χ				
Exposure to harmful substances:	Х				Х		Х			Х	Х				
Contact with caustic or corrosive substances:	Х						Х			Х	Х				
Explosion:	Х				Х		Х			Х	Х				
Fire:	Х					Х	Х			Х	Х				
Run over or hit by vehicles:		Х				Χ	Х			Х					
Non traumatic pathologies:	Х				Х		Х			Х					
"In itinere":	Х				Х		Χ			Х	Χ				

gaps will be covered by boards

there won't be any insecured building edges

if there are falling objects, the area has to be locked by a hoarding

there will always be enough fresh water on construction site

coordination of the working steps

the construction site will be cleaned permanently

workers are just allowed to work 8 hours a day

shaded area by staff pavilion

2 fire extinguishers

working at night- illumination of the construction site by spotlights (min. 4 for the area - more lights for specific working place),incombustible emission to avoid complexity (if possible)

One worker is just allowed to carry objects with a weight below 25 kg (men) / 20 kg (women)

for the electrictity fomed wokers in the current safty instructions, for the installation power off and secured

if someone is working at the floor, the gap has to be secured by someone else

ladders have to be fixed or secured by another worker

externals are not allowed to enter the construction site

at least 1 first aider in each shift

ladder secured by another person

we have a hoarding

Individual protection equipment:

Safety helmet, girdle, safety gloves, woking clothes, goggles, breathing mask

Signs:

individual protection - obligation of wearing a helmet and safety shoes, floating loads, entrance is prohibited, smoking is prohibited

Prevention procedure:

health and safety tutorial

each working stap will be trained by the workers in Stuttgart before

machinery will be checked (CE)

the workers have the licences according to their vehicles

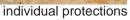
In all SENMUT-tables there are risks which eventually won't appear but they are considered in terms of better safety for the workers/team-members involved.

Annex 2 Safety Equipment List

All safety equipment have CE marking.

SAFETY EQUIPMENT LIST				
Classification / Name	expected Number			
First aid				
first-aid equipment coolbox for coldpack high-level sunscreen insect bite precaution international travel insurance trained person in first aid preventive medicine - for cold/sunstroke/sunburn/ etc.	2 1 2 by themselves 2 by themselves all participating 1 each shift at the team bus			
Individual Protection				
safety vest orange safety vest yellow work gloves safety helmet safety goggles safety boots hearing protection immunisation recommended breathing masks	10 6 all participating 15 5 all participating 5 all participating 5			
Construction site ordinance Walkie Talkie for site communication telescope spotlights staff pavilion (beside the container) storage container for tools & equipment warning signs (see signs) garbage box for cleaning the site ground fault circuit interruptor (Fi) AB fire extinguisher warning tape (red/white) hoarding / access control for the site	all participating 4 6 1 team bus several 1 2 2 2 90 m			







circular hand saw







circular saw







fork lift - inspection sticker















Health and Safety

Annex 3 Construction Site Ordinance - home+

Every team member, participating on the working site in the Solar Decathlon Europe 2010, has read, understand and signed the following document.

Construction Site Ordinance - home[†]

Preamble

This Ordinance is designed to ensure an essential improvement of safety and health protection for employees on the construction site.

This construction site ordinance addresses all work executed by members of the Solar Decathlon Team or by authorized third parties on site or off site for the Stuttgart University of Applied Sciences (HFT Stuttgart) Solar Decathlon Europe project.

Even though time is short there is no reason for working at a hectic pace and renouncing the exactitude or safety rules.

High spirits shall attend our construction process. Agreements shall always be respected and help shall always be offered as well as accepted.

Keeping this in mind, all Solar Decathlon Team Members will sign this document, thereby being notified of the following vital information, and agreeing to the basic principles stated above and below.

General rules of behavior

- No one has to prove him- or herself on the working site. This is especially true to the operation of power tools and lifting heavy weights. No one has to be ashamed of not being capable of doing something. Helping each other is desired.
- Orders of the site management, especially relating to safety have to be followed always and immediately.
- Everyone is responsible for preventing himself and others from accidents. That includes wearing of appropriate personal protective equipment (PPE).
- No one ever works alone on the site
- The site has always be under supervision, as long as tools are outside of the storage containers (in this case our team-bus).
- Site and containers have to be kept clean and in order. After ending work, tools have to be stored in their appropriate boxes and stowed away. Empty batteries have to be reloaded in their loading stations. The construction site has to be swept and trash has to be disposed. The office container (team-bus) has to be left in clean state. This is especially true to remained foods and empty dishes. Beamers, smartboards and computers have to be turned off, as well as lights and heaters. Windows have to be closed and the containers locked.
- The operation of a site radio is allowed.
- Using of personal headphones during construction work is prohibited due to safety. Rules for tool operations
- Power tools are only to be operated after instruction through briefed persons.

Specific Rules

1st Aid upon work accidents:

- First-aid kits are stored in the back of the team-bus. A list of injuries is kept, which means that every injury is documented and also every use of dressing material (type and amount). The list is in the 1st Aid kit.
- If anyone takes the last piece of a certain dressing material, he has to inform the health & safety officer immediately to get replacement.

- For larger accidents the health & safety officer is responsible for reporting the accident and manage the travel insurances (from which country, contact data, ...).
- A small group of our people is trained in 1st Aid so there is at least 1 person with such a training in a working shift. Their commands have to be followed.

Call the ambulance at 112 for serious accidents. Stay calm and give the following address:

In front of "Ermita de la Virgen del Puerto" at the Villa Solar area – from there the ambulance will be guided from a team-member. It's the house next to the pedestrian bridge.

- One person should stand on the street to direct the ambulance
- If possible, give following information during the emergency call:
- 1. Where is the site?
- 2. What happened?
- 3. How many persons injured?
- 4. What kind of injuries?
- 5. Wait on questions give cell phone number

Fire

- One fire extinguisher is in the back of the team-bus beside the first aid kit and another fire extinguisher is located at the south-stocks.
- call the fire department at 112 or 080 **and** inform the university fire watch captain, Health & Safety Officer or inform the nearest team-member.

Smoking and other rules

- Smoking is prohibited inside the team-bus, even if it rains and have to keep site clean of cigarette waste there must be a special smoking area
- Smoking is prohibited during the work, especially while operating power tools. Entertainment Electronics:

Rules concerning personal protective equipment

- Safety boots have to be worn at all times when working.
- Helmets have to be worn during overhead work, when working on ladders, scaffolding, during crane and forklift operation or working with oversized building components.
- Safety goggles must in particular be worn during chipping work, such as working with woods and metals. Ordinary glasses and sunglasses don't replace safety goggles.
- When power tools making noises above 85dB(A) are operated, ear muffs have to be worn.
- Breathing masks have to be worn during sanding and spraying.
- SAFETY GLOVES MUST NOT BE WORN DURING OPERATION OF POWER SAWS AND POWER DRILLS.
- Safety gloves have to be worn when using hazardous materials or when things will be carried.

Ordinances of the site management have to be followed immediately and at all times.

Site Access

- Only Solar Decathlon Team members, or persons authorized by Solar Decathlon Team members are allowed to be on site. Entering the site by visitors is generally prohibited, especially during dangerous work, e.g. crane operation.

- All visitors have to comply with this site ordinance or be instructed by the team members. All visitors must follow commands of team members and must wear appropriate PPE.

Attachment: Abstract from the building code to remember

In case of repeated incompliance with the safety conditions or violations of the penalties of total or partial stoppage or closure of the house, the SDE Health and Safety Officer can recommend that the Competition Manager impose a sanction in terms of score points. If safety risk conditions exist or the Solar Decathlon Building Codes are ignored, the SDE Building Official has the authority to prevent that the house being opened to the general public and give a sanction in terms of score points in the contest of team communication.

Severability Clause (signed by ever team member)

- In case any rule stated in this document contradicts effective law, this rule will be ineffective, all other rules though remain untouched.

I have read and understood this site ordinance and I am not imposing any objections.

Date:	
>>>	Location: Stuttgart
Name/Semester:	
>>>	
With the following signatures you attest to have:	
A private health insurance coverage for abroad is existing:	
>>>	
Immunisation (at least for Tetanus!) is existing (please look a	t your vaccination card):
>>>	

Annex 4 University Declarations

The document will satisfy the regulation of the article 5.2.2.b del RD 1627/1997.

The following declarations from the Stuttgart University of Applied Sciences show:

- All workers will comply with the health & safety report
- All students received instructions of the specific work
- All workers participating passed a medical examination

home+

Declaration

MOT. CRELLERS

Hochschule für Technik Stuttgart

The team of the Hochschule für Technik Stuttgart and all its students and workers participating in Solar Decathlon Europe 2010 in Madrid will comply with the schedule according to the Health and Safety Report to avoid and minimize labour risks. This Report agree with the Solar Decathlon Europe 2010 Rules and Regulations which are based on the RD 1627/1997, Art. 5.2.2b

Das Team der Hochschule für Technik Stuttgart und all seine am Solar Decathlon Europe 2010 in Madrid teilnehmenden Studenten werden den Plan zur Vermeidung und Minderung von Gefahren am Arbeitsplatz nach dem Health and Safety Report befolgen. Dieser ist nach den Angaben der Solar Decathlon Europe 2010 Rules and Regulations erstellt worden, welche auf dem RD 1627/1997, Art. 5.2.2b basieren.

Name of authorized signatory (Name eines Unterschriftberechtigten)

Prof. R. Franke Rektor

Schellingstraße 24 70174 Stuttgart

HOCHSCHULE FÜR TECHNIK STUTTGART

> Postfach 10 14 52 70013 Stuttgart

> > Health and Safety

home+

Declaration

All students have received well-directed instructions of the specific work formation for the assembly and disassembly of the prototype of the Hochschule für Technik Stuttgart considering all prospective aspects of safety at work. This prototype will be assembled and disassembled in the Solar Decathlon Europe 2010 contest in Madrid.

Alle Studenten haben eine gezielte Ausbildung unter allen zu erwartenden Aspekten des Arbeitsschutzes zum Auf- und Abbau des Hauses der Hochschule für Technik erhalten. Dieses Haus wird im Rahmen des Solar Decathlon Wettbewerbes Europa 2010 in Madrid auf- und abgebaut)

Name of authorized signatory (Name eines Unterschriftberechtigten)

PROF. R. FARNUE Que Sun-

HOCHSCHULE FÜR UNIVERSITY OF TECHNIK STUTTGART APPLIED SCIENCES Schellingstraße 24 70174 Stuttgart

Postfach 10 14 52 70013 Stuttgart

University (Universität)

Solar Decathlon Europe 2010 | Team HFT Stuttgart | Schellingstr. 24 | 70174 Stuttgart

home+

Medical Certification

All students and workers participating in the "Solar Decathlon Europe 2010" in Madrid who will be on the site have passed a medical examination. From a medical point of view they all are suitable for working on a construction site.

Name of authorized signatory (Name des Unterschriftberechtigten)

Schellingstraße 24 70174 Stuttgart Postfach 10 14 52 70013 Stuttgart

Hochschule für Technik Stuttgart

PROF. Q. FIKHUS

Solar Decathlon Europe 2010 | Team HFT Stuttgart | Schellingstr. 24 | 70174 Stuttgart

Annex 5 Medical Certificate

This is the form used for the medical certification for each student.

M	PH	ica	IC	ort	ifi	ca	to
IVI	CU	L		CIL		L a	L

Medical certification for the participatio	n in the "Solar Decathlon Europe 2	2010" in Madrid.
Ärztliche Bescheinigung für die Teilnah	me am ,,Solar Decathlon Europe 2	2010" in Madrid.
(name / Name)	(first name / Vorname)	
(date of birth / Geburtsdatum)	_	
(place of birth / Geburtsort)	_	
is from a medical poin There are neither physical nor mental	t of view suitable for working on illnesses or physical adverse effect the work on the site.	
Es liegen weder körperliche und geistig	Sicht für das Arbeiten auf einer	e Beeinträchtigungen vor, welche die
(date / Datum)	(signature of physician / Unterschrift des Arztes)	(stamp of the physician / Stempel des Arztes)

Annex 6 Employer Certification

Showing the certificates from the employers.

- Employer details
- Shows the extern employee details, who will participate on the construction site of the SDE
- Certification, that all tools apply with the CE-sign
- Construction Site Ordinance (showing the 3rd page, signed)

Our transport partner is Paule. It will be the assistant at the assembly/disassembly.

Concern:

Hermann Paule GmbH & Co. KG Augsburger Str. 704 70329 Stuttgart

Contact address guarantor:

Hr. Schmid

Tel: 0711/32016-22 Mobil: 0170/3320413

E-Mail: R.Schmid@Hermann-Paule.de

Crafts:

Transport of the moduls and equipment cranework

Applied equipment:

Mobile crane

Awning trailer truck

Low loader

Possible dangers:

Effects of the weather

Tie-down

Works below floating loads

Preventive measurements:

- Personal: safety helmets, safety vests, safety shoes and safety gloves
- Technical: attachment point defined in advance
- Functional: partial barring of the Breitscheidstraße during the crane works



will be added soon



One of our Sponsors is "Müller Holzbau GmbH" (wooden structure) on site assistance.

Concern:

Müller Holzbau GmbH Pappelauer Str. 51 89134 Blaustein Dietingen

Contact address guarantor:

Benjamin Eisele

Benjamin.eisele@muellerblaustein.de

Tel. direct: 0049 7304 9616 11 Mobil: 0049 179 9126900

Crafts:

Montage woodwork, terraces

Applied equipment:

Crane, ladders, electrical hand apparatus 230V, electrical hand apparatus driven by a accumulator

Possible dangers:

Objects falling down from higher parts of the building Objects falling down during the application of a crane Electric shock by damaged machines or tools

Preventive measurements:

Personal: safety clothing including robust work clothes, safety shoes S3, ear protector, eye

- protection and gloves

Technical: solely application of maintained apparatus and machines

- Functional: No stay under lifted loads, visits of security-relevant courses and retrainings currently,
- health and safety briefing when there are special risks

coverage: Statutory accident insurance

home+

Employment

The following employees will participate in the "Solar Decathlon Europe 2010" in Madrid. This company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

Die folgenden Angestellten werden am "Solar Decathlon Europe 2010" in Madrid teilnehmen. Das Unternehmen wird im Rahmen dieser Veranstaltung das Team der Hochschule für Technik Stuttgart bei baulichen Maßnahmen unterstützen.

Employee (Name and Firstname)	Identification number	qualification
Mitarbeiter (Name und Vorname)	Personalausweisnummer	Qualifizierung
Eisele, Benjamin	612410204	Strictural Engineer Project Manager
Schmid, Bernd	44004475791	Master of Trade Toleman
Matscheho, Andreas	A4005170401	Skilled Labourer

Müller Holzbau GmbH

Company (Unternehmen)

signature authorized signatory (Unterschrift des Unterschriftsberechtigten)

Müller Holzbau GmbH Pappelauer Str. 51 D-89134 Blaustein Tel +49 73 04-96 16-0 Fax +49 73 04-96 16-16

stamp of the company (Stempel des Unternehmens)

home+

Certification

Certification of all machinery and tools that will be used in the "Solar Decathlon Europe 2010" in Madrid. The following company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

Zertifizierung für alle Maschinen und Geräte, die beim "Solar Decathlon Europe 2010" in Madrid benutzent werden. Das folgende Unternehmen wird im Rahmen dieser Veranstaltung das Team der Hochschule für Technik Stuttgart bei baulichen Maßnahmen unterstützen.

Müller Holzbau GmbH

Company (Unternehmen)

I assure that all machinery and tools that will be used in Madrid are CE-certified or that they have an equivalent certification which is valid in Europe. I also guarantee that they are in a good order and condition.

Ich versichere, dass alle Maschinen und Geräte, die wir in Madrid benutzen werden, eine CE-Zertifizierung oder eine andere gleichwertige in Europa gültige Zertifizierung besitzen. Ebenso garantiere ich, dass sie sich in einem einwandfreien Zustand befinden.

signature of authorized signatory (Lynterschrift des Unterschriftsberechtigten)

Müller Holzbau GmbH Pappelauer Str. 51 D-89134 Blaustein Tel +49 73 04-96 16-0 Fax +49 73 04-96 16-16

www.muellerblaustein.de stamp of the company (Stempel des Unternehmens)

Construction Site Ordinance

home[†]

- All visitors have to comply with this site ordinance or be instructed by the team members. All visitors must follow commands of team members and must wear appropriate PPE.

Attachment: Abstract from the building code to remember

In case of repeated incompliance with the safety conditions or violations of the penalties of total or partial stoppage or closure of the house, the SDE Health and Safety Officer can recommend that the Competition Manager impose a sanction in terms of score points. If safety risk conditions exist or the Solar Decathlon Building Codes are ignored, the SDE Building Official has the authority to prevent that the house being opened to the general public and give a sanction in terms of score points in the contest of team communication.

Severability Clause (signed by ever team member)

- In case any rule stated in this document contradicts effective law, this rule will be ineffective, all other rules though remain untouched.

I have read and understood this site ordinance and I am not imposing any objections.

Date:

Name of Company

>>> 18/05/2010

Miller Holslan Combit

Müller Holzbau GmbH
Pappelauer Str. 51
D-89134 Blaustein

Tel +49 73 04-96 16-0 Fax +49 73 04-96 16-16 www.muellerblaustein.de

müllerblaustein

Signature

...<u>35.70</u>

Another sponsor is "MBM Konstruktionen" (glass fronts).

Concern: MBM Konstruktionen GmbH

Alte Stadt 4

D-74219 Möckmühl

Herr Michael Lang, Tel. +49 (0) 6298 - 38 243, lang@mbm-konstruktionen.de

Contact address guarantor:

Herr Daniel Vogelmann, project leader

Herr Lars Thalwieser, construction/montage,

Tel. +49 (0) 6298 - 38 254

Tel. +49 (0) 6298 - 38 296

mobile +49 (0) 171 - 3035045

thalwieser@mbm-konstruktionen.de

vogelmann@mbm-konstruktionen.de

Crafts: Aluminum- glass- facade

Applied equipment: Cutting equipment

Cordless screwdriver

Percussion drill

Possible dangers: Noise, Dust

Falling and flying objects Injuries caused by tools

Preventive measurements:

- Personal: helmets, welding, safety shoes (S3) and gloves

- Technical: Machinery and tools are controlled and maintained regularly by extern experts and confirm with the European norms and standards
- Functional: Regularly there are briefings about the general regulations of safety at work and in addition to that project-oriented briefings by our site-supervisor. Locking the site by suitable locking-measures.

Insurance

We are member of the Berufsgenossenschaft Metall Nord Süd, head office in 55130 Mainz. We also have a casualty insurance at the HDI Gerling, head office in 30633 Hannover.

h	\sim	m	۵	+

Employment

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Employee (Name and Firstname) Mitarbeiter (Name und Vorname)	Identification number Personalausweisnummer	qualification Qualifizierung
Falkenthal, Kai	6486307840D	Metallbauer Konstruktionstechnik

MBH Konstuktionen GmbH, D-74219 Höckmühl

Company (Unternehmen)

signature of authorized signatory (Unterschrift des Unterschriftsberechtigten)

KONSTRUKTIONEN
MBM Konstruktionen GmbH
Alte Stadt 4, D - 74219 Möckmühl
Font 08298/38-0. Fax: 08298/38-13

stamp of the company (Stempel des Unternehmens)

home+

Certification

Certification of all machinery and tools that will be used in the "Solar Decathlon Europe 2010" in Madrid. The following company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

Zertifizierung für alle Maschinen und Geräte, die beim "Solar Decathlon Europe 2010" in Madrid benutzen werden. Das folgende Unternehmen wird im Rahmen dieser Veranstaltung das Team der Hochschule für Technik Stuttgart bei baulichen Maßnahmen unterstützen.

MBM Konstruktionen GmbH
Company (Unternehmen)

I assure that all machinery and tools that will be used in Madrid are CE-certified or that they have an equivalent certification which is valid in Europe. I also guarantee that they are in a good order and condition.

Ich versichere, dass alle Maschinen und Geräte, die wir in Madrid benutzen werden, eine CE-Zertifizierung oder eine andere gleichwertige in Europa gültige Zertifizierung besitzen. Ebenso garantiere ich, dass sie sich in einem einwandfreien Zustand befinden.

signature of (Unterschrift des Unterschriftsberechtigten)

KONSTHUKTIONEN VIBM Konstruktionen GmbH Ville Stedt 4, D • 74219 Möckmüh Fon: 08299/38•0, Pen: 08298/3813

stamp of the company (Stempel des Unternehmens)

Construction Site Ordinance

home[†]

- All visitors have to comply with this site ordinance or be instructed by the team members. All visitors must follow commands of team members and must wear appropriate PPE.

Attachment: Abstract from the building code to remember

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Severability Clause (signed by ever team member)

- In case any rule stated in this document contradicts effective law, this rule will be ineffective, all other rules though remain untouched.

I have read and understood this site ordinance and I am not imposing any objections.

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>>> <u>18. 05. 2010</u>

Name of Company

>>> MBM Konstruktionen GmbH

Signature

>>>

KONSTRUKTIONEN
MBM Konstruktionen GmbH
Ate Stadt 4, D - 74219 Möckmöhl
Fon: 06298/38-0, Fax: 06298/3813

Stuttgart University of Applied Sciences | www.sdeurope.de

Another sponsor is "EGW" (heating, solar, plumbing).

Concern: E.G.W. GmbH

Birkendorferstrasse 42 D-88400 Biberach

Tel. +49 (0) 7351 - 180159-0, info@e-g-w.com

Contact address guarantor:

Herr Valentin Neumüller Florianstr. 20 70188 Stuttgart

Crafts: Heating, Sanitary, Solar

Employment

The following employees will participate in the "Solar Decathlon Europe 2010" in Madrid. This company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

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Employee (Name and Firstname) Mitarbeiter (Name und Vorname)	Identification number Personalausweisnummer	qualification Qualifizierung
Neumüller Valentin	711319073	Obermonteur Heizung-Lüftung-Sanita

88400 Biberach Tel. 0 73 51 - 18 01 59 - 0

Company (Unternehmen)

signature of authorized signatory (Unterschrift des Unterschriftsberechtigten)

Heizung * S Birkendorfer Straße 42 88400 Biberach Tel. 0 73 51 – 18 01 59 – 0

stamp of the company (Stempel des Unternehmens)

home+

Certification

Certification of all machinery and tools that will be used in the "Solar Decathlon Europe 2010" in Madrid. The following company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

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Birkendurfer Straße 42 BB400 Biberach Tel. 0 73 51 – 18 01 59 – 0

Company (Unternehmen)

I assure that all machinery and tools that will be used in Madrid are CE-certified or that they have an equivalent certification which is valid in Europe. I also guarantee that they are in a good order and condition.

Ich versichere, dass alle Maschinen und Geräte, die wir in Madrid benutzen werden, eine CE-Zertifizierung oder eine andere gleichwertige in Europa gültige Zertifizierung besitzen. Ebenso garantiere ich, dass sie sich in einem einwandfreien Zustand befinden.

signature of authorized signatory (Unterschrift des Unterschriftsberechtigten)

C.Q.W. 3

stamp of the company (Stempel des Unternehmens)

) 88400 Biberach Tel. 0 73 51 – 18 01 59 – 0

Construction Site Ordinance home* - All visitors have to comply with this site ordinance or be instructed by the team members. All visitors must follow commands of team members and must wear appropriate PPE. Attachment: Abstract from the building code to remember In case of repeated incompliance with the safety conditions or violations of the penalties of total or partial stoppage or closure of the house, the SDE Health and Safety Officer can recommend that the Competition Manager impose a sanction in terms of score points. If safety risk conditions exist or the Solar Decathlon Building Codes are ignored, the SDE Building Official has the authority to prevent that the house being opened to the general public and give a sanction in terms of score points in the contest of team communication. Severability Clause (signed by ever team member) - In case any rule stated in this document contradicts effective law, this rule will be ineffective, all other rules though remain untouched. I have read and understood this site ordinance and I am not imposing any objections. Date: 19.05.2010 Name of Company Birkendorfer Stralle 42 88400 Biberach Tel. 0 73 51 - 18 01 59 - 0 Signature

Stuttgart University of Applied Sciences | www.sdeurope.de

Another sponsor is "Imtech" (electrical system).

Concern: Imtech Deutschland GmbH & Co. KG

Niederlassung Stuttgart

Motorstr. 62 70499 Stuttgart

Contact address guarantor:

Sven Woithe

Niederlassung Stuttgart

Motorstr. 62

70499 Stuttgart

Tel 0049 711 1393 451

Crafts: electrician

home+	

Employment

The following employees will participate in the "Solar Decathlon Europe 2010" in Madrid. This company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

Die folgenden Angestellten werden am "Solar Decathlon Europe 2010" in Madrid teilnehmen. Das Unternehmen wird im Rahmen dieser Veranstaltung das Team der Hochschule für Technik Stuttgart bei baulichen Maßnahmen unterstützen.

Employee (Name and Firstname) Mitarbeiter (Name und Vorname)	Identification number Personalausweisnummer	qualification Qualifizierung
Woithe, Sven	605956641	Elektroiustallateur

Company (Unternehmen)

signature of authorized signatory (Unterschrift des Unterschriftsberechtigten)

Intech Deutschland GmbH & 60. KS Niederlassung Stuttgart

eleton +49 (0) 7 3 13 93 45

home+

Certification

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lusted Deutschland GubH + Co. 46

Company (Unternehmen)

I assure that all machinery and tools that will be used in Madrid are CE-certified or that they have an equivalent certification which is valid in Europe. I also guarantee that they are in a good order and condition.

Ich versichere, dass alle Maschinen und Geräte, die wir in Madrid benutzen werden, eine CE-Zertifizierung oder eine andere gleichwertige in Europa gültige Zertifizierung besitzen. Ebenso garantiere ich, dass sie sich in einem einwandfreien Zustand befinden.

signature of authorized signatory (Unterschrift des Unterschriftsberechtigten)

Imtech Deutschland GmbH & Co. KG

Niederlassung Stuttgar

stamp of the co

93-451/. (193-451/) des Unternehmens)

Construction Site Ordinance

home[†]

- All visitors have to comply with this site ordinance or be instructed by the team members. All visitors must follow commands of team members and must wear appropriate PPE.

Attachment: Abstract from the building code to remember

In case of repeated incompliance with the safety conditions or violations of the penalties of total or partial stoppage or closure of the house, the SDE Health and Safety Officer can recommend that the Competition Manager impose a sanction in terms of score points. If safety risk conditions exist or the Solar Decathlon Building Codes are ignored, the SDE Building Official has the authority to prevent that the house being opened to the general public and give a sanction in terms of score points in the contest of team communication.

Severability Clause (signed by ever team member)

- In case any rule stated in this document contradicts effective law, this rule will be ineffective, all other rules though remain untouched.

I have read and understood this site ordinance and I am not imposing any objections.

ne of Company
1-1-1 20 1-11 1 1 110 1 110
Imtech Deutschland GmbH & Co KG

Stuttgart University of Applied Sciences | www.sdeurope.de

Another sponsor is "Baumgartner" (building automation).

Concern:	baumgartner GmbH
	Westendstrasse 19
	77971 Kippenheim
Contact addre	ess guarantor:
	Sigfried Baumgartner
	Tel. +49 7825 - 870846
	Fax. +49 7825 - 870847
	info@baumgartner-gmbh.de
Crafts:	electrical engineering
	building engineering
Applied equip	ment:
Possible dang	gers:
Preventive me	easurements:
_	
Insurance	

h	0	m	Δ	7

Employment

The following employees will participate in the "Solar Decathlon Europe 2010" in Madrid. This company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

Die folgenden Angestellten werden am "Solar Decathlon Europe 2010" in Madrid teilnehmen. Das Unternehmen wird im Rahmen dieser Veranstaltung das Team der Hochschule für Technik Stuttgart bei baulichen Maßnahmen unterstützen.

Ouglifyiorung	
Mitarbeiter (Name und Vorname) Personalausweisnummer Qualifizierung	
Schastian Frenk 679208967 electronics installed	

Baumgartna GmbH
Company (Unternehmen)

signature of authorized signatory (Unterschrift des Unterschriftsberechtigten)

aumgartner ELECTRICAL - ENGINEERING BUILDING - ENGINEERING Westendstraße 19 - 77971 Kippenheim
Telefon 0 78 25 - 870 846
Telefax 0 78 25 - 870 847
e-mail: info@baumgerings Gibb Unternehmens)

home+

Certification

Certification of all machinery and tools that will be used in the "Solar Decathlon Europe 2010" in Madrid. The following company will support the Team of the Stuttgart University of Applied Sciences in structural measures for this event.

Zertifizierung für alle Maschinen und Geräte, die beim "Solar Decathlon Europe 2010" in Madrid benutzen werden. Das folgende Unternehmen wird im Rahmen dieser Veranstaltung das Team der Hochschule für Technik Stuttgart bei baulichen Maßnahmen unterstützen.

Bourn gas trus Gm/b K
Company (Unternehmen)

I assure that all machinery and tools that will be used in Madrid are CE-certified or that they have an equivalent certification which is valid in Europe. I also guarantee that they are in a good order and condition.

Ich versichere, dass alle Maschinen und Geräte, die wir in Madrid benutzen werden, eine CE-Zertifizierung oder eine andere gleichwertige in Europa gültige Zertifizierung besitzen. Ebenso garantiere ich, dass sie sich in einem einwandfreien Zustand befinden.

signature of authorized signatory (Unterschrift des Unterschriftsberechtigten)

baumgartner

FLECTRICAL - ENGINEERING BUILDING) - ENGINEERING Westendstrate 19 77971 Kippenneim

stamp of the company (ຮັງຄາກອີງ des Unternehmens)

www.baumgartner-gmbh.de

Construction Site Ordinance home

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Severability Clause (signed by ever team member)

- In case any rule stated in this document contradicts effective law, this rule will be ineffective, all other rules though remain untouched.

I have read and understood this site ordinance and I am not imposing any objections.

Date:

>>> <u>hippenheum</u>, 20.05.2010

Name of Company

>>> <u>Baumgorhe</u> <u>GmbK</u>

Signature

>>> D

Stuttgart University of Applied Sciences | www.sdeurope.de

Annex 7 E xternal skid resistance test –the material was certified by the IFA-institute

- certification of skid resistance
- Pictures from the test



Institut für Arbeitsschutz der DGUV, Alte Heerstr. 111, 53757 Sankt Augustin

Fachbereich 5: Unfallverhütung/Produktsicherheit

Hochschule für Technik Stuttgart Postfach 10 14 52 70013 Stuttgart

Ihr Zeichen: Claudia Röttinger Ihre Nachricht vom: 02.03.2010 Unser Zeichen: 621.17-Wm/st-Ansprechpartner/in: Herr Wilm

Telefon: 02241 231 2561 Telefax: 02241 231-2234 E-Mail: Norbert.Wilm@dguv.de

Datum: 11.03.2010

PRÜFMITTEILUNG

Prüfobjekt:

Holzdiele geriffelt in eine Richtung

Prüf-Nr.:

2010 20878/3210

Einzelprüfung - Bestimmung der rutschhemmenden Eigenschaften von Bodenbelägen nach DIN 51130, Ausgabe Juni 2004 und BGR 181 aktualisierte Fassung Oktober 2003, Tabelle 1, Gesamtmittelwert von mindestens 6°

	(R11)	
Semessener Neigungswinkel [°]:	19,9	28,7
Riffelung:	längs	quer

Die ermittelten Messwerte gelten nur für die geprüften Objekte. Eine Verwendung für Werbe- oder Verkaufszwecke bzw. eine Veröffentlichung der Ergebnisse ist nicht zulässig.

Die Reste der Prüfobjekte bleiben 6 Wochen in Aufbewahrung.

IFA - Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung Im Auftrag

Norbert Wilm

Ref 54\Bodenbelaege\IFA 2010\Pruefmitteilungen IFA 2010\Hochschule Technik 2010 20878.doc

Deutsche Gesetzliche Unfallversicherung e.V. (DGUV)

Spitzenverband der gewerblichen Berufsgenossenschaften und der Unfallversicherungsträger der öffentlichen Hand

Institut für Arbeitsschutz der DGUV

Institut für Arbeitsschutz der DGt Alte Heerstraße 111 53757 Sankt Augustin Telefon +49 2241 231-02 Telefax +49 2241 231-2234 E-Mail ifa@dguv.de

Commerzbank AG Bonn Commerzoank AG Bonn
BLZ 380 400 07
Konto-Nr. 330 533 100
IBAN DE32 3804 0007 0330 5331 00
BIC: COBADEFF Zuschriften bitte an das Institut richten, nicht an Einzelpersonen

USt-ID-Nr, DE 123 382 489 Steuer-Nr. 222/5751/0325 Internet www.dguv.de/ifa

Slipperiness of the floors						
Location	Construction Material	Classes	Rules			
		EN	Requirement			
Dry interior areas surface`s slope less than 6 %		DIN 51130 and DIN 5120	R10			
exterior areas			R11			





Annex 8 Fire reaction type of construction elements

Fire reaction of construction elements						
Location Construction Material Classes R						
		EN	Requirement			
Ceilings	see. FP-003 CEILING		C- s2, d0			
exterior wall's covering	waterproofing	1187 and 13501-5	B roof (t1)			
flooring	oak parquet		DFI S1			

Annex 9 Fragile elements

Fragile Elements					
Location Glas Type		Specification			
Gap 1:	overhead fixed glazing	laminated safety glass 16 mm, 2x toughened safet glass with film PVB 0,76 mm			
	lamella glazing	lamella glazing 12 mm			
fixed glazing and doors, triple insulating glass		toughend safety glass 6 mm, cavity with argon fill 16 mm, float glass 4 mm, cavity with argon fill 16 mm, laminated safety glass 6 mm			
	overhead fixed glazing, triple insulating glass	toughend safety glass 10 mm, cavity with argon fill 12 mm, toughend safety glass 10 mm, cavity with argon fill 10 mm, laminated safety glass 16 mm			
Gap 2+3:	window, triple insulating glass	toughend safety glass 6 mm, cavity with argon fill 16 mm, float glass 4 mm, cavity with argon fill 16 mm, laminated safety glass 6 mm			
	lamella glazing	lamella glazing 12 mm			
Module 3: facade fixed glazing and doors, triple insulating glass		toughend safety glass 6 mm, cavity with argon fill 16 mm, float glass 4 mm, cavity with argon fill 16 mm, laminated safety glass 6 mm			

Annex 10 Inspection Card



Inspection Card

Participating University HFT Stuttgart Lot No: 14

Inspections' Responsibles			
Building Code:	Nansi Palla	Electrical:	Siegfried Baumgartner
Plumbing + Mechanical:	Sebastian Schmidt	Event:	Dalet Bodan

Required Inspections	Date	Inspector	Comments
BUILDING CODE			
Fire Safety			
Fire Propagation. Materials	13.06.2010		
Emergency Evacuation Plan	15.06.2010		
Fire Protection Equipment	13.06.2010		
Safety in use			
Stairs/Ramps: Rails,	14.06.2010		
Fixed Elements	15.06.2010		
Glazing	15.06.2010		
Accessibility			
Exterior - Interior Accessible Route	14.06.2010		
Exterior - Interior Accessible Route	14.06.2010		
Structural Safety			
Foundation	08.06.2010		
Exterior Structure: deck,	14.06.2010		
Structural Calculation	13.06.2010		
Code Compliance	13.06.2010		
Final Building Code	15.06.2010		
PLUMBING			
Plumbing	13.06.2010		
Water Storage Systems	13.06.2010		
Water Closet Disconnection	13.06.2010		
Sink and dishwasher connection - blackwater	13.06.2010		
Water Treatment System	13.06.2010		
Final Plumbing Inspection	15.06.2010		
MECHANICAL			
Mechanical Systems	15.06.2010		
Solar Systems	15.06.2010		
Hydraulic pressure	15.06.2010		
Safety Temperature & Pressure Valves	15.06.2010		
	45.00.0040		
Final Mechanical Inspection	15.06.2010		
ELECTRICAL	45.00.0040		
DC AC	15.06.2010		
	15.06.2010		
Connection	15.06.2010		
Final DC Electric	15.06.2010		
Final Electrical Inspection	15.06.2010		
EVENT	. 5.55.2010		
Public Exhibit Elements	16.06.2010		
Site Clean-Up	16.06.2010		
	. 5.55.2010		
Final Event Inspection	16.06.2010		
FINAL INSPECTION	17.06.2010		"House's Opening"

www.sdeurope.org

E.T.S. de Arquitectura de Madrid. Av. Juan de Herrera. 4. 28040. Madrid

Enclosed safety plans

Showing the site, lot limits, signs, access, timing, number of people, areas, site facilities, machinery

HS-001c LOT - SURROUNDING

On the following drawings you can see the assembly units with the risks and collective protections:

HS-101 - ASSEMBLY 01

HS-102 - ASSEMBLY 02

HS-103 - ASSEMBLY 03

HS-104 - ASSEMBLY 04

HS-105 - ASSEMBLY 05

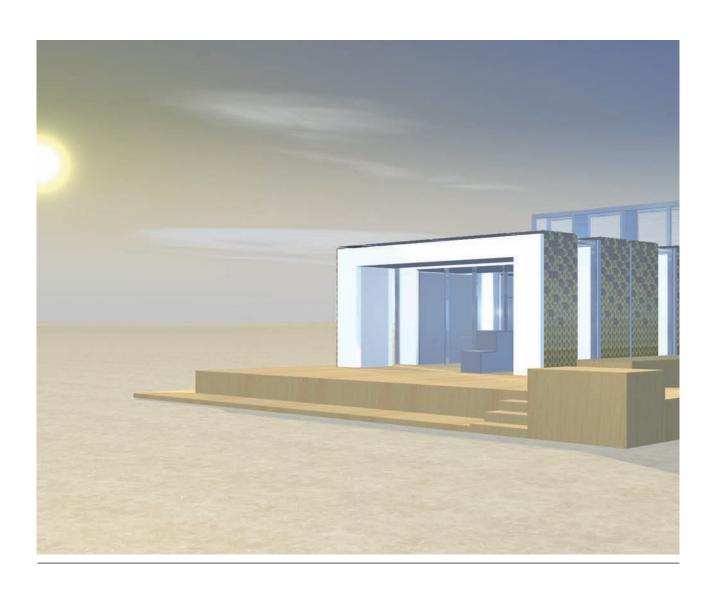
HS-106 - ASSEMBLY 06

HS-107 - ASSEMBLY 07

HS-108 - ASSEMBLY 08

home+			

Appendix 1 Construction Specifications



Einer der Pioniere im Aluminiumvorhangschienenbau

Produkte



HELMO Vorhangschienen

Schulstraße 49 D-70794 Filderstadt info@helmo.de

Informationen

Helmo Fachhändler Wir verkaufen unsere Qualitätsprodukte ausschließlich über den Fachhandel.

Download Wichtige Dokumente zum Herunterladen.

Kontakt/Anfrage Gerne können Sie direkt mit uns Kontakt aufnehmen. Willkommen Produkte Wir über uns

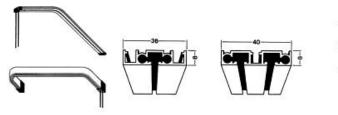
Schnurzugschienen

HELMO Schnurzugschienen 3000 komplett mit Zubehör (Gelenkgleiter)

Zurück zur Produktgruppenauswahl

Die Schienen sind in mindestens 5 Farbvarianten erhältlich (näheres in der Artikelbeschreibung):





Schnurzugschiene - Best.Nr. 3114

mit Click-Gelenkgleitern erhältlich in silber, gold, braun, schwarz (eloxiert) weiß (pulverbeschichtet)



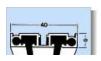
Schnurzugschiene - Best.Nr. 3136

mit Click-Gelenkgleitern erhältlich in silber, gold, braun, schwarz (eloxiert) weiß (pulverbeschichtet)



Schnurzugschiene - Best.Nr. 3140

mit Click-Gelenkgleitern erhältlich in silber, gold, braun, schwarz (eloxiert)





Hotline 0800 - 5 76 66 96



Teil Kapitel Seite
A – Kronoply OSB Technical Information

Kronoply F** - Characteristic Values**

		Strand direction						
			Major axis Minor axis					
		Thickness range [mm] $8 - \le 18 \mid 18 - \le 25 \mid > 25 - 30 \mid 8 - \le 18 \mid 18 - \le 25 \mid > 25 - 30$					ī	
	d	8 - ≤18	18 - ≤ 25	>25 - 30	8 - ≤18	18 - ≤ 25	>25 - 30	
strenght values [N/mm²]								
Panel loading			93.10(3)					
Bending	f _{m,k}	28,0	23,0	23,0	14,0	12,5	12,5	
Panel Shear	f _{v,k}		1,5			1,5		
Disk loading						***		
Bending	f _{m,k}	19,5	17	7,0	13,5	12	2,5	
Tension	f _{t,k}	12,0	10),5	8,0	7	,5	
Compression	f _{c,k}	14,0	12	2,5	11,0	10),5	
Panel Shear	f _{v,k}	8,0	7	,0	8,0	7.	,0	
	stiffi	ness valu	es [N/mm	1 ²]	N 34			
Panel loading	2		-					
Bending	E _{m,mean}		6500			3000		
Panel Shear	G_{mean}		100	***************************************		100		
Disk loading					8.0	100		
Bending	E _{m,mean}		3500		Name of the second	2500		
Tension	E _{t,mean}	(0.000 pg	3500			2500		
Compression	E _{c,mean}		3500			2500		
Panel Shear	G_{mean}		1000			1000		
The characteristic values for stiffne	ess E _{os} an	d G _{os} shou	ıld be used	the follo	wing fact	ors:		
$E_{05} = 0.9 \text{ x } E_{mean} \text{ and } G_{05} = 0.9 \text{ x } E_{mean}$		Land of						
D '''		and ph	ysical val					
Densitiy acc. to EN 323	m			620 k				
Tolerance in thickness		± 0,4 mm						
Internal bond acc. to EN 1087-1	σ_{z_y}	0,14	0,12	0,10	0,14	0,12	0,10	
Thermal conductivity acc. to EN 13986	λ	0,13 W/mK						
Water vapour diffusion resistance factor	μ	200/300						
Swelling in thickness acc. to EN 317 ≤ 9 %								
Formaldehyde emission E1 – Adhesives 100% free of formaldehyde < 0,03 ppm					03 ppm			
Use class acc. to ENV 1995-1-1 Fire resistance class acc. to EN 1350								
National Technical Approval	1-1							
National Technical Approval Z-9.1-618								



I-Joist Building Systems for floors, roofs & walls



AREAS OF APPLICATION

Studs for highly insulated walls with reduced thermal bridging

Joist for **floors** in timber-frame and masonry applications

Rafters **for** roofs in timber-frame and masonry applications



- Lightweight and dimensionally stable
- Service: design, take offs, extensive technical brochures
- Superior strength and easy installation of services
- Reduces thermal bridging
- Also available as a pre-insulated wall stud
- Easy cutting with hand or machine tools
- Solid timber flanges dried, machine stress graded and finger jointed.
 Webs from high grade natural fibreboard
- ETA European Technical Approval
- National distribution
- FSC® Certified













STEICO - LIVING NATURALLY!

STEICO products are innovative building materials that offer long-term performance, increase the comfort of living and help to visibly increase the energy efficiency in buildings. STEICO products are especially economical and environmentally-friendly as they are produced from sustainable resources. Whether for engineered timber elements or insulation materials, roofing boards or wall panels, STEICO offers a suitable product for each building application!

All STEICO products benefit from the properties of the natural materials that they are manufactured from. All products are easy to handle, non-allergenic and durable, i.e. building materials for future generations.

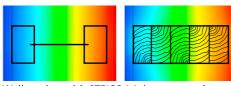
THE STEICOconstruction PRE-INSULATED BEAMS

One speciality are the pre-insulated studs. The space between the web and the flange is pre-insulated with STEICO insulation materials, made from natural wood fibres. Accordingly, there is no requirement for profiling the insulation to fit the recess of the I section on site. This means you can handle the studs in the same way as you would traditional solid studs.



STEICO pre-insulated beams are a pre-requisite in highly insulated wall construtions with reduced thermal bridging. Excellent results for both winter and summer heat protection as well as for sound and fire issues can be achieved when combined with the STEICO insulation system.

REDUCTION OF THERMAL BRIDGING



Wall section with STEICO I-Joist compared with a solid stud

The more technically advanced insulation materials become, the more focus has to be applied to the structural elements of a construction. In spite of the good structural properties of

wood, solid timber studs and rafters allow heat to pass from the inside to the outside of a wall or roof. This means that they are in effect a thermal bridge and this can be improved.

The I section profiles of the STEICO*joist* and STEICO*wall*, with their reduced cross section of an 8 or 6 mm web, reduce the capacity for a thermal bridge. In addition this leads to a reduction of raw materials in a typical construction of about 50%. Today, the depth of insulation materials required can dictate the overall dimensioning of a structure. The depth of insulation may be reduced by the use of STEICO I-Joist products, by increasing thermal efficiency and raw material usage.

FIRE PERFORMANCE

STEICO*joist* and STEICO*wall* have fire classifications according to EN 1301-1:2002: D-s2,d0. Floor constructions with fire resistance of 30 and 60 minutes are approved. Please contact STEICO Ltd. for further information.







LIGHTWEIGHT IN COMBINATION WITH HIGH BEARING CAPACITY



STEICOjoists fulfil the demands from house builders for greater clear spans and better dimensional stability, whilst not increasing the size of the cross section of the construction elements. STEICOjoists have a high strength to weight ratio in relation to its equivalent solid

timber section. Whilst steel, concrete and large section solid timber components require mechanical handling, the STEICO*joists* are up to 50% lighter than solid timber and maybe manually handled. Handling becomes easier, thus erection times are significantly reduced, making extensive labour cost savings.

INSTALLATION OF HOLES



The amount of pipes for plumbing and air conditioning in modern buildings is growing constantly. Installation of services on the intermediate floors can cause problems and can lead to unnecessarily deep floor build ups and increasing costs. Using the STEICOjoist you can drill certain service access

holes in the web without a reduction of the load bearing capacity of the beam.

STATE OF THE ART CONSTRUCTION SOFTWARE

A bespoke software package for STEICO I-Joist products provides an exceptional technical support service for the user. The software provides engineering calculations, material take offs as well as construction drawings and details. Please contact STEICO Ltd. for further information.



PROVEN QUALITY



- Flanges from machine graded, finger-jointed softwood
- High tensile strength 22 N/mm² with STEICOjoist
- Strength Graded to L36-Joists & L17-Walls
- Webs from Natural Fibre Board according to EN 622-2
- High shear capacity 14 N/mm²

ADDITIONAL SERVICES

- Detailed technical literature
- Framing and Design software for take offs and design
- Partnerships with Simpson Strong-Tie and Cullens





OVERVIEW OF ALL I-JOISTS

Reduction of thermal bridging



Easy installation of services



Lightweight. Easy to handle and install



High dimensional stability through controlled moisture content



Available preinsulated to form a solid cross section for ease of installation



High load bearing capacity

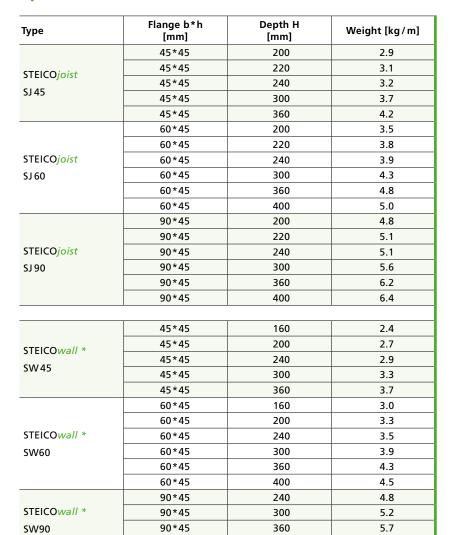


Easy to machine

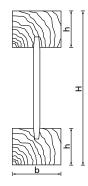


Strict manufacturing tolerances





Available in lengths up to 13.5 m.



Lengths of up to 16 meters, depths from 160 - 400 mm and the option for pre-insulation combine to make the STEICOconstruction range a fully integrated construction system.

90*45

The STEICO*construction*Building System meets the requirements of:

- The Building Regulations
- NHBC Standards

400

- ZURICH Insurance
- Robust Details Ltd.









Operating site certified according to ISO 9001:2000

5.8



Your STEICO partner





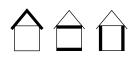


AREAS OF USE

Joists, beams, studs, purlins, top plates, window and door lintels, main beams, structural boards etc.

Various industrial applications.

System component for the **STEICO***construction* building system.



- LVL Laminated Veneer Lumber for various applications
- Available in a wide range of thicknesses and formats
- High strength to weight ratio
- Dimensional stability
- High compression strength for Rimboard applications
- Easily cut and machined using traditional tools
- Minimal settlement
- High connection capacity and fixing withdrawal strength
- Efficient use of timber resources

For further information, please visit www.steico.com



STEICOultralamTM: Laminated veneer lumber for the highest demands

> STEICOultralam™ is made of multiple 3 mm layers of graded laminated spruce veneers. This disperses knots and irregular growth, producing a practically homogeneous cross section. This construction means that STEICOultralam™ is highly rigid and dimensionally stable.



Producing the product in this method also allows a larger variety of formats to be produced thanks to the production of a blank sheet up to 20.5 m long and 1.25 m wide.

CE-certified

In an initial step, the Stuttgart Materials Testing Institute of the University of Stuttgart (Germany) have certified STEICOultralam R™, with lateral veneer layers. The certification of STEICOultralam X[™], with crosswise veneer layers is currently being prepared and is expected to be available soon.

STATE OF THE ART PRODUCTION







Peeling of the veneers. Log processing takes under 3 sec.

Veneer on its way to grading and further processing.

'Grenzebach' dryer and veneer









Gluing and lay-up of the dried

The world's longest 'Dieffenbacher' press

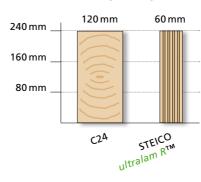
Finished products after pressing

Ongoing quality control

Taleon Terra Industries has set up the world's most modern laminated veneer lumber production facility close to Moscow (Russia) - with STEICO as an exclusive distribution partner for Central and Western Europe. International know how and state of the art technology are the guarantee for ongoing high quality.

STEICO has many years experience in production and sales of engineered wood products and ecological building materials. Thus STEICO provides not only professional sales and technical services but also ensures the fast international availabilty of the

Cross sections with same bending strength



STEICOultralam R™ IS ONE OF THE MOST RIGID ENGINEERED WOOD PRODUCTS AVAILABLE

The current test figures that were identified during CE-certification, confirm the high quality of STEICOultralam™. The vertical bending strength is 48 N/mm² and the characterisitic flat bending strength is 50 N/mm². This means that the bending strength is twice that of normal C24. The tension strength is an impressive 38 N/mm², and the modulus of elasticity has an average of 14,000 N/mm². This means: slender structural elements, less materials and reduced costs.



Powerful engineered timber product for rectangular cross sections. With STEICO*ultralam™* R elements all veneer layers are glued together longitudinally.





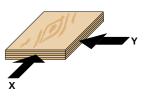
Cross laminated STEICOultralam™ means that one-fifth of the veneers are glued crosswise - improving the lateral bending strength and stiffness of the board.



CE-certification expected in third quarter

STEÎCO ultralam[™]i

Special qualities for industrial purposes can be made on request due to the state of the art production technology.



2 STEICOultralam™

Printed on FSC® certified paper | Date 05/2009. Valid to subsequent revisions.

*To be used as part of a multi-ply beam or rimboard only.

AVAILABLE FORMATS OF STEICOultralam R™

STEICO $ultralam\ R^{ exttt{TM}}$ is being produced and monitored according to the

and monitored according to the harmonised European product standard EN 14374 and bears the CE mark.



CERTIFICATION

STORAGE/TRANSPORT

STEICOultralam™ laminated veneer lumber should be stored flat. The distance between the supporting beams should not exceed 2 m. STEICOultralam™ should be protected from the elements during transport.

MOISTURE

STEICOultralam™ should be protected from excessive exposure to moisture. STEICOultralam R™ is produced and delivered with a moisture content of approximately 8-10%.

Length [mm]	Thickness [mm]	Width [mm]	Pieces/Pak.	Weigth/Pak. [kg]
		200	30	ca. 1,690
		220	30	ca. 1,690
12.000	30	240	25	ca. 1,690
12,000	39	300*	20	ca. 1,690
		360*	15	ca. 1,690
		400*	15	ca. 1,690
		200	30	ca. 1,950
		220	30	ca. 2,140
12.000	45	240	25	ca. 1,950
12,000	45	300	20	ca. 1,950
		360*	15	ca. 1,750
		400*	15	ca. 1,950
		200	18	ca. 1,950
		220	15	ca. 1,790
12.000	75	240	15	ca. 1,950
12,000	75	300	12	ca. 1,950
		360	12	ca. 2,340
		400	9	ca. 1,950
		200	18	ca. 2,340
		220	15	ca. 2,140
13.000	90	240	15	ca. 2,340
12,000		300	12	ca. 2,340
		360	9	ca. 2,100
		400	9	ca. 2,340

Customized sizes and qualities are available on request as well as special packaging and shipment.

CHARACTERISTIC DESIGN VALUES FOR STEICOultralam R™ according to EN 14374 to be used in design according to Eurocode 5 in N/mm²

Characteristic density = 480 kg/m ³ . Size effect parameter s = 0.15	Panel Applications	Beam Applications	
		4	
Bending strength $f_{m,0,k}$	50.0	48.0	
Tension strength $f_{t,0,k}$	36.0	36.0	
Compr. strength parallel to grain f _{c,0,}	, _k 38.0	38.0	
Compr. strength perpendicular			
to grain f _{c,90,k}	3.0	6.0	
Shear strength $f_{v,k}$	_*	5,0	
Modulus of elasticity E _{0,mean}	14,000	14,000	
Shear modulus G _{mean}	_*	350	

^{*} to be currently determined







d Strict manufacturing tolerances



High dimensional stability



Easy to machine



Heights to match STEICO I-Joists



Your STEICO partner

www.steico.com

Product description Page 1 of 1



Bruno Berthold OHG

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Product description

Product description

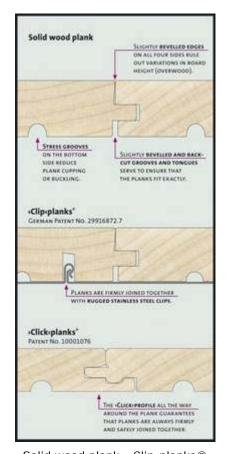
Solid wood planks are milled from one solid piece of wood. This is the main difference between them and all types of engineered flooring. Engineered floors are made of three to seven layers of thin wood that are stacked together and then glued. Solid wood planks are milled with tongue and groove on all four sides. This makes possible a time- and cost-saving continuous installation. Slightly bevelled edges on all four sides rule out variations in board height, often referred to as <code>>overwood</>>,</code> and guarantee an even surface. An exact fitting of the planks is achieved by slightly bevelled and backcut tongues and grooves. Stress grooves on the bottom side of the planks prevent them from cupping or buckling.

Dimensions

Exact fitting is a top priority for berthold. We guarantee the following tolerances: max.0.5mm in width, max.0.2mm of height difference between two planks. Constant electronic and manual controls guarantee the highest degree of precision and quality possible.

Moisture content

berthold solid wood planks have a moisture content of 9% ($\pm 2\%$), the optimum value for the intended use. Each plank is measured and rejected if its moisture content exceeds the limits set. The planks are then packed in shrink foil as a protection against further fluctuations in moisture content.



Solid wood plank, >Clip<planks© and >Click<planks©

Species

berthold solid wood planks are available in a broad range of species and grades. Grading is based on norms developed by berthold. The pictures shown in this Site do not document all characteristics of solid wood planks. Solid wood planks are a natural product and they cannot be compared with the uniformity of an engineered product. Despite strict controls it is possible that certain planks may show flaws which were overlooked or classified as insignificant in the grading process. These flaws include slight cracks, split or roughed-out knots, uneven colour or structure. It is not possible to fully rule out these natural flaws. Indeed, many customers see these flaws as part of the special charm of solid wood planks, a feature which distinguishes an authentic wood floor from its artificial substitutes.

Hardness categories Page 1 of 1



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Hardness categories

Hardness categories

The durability of a wood floor depends mainly on the wood species used. The hardness of a wood species reflects its robustness. In physical terms, the density of a wood species indicates its hardness. Density is defined as a given material's ratio of mass to volume, measured in g/cmD. Put more simply: the higher a material's density, the heavier it is – the heavier, the harder – the harder, the

Our table indicates approximate values only, because real hardness values vary in relation to the individual growth conditions of every tree.

more durable. The following table shows the density (g/cm3) of wood species offered by berthold at an indoor humidity level of 12%:

Wood species	Density(g/cm³)	Categorie of hardness
Nordic spruce	0,47	1 -soft wood
Nordic pine	0,52	
Alder	0,52	
Douglas fir	0,56	
American cherry	0,58	
Finnish birch	0,58	
Siberian larch	0,59	
Honduran pitch pine	0,63	2 -hard wood
Ash	0,65	
Elm	0,65	
American walnut	0,65	
Beech	0,68	
Oak	0,71	3 -very hard wood
Canadian birch	0,71	
Hard maple	0,72	
Hornbeam	0,73	
Kempas	0,84	
Merbau	0,85	
Jatoba	0,90	

Installation Page 1 of 1



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Installation

Screwing, cliping, gluing - three solutions in any case

berthold offers solid wood planks for three types of installation. We provide solutions for the traditional **screwing** or nailing down on a wooden subfloor, for a floating installation whith **berthold-clips** and for **gluing** down on a concrete floor.







INFORMATIONS DIENST HOLZ

Merkblattreihe Holzarten Blatt 63 Eiche und Austauschhölzer

Herausgeber:

Verein Deutscher Holzeinfuhrhäuser e.V., Heimhuder Straße 22, 2000 Hamburg 13

Telefon (040) 455554

Arbeitsgemeinschaft Holz e.V., Füllenbachstraße 6, 4000 Düsseldorf 30

Telefon (0211) 434635

Die Notwendigkeit, weniger bekannte Hölzer stärker als bisher zu nutzen und die gesteigerte Nachfrage nach bestimmten, aber mengenmäßig oder qualitativ nicht entsprechend vorhandenen Arten zu verringern, führte zur Entwicklung der sogenannten Austauschhölzer. Für diese Gruppe ist charakteristisch, daß ihre Arten oft nur in bestimmten Eigenschaften, wie dem Aussehen oder den technischen Eigenschaften, der auszutauschenden Holzart entsprechen müssen. Das kann bei einem für unterschiedliche Zwecke eingesetzten Holz bedeuten, daß für diese eine Art, der jeweiligen Verwendung entsprechend, auch unterschiedliche Hölzer als Austausch in Frage kommen. Nur selten wird es möglich – und auch erforderlich – sein, alle Eigenschaften der zu ersetzenden Holzart in einem Austauschholz wiederzufinden.

Austauschhölzer sind mit ihrem eigenen Namen und nicht mit dem der auszutauschenden Holzart zu bezeichnen; Hinweise, wie z.B. auf ein "eichenähnliches" Aussehen, auf die Herkunft oder auf der Eiche entsprechende Verwendungsmöglichkeiten können nützlich sein. Anderenfalls würde es, abgesehen von Mißverständnissen, häufig zu Falschverwendungen kommen, weil die Austauschhölzer den auszutauschenden Hölzern oft nur teilweise gleichen.

Eichenhölzer

Als solche können alle Hölzer der artenreichen Gattung *Quercus* aus der Familie der Fagaceen bezeichnet werden. Wegen der teilweise unterschiedlichen technischen Eigenschaften oder des teilweise ungleichen Aussehens werden diese Eichenhölzer in drei Hauptgruppen unterteilt, von denen für die europäische Holzwirtschaft nur die Artengruppe der Weißeichen und die Artengruppe der Roteichen bedeutend sind.

	Handelsnamen:	DIN-Kurzzeichen:	Botan. Bezeichnungen:			
	Elono, ottolororo,		Quercus robur; Quercus petraea.			
	b) Natürliche Verbreitung: Osta	sien				
	Eiche, Japan. Eiche, Mizunara und andere	EIJ	Quercus grosseserrata (= Q. mongolica).			
	c) Natürliche Verbreitung: Nordamerika					
	Eiche, White oak; Eiche, Swamp white oak; Eiche, Bur oak; Eiche, Chincapin oak und andere	EIW EIW EIW	Quercus alba; Quercus bicolor; Quercus macrocarpa; Quercus muehlenbergii			
Roteichen	a) Natürliche Verbreitung: Euro	opa, Vorderasien				
	Eiche, Zerreiche; Eiche, Persische Eiche;	_	Quercus cerris; Quercus castaneaefolia			
	b) Natürliche Verbreitung: Nordamerika (in Europa angebaut)					
	Eiche, Amerikan. Roteiche, Northern red oak;	EIR	Quercus rubra;			
	Eiche, Amerikan. Roteiche, Southern red oak und andere	EIR	Quercus falcata.			

Weißeichen und Roteichen

Beschreibung

Stammform: Überwiegend gut geformt; Längen bis 15 m astfrei und Durchmesser 0,3 bis 0,8 m, vereinzelt auch darüber (Handelsholz).

Farbe und Struktur des Holzes: Splint (in Abhängigkeit von Standort, Alter und Art) 2 bis 8cm breit, weiß bis hellgrau (Weißeichen) oder hellgrau bis blaßrosa (Roteichen). Kernholz (Weißeichen) blaßhellbraun, sehr vereinzelt auch mit leicht rötlichem Ton; bei Roteichen überwiegend hellrötlich grau bis rötlichbraun, selten auch hellbraun; im inneren Kernholz beider Gruppen können dunkelbraune oder rötlich-braune Streifen vorkommen. – Als Mooreichen werden Hölzer bezeichnet, die sich unter bestimmten Voraussetzungen durch eine langzeitige Lagerung in nassen Böden teilweise oder total schwarz verfärbten, ohne daß wesentliche Veränderungen der Festigkeit eintreten.

Poren im Frühholz grob und ringförmig geordnet (Jahrringe), entsprechend der Grob- oder Feinjährigkeit ("Milde") mehr oder minder deutliche Fladern bzw. Porenstreifen hervorrufend; Poren im Spätholz der Weißeichen extrem fein, nur auf Querschnitten noch als helle, radial gerichtete Felder wahrzunehmen; Spätholzporen bei Roteichen bis mittelgroß, nicht zahlreich, in radialen Reihen geordnet und oft, auch ohne Lupe, auf glatten Querschnitten gut erkennbar. Markstrahlen außergewöhnlich: Im gleichen Holz sehr schmal oder bis mehrere mm breit und über 1 cm hohe, sehr auffällige Spiegel bildend ("Spiegeleiche").

Speicherzellen in sehr feinen, hellen Bändern, nur bei manchen Hölzern noch auf Querschnitten wahrnehmbar.

Roteichen sind von Weißeichen mikroskopisch an den Spätholzporen unterscheidbar.

Abweichungen: Amerikan. Weißeichen können dunkle, als "minerals" bezeichnete Verfärbungen aufweisen.

Gesamtcharakter: Durch Porenverteilung und große Markstrahlen deutlich strukturierte Gruppen, deren hellbraune Hölzer überwiegend zu den Weißeichen und deren rosabraune Hölzer überwiegend zu den Roteichen zählen.

Handelsform

Rundholz, Schnittholz, Schwellen (nach nationalen Vorschriften), Möbelteile, Profilhölzer, Parkett, Furniere, Paneele.

Eigenschaften

Artengruppe:		Weißeichen	Roteichen
Gewicht ungetrocknet	ca.	950-1050 kg/m ³	1000-1100 kg/m ³
darrtrocken	ca.	0,60-0,65 g/cm ³	0,63-0,68 g/cm ³
Druckfestigkeit	ca.	50-54 N/mm ²	45-50 N/mm ²
Biegefestigkeit	ca.	92-98 N/mm ²	95–105 N/mm ²

Mittelschwere Hölzer mit oft höheren physikalischen Werten bei den Roteichen. Bearbeitbarkeit überwiegend gut, Stehvermögen bei den geradfaserigen und milden Qualitäten befriedigend bis gut, bei schwereren Qualitäten durch stärkere Schwindung bzw. Quellung beeinträchtigt. Die Trocknung ist wegen Neigung zur Rißbildung vorsichtig zu steuern. Roteichen sind, im Gegensatz zu Weißeichen, aufgrund der meist offenen Poren für Flüssigkeiten durchlässiger und tränkbar. Durch Eisenmetalle treten bei nassen Hölzern

durch den hohen Gerbsäuregehalt starke Reaktionsverfärbungen auf und durch alkalische Gase, wie z.B. Ammoniak, kann bei trockenen Weißeichen eine durchgehende braune bis fast schwarze Färbung ("Räuchern") erzielt werden (vgl. Farbe und Struktur; Mooreichen). – Frische Hölzer mit stark saurem Geruch.

Widerstandsfähigkeit gegen Pilzbefall bei Weißeichen gut, bei Roteichen (ungeschützt) nicht ausreichend für eine dauernde Außenverwendung.

Verwendung

Die Weißeichen und Roteichen sind aufgrund gleicher oder sehr ähnlicher Festigkeitseigenschaften im konstruktiven Bereich (Innenausbau) in gleicher Weise verwendbar, für den Außenbau sind die Hölzer der Roteichen durch eine Kesseldruckimprägnierung zu schützen; wo Biegefestigkeit und Elastizität bedeutend sind, sind Roteichen vorzuziehen, dagegen sind diese im

Behälterbau (für Flüssigkeiten) ungeeignet. Im Möbelbau sowie im Ausstattungsbereich, als Vollholz oder Furnier, wird das gleichmäßig hellfarbige und feinjährige Holz der Weißeichen am höchsten bewertet; daneben werden aber häufiger gute Qualitäten der Roteiche, vor allem für eine gebeizte oder gebleichte Anwendung verwendet.



va-Q-vip B

Product Data Sheet

Characteristics

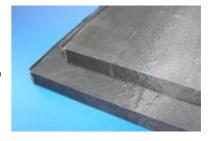
The vacuum insulation panel va-Q-vip B is officially certified with approval No. Z-23.11-1658 from the German Institute for Building Technology (DIBT) on 21 June 2007. The core of the panel consists of an amorphous silicon dioxide powder and an inorganic opacifier. The panel is sealed under vacuum into a metallized high barrier film. The high barrier film itself is covered on the exterior with a black protection fleece. The flammability of va-Q-vip B is according to DIN 4102-B2.

va-Q-vip B panels are characterized by their special film folding technology (va-Q-seam) at the edges. Therefore individual panels can be tightly fitted together, making an almost gapless assembly possible. Other shapes are available on request.



Applications

va-Q-vip B is specially developed for building insulation applications. The va-Q-vip B with a drastically reduced insulation thickness open up new possibilities in building insulation. va-Q-vip B has currently been approved again. va-Q-vip B can be used the widest field (DAD, DAA, DZ, DI, DEO, WAB, WH and WI according to the standard DIN V 4108-10, table 1) in building applications (internal and external insulation, wall, floor, roof, etc.).



Advantage

- The first vacuum insulation panel approved for building application by DIBT
- Drastically reduced heat fluxes and insulation thickness
- Increased usable space
- Extra protection layer for safe installation

Product data

Surface color:	Black
Geometry:	Rectangular shape (without flanges*)
Density (bulk, DIN EN 1602):	180 - 210 kg/m³
Thermal conductivity	
=> Initial value:	< 0.0053 W/(mK)
=> Including aging and edge losses:	0.0080 W/(mK)
=> If aerated:	0.020 W/(mK)



Temperature range during application:	-70 to +80 °C
Humidity range during application:	0 to 60 %
Internal gas pressure:	< 5 mbar (at delivery)
Increase of gas pressure:	ca. 1 mbar/year (measured, 20 mm thickness)
Dimension	
=> Maximum (length x width):	1200 mm x 1000 mm
=> Minimum (length x width):	400 mm (L) x 300 mm (W)
Thickness:	10 to 40 mm
Length and width tolerance	
=> 0 to 500 mm:	+2 / -4 mm
=> 501 to 1000 mm:	+2 / -5 mm
=> 1001 to 1200 mm	+3 / -6 mm
Thickness tolerance:	+/- 1 mm
Specific heat:	0.8 kJ/(kg·K) (at room temperature)
U-value (with 20 mm thickness)	
=> Initial value:	0.25 W/(m ² K)
=> Including aging and edge losses:	0.40 W/(m ² K)
Mass per area:	4 kg/m² (at 20 mm thickness)
External pressure load:	ca. 150 kPa (at 10% compression)
Flammability:	DIN 4102-B2
Lifetime:	Up to 30 - 50 years

 $[\]ast$ For 10 mm and 15 mm thickness panels part of the lid is on the surface increasing the thickness by 1 mm.

All figures are intended as a guide and should not be used for preparing specifications.

Product Data Sheet Edition: 5/2007 Version no.: 0004

TS77 - 15E

Overview:	TS77-15E is a heat-weldable roof membrane made by the extrusion-coating process on Sika Sarnafil's proprietary manufacturing equipment. TS77-15E is provided for mechanically attached roof systems and is produced with an integral fiberglass mat reinforcement for dimensional stability and a polyester scrim for excellent durability. TS77-15E is 6.5 ft. (2 meters) wide and 49 ft. and 2 in. (15 meters) long.
Composition:	TS77-15E is a high-quality flexible polyolefin alloy (FPO-A) membrane containing advanced polymers, stabilizers, fiberglass and polyester reinforcement. The standard color of the top surface is beige and the underside color is dark gray.
Features:	The patented extrusion-coating process causes TS77-15E to have an encapsulated reinforcement with high internal strength. TS77-15E is thicker than many competitive products which can improve weldability and service life. TS77-15E is available in a standard thickness of 60 mil (1.5 mm). The dimensional stability and weatherability of TS77-15E membranes are excellent compared to competing products.
Packaging:	TS77-15E rolls are wrapped in a protective film and strapped to a wood pallet.
Installation:	TS77-15E is installed by a Sika Sarnafil Authorized Applicator. After placement of the insulation boards on the roof deck or after proper preparation of a different substrate, the TS77-15E is unrolled, fastened to structural deck and the seams overlapped in accordance with Sika Sarnafil's Technical requirements. The seams are prepared with Sarnafil T Prep and then heat welded together by trained operators using Sika Sarnafil's hot-air welding equipment.
Availability:	TS77-15E is available directly from Sika Sarnafil Authorized Applicators. Contact your Sika Sarnafil Regional Office or visit our website for further information.
Warranty:	Upon successful completion of the installed roof by the Sika Sarnafil Authorized Applicator, Sika Sarnafil can provide a Warranty to the Building Owner via the Authorized Applicator.





Maintenance:	TS77-15E membrane requires no maintenance. As a prudent preventative measure, Sika Sarnafil recommends that the Owner or that the Owner's designated representative inspect the installed roof system for damage, plugged drains, weathered sealants, etc. at least twice a year and after each storm.
Technical:	Sika Sarnafil provides technical support. Technical staff is available to advise Applicators as to the correct installation methods of TS77-15E.

Technical Data (as manufactured):		Typical
<u>Parameters</u>	ASTM <u>Test Method</u>	Physical <u>Properties</u>
Reinforcing Material		Fiberglass & Polyester
Overall Thickness, min., inches (mm)	D638	0.060 (1.5)
Tensile Strength, min., psi (MPa) - machine x transverse	D412 Die C	1500/1300 (10/9)
Ultimate Elongation, min.	D412	500%
Seam Strength*, min., (% of tensile strength)	D638	75
Retention of Properties After Heat Aging	D573	
Tensile Strength, min., (% of original)	D412 Die C	90
Ultimate Elongation, min., (% of original)	D412	90
Tearing Strength, min., kN/m (lbf/in)	D412 Die C	60 (340)
Low Temperature Bend, -30 °F (-35 °C)	D2137	Pass
Accelerated Weathering Test (Florescent Light, UV exposure)	G154	Pass
Cracking (7x magnification)		None
Discoloration (by observation)		Negligible
Crazing (7x magnification)		None
Linear Dimensional Change	D1204	±1.0%
Weight Change After Immersion in Water, max.	D471	±4.0%

^{*}Failure occurs through membrane rupture not seam failure.

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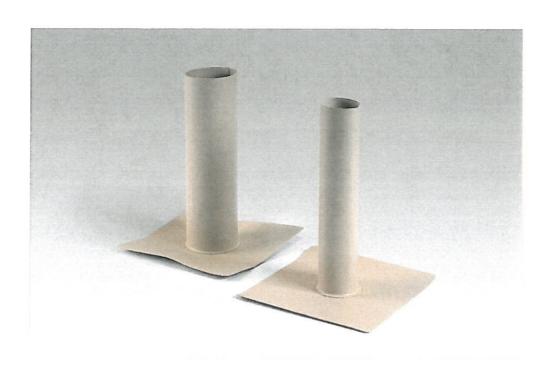
Sarnafil® Dunstrohreinfassungen FPO

Fertigteil Zubehör für FPO Rohr-/ Dunstrohr Anschlüsse

Produkt- beschreibung	Sarnafil® FPO Rohr-/ und Dunstrohreinfassungen werden auf Materialbasis der Abdichtungsbahnen - Flexible Polyolefine (FPO) - mit einem einlagigen Glasvlies, unter Zusatz von UV-Stabilisatoren und einem Flammschutz hergestellt.
Anwendung	Sarnafil [®] FPO Rohr-/ und Dunstrohreinfassungen werden zum fachgerechten Anschluss bei vorhandenen Detailanschlüssen auf die Sarnafil [®] G/S und Sikaplan [®] PVC Abdichtungsbahnen eingesetzt.
Beschreibung / Vorteile	 Sehr gute Wetterbeständigkeit und UV-Verträglichkeit Einfache und sichere Anwendung Sehr gutes thermisches Verschweißen Einfaches Recycling
Test	
Anforderungen / Standards	Brandklassifizierung EN 13501-1, Klasse E Qualitäts Management Zertifizierung EN ISO 9001/14001
Produktdaten	
Form	
Oberfläche	glatt
Farbe	Beige / grau fenstergrau (ähnlich RAL 7040)
	Weitere Farben auf Anfrage und Lieferzeit möglich
Verpackung	Abhängig von den Bestellmengen und Produktgrößen, werden die Sarnafil [®] FPO Rohr-/ und Dunstrohreinfassungen in Paletten oder Kartonagen geliefert.
Lagerung	
Lagerbedingungen	Sarnafil® FPO Rohr-/ und Dunstrohreinfassungen trocken lagern.
Lagerdauer	Sarnafil [®] FPO Rohr-/ und Dunstrohreinfassungen unterliegen bei korrekter Lagerung keiner Anforderung.







Art. Nr	Farbe	Durch - messer	Stutzen- länge	Tablettgröße	Material- dicke
110461	beige	00			3
135689	RAL 7040	82 mm			
110462	beige	00			
135692	RAL 7040	92 mm			
110456	beige	102 mm 112 mm 127 mm 142 mm			
135693	RAL 7040		102 mm		
110457	beige		400	000 000	4 =
125517	RAL 7040		400 mm	300 x 300 mm	1.5 mm
110458	beige				
135695	RAL 7040				
110459	beige				
135696	RAL 7040				
110460	beige	1			
135462	RAL 7040	167 mm			

Weitere Durchmesser auf Anfrage und Lieferzeit möglich

Flexible Polyolefine (FPO)		
iegelschweißen / Boge	nschweißen	
n		
1 1	Sarnafil [®] TG 66-Bahnen Sarnafil [®] TG 76-Bahnen Sarnafil [®] TS 77-Bahnen	
Anwendungen / Bedingungen / Limits		
Verlegehinweise		
Die jeweils gültigen Verlegerichtlinien für Sarnafil [®] - Abdichtungsbahnen sind zu beachten.		
Die Anwendung sollte nur von geschulten Sika Roofing Verlegern ausgeführt werden. Temperaturbeschränkungen bei der Verlegung der Sarnafil [®] FPO Rohr-/ und Dunstrohreinfassungen: Oberflächentemperatur: -30 ℃ min. / +60 ℃ max. Umgebungstemperatur: -20 ℃ min. / +60 ℃ max. Die Anwendung von Hilfsprodukten, z.B. Kontaktkleber / Reiniger muss die Umgebungstemperatur gleich > +5 ℃ sein. Bitte beachten Sie für weitere führende Informationen die entsprechenden Produktdatenblätter.		
ie me	jeweils gültigen Verlechten. Anwendung sollte nurden. aperaturbeschränkung strohreinfassungen: rflächentemperatur: gebungstemperatur:	

Alle technischen Daten in diesem Produktdatenblatt sind unter Laborbedingungen erhoben worden. Individuell abweichende – den örtlichen Gegebenheiten unterliegenden gemessene Werte – liegen außer unserer Kontrollmöglichkeit.	
Bei der Anwendung der Produkte ausserhalb Deutschlands sind die jweiligen lokalen gesetzliche Anforderungen des Landes zu beachten! Bitte beachten Sie das jeweils gültige Produktdatenblatt in der jeweils gültigen Fassung und Inhalten des Landes!	
Die Produkte unterliegen keiner EC - Regelung bezügl. gewährlicher Produkte. Die Ergebnisse des Sicherheitsdatenblatt folgt der EC- Richtlinien 91/155 EWG und wird für das in den Markt bringen, deren Transport und Anwendung nicht benötigt. Bei zweckentsprechender Anwendung besteht keine Gefahr für die Umwelt.	
Bei thermischer Verschweißung in geschlossenen Räumen ist auf ausreichend Frischluft zu achten. Bitte die lokalen Sicherheitsanforderungen beachten.	
rtklasse Das Produkt ist nicht im Sinne"gefährdender Produkte" eingestuft.	
Das Material ist recycelbar. Lokale Anforderungen bzgl. der Entsorgung sind zu beachten!	

Haftungsausschluss: Die vorstehenden Angaben, insbesondere die Vorschläge für Verarbeitung und Verwendung unserer Produkte, beruhen auf unseren Kenntnissen und Erfahrungen im Normalfall, vorausgesetzt die Produkte wurden sachgerecht gelagert und angewandt. Wegen unterschiedlichen Materialien, Untergründen und abweichenden Arbeitsbedingungen kann eine Gewährleistung eines Arbeitsergebnisses oder eine Haftung, aus welchem Rechtsverhältnis auch immer, weder aus diesen Hinweisen, noch aus einer mündlichen Beratung begründet werden, es sei denn, dass uns insoweit Vorsatz oder grobe Fahrlässigkeit zur Last fällt. Hierbei hat der Anwender nachzuweisen, dass er schriftlich sind die Zur seschemäßen und arfelwerzersesbeden Beutzilken durch Silte arfedstlich eind. alle Kenntnisse, die zur sachgemäßen und erfolgversprechenden Beurteilung durch Sika erforderlich sind, Sika rechtzeitig und vollständig übermittelt hat. Der Anwender hat die Produkte auf ihre Eignung für den vorgesehenen Anwendungszweck zu prüfen. Änderungen der Produktspezifikationen bleiben vorbehalten. Schutzrechte Dritter sind zu beachten. Im Übrigen gelten unsere jeweiligen Verkaufs- und Lieferbedingungen. Es gilt das jeweils neueste lokale Produktdatenblatt, das bei uns angefordert werden

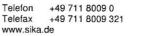


Sika Deutschland GmbH

70439 Stuttgart

Kornwestheimer Straße 103-107





Sarnafil® Verbundblechtafeln und -coils

Verbundblechtafeln und -coils mit einseitig oberseitiger Sarnafil® Kaschierung

Produkt- beschreibung	Sarnafil [®] Verbundblechtafeln und —coils sind feuerverzinkt. Die Oberfläche ist mit einer Sarnafil [®] FPO Kunststoffabdichtungsbahn laminiert. Unterseitig mit einem Schutzanstrich versehen. Dieser dient der Transportsicherheit Die Verbundbleche werden zur Herstellung von Randabschlüssen und Anschlüssen für die Sarnafil [®] FPO Abdichtungsbahnen eingesetzt. Die Bleche sind bitumenbeständig.	
Anwendung		
Eigenschaften	 Witterungs- und UV-stabil Die FPO Verbundbleche sind oberseitig thermisch verschweißbar Schneiden und Biegen der Verbundbleche vor Ort oder in der Werkstatt Einsetzbar mit allen Sarnafil FPO Abdichtungsbahnen Gegen Umwelteinwirkungen stabil Dauerhafte Verklebung der Metalloberfläche mit der Abdichtungsbahn FPO Die Oberfläche der Verbundbleche werden mittels Heißluftverschweißung dauerhaft miteinander verbunden 	

Tests

Normen / Anforderungen Erfüllt die DIN EN 10142: verzinkte Verbundbleche Qualitäts Management System EN ISO 9001/14001

Produktdaten

Form

Aufbau Oberfläche: glatt

Dicke:

Sarnafil® Bahn: 1.1 mm verzinktes Metallblech 0.6 mm Gesamtdicke: 1.7 mm

Farbe Oberfläche: FPO Verbundblech: beige oder RAL 7040 fenstergrau

Unterseite: Metall: (Rostschutz)





8			
Verpackung	Sarnafil [®] Verbundblech Verpackung Länge Breite Gewicht Gewicht pro Verbundblech	2.00 1.00	m kg/m²
	■ Verpackung Länge Breite Gewicht Gewicht pro Palette	3.00 1.00	m kg/m²
	Sarnafil [®] Rolle / Coil Verpackung Länge Breite Gewicht Gewicht pro Rolle / Coil	30.00 1.00	m kg/m²
Lagerung			
Lagerbedingungen	Sarnafil® Verbundbleche und -coils müssen horizontal gelagert und dauerhaft gegen Tageslicht, Regen und Schnee geschützt werden. Nicht mehr als zwei Paletten übereinander stapeln. Produkte können bei korrekter Lagerung dauerhaft eingesetzt werden.		
Anwendungen			
Systembeschreibung	Zusätzliche Produkte: - Sarnaplast 2235 - Primer 501 - Abdichtungsband		
	Anwendungfreigabe für: - Sarnafil [®] TG 66 - Sarnafil [®] TG 76 - Sarnafil [®] TS 77 - Sarnafil [®] T 66-15 D		
Anwendungs - bedingungen			
Temperatur	Der Einsatz der Sarnafil [®] Verbundbleche ist auf geographische Regionen mit durchschnittlichen Monatstemperaturen vom Minimum – 50 ℃ begrenzt Die durchschnittliche Umgebungstemperatur darf nicht + 50 ℃ dauerhaft überschreiten.		

Verarbeitungshinv	veise
Verarbeitung	Zusätzlich zu den aktuell gültigen Sarnafil [®] Verlegeanleitungen.
	Bearbeitung: Geeignete Werkzeuge zum sauberen und glatten Schneiden einsetzen. Wenn die Sarnafil [®] Verbundbleche entsprechend den örtlichen Gegebenheiten verarbeitet werden, darf der Biegeradius nicht kleiner als das Dreifache der gesamtem Dicke der Verbundbleche betragen. Ansonsten kommt es zu Rissen der laminierten Abdichtungsbahn.
	Befestigung: Die lokalen Vorschriften und technischen Regeln sind zu beachten!
	Thermische Längenänderungen: Sarnafil [®] Verbundbleche müssen entsprechend fixiert werden. Zusätzlich muss zwischen den Blechtafeln ein Spalt von 3 – 5 mm vorgesehen werden.
Verlegung	Um die Verbundbleche im Sinne der Verlegeanleitung der Sika Roofing zu verarbeiten, empfehlen wir die Sika Verlegerschulungen.
	Temperaturbeschränkungen für die Installation mit den Sarnafil [®] Abdichtungsbahnen:
	Oberflächentemperatur: -30 °C min. / +60 °C max. Umgebungstemperatur: -20 °C min. / +60 °C max.
	Bei der Verarbeitung von Hilfsprodukten, z.B. Kontaktkleber / Reiniger muss die Umgebungstemperatur über +5 ℃ sein. Bitte beachten Sie auch die entsprechenden Produktdatenblätter der Hilfsstoffe!

Angabenerhebung	Alle technischen Daten in diesem Produktdatenblatt sind unter Laborbediingungen erhoben worden. Individuell abweichende – den örtlichen Gegebenheiten unterliegenden gemessenen Werten – liegen außer unserer Kontrollmöglichkeit.
Gesundheits- und Sicherheits- informationen	Die Verbundbleche unterliegen nicht der CE Kennzeichnung. Die Angaben des Sicherheitsdatenblattes entsprechen der EC-Richtlinien 91/155 EWG Für den Transport oder die Anwendung des Produktes ist kein Sicherheitsdatenblatt notwendig. Das Produkt führt bei der fachgerechten Anwendung zu keinen Umweltbeeinträchtigungen oder Schädigungen.
Sicherheitshinweis	Bei der thermischen Verschweißung der Verbundbleche ist in geschlossen Räumen eine ausreichende Frischluftzufuhr sicherzustellen. Lokale Sicherheitsanforderungen sind zu beachten!
Transport	Die Produkte sind nicht als Gefahrgutstoffe klassifiziert
Entsorgung	Das Material ist recyclebar. Lokale Entsorgungsanforderungen sind zu beachten!

Haftungsausschluss: Die vorstehenden Angaben, insbesondere die Vorschläge für Verarbeitung und Verwendung unserer Produkte, beruhen auf unseren Kenntnissen und Erfahrungen im Normalfall, vorausgesetzt die Produkte wurden sachgerecht gelagert und angewandt. Wegen unterschiedlichen Materialien, Untergründen und abweichenden Arbeitsbedingungen kann eine Gewährleistung eines Arbeitsergebnisses oder eine Haftung, aus welchem Rechtsverhältnis auch immer, weder aus diesen Hinweisen, noch aus einer Produkten Porerindet werden eine Gebruchen den gestellt Vergetz einer betreiten. mündlichen Beratung begründet werden, es sei denn, dass uns insoweit Vorsatz oder grobe Fahrlässigkeit zur Last fällt. Hierbei hat der Anwender nachzuweisen, dass er schriftlich alle Kenntnisse, die zur sachgemäßen und erfolgversprechenden Beurteilung durch Sika erforderlich sind, Sika rechtzeitig und vollständig übermittelt hat. Der Anwender hat die Produkte auf ihre Eignung für den vorgesehenen Anwendungszweck zu prüfen. Änderungen der Produktspezifikationen bleiben vorbehalten. Schutzrechte Dritter sind zu beachten. Im Übrigen gelten unsere jeweiligen Verkaufs- und Lieferbedingungen. Es gilt das jeweils neueste lokale Produktdatenblatt, das bei uns angefordert werden sollte.





Sarnafil®



Produktdatenblatt

Handelsname _____

Hersteller	Nawarotec GmbH
	CH-8919 Rottenschwil
Chemische Zusammensetzung	Keratinfaser (Schafschurwolle)
Verwendung	Wärme-, Kälte-, Schalldämmung, Schadstoffabbau
Farbe	weiβ, braun/meliert
Geruch	charakteristisch
Physikalische Eigenschaften:	
Dichte	35 - 40 kg/m³
pH-Wert	7,1 - 7,4
Flammpunkt	~ 570° C - 600° C
Thermische Zersetzung	über 240° C
LOI (Limiting Oxygen Index)	25,2 %
Brennbarkeit	EURO-Klasse E
Baustoffklasse	B2
Brandkennziffer	5,3
Wasserdampfdiffusionsdurchlässigkeit µ	1
Wärmeleitfähigkeit Nennwert $\lambda_{D(23/50)}$	0,035 W/mK

klimalan (Typ NWL)

Inhaltsstoffe

Wassergehalt	14 % - 16 %
Restfettgehalt	0,3% - 0,5% Lanolin
Mottenschutz (Wirkstoffgehalt)	1% Sulcofuron-Natriumsalz
Flammschutzmittel	keine
Pestizide	keine
Synthetikfasern, Bindemittel	keine

Wärmespeicherkapazität ______ 1.630 J/kg*K Schallabsorptionsgrad _____ α = 0,60 (H)

Schallabsorptionsklasse ______ C

Sonstige Angaben:

,	
Feinstaubbelastung	keine
Setzverhalten	keine
Löslichkeit in Wasser	keine
Löslichkeit in organischen Lösungsmitteln	keine





LINIREC® Recyclingbauplatte

Die LINIREC[®] Recyclingbauplatte ist eine Konstruktionsbauplatte aus recyceltem Polyurethan (PUR) - Hartschaum. Die Bearbeitung der Platten kann mit den üblichen Holzbearbeitungsmaschinen / Holzbearbeitungswerkzeugen erfolgen. Die Bauplatte ist mechanisch hoch belastbar, sehr hart und feuchtigkeits-stabil. Auf Grund ihrer guten Wärmedämmeigenschaft eignet sich die LINIREC [®] Recyclingbauplatte insbesondere zur thermischen Trennung beim Bau von Gebäuden nach der EnEV, sowie beim Bau von Passivhäusern.

Darüber hinaus können durch die LINIREC[®] Recyclingbauplatten sichere und äußerst langlebige Detaillösungen im Steil- und Flachdach realisiert werden.
Auf Anfrage kann die LINIREC[®] Recyclingbauplatte individuell konfektioniert werden.

Für Tür- und Fassadenfüllungen kann die LINIREC® Recyclingbauplatte mit individuellen Deckschichten kaschiert werden.

Alterungsbeständigkeit

Chemikalienbeständigkeit

Feuchtigkeitsstabil, kein Schimmeln, bzw. Fäulnisbildung

Baubiologisch und bauökologisch unbedenklich

Aufbau	Dämmkern	aus recyceltem PUR - Hartschaum
	Raumgewicht	ca. 500 kg/m³ ± 50 kg/m³ weitere Rohdichten auf Anfrage
	Wärmeleitfähigkeit	$\lambda \leq 0.075 \text{ W/(mK)}$
	einsetzbar im Temperaturbereich kurzfristig belastbar	- 50°C bis + 90°C bis + 250°C
	Druckspannung bei 5% Stauchung nach DIN 53421	1,3 bis 2,5 N/mm ²
	Dickenquellung im Wasser 24 h bei +20°C nach DIN 68763	+ 0,6 bis + 1,0%
	Dickenquellung in Wasser 7 Tage bei +20°C nach DIN 68763	+ 1,0 bis + 1,5%
	Dickenquellung 2 h in Kochwasser	+ 2 bis + 3%
	Alterungsbeständigkeit	fäulnisbeständig und unverrottbar
	Chemikalienbeständigkeit	beständig gegen Mineralöle, Aceton, Methylenchlorid, verdünnte Laugen und Säuren
Kanten		stumpf
Baustoffklasse nach DIN 4102		B2 normal entflammbar
Formate		1250 mm x 2500 mm
Plattenstärken		12 mm bis 40 mm

Dicke (mm)	Breite x Höhe (mm)
15	2500 x 1250
17	2500 x 1250
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Zwischendicken auf Anfrage!

Die Preise verstehen sich zzgl. der gesetzl. MwSt. und gelten bis zum Erscheinen einer neuen Preisliste. Dieses Angebot basiert auf unseren Verkaufs-, Lieferungs- u. Zahlungsbedingungen.

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va-Q-vip B

Product Data Sheet

Characteristics

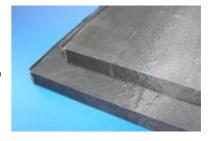
The vacuum insulation panel va-Q-vip B is officially certified with approval No. Z-23.11-1658 from the German Institute for Building Technology (DIBT) on 21 June 2007. The core of the panel consists of an amorphous silicon dioxide powder and an inorganic opacifier. The panel is sealed under vacuum into a metallized high barrier film. The high barrier film itself is covered on the exterior with a black protection fleece. The flammability of va-Q-vip B is according to DIN 4102-B2.

va-Q-vip B panels are characterized by their special film folding technology (va-Q-seam) at the edges. Therefore individual panels can be tightly fitted together, making an almost gapless assembly possible. Other shapes are available on request.



Applications

va-Q-vip B is specially developed for building insulation applications. The va-Q-vip B with a drastically reduced insulation thickness open up new possibilities in building insulation. va-Q-vip B has currently been approved again. va-Q-vip B can be used the widest field (DAD, DAA, DZ, DI, DEO, WAB, WH and WI according to the standard DIN V 4108-10, table 1) in building applications (internal and external insulation, wall, floor, roof, etc.).



Advantage

- The first vacuum insulation panel approved for building application by DIBT
- Drastically reduced heat fluxes and insulation thickness
- Increased usable space
- Extra protection layer for safe installation

Product data

Surface color:	Black
Geometry:	Rectangular shape (without flanges*)
Density (bulk, DIN EN 1602):	180 - 210 kg/m³
Thermal conductivity	
=> Initial value:	< 0.0053 W/(mK)
=> Including aging and edge losses:	0.0080 W/(mK)
=> If aerated:	0.020 W/(mK)



Temperature range during application:	-70 to +80 °C
Humidity range during application:	0 to 60 %
Internal gas pressure:	< 5 mbar (at delivery)
Increase of gas pressure:	ca. 1 mbar/year (measured, 20 mm thickness)
Dimension	
=> Maximum (length x width):	1200 mm x 1000 mm
=> Minimum (length x width):	400 mm (L) x 300 mm (W)
Thickness:	10 to 40 mm
Length and width tolerance	
=> 0 to 500 mm:	+2 / -4 mm
=> 501 to 1000 mm:	+2 / -5 mm
=> 1001 to 1200 mm	+3 / -6 mm
Thickness tolerance:	+/- 1 mm
Specific heat:	0.8 kJ/(kg·K) (at room temperature)
U-value (with 20 mm thickness)	
=> Initial value:	0.25 W/(m ² K)
=> Including aging and edge losses:	0.40 W/(m ² K)
Mass per area:	4 kg/m² (at 20 mm thickness)
External pressure load:	ca. 150 kPa (at 10% compression)
Flammability:	DIN 4102-B2
Lifetime:	Up to 30 - 50 years

 $[\]ast$ For 10 mm and 15 mm thickness panels part of the lid is on the surface increasing the thickness by 1 mm.

All figures are intended as a guide and should not be used for preparing specifications.





LINIREC® Recyclingbauplatte

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Chemikalienbeständigkeit

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Baubiologisch und bauökologisch unbedenklich

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	Druckspannung bei 5% Stauchung nach DIN 53421	1,3 bis 2,5 N/mm ²
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	Alterungsbeständigkeit	fäulnisbeständig und unverrottbar
	Chemikalienbeständigkeit	beständig gegen Mineralöle, Aceton, Methylenchlorid, verdünnte Laugen und Säuren
Kanten		stumpf
Baustoffklasse nach DIN 4102		B2 normal entflammbar
Formate		1250 mm x 2500 mm
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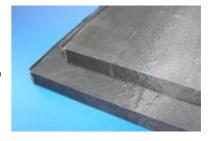
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Kanten		stumpf
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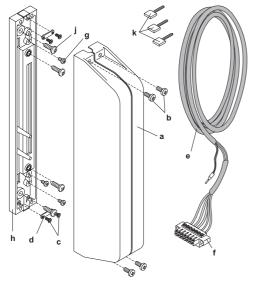
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Lamellenantrieh/Louvre Drive

LAH 61-K



- a Lamellenantrieb/ Louvre Drive **LAH 61-K**
- b Linsenschrauben/ Tallow-drop screw M 4 x 12
- c Linsenschrauben/ Tallow-drop screw $M2.5 \times 5$
- d Kabelklemme/ Cable clamp
- e 230V Kabel 6 polig/ 230V cable 6-pole
- Stecker 7 polig/ Plug 7-pole
- g Linsenschraube/ Tallow-drop screw M3x6
- h Grundplatte/ Mounting plate
- Blechschrauben/ Sheet metal screw ST 4.2 x 16
- k Kabelhalter/ Cable fastener

Anwendung / Application

Der Lamellenantrieb LAH 61-K wurde speziell für die stufenlose elektrische Bedienung von Hahn-Lamellen des Typs S9, S9iV, S9iVt-05 entwickelt. Er zeichnet sich besonders durch geringe Laufgeräusche, einen hohen Wirkungsgrad und eine lange Lebensdauer aus. Über eine PC-Busschnittstelle können Öffnungswinkel, Abschaltkräfte und Laufgeschwindigkeiten objektspezifisch parametriert werden.

Um Quetschgefahr zu verringern, kann in ZU-Richtung die Laufgeschwindigkeit und die Schließkraft im Handeingriffsbreich reduziert werden. Erfolgt in diesem Bereich eine Überlastabschaltung in ZU-Richtung, öffnet der Antrieb wieder und schließt nach 5 Sek, erneut. Bei erhöhtem Kraftbedarf können auch zwei Antriebe an einem Lamellenfenster montiert werden. Die 5 Kraft- und Positionsregelung sorgt dafür, dass beide Antriebe gleichmäßig und sicher AUF und ZU fahren. Bei Ausfall eines Antriebes, z.B. durch Kabelbruch oder Überlast, schaltet sich der andere Antrieb automatisch ab. Somit wird Glasbruch vermieden.

Louvre drive LAH 61-K has been specially designed for infinitely variable electrical control of Hahn-louvres of type S9, S9iV, S9iVt-05. Its remarkable features are low running noises, high efficiency and long-lasting lifetime.

Aperture angles, rupturing capacities and running speeds can be object-specifically parameterized via PC-BUS-interface.

Running speed and locking pressure can be reduced in CLOSED - direction within reach for reducing the danger of squeezing. If an overload cutoff is effected in this area in CLOSED-direction, the drive will run open again and close renewed after 5 seconds. In case of increased power requirement, two drives can be mounted as well on one louvre window. A power- and positioning system will ensure, that both the drives will run evenly and reliably OPEN and CLOSED. In case of failure of one of the drives, e.g. by parting of a cable or overload, the other drive will automatically switch off. Broken glass will be consequently avoided.

Technische Daten / Technical Data

: 230VAC/ 50 ... 60Hz Versorgung

Leistung : 16VA Strom : 70mA

Einschalt-

spitzenstrom: 20A für 1ms Drehmoment : bis ca. 6Nm

einstellbar

: IP 54 Schutzart

Temp.-Bereich : -5°C bis 70°C Betriebsart : Kurzzeit (30% ED)

Störemission : DIN FN 55011

Störfestigkeit : DIN EN 50081-2/ DIN FN 50082-2

DIN EN 61000-4-2,-3,-4/

DIN EN 50204

Lebensdauer : min. 10.000 Doppelhübe

Gehäuse : Zinkdruckguss,

RAL 9006 (weissalum.)

: 2,5m Silikon Kabel Anschluss

Power supply : 230VAC/ 50 ... 60Hz

Performance: 16VA · 70mA Current

Inrush

: 20A for 1ms current Torque : adjustable up to

approx. 6Nm

Protective

system : IP 54

: -5°C to 70°C Temp.-class

Class of rating: short-time (30% ED)

Interferina : DIN EN 55011

emission

Connection

Resistance to : DIN EN 50081-2 /

DIN FN 50082-2

DIN EN 61000-4-2,-3,-4 /

DIN EN 50204

I ifetime : min. 10.000 double strokes Housing

: zinc-diecasting,

RAL 9006 (white alum.) : 2,5m silicone cable

Sicherheitshinweise / Safety Notes

Betriebsspannung 230VAC!

L+N nicht vertauschen und den PE anschliessen, ansonsten Fehlfunktion und Zerstörung des Antriebes möglich! Einbau und Inbetriebnahme nur durch autorisiertes und qualifiziertes Fachpersonal!

Wir empfehlen, dieses ausschließlich durch einen D+H-Partner vornehmen zu lassen, der durch regelmäßige Werksschulungen seine Qualifikation und Erfahrung sicherstellt. Nur für die Innenmontage geeignet, bei Gefahr von Regen (z.B. an Lichtkuppel) grundsätzlich Regenmelder verwenden.

Operating voltage 230VAC!

Do not interchange L+N and connect PE (protective conductor), otherwise malfunction and destruction of the drive possible! Mounting and starting only by authorized and qualified experts!

We recommend, that mounting and starting is exclusively carried out by a D+Hdistributor, who is highly qualified and experienced by regular in-house training. Only for inside mounting suitable; where danger of rain (e.g. at domelights) always use rain detectors.

Quetschgefahr im handzugänglichen Bereich! Beiliegenden roten Sicherheitszettel beachten!

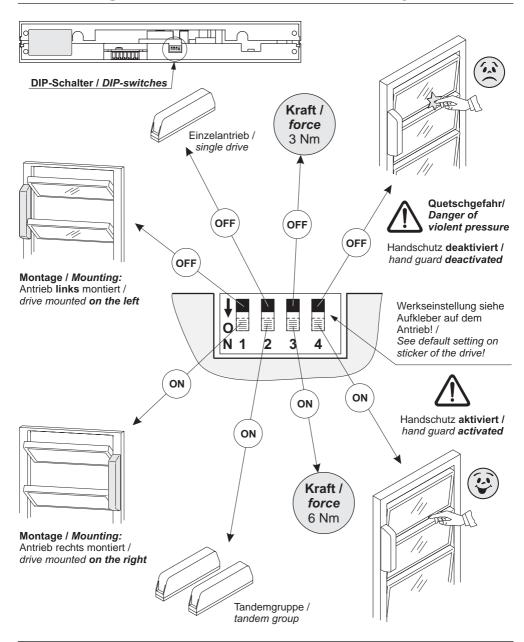


Danger of violent pressure within reach! Observe enclosed red safety slip!

Die bestehenden Vorschriften, z.B. VDE 0833, VDE 0100, DIN 18232, VdS 2221, sowie die Bestimmungen der örtlichen Feuerwehr sind zu beachten.

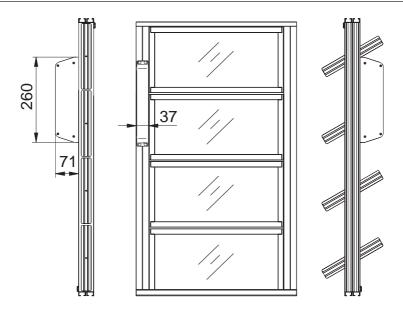
Observe the existing regulations, e.g. VDE 0833. VDE 0100. DIN 18232. VdS 2221. as well as the instructions of the local firebrigade.

Einstellung DIP-Schalter / DIP-switches adjustment



Vor Veränderung der DIP-Schalter ist Rücksprache mit der Firma Glasbau Hahn zu halten! / Before changing of the DIP-switches, please consult Glasbau Hahn!

Abmessungen / Dimensions

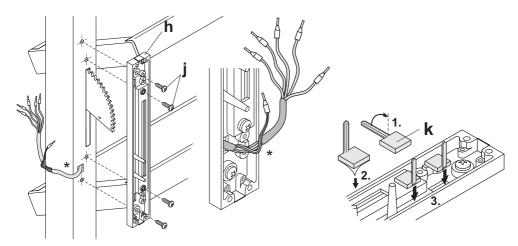


Montage / Mounting

Die Grundplatte (h) mit den Schrauben (j) auf den Rahmen der Lamelle schrauben. Kabelhalter (k) zur Kabelbefestigung an die Grundplatte kleben.

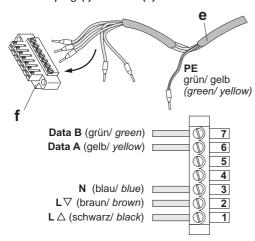
Screw mounting plate (h) with screws (j) on frame of the louvre.

Glue cable fastener (k) on mounting plate for fastening of the cable.



- * Wird das Kabel im Rahmen verlegt darauf achten, dass das Kabel durch die vorhandene Ausfräsung gesteckt wird!
- * If the cable will be laid in frame, observe, that the cable will be put through the existing countersinking!

2Den Stecker (f) an das Kabel (e) anschließen./ Connect plug (f) to cable (e).

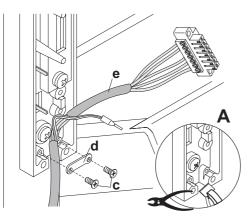


Q Bei Montage auf dem Rahmen:

Auf der Grundplatte die entsprechende Kabeleintrittsstelle mit einer Zange ausbrechen. Anschließend das Kabel (e) mit der Kabelklemme (d) und den Schrauben (c) an der Grundplatte befestigen.

With mounting on frame:

Tweak out a corresponding space for the cable entry by using pliers. Afterwards fasten the cable (e) on mounting plate with cable clamp (d) and screws (c).

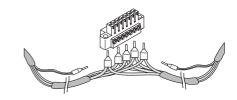


Kabelanschluss:

Bei mehrfach verschalteten Antrieben sind die Aderendhülsen der vorkonfigurierten Kabel durch entsprechend passende Doppeladerendhülsen zu ersetzen.

Cable connection:

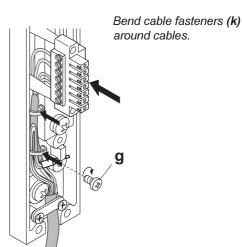
In case of multiple connected drives, the wire end ferrules of the pre-configured cables must be replaced by adequate suitable dual wire end ferrules.



Das Erdungskabel mit der Blechschraube (g) an der Grundplatte befestigen. Den Stecker dann auf den Klemmenplatz stecken und dabei die Kabelendmantelung in die Grundplatte fest hineindrücken.

Kabelhalter (k) um die Kabel biegen.

Fasten earth cable on mounting plate with sheet metal screw (g). After that, place plug on terminal slot and doing this, press cable end case firmly into mounting plate.



Das Erdungskabel des Antriebes (a) mit der Grundplatte verbinden (erden).

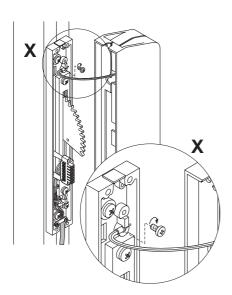
Connect earth cable of the drive (a) with mounting plate (connect to earth).

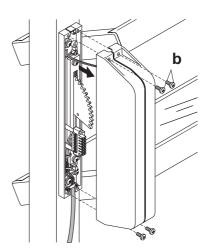
Den Antrieb auf die Grundplatine stecken und mit den Schrauben (b) festschrauben.

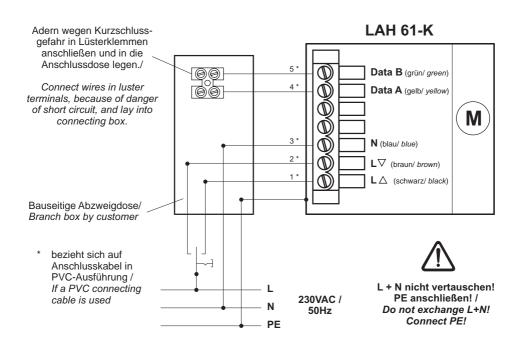
Achtung! Dabei Erdungskabel in den Antrieb zurückstecken, damit es nicht eingeklemmt wird.

Plug drive on motherboard and screw down with screws (b).

Attention! In the process, put earth cable back into drive, so that it will be not squeezed.







Inbetriebnahme / Starting

Bei einer bauseitigen Montage des Antriebes muss einmalig ein Nullabgleich durchgeführt werden. Hierzu wird der Antrieb wie zuvor beschrieben montiert und angeschlossen. Unabhängig von der Stellung der Lamellen muss der Antrieb in ZU-Richtung angesteuert werden.

Nach erfolgter Überlastabschaltung in Laufrichtung "ZU" hat der Antrieb jetzt einen neuen Nullpunkt bekommen.

Achtung! Der Handschutz ist bei diesem einmaligen Vorgang deaktiviert!

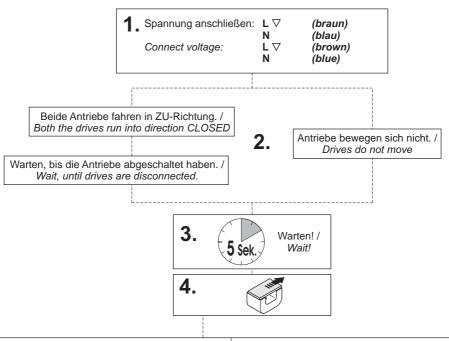
A single null balance must be carried out, in case of mounting of the drive by customer. For this, the drive will be mounted and connected as described before. The drive must be triggered in CLOSED-direction independent of position of the louvers.

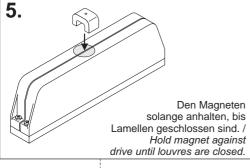
After overload cutoff in direction "CLOSED" has been carried out, the drive will have got a new zero point.

Attention! The hand guard is deactivated during this process!

Nullabgleich mit Dauermagnet / Null Balance with Permanent Magnet

Alternativ kann der Antrieb auch mit der Software **SW-LAH** referenziert werden. *The drive can be alternatively referenced with software* **SW-LAH** *as well.*



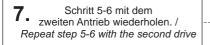


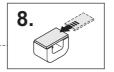
6. Der Antrieb hat jetzt einen neuen Nullpunkt bekommen!

Zur Kontrolle des Nullabgleiches kann der Magnet noch einmal an den Antrieb gehalten werden. Wenn kein leises Klicken im Antrieb zu hören ist, ist der Nullabgleich erfolgreich durchgeführt worden.

The drive has got a new zero point now!

Hold magnet once again against drive for checking of null balance. Null balance has been successfully carried out, if there is no low clicking to hear in the drive.







Es müssen immer **beide** Antriebe einen neuen Nullpunkt bekommen! / Adjust always to **both** the drives a new zero point.



HAHN-Lamellenfenster Montageanleitung

Warenannahme / Handling / Montage



Hafenstraße 5 - 7 . D-63811 Stockstadt/Main Telefon +49 6027 4162-0 . Telefax +49 6027 4162-99 info@werk2.glasbau-hahn.de . www.glasbau-hahn.de

Einleitung



Diese Montageanleitung ist lediglich ein Auszug aus dem HAHN-Lamellenfenster Anleitungshandbuch. Bitte lesen Sie das Anleitungshandbuch im Vorfeld sorgfältig durch und machen es den entsprechenden Personengruppen an geeigneter Stelle zugänglich. Wir weisen darauf hin, dass bei Nichtbeachtung der Hinweise, Gewährleistungsansprüche entfallen können.

Inhalt:

- 1. Einleitung
- 2. Warenannahme / Montagevorbereitung
 - 2.1. Entladung und Zwischenlagerung
 - 2.2. Transportschäden
 - 2.3. Auspacken
 - 2.4. Handling auf der Baustelle
- 3. Montage
 - 3.1. Richtiges verklotzen
 - 3.2. Ausrichten des Elements
 - 3.3. Elementbefestigung
 - 3.3.1 Verschraubung durch Elementrahmen
 - 3.3.2 Befestigung mit Laschen
 - 3.3.3 Einbau in Fassadenkonstruktion
 - 3.4. Rahmenkopplung mehrreihiger Elemente
 - 3.5. Zusammensetzen höhengeteilter Elemente
 - 3.6. Zusätzliche Einbaurichtlinien für WK2 (S9-iVt-05)
 - 3.7. Einglasen Lamellenfenster S9
 - 3.8. Einglasen Lamellenfenster System naco
 - 3.9. Lamellenfenster Integral / Rahmenabdeckung
 - 3.10. Testlauf / Inbetriebnahme

2. Warenannahme / Montagevorbereitung

2.1 Entladung und Zwischenlagerung

Die angelieferten HAHN-Lamellenfenster sind senkrecht in Kisten verpackt. Das Entladen vom Transportfahrzeug muss mit geeigneten Mitteln und Hebezeugen mit ausreichender Tragkraft erfolgen (z.B. Stapler). Die Kisten sind vorsichtig und verkehrssicher auf ebenes Gelände abzustellen. Die Kisten dürfen nicht gestapelt werden! Bei der Lagerung der Lamellenfenster auf der Baustelle, besteht die Gefahr der Kondenswasserbildung in den Elektroantrieben! Dies ist durch geeignete Maßnahmen zu verhindern.

2.2 Transportschäden



Nach Entladung ist die Lieferung zuerst nach Beschädigungen zu untersuchen. Äußerlich erkennbare Beschädigungen oder Verluste müssen bei Abnahme des Frachtgutes durch einen entsprechenden Vermerk des Transportunternehmens auf dem Frachtbrief bescheinigt werden. Bei Bahntransporten ist außerdem von der Bahn eine Tatbestandsaufnahme anzufordern.

Bei nicht sofort erkennbaren Schäden, die sich erst beim Auspacken herausstellen:

- 1. Sendung unverändert liegen lassen
- 2. GLASBAU HAHN unverzüglich schriftlich, möglichst unter Beilage von Photos, über die Art und den Umfang des Schadens informieren

Die Benachrichtigung von GLASBAU HAHN muss spätestens erfolgen:

- Bei Anlieferung durch Paketdiensten (UPS) oder Postsendungen binnen 24 Stunden
- Bei Anlieferung durch die Bahn binnen 24 Stunden
- Bei Kfz-Transporten durch Spediteure oder Fuhrunternehmen binnen 7 Tagen

Bei Postsendungen, die äußerlich erkennbare Schäden aufweisen, ist vor der Annahme der Sendung der Schaden vom Auslieferungspostamt aufnehmen zu lassen. Bei äußerlich nicht erkennbaren Schäden an einer Postsendung ist der Schaden nach seiner Feststellung unverzüglich dem Zustell- bzw. Ausgabepostamt unter Vorlage der gesamten Sendung anzuzeigen. Das Verpackungsmaterial bis zur Klärung aufbewahren.

2.3 Auspacken

Um die stabile Lage der gepackten Fenster bei der Kistenöffnung sicherzustellen, ist die Kiste vor dem Öffnen mit geeignetem Material, vorne zu unterklotzen, so dass sie nach hinten leicht schräg steht. Die Kiste kann nun oben geöffnet werden (Hinweis auf Kiste!). Das Verpackungsmaterial ist gemäß den Vorschriften am Bestimmungsort zu entsorgen.



2.4 Handling auf der Baustelle

Das weitere Handling auf der Baustelle findet nur bei geschlossenen Lamellen statt. Die Lamellenfenster können horizontal oder vertikal vertragen werden. Die Rechtwinkligkeit der Fenster ist dringend einzuhalten. Biegung und Torsion sind, wegen möglicher Beschädigungen an der Mechanik oder Glasbruch, zu vermeiden. Die Elemente dürfen beim Aufstellen nicht über die Ecke gestürzt werden. Das Fenster darf nicht zerlegt werden!

Handling nur bei geschlossener Lamelle!



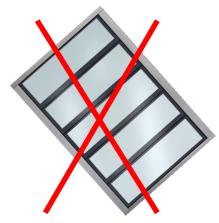


Lamellenfenster horizontal oder vertikal vertragen!





Lamellenfenster nicht über die Ecke stürzen oder verwinden!



Lamellenfenster nicht zerlegen!



3.0 Montage



Unter Berücksichtigung der nun folgenden Montagehinweise sollte der Einbau nur durch Fachkräfte erfolgen, da ein Großteil aller Schäden auf eine falsche Montage zurückzuführen ist.

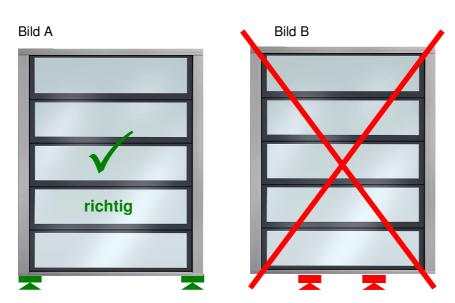
Der Motortyp LAH 61 und LAH 61K darf nur nach vorheriger Rücksprache mit GLASBAU HAHN abgenommen werden.

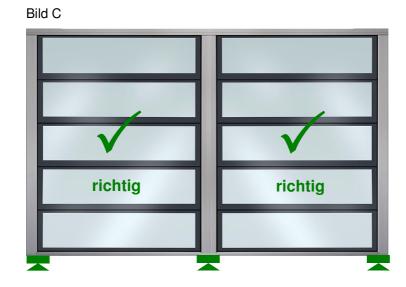
3.1 Richtiges Verklotzen

Prüfen und vergleichen Sie, vor dem Einsetzen des Fensters, die Elementmaße mit den Maßen der Einbauöffnung (es muss ausreichend Luft vorhanden sein).

Um eine einwandfreie Funktion und Dichtigkeit der Fenster zu erreichen, muss das Element horizontal und vertikal exakt ausgerichtet und verklotzt werden. Die Verklotzung muss an den wichtigen und richtigen Stellen erfolgen. Das obere und untere Rahmenprofil darf nur im Bereich der seitlichen Rahmenprofile unterlegt werden (Bild A / B). Hierdurch wird verhindert, dass sich diese Profile durchbiegen und eine Schwergängigkeit, hervorgerufen durch ungenügenden Abstand zwischen Rahmenprofil und Lamelle, entsteht. Bei Doppelelementen muss im Bereich des mittleren Rahmenprofils ebenfalls unterlegt werden (Bild C).



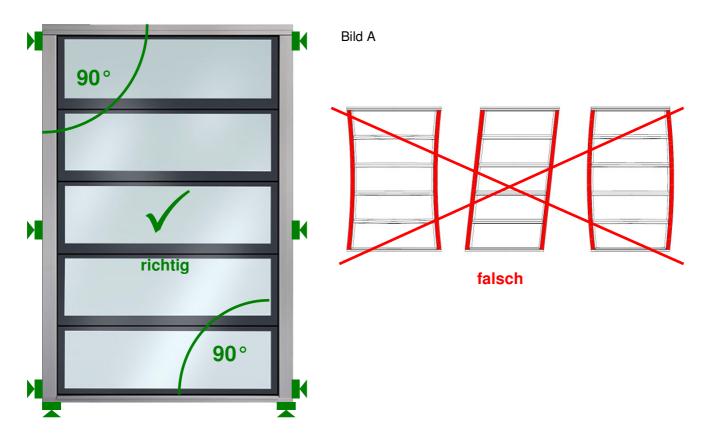




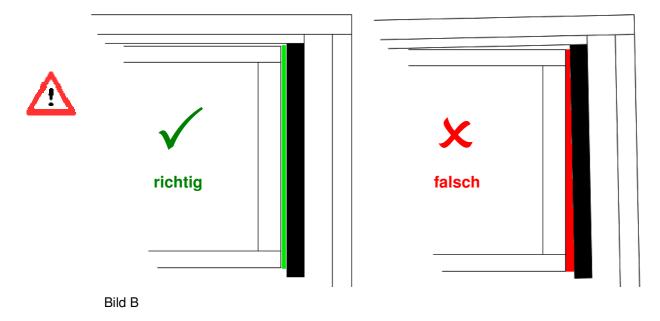
3.2 Ausrichten des Elements



Um eine einwandfreie Funktion und Dichtigkeit zu erreichen, muss das Lamellenfenster horizontal und vertikal exakt ausgerichtet werden und die Elementrahmen parallel zueinander stehen (Bild A). Dies ist besonders beim seitlichen verklotzen zu beachten. Nach dem provisorischen befestigen müssen die Diagonalmaße, sowie die lotrechte Lage überprüft werden.



Ein fehlerhafter Einbau ist durch ungleiche Abstände zwischen den Lamellen und dem Lamellenbeschlag (seitliche, vertikale Bürstendichtung) zu erkennen (Bild B). Die Einzelllamelle sollte sich im geöffneten Zustand ca. 1-2 mm horizontal bewegen lassen. Breiten und Höhenmaße müssen auf jedem Abschnitt des Lamellenelements gleich sein.



3.3 Elementbefestigung

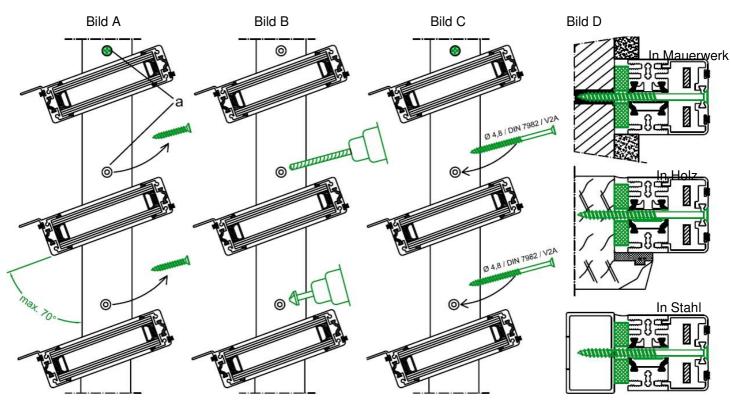
3.3.1 Verschraubung durch Elementrahmen

Bei dieser Befestigungsart, dürfen nur die von GLASBAU HAHN vorgesehenen Bohrungen im Beschlagprofil verwendet werden. Für die Befestigung dürfen keine Schlagdübel o.ä. verwendet werden.

Montagereihenfolge:

- Ausgangspunkt: Elementrahmen ist in Bauöffnung verklotzt, ausgerichtet und gesichert
- Lamellenfenster max. 70° öffnen (Schubstangen können sonst beschädigt werden) (Bild A)
 Achtung: Elektroantrieb LAH 61 / LAH 61K nur nach vorheriger Rücksprache mit GLASBAU HAHN abnehmen!
- Herausdrehen der Senkschrauben im Beschlag (Bild A)
 - Verschraubung in Holz => alle Beschlagsschrauben
 - Verschraubung in Stahl/Mauerwerk => bis 250mm Lamellenhöhe, jede zweite Schraube
 - => ab 250mm Lamellenhöhe, alle Schrauben
- Durch Elementrahmen bohren (Bohrer ⊗5mm), Unterkonstruktion nur anbohren (Bild B)
- Kernlochbohrung für Ø4,8mm Senkschraube in Unterkonstruktion setzen (Bild B).
 Bei Befestigung in Mauerwerk muss das Lamellenfenster für die Dübelmontage nochmals herausgenommen oder aus der Laibung geneigt werden.

- ⚠
- Alle Schraubverbindungen zwischen Lamellenfenster und Wand druckfest hinterfüttern
 (Bilder D / ist notwenig um ein Auseinanderziehen des Elementrahmens zu verhindern)
- Schrauben anziehen



Zeichnungsdarstellung am Beispiel S9-iVt-05.

3.3.2 Befestigung mit Laschen

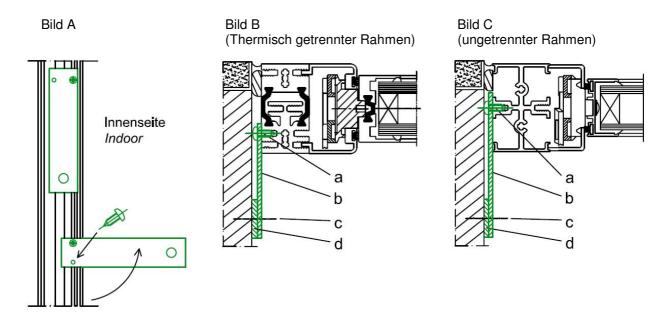
Diese Befestigungsart wird vorwiedend bei Mauerwerk als Unterkonstruktion gewählt. Sofern bei der Bestellung nicht anders definiert, haben die Edelstahllaschen eine Abmessung von 30x2x130mm mit einer großen Bohrung für die Dübelbefestigung. Die Laschen sind an den vertikalen Rahmenprofilen, in einem Abstand von 40 - 70cm (Windlastabhängig) angeordnet.

Montagevorbereitung:

- Laschen am Elementrahmen um 90° nach innen drehen und mit zweiter Schraube sichern. (Bild A)
- Dübel bereitlegen (nicht im Lieferumfang)
 (Die Auswahl des Dübels muss bereits bei der Planung erfolgen. Diese ist abhängig vor der
 Beschaffenheit der Wand (Beton, Mauerwerk (Ziegel, Kalk-Zement etc.)) und der Höhe der
 Lastbeanspruchung durch Wind. Der erforderliche Randabstand ist wiederum von der Art und Größe des Dübels abhängig.)

Montagereihenfolge:

- Ausgangspunkt: Elementrahmen ist in Bauöffnung verklotzt, ausgerichtet und gesichert
- Durch große Bohrung in Lasche hindurch in Wand Bohren
- Dübelmontage gemäß Herstellerangaben
- Lasche im Dübelbereich hinterfüttern (Bild B und C)
- Dübel anziehen



Zeichnungsdarstellung am Beispiel S9-iVt-05 (Bild A und B) und S9-iV (Bild C).

Legende:

- a.) Je Lasche 2x Linsenkopfschraube ○4,2 (V2A)
- b.) Lasche 30x2x130 Standardmaße / V2A
- c.) Dübel (nicht im Lieferumfang enthalten)
- d.) Unterlage (bauseits)

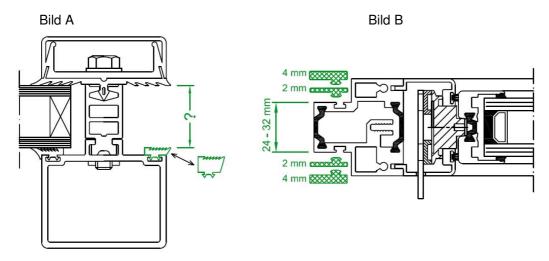
3.3.3 Einbau in Fassadenkonstruktionen

Alle HAHN-Lamellenfenster können mit einem umlaufenden Klemmbereich für einen Einbau in Fassadenkonstruktionen, in nahezu jeder gewünschten Klemmstärke, ausgestattet werden (muss bei Bestellung definiert werden).

Montagevorbereitung:

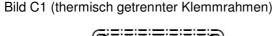
Vor dem Einbau ist die Klemmstärke der Fassadenkonstruktion mit der Klemmstärke am Lamellenfenster (Bild A) zu vergleichen. Sollte dies nicht übereinstimmen, müssen Dichtungen in der passenden Abmessung am Fassadensystem getauscht werden (wenden Sie sich an den Systemgeber der Fassadenkonstruktion).

Alternativ hierzu kann an Lamellenfenstertypen mit dem 47mm tiefen HAHN- Klemmrahmensystem (S9-45°, S9-iVt-05, S9-iVt-05 Ganzglas, S9-iVt-08 Ganzglas) die Klemmstärke auf der Baustelle umgerüstet werden (Bild B). Dies Erfolgt durch herausziehen nicht benötigter bzw. eindrücken notwendiger EPDM Distanzprofile aus der Nut im Rahmenprofil. Mögliche Klemmstärken sind: 24, 26, 28, 30 und 32mm.



Montagereihenfolge:

- Lamellenfenster in Bauöffnung einsetzen, verklotzten und ausrichten (Siehe Punkt 13.1 und 13.2)
- Provisorische Befestigung in Fassadenkonstruktionen Sofern bei der Fenstermontage die Deckleiste der Fassadenkonstruktion nicht sofort montiert werden kann, wird eine provisorische Verschraubung notwendig. Diese kann gemäß Bild C1 und C2 erfolgen, sofern das Fassadensystem dies zulässt (Rücksprache mit Systemgeber).



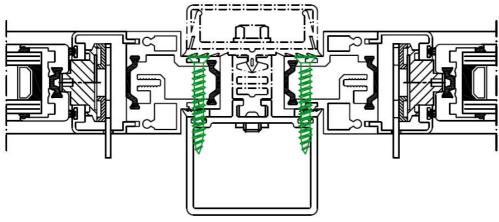
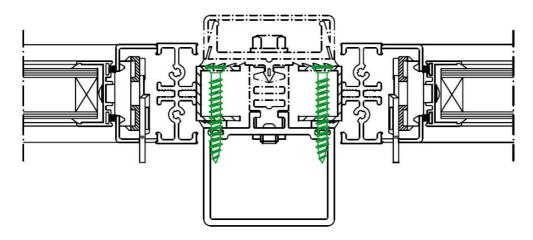


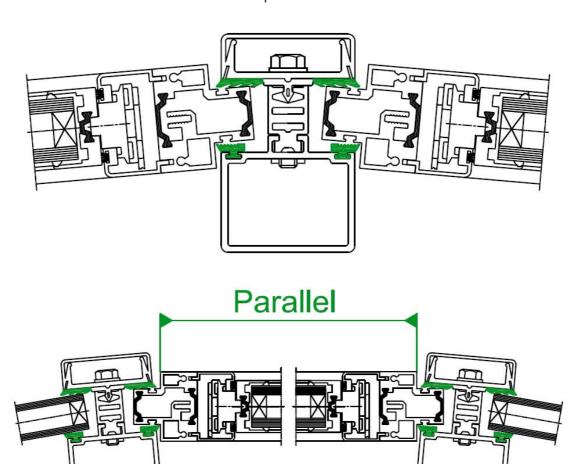
Bild C2 (thermisch ungetrennter Klemmrahmen)



 Deck/Klemmleiste des Fassadensystems, gemäß Angaben des Systemgebers, aufsetzen und verschrauben

Montagehinweis zu polygonalem Einbau in Fassadenkonstruktionen

Bei polygonalem Einbau muss das Lamellenfenster seitlich so verklotzt bzw. unterfüttert werden, dass die vertikalen Profile des Lamellenfensters parallel zueinander stehen.



3.4 Rahmenkopplung mehrreihiger Elemente

Geteilte, mehrreihige Lamellenelemente müssen zwecks Kopplung an den vertikalen Rahmen verschraubt werden. Hierbei dürfen nur von GLASBAU HAHN vorgesehene Bohrungen im Beschlagprofil verwendet werden.

Montagereihenfolge:

- Ausgangspunkt: Die Elementrahmen sind in Bauöffnung verklotzt, ausgerichtet und gesichert
- Lamellenfenster max. 70° öffnen (Schubstangen können sonst beschädigt werden)
 Achtung: Elektroantrieb LAH 61 / LAH 61K nur nach vorheriger Rücksprache mit GLASBAU HAHN abnehmen!

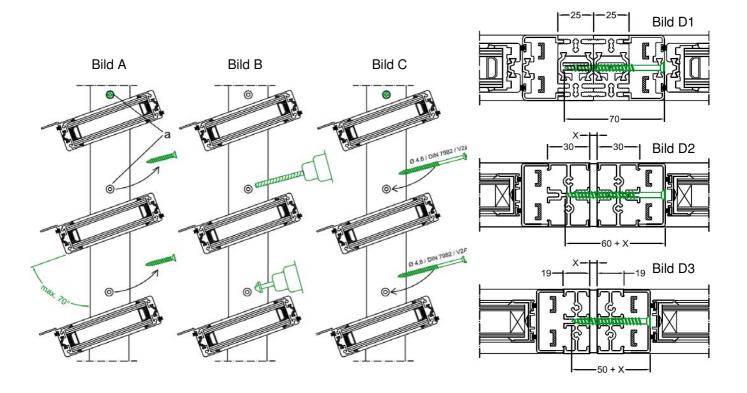


- => bis 250mm Lamellenhöhe, jede zweite Schraube
- => ab 250mm Lamellenhöhe, jede Schraube
- Durch beide Elementrahmen bohren (Rahmen 1 = 5mm / Rahmen 2 = 4,2mm / Bild B)

Bild D1 = S9-iVt-05, S9-iVt-05 Ganzglas (bei47er Rahmen), S9-iVt-08 Gangglas, S9-45°

Bild D2 = S9 und S9-iV mit 30mm breitem Rahmenprofil

Bild D3 = S9 und S9-iV mit 19mm breitem Rahmenprofil



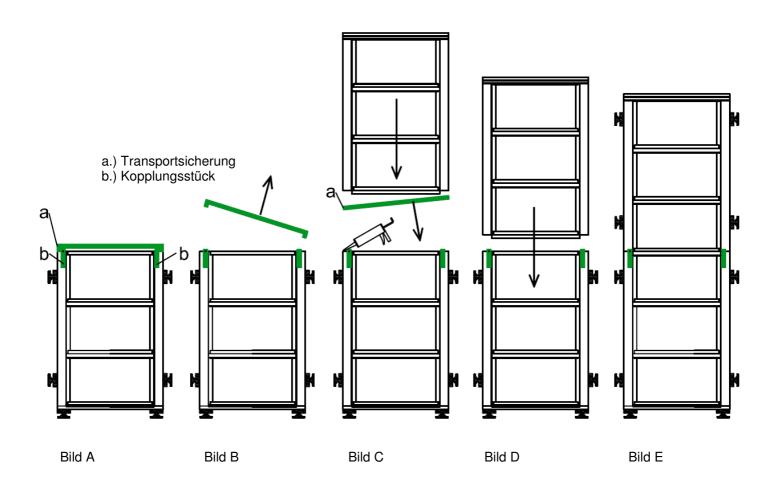


3.5 Zusammensetzen höhengeteilter Elemente

Aus Transport- oder Gewichtsgründen werden besonders hohe Lamellenfenster in der Höhe geteilt gefertigt und angeliefert.

Montagereihenfolge:

- Unteres Elementteil in Bauöffnung einsetzen, verklotzten, ausrichten und sichern (Bild A)
 (Punkte 13.1 Richtiges verklotzen, 13.2 Ausrichten des Elements und 13.3 Elementbefestigung beachten)
- Transportsicherung am unteren Elementteil abnehmen (i.d.R. Holzleiste) (Bild B)
- An den Kopplungsstücken Silikonnaht ziehen (Bild C)
- Transportsicherung am oberen Elementteil abnehmen (Bild C)
- Oberes Elementteil auf unteres Elementteil aufsetzen. Mit Hilfe der Kopplungsstücke wird das obere Element passgenau auf das untere in Position gebracht. (Bild D)
- Oberes Elementteil verklotzten, ausrichten und sichern (Bild E)
 (Punkte 13.1 Richtiges verklotzen, 13.2 Ausrichten des Elements und 13.3 Elementbefestigung beachten)



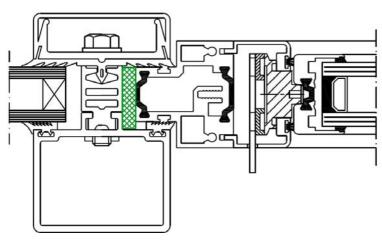
3.6 Zusätzliche Einbaurichtlinien bei WK2 (Lamellenfenster S9-iVt-05)

Sofern das HAHN-Lamellenfenster S9-iVt-05 in der Widerstandsklasse 2 (WK2) Ausführung bestellt wurde (gem. DIN V ENV 1627, muss bei Bestellung angegeben werden), müssen, neben dem allgemeinen Montagehinweisen, weitere Einbaurichtlinien beachtet werden.

Einbau in Fassadensystem

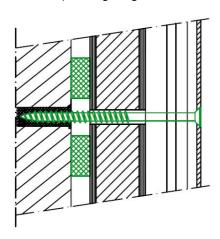
Mindestens an jeder zweiten Lamelle muss eine druckfeste Hinterfütterung mit einem Kunststoffklotzmaterial von min. 70mm Länge bauseits eingebracht werden (Bild A).





Einbau in Massivwand

Das Lamellenfenster muss mindestens jede zweite Lamelle durch den vertikalen Elementrahmen verschraubt und mit einem Kunststoffklotzmaterial druckfest Hinterfüttert werden (keine Schlagdübel o.ä.). Es dürfen nur von GLASBAU HAHN vorgesehenen Bohrungen im Beschlagprofil verwendet werden (Montagefolge siehe Punkt 13.3.1).



WK2 Bedingungen an Massivwand:

Mauerwerk nach DIN 1053-1

- Mindest - Nenndicke: 115mm

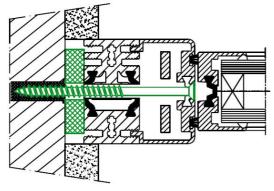
- Druckfestigkeitsklasse der Steine: Min. Klasse 12

- Mörtelgruppe: Min. 2

Stahlbeton nach DIN 1045

- Mindest - Nenndicke: 100mm

- Festigkeitsklasse B15



3.7 Einglasen Lamellenfenster S9

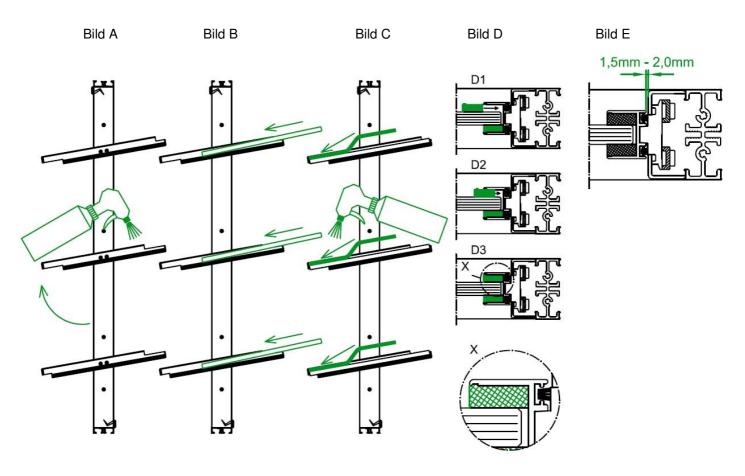
Das HAHN-Lamellenfenster S9 wird, sofern nicht anders vereinbart, unverglast ausgeliefert. Die Verglasung erfolgt bauseits von der Gebäudeinnenseite.

Montagereihenfolge:

- Ausgangspunkt: Elementrahmen ist in Bauöffnung fest montiert und ausgerichtet.
- Lamellenfenster öffnen (Bild. A.)
 Achtung: Elektroantrieb LAH 61 / LAH 61K nur nach vorheriger Rücksprache mit GLASBAU HAHN abnehmen!



- Glasscheiben sortieren und zurechtlegen (Achtung: Teilweise haben die untere und/oder die obere Glasscheibe ein anderes Höhenmaß)
- Glasscheiben in die Glashalterprofile einschieben und zwischen den Glashalteprofilen vermitteln (Bild B.)
- Lose mitgelieferte Silikon- Blockprofile mit Glasreiniger einsprühen und in die offene Fuge am Glashalteprofil einrücken (Bild C)
- Das Blockprofil so weit eindrücken bis die Nase einrastet (Bild D 1-3, Detail X)
- Fenster Schließen
- Glashalteprofile ausrichten (durchgängig paralleles Spaltmaß von 1,5mm bis 2mm über die gesamte Länge / Bild E)
- Testlauf

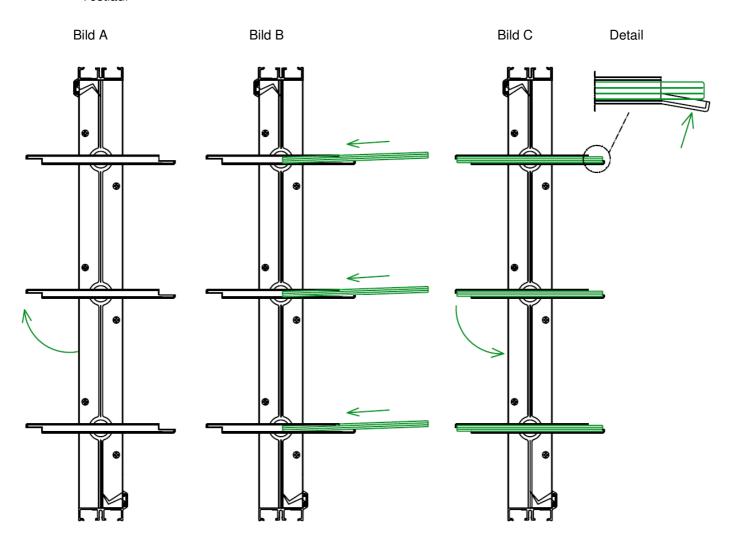


3.8 Einglasen Lamellenfenster System naco

Das HAHN-Lamellenfenster System naco wird grundsätzlich unverglast ausgeliefert. Die Verglasung erfolgt bauseits von der Gebäudeinnenseite.

Montagereihenfolge:

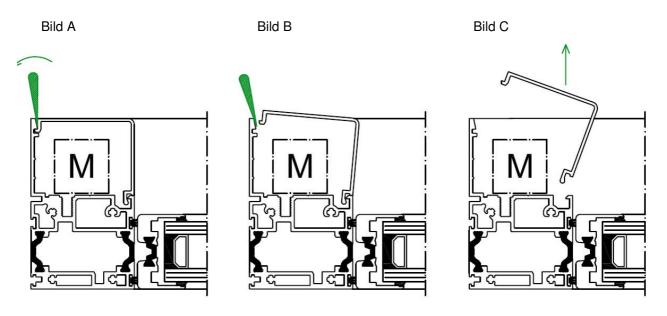
- Ausgangspunkt: Elementrahmen ist in Bauöffnung fest montiert und ausgerichtet
- Lamellenfenster öffnen (Bild. A.)
- Glasscheiben in die Glashalterprofile einschieben und zwischen den Glashalteprofilen vermitteln (Bild B.), Glasscheiben klemmen sich selbst
- Glashalter am Ende zubiegen (Bild C und Detail)
 Durch das Einlegen eines dünnen Klotzholzes zwischen Biegekante und Glas, wird dieser Montageschritt erleichtert
- Fenster Schließen
- Testlauf



3.9 Lamellenfenster Integral / Rahmenabdeckung

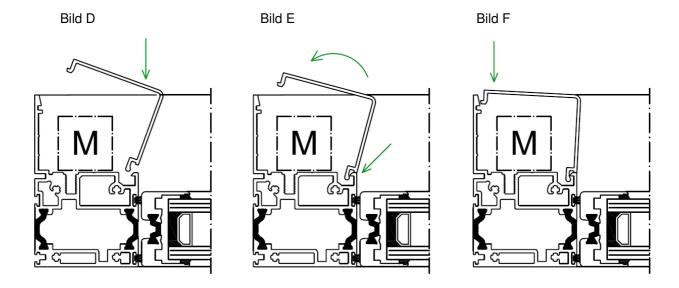
Öffnen der Rahmenabdeckung

Das Öffnen des vertikalen Rahmens erfolgt mit einem Spachtel. Dieser wird vorsichtig in der Profilfuge angesetzt (Bild A) und gedreht, bis sich das Abdeckprofil löst (Bild B). Dieser Vorgang an verschiedenen Höhenpositionen wiederholen. Anschließend kann das Abdeckprofil herausgenommen werden (Bild C).



Schließen der Rahmenabdeckung

Zum Schließen des vertikalen Rahmens, wird das Abdeckprofil etwas geneigt und zum Elementrahmen geführt (Bild D). Anschließend wird das Abdeckprofil so weit gedreht, bis es am Elementrahmen anliegt (Bild E). Nun auf das Profil drücken, bis es einrastet (Bild F). Dieser Vorgang muss an verschiedenen Höhenpositionen wiederholt werden.

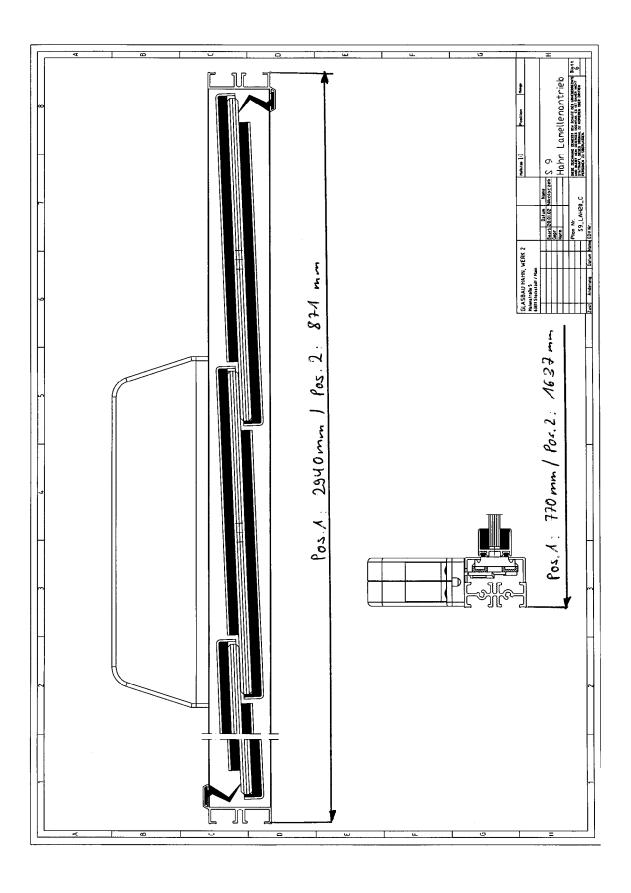




3.10 Testlauf / Inbetriebnahme

Nach dem korrekten Einbau ist an dem Lamellenfenster eine Funktionsprüfung vorzunehmen. Hierfür ist der Motor anhand des jeweiligen Schaltplans (siehe www.glasbau-hahn.de), an die entsprechende Spannungsversorgung anzuschließen (nur durch autorisierte Elektrofachkraft) und mindestens einmal aufund zuzufahren. Sollte hierbei festgestellt werden, dass das Fenster nicht einwandfrei öffnet bzw. schließt, ist der Einbau zu überprüfen. Sinngemäß gilt dies auch für mechanische Antriebe.

Eine Betätigung der Lamellenfenster darf nur über die dafür vorgesehenen Antriebshebel erfolgen. Bei einer Verstellung der Elemente durch Drücken gegen die Lamellen, entgegen der Kraft der Antriebsmechanismen, können Drehlager und Mechanik beschädigt werden. Eine einwandfreie Funktion und Dichtigkeit ist dann nicht mehr gewährleistet. Der Öffnungsbereich der Lamellen ist von Hindernissen freizuhalten. Es dürfen auf den Lamellen keine Gegenstände abgelegt und auch keine Kabel, Schläuche oder dergleichen durch das geöffnete Lamellenfenster hindurch geführt werden.



1. DESCRIPTION

1.1 What is BI-Combiset?

BI-Combiset is the BGT brand name for laminated safety glass (VSG). It consists of at least two single panes of glass with are joined together by a strong, tear-resistant polyvinyl-butyral film (PVB). The safety effect of VSG depends on the one hand on the high tear resistance of the PVB film and on the other hand on its excellent adhesion to the glass. The strength of the tough film makes it possible to manufacture laminated glass, which provides protection from thrown articles, break-in, gunshot and explosion. In addition the excellent adhesion to glass also provides a strong binding system for splinters and thereby a reduction in the risk of injury.

BI-Combiset can consist of combinations of float glass, tempered and semi-tempered glass or colour-coated glass. Moreover all VSG units can be further processed into insulating glass.

1.2 Manufacture

According to the desired function and the resulting structure one or more PVB intermediate layers are placed between the individual glass panes and then pressed together with the glass in a rolling process. The preconnected elements are thereafter put into an autoclave in which they are joined together under temperature and pressure into a solid and clearly transparent unit.

1.3 Brand symbol / approval markings

The corresponding brand symbol is applied according to the version and the product specification.

2. PROPERTIES

2.1 Impact resistance

As a high-quality safety glass, BI-Combiset fulfills the requirements of the pendulum impact test according to DIN 52337 and DIN 52338.

2.2 Bending strength

The bending strength of the laminated glass is determined by the strength of the individual panes.

	Strength	Permitted stress *
Float glass	45 N/mm²	15 N/mm ²
ESG	120 N/mm²	50 N/mm ²
TVG	70 N/mm ²	29 N/mm ²

In calculating the stress in laminated glass the adhesive effect of the films is not taken into account.

2.3 Temperature resistance

In the case of laminated safety glass (VSG) a temperature resistance of up to 60° C is specified. The continuous temperature load on VSG should not exceed 70° C.

The thermal coefficient of elongation is approx. $9 \times 10^{-6} \text{ K}^{-1}$ as for single glass.

The heat transition coefficient (k value) of VSG glass is hardly influenced at all by the mostly thin films. The changes with respect to single glass can be neglected.

 Taking account of a corresponding safety correction value.

2.4 Light transmission

The light transmission of VSG glass is similarly hardly influenced at all by the mostly thin films and accordingly corresponds to the sum of the individual glass panes. At a thickness of 8 mm BI-Combiset has a light transmission of approx. 88 %. For the high protective classes (e.g. B3, break-in resistance) the noticeable fall in light transmission can be compensated for by the use of white glass (float glass which is low in iron-oxide).

PVB films act as UV absorbers, i. e. the ultraviolet radiation of the sunlight is absorbed and not transmitted through. Thus for example sensitive products can be protected from "yellowing"

In comparison:

Structure	UV transmission in the visible range 280 - 380 nm
2 x 4 mm glass	43,3 %
2 x 4 mm glass + 0,38 mm film*	≤ 2,4 %
2 x 4 mm Glas + 0,76 mm film*	≤ 0,5 %

^{*} Film for building glazing and other applications except for automotive.

2.5 Sound insulation

Laminated glass has better sound insulation properties in comparison with the same thickness of monolithic glass panes. Firstly the higher elasticity of the plastic compared with glass reduces the flexural stiffness for the same weight resulting in an improvement in vibration behaviour. Secondly the internal damping of laminated glass is higher than that for single glazing. The improvement in the evaluated sound absorbing value with PVB is typically approx. 2 dB.

TYPES OF LAMINATED SAFETY GLASS

3.1 BI-Combiset standard glass

Splinter-binding laminated safety glass made from two or more panes of plate glass contains as standard one 0,38 mm thick PVB film. Thicker films (0,76 mm; 1,14 mm; 1,52 mm) and more layers of film can be supplied.

3.2 BI-Combiset for attack-resistant glazing

BI-Combiset is also available in various types and versions of attack-resistant glazing. This glazing is used in the public, commercial and private areas whereby the user can determine the type of attack-resistant glazing and its resistance class according to the desired protective effect.

The safety classifications are:

3.2.1 Resistance to penetration by thrown items

Classes A1 to A3 according to DIN 52 290 Part 4

Classes P1 - P4 according to EN 356

3.2.2 Resistance to breaking in/out

Classes B1 - B3 according to DIN 52 290 Part 3

Classes P5 - P8 according to EN 356 Classes EH01 -EH3 according to VDS

BGT Bischoff Glastechnik possesses its own permits for these classifications. You can find the exact type descriptions with the permit numbers from the following lists.

3.2.3 Comparison of attack-resistant glass types

Type of glass	Resistance class accor- ding to DIN 52 290	Resistance class accor- ding to EN 356	Resistance class accor- ding to VdS	Applicational examples	Type of test	Testing institute / test certificate or approval
P1 - 07	-	P1	-	Single and multi- family houses	3 x falling ball from 1,5 m height	MPA 410 119 495
A1 - 07	A1	P2	÷	In housing estates	housing estates 3 x falling ball from 3,5 m height	
A2 - 08	A2	Р3	-	Remote houses	3 x falling ball from 6,5 m height	MPA 410 120 295
A3 - 08	A3	P4	-	Exclusive houses and villas	3 x falling ball from 9,5 m height	MPA 410 117 195
ЕН01 - 08	А3	P4	EH01	Exclusive houses and villas	3 x falling ball from 9,5 m height	VdS M 94 406 15A
EH02 - 09	-	-	EH02	Schools and kindergardens	9 x falling ball from 12,5 m height	VdS M 94 406 15B
B1 - 18	B1	P6	-	Parts of shops	30 - 50 axe strikes	MPA DB 95023
B2 - 20	B2	P7	2)	Art and antique businesses	51 - 70 axe strikes	MPA DB 95024
EH2 - 24	5.	4 .	EH2	Museums, psych- iatric institutions 51 - 70 axe strikes		VdS M 954 1218 A
B3 - 24	В3	P8	.S#1	Jewellers, courts over 70 of justice axe strikes		MPA DB 96006
ЕНЗ - 35	-	*	ЕН3	Manufacturing facilities for furs and leather goods	Manufacturing over 70 cilities for furs axe strikes	

Up to class EH02 falling ball tests are carried out according to standard processes. Here it is determined whether a steel ball of about 4 kg can penetrate the sample upon impact with the required number of tests and at the corresponding falling heights. Higher resistance classes are tested under defined conditions for exam-

ple according to the German standard DIN 52290.

Typical applicational areas are the glazing of windows and doors of private and commercial premises against break-ins, the glazing of psychiatric clinics and courts of justice, as well as the glazing of animal cages, open-air enclosures and aquaria.

3.2.4 Gunshot resistance

Gunshot-resistant glazing is mainly used in banks, administrative and business premises. BGT has its own permits available for this category (see table). Tests on splinter-free designs can be carried out as required by the customer.

Type of glass	Resistance class according to DIN 52 290	Resistance class accor- ding to EN 1063	Type of gun	Calibre	Test institute / test certificate or approval number
BR1 SA-15	127	BR1 SA	Rifle	22 lr	DSC 96 029
BR1 SF-21	:=1	BR1 SF	22	,,	DSC 96 039
BR2 SA-22	C1 SA / B1	BR2 SA	Handgun	9 mm Para	DSC 96 030
BR3 SA-25	C2 SA	BR3 SA	Handgun	357 Magnum	DSC 96031
BR4 SA-29	C3 SA	BR4 SA	Handgun	44 Magnum	DSC 96032
BR5 SA-40	•	BR5 SA	Rifle	5,56 x 45	DSC 96 040
BR6 SA-51	C4 SA	BR6 SA	Rifle	7,62 x 51	DSC 96 041
SG1 SA-37		SG1 SA	Shotgun	12/70	DSC 96 042
SG2 SA-45		SG2 SA	Shotgun	12/70	DSC 96 043

3.2.5 Explosion resistance

Glazing in public buildings and military facilities, e.g. airports.

Classes D1 to D3 according to DIN 52 290 Part 5.

3.2.6 Installation information for attackresistant glazing

BI-Combiset panes have been tested by official testing institutes. Changes in the structure are thus only possible by additional layers on the attack side with or without intermediate gaps, i. e. all tested glass can also be offered as insulating glass combinations.

Combinations with tempered glass panes have been subjected to supplementary tests and are approved for use unter the type designation with the suffix "E" (see also Point 7)

In principle the protection described can only be achieved if the panes are bordered on all sides with a frame. Glazing beads are funda-

mentally to be mounted on the opposite side from the likely attack side so that they can withstand attack. BI-Combiset panes can be constructed asymmetrically. For this reason when ordering and during glazing it is particularly important to be aware of the attack side and the protective sid. This protective side is marked with a corresponding label in the manufacturing works.

3.3 BI-CombisetHestral

BI-Hestral, heat strengthened - or sometimes also called semi-tempered - glass, is a safety glass whose internal stress range is between normal float glass and tempered glass.

The difference between heat strengthened and fully tempered glass is the fracture appearance when broken. Whilst fully tempered glass breaks up into a multitude of small crumbs, heat strengthened glass bursts out from the impact point with radial cracks.

BI-HESTRAL, when combined as a laminated glass, offers quite considerable advantages in certain applicational areas where particular safety criteria must be satisfied.

Due to the toughness of the film the necessary residual safety is achieved in the case of a breackage (e.g. due to vandalism or gunshot). In the most frequent cases only one pane is destroyed and the function and bearing capacity of the glass pane combination is retained. If both panes are destroyed the fracture appearances of the outer und inner pane are normally not congruent, which means that the laminated glass package still possesses a residual bearing capacity and thus the stability and function are largely retained. The broken pieces adher to the film and remain dimensionally stable. No dangerous parts splinter off or fall down.

Laminated glass panes, in which both panes are fully tempered, would have a much lower stability in such a case. If both panes are broken thousands of tiny cracks occur due to the crumbling action, which causes the whole element to become unstable.

BI-CombisetHestral is therefore extremely recommendable for overhead, balustrade and façade glazing.

3.4 ALARM BI-Combiset

All BI-Combiset types can be provided with ALARM BI-TENSIT.

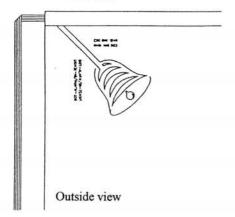


Fig. 1: BGT Alarm spider with 4 core flat cable. The conductor strips are burned into the surface of the glass.

The approval of ALARM BI-TENSIT as BI-Combiset laminated safety glass is granted under the number G 195034.

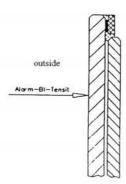


Fig. 2: ALARM BI-TENSIT combined with BI-Combiset laminated safety glass.

The insulation glazing has the approval - number G 195100.

3.5 BI-Combiset special combinations

VSG-glass can be manufactured with a multitude of functional glass products. Amongst these are BI-TENSIT safety glass; BI-COLOR colour-coated glass; BI-FireStop - fire protection glass, sun and sound insulating glass as well as white glass.

We would be happy to advise you on the great number of combination options.

4. APPLICATIONS

4.1 Overhead glazing/ roof glazing

In this application protection from falling objects - and at the same time in the case of glass breakages protection from pieces of glass - are the decisive factors. For the reason laminated safety glass is specified for overhead glazing. The splinter-binding properties of VSG guarantee a high level of safety. (In this connection read the special information under Point 3.3)

4.2 Balustrade glazing

To provide safety from falling balustrade glazing is usually made from laminated safety glass.

If there is mechanical overload (shock or impact) the glass breaks, however the broken pieces adher firmly to the intermediate layer. The risk of injury is significantly reduced since no loose or sharp-edged glass splinters can occur.

4.3 Window glazing for high-speed vehicles

All VSG glass intended for use in vehicles must be approved and must carry the approval stamp. The tests are carried out by the safety glass testing centre at the premises of the National Material Testing Authority in Dortmund. The exakt requirements for the respective application are officially specified.

4.4 BI-StepColor, walk-on glass

You can find a detailed description with applicational options and technical data in our product information sheet entitled: BI-StepColor

5. GLASS DIMENSIONS AND TOLERANCES

5.1 BI-Combiset strip dimensions

The glass panes which can be supplied in strip form are summarized in the following table.

Supplied loose on cradles

Typ 3/0,38/3 (glass/film/glas		0,76/3		
Size (mm)	Panes/ stuck	Sq.m/ pane	Sq.m/ total	Weight (kg)
2000 x 3210	13	6,24	99,84	1216
2250 x 3210	13	7,22	101,08	1408
2400 x 3210	13	7,70	92,40	1501
Type 4/0,38/	4 oder 4	1/0,76/4	4	
2000 x 3210	10	6,24	74,88	1248
2250 x 3210	10	7,22	72,20	1444
2400 x 3210	10	7,70	69,30	1540

5.2 Dimensions

The normal maximum production thickness of BI-Combiset is 80 mm.

Maximal dimension (mm)	Minimal dimension (mm)		
Autoclave 1:			
2700 x 3800			
2150 x 4050	300 x 400		
Autoclave 2:			
1910 x 6900			
Autoclave 3:			
1800 x 3210			

max. pane weight:

Single pane: 350 kg

Total package: 1000 kg

Other maximum formats can be realized by means of the vaulted door of the autoclave. Sizes in excess of the format 2700 x 3800 mm however can only be made in low piece quantities. Please ask our responsible sales staff.

5.3 Dimensional tolerances

The dimensional tolerances of BI-Combiset laminated safety glass are derived from the dimensional tolerance of the individual panes and the displacement tolerance during assembly.

5.3.1 <u>Dimensional tolerances for cut edges</u> and bordered edges

Pane size	Element thickness				
Width or height	Up tp 8 mm	Over 8 mm	With minimum of 1 single pane from 10 mm thickness		
to 1000 mm	± 1,0	± 1,5	± 2,5		
to 1500 mm	± 1,5	± 2,0	± 3,0		
to 2000 mm	± 1,5	± 2,0	± 3,5		
to 2500 mm	± 2,5	±3,0	± 4,0		
over 2500 mm	± 3,0	±3,5	± 4,5		

5.3.2 <u>Dimensional tolerances for ground</u> edges

Pane size		Glass thickness				
Width or height	Up to 24 mm	Up to 35 mm	over 35 mm			
Up to 500 mm	± 1,0					
Up to 1000 mm	+ 1,0 - 2,0	+ 1,0	+ 1,0 - 4,0			
over 1000 mm	+ 1,0					

Combinations of BI-TENSIT, BI-HESTRAL, BI-COLOR and BI-FireStop cannot be modified or processed after manufacture

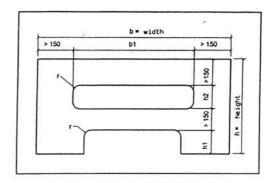
5.3.3 Cut-out tolerances

The highest value of the sums of all cut-out heights and widths

h₁ + h₂ with respect to h or

 $b_1 + b_2$ with respect to b

should be taken from the following table depending upon the glass thickness.



The minimum size of the remaining glass land: 150 mm.

Corner radius, smallest radius r in mm:

- for finely-ground edges

r ≥ 10 mm

- for polished edges

 $r \ge 25 \text{ mm}$

from glass thickness 26 mm

 $r \ge 20 \text{ mm}$

For cut-outs with semi-circles the hole tolerances will apply.

Glass thick- ness in mm	Guide value for total height or width of all cut outs	Tolerances in mm
7	0,1 b or h	± 2
9	0,2 b or h	± 2
10 - 15	0,3 b or h	± 2
16 - 20	0,4 b or h	± 2
22 - 27	0,5 b or h	±3

5.3.4 Hole tolerances

Hole diame-	Tolerances			
	Holes	Hole position		
Up to 90 mm	- 0 / + 2 mm for glass thickness < 24 mm - 0 / + 3 mm for glass thickness ≥ 24 mm	± 2,0 mm		
Up to 250 mm	- 0 / + 4 mm for glass thickness < 24 mm - 0 / + 5 mm for glass thickness ≥ 24 mm	± 2,0 mm		

Larger diameters upon request.

Oterhwise the technical production restrictions apply for the respective type of glass. More details can be dound in the corresponding BGT product information sheets (BI-Tensit, BI-FireStop, BI-StepColor)

5.3.5 Offset tolerances

Offsets for tempered glass:

For tempered VSG combinations it is logical to use the holes and/or partial sections of the individual monolithic panes. Through this offsets occur during lamination, which are added together from the tolerances of the geometrical holes / partial sections and their positions. Offsets of 3 mm and more (depending on the size of the unit) must be included.

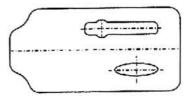
If the tolerances are very low this must be agreed technically beforehand.

6. SPECIAL SHAPES

Laminated glass packages made from 2-fold non-tempered glass can be cut in a conventional way for package thicknesses of up to about 10 mm. If the thickness or number of panes is more than this BGT can cut them on a modern CNC-controlled water-jet cutting system. By using the medium of water, mixed with grinding sand, glass panes of 3 - 65 mm thickness and with a maximum size of 2000 x 4000 mm can be processed. The cut edges have a ground matt appearance. The danger of being injured on this edge is very low.

The water-jet cutting system permits glass panes of all conceivable shapes and with complicated cut-outs and sections to be produced. This is done with the highest precision and quality, as can only guaranteed with a computer-controlled system.

Examples of shapes







7. TECHNICAL OVERVIEW OF ATTACK-RESISTANT GLAZING TYPES

Type of glass	Resistance classes (n)	Total thickness (mm)	Thickness tolerance (mm)	Weight kg/m²	Max. dimension mm x mm	Evaluated sound insulation value (Rw dB)*	k-value W/m²K	Light trans- mission %
P1 - 07	P1	7	+ 1 / - 0,5	16	2250 x 3200	33	5,8	90
P1 - 09	P1	9	+ 1 / - 0,5	21	2400 x 3600	34	5,8	89
P1 - 27	P1	27	+2/-0,5	31	2250 x 3600	≤ 37 *	≥ 1,1 *	≤ 82 *
A1 - 07	A1	7	+1/-0,5	16	2250 x 3200	33	5,8	90
A1 - 08E	A1	8	+ 1 / - 0,5	16	2100 x 3200	34	5,8	90
A1 - 09	A1	9	+ 1 / - 0,5	21	2400 x 3600	34	5,8	89
A1 - 27	A1	27	+2/-0,5	31	2250 x 3600	≤ 37 *	≥ 1,1 *	≤ 82 *
A2 - 08	A2	8	+1/-0,5	16	2250 x 3200	34	5,8	90
A2 - 08E	A2	8	+ 1 / - 0,5	16	2100 x 3200	34	5,8	90
A2 - 10	A2	10	+1/-0,5	21	2400 x 3600	35	5,8	89
A2 - 28	A2	28	+2/-0,5	31	2250 x 3600	≤ 37 *	≥ 1,1 *	82 *
A3 - 08	A3	8	+ 1 / -1	17	2250 x 3200	34	5,8	90
A3 - 08E	A3	8	+1/-1	17	2100 x 3200	34	5,8	90
A3 - 10	A3	10	+ 1 / -1	22	2400 x 3600	35	5,8	89
A3 - 28	A3	28	+ 2 / -0,5	32	2250 x 3600	≤ 38 *	≥ 1,1 *	≤ 82 *
EH01 - 08	EH01 / A3	8	+ 1 / - 1	17	2250 x 3200	34	5,8	90
EH01 - 08E	EH01 / A3	8	+1/-1	17	2100 x 3200	34	5,8	90
EH01 - 10	EH01 / A3	10	+1/-1	22	2400 x 3600	35	5,8	89
EH01 - 28	EH01 / A3	28	+2/-0,5	32	2250 x 3600	≤ 38 *	≥ 1,1*	≤ 82 *
EH02 - 09	EH02	9	+ 1 / -1	18	2250 x 3200	34	5,8	89
EH02 - 10E	EH02	10	+1/-1	18	2100 x 3200	34	5,8	89
EH02 - 11	EH02	11	+1/-1	23	2400 x 3600	35	5,8	89

Type of glass	Resistance classes (n)	Total thickness (mm)	Thickness tolerance (mm)	Weight kg/m²	max. dimen- sion mm x mm	Evaluated sound insulation value (Rw dB)*	k-value W/m²K	Light- trans- mission %
EH02 - 27	EH02	27	+ 2 / - 0,5	33	2250 x 3600	≤38 *	≥ 1,2 *	≤ 82 •
B1-18	B1	18	+ 1 / - 1	37	2400 x 3600	39	5,8	n.b.
B1-18E	B1	18	+ 1 / - 1	37	2100 x 3200	39	5,8	n.b.
B2-20	B2	20	+ 1,5/ - 0,5	43	2400 x 3600	39	5,8	n.b.
B2-20E	B2	20	+ 1,5/ - 0,5	43	2100 x 3200	39	5,8	n.b.
EH2-24	EH2	24	+ 2 / - 0,5	48	2400 x 3600	40	5,8	n.b.
EH2-24E	EH2	24	+ 2 / - 0,5	48	2100 x 3200	40	5,8	n.b.
B3-24	В3	24	+ 1 / - 1,5	46	2400 x 3600	40	5,8	n.b.
B3-24E	В3	24	+ 1 / - 1,5	46	2100 x 3200	40	5,8	n.b.
ЕН3-35	ЕН3	35	+ 2 / - 0,5	76	2400 x 3600 max. 6,5 m ²	42	5,8	n.b.
ЕН3-35Е	ЕН3	35	+ 2 / - 0,5	76	2100 x 3200 max. 6,5 m ²	42	5,8	n.b.

^{*} Approx. Value without test certificate

Isulated glass is identified clearly by the grey grid layout. For insulated glass the maximum sound insulation cannot be achieved simultaneously with minimum k values. Please enquire about the technical feasibility.

In the case of type descriptions which end in "E", there is the option of integrating our products: BI-TENSIT fully-tempered safety glass, BI-HESTRAL semi-tempered safety glass, BI-Color colour-printed glass and Alarm BI-TENSIT alarm glass.

^{*} These values depend on the coating and the gas filling.

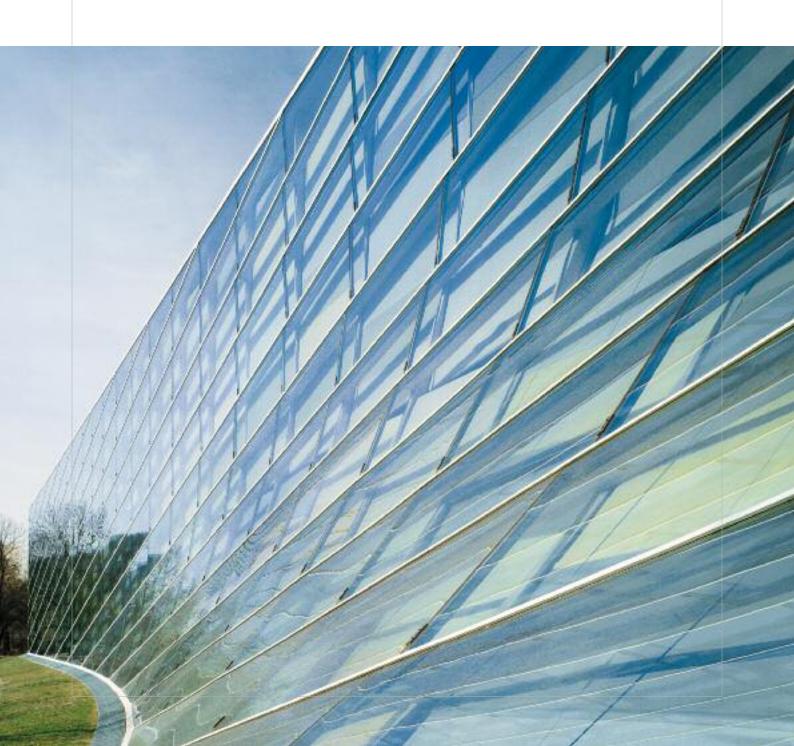
Type of glass	Resistance class accor- ding to EN 1063	Resistance class accor- ding to DIN 52 290	Total thickness (mm)	Thickness tolerance (mm)	Weight kg/m²	k-value W/m²K	max. size mm x mm
BR1 SA-15	BR1 SA	-	15	+1/-1	37,5	5,8	2400 x 3300
BR1 SF-17	BR1 SF	-	17		42,5	5,8	2400 x 2940
BR1 SF-21	BR1 SF	-	21	+ 2 / - 1	52,5	5,8	2400 x 2380
BR2 SA-22	BR2 SA	C1 SA / B1	21	+ 2 / - 1	54,5	5,8	2400 x 2290
BR3 SA-25	BR3 SA	C2 SA	24	+ 2 / - 1	61,7	5,8	2400 x 2040
BR4 SA-29	BR4 SA	C3 SA	29	+ 3 / - 1	72,6	5,8	2400 x 1750
BR5 SA-40	BR5 SA		40	+ 3 / + 1	100,0	5,8	2400 x 1250
BR6 SA-51	BR6 SA	C4 SA	50	+ 3 / - 1	126,4	5,8	2400 x 1000
BR6 SF-72	BR6 SF		72	+ 3 / - 1	180,0	5,8	2400 x 710
BR7 SA-75	BR7 SA		75		188,0		2400 x 670
BR 7 SF-75	BR7 SF		75		188,0		2400 x 670
SG1 SA-37	SG1 SA	-	38	+ 3 / - 1	95,5	5,8	2400 x 1310
SG2 SA-45	SG2 SA	-	45	+ 3 / - 1	113,3	5,8	2400 x 1125

Sound absorption values and light transmission upon request.



SILVERSTAR® COMBI und SUNSTOP T Sonnenschutzgläser

Die Farben der Sonne



Doppelstrategie durch Sonnenund Wärmeschutz mit der SILVERSTAR® COMBI-Beschichtung.

Wirkungsvolle SILVERSTAR COMBI-Beschichtungen

Eine Unterstützung in der Umsetzung moderner Architektur sind die wärmedämmenden selektiven SILVERSTAR COMBI-Beschichtungen. Mit einer abgestimmten Bandbreite an Beschichtungssystemen für die unterschiedlichsten Anforderungen erhalten Planer und Architekten ein zugeschnittenes Angebot an Sonnenschutz, Wärmedämmung und Lichttransmission. Die in mehrerer Hinsicht verbundenen Funktionen optimieren kosteneffizient das Gesamtenergiemanagement des Gebäudes. Die Aufgabe, den Wärmedurchlass auf ein absolutes Minimum zu reduzieren wird überzeugend erfüllt. Die Folgen werden nicht nur in den stark verminderten Heizkosten spürbar, sondern auch im deutlichen Zugewinn bei der Behaglichkeit.

Durch die herausragenden Sonnenschutz-Eigenschaften wird das Aufheizen der Innenräume vermieden, die Sonnenenergiestrahlung wird wirkungsvoll reflektiert. Ein wichtiger Beitrag zur Kostenminimierung der Kühlenergie wird geleistet. Aber auch passivsolare Energiezugewinne sind gemäß den gesetzlichen Regelungen möglich. Diese Funktionseinheit geht bei allen SILVERSTAR COMBI-Beschichtungen einher mit unvergleichlicher Transparenz. Gut belichtete Räume schaffen die Balance zwischen angenehmen Arbeitssituationen und der Reduzierung von künstlicher Beleuchtung.

Eine ausgezeichnete Selektivität ist das Merkmal moderner Sonnenschutzbeschichtungen. Dieser Einklang von Leistungsfähigkeit in Lichttransmission und Gesamtenergiedurchlass ist das Resultat eines komplexen Schichtsystems. Die langwelligen Infrarotstrahlen, die maßgeblich für das Aufheizen der Räume verantwortlich sind, werden am Durchgang gehindert – sie werden von der Schicht effektiv reflektiert. Die kurzwelligere, sichtbare Strahlung hingegen findet beinahe ungehindert Durchlass.

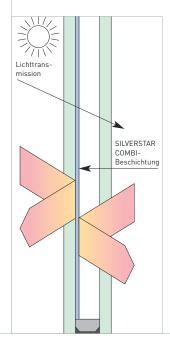
Breites Sortiment an COMBI-Beschichtungen für ein breites Einsatzspektrum

Mit High-Performance im Glas findet dieses in unterschiedlichen Anwendungsgebieten seinen Einsatz. Nicht nur bei großflächigen Glasfassaden werden die Multitalente geschätzt. Gerade auch im städtischen Wohnungsbau, der Renovation oder bei Glasanbauten, speziell bei Wintergärten, zeigen die Allroundeigenschaften ihr Können. Je nach Einsatzort ist die Möglichkeit als ESG- oder VSG-Ausführung gegeben.



Im Dialog mit der Umgebung

Der dezente Auftritt symbolisiert Offenheit und Eleganz. Durch bestechende Transparenz und wahlweise ausgezeichnete Farbneutralität oder definierte Farbnuancen fügt sich die Verglasung harmonisch in jedes bauliche Umfeld. Geradezu zu einer Einheit verwoben wird die gesamte Außenhülle eines Objektes durch den Einsatz von farbangepassten Brüstungsplatten – eine Homogenität der besonderen Art.



Referenzen mit SILVERSTAR® COMBI Gläsern.











		Linke Seite: Walterboscomplex, Apeldoorn (NL)
П		SILVERSTAR COMBI Neutral 50/25

Santander Consumer Bank, Mönchengladbach (D) SILVERSTAR SELEKT

Bibliothèque de Troyes (F) SILVERSTAR SELEKT

Drehscheibe Frankfurt	(D)
SII VERSTAR SELEKT	

Deutscher Wetterdienst, Offenbach (D) SILVERSTAR COMBI Neutral 70/35

SAP Campus II, Walldorf (D) SILVERSTAR COMBI Neutral 61/32

Alles spricht für Sonnenschutz mit SILVERSTAR® SUNSTOP T.



Intelligenter Sonnenschutz mit SILVERSTAR

SILVERSTAR SUNSTOP T Sonnenschutzverglasungen zeichnen sich durch einen enorm niedrigen Sonnenenergiedurchgang aus. Dieser beugt der unerwünschten Raumüberhitzung bei gleichzeitig hoher Lichtdurchlässigkeit und bestechender Außenansicht wirksam vor. Die Vorbildlichkeit in den Reflexionswerten trägt zu einem gezielt niedrigen Energieverbrauch für Klimaanlagen und somit zur deutlichen Kostensenkung bei.

SILVERSTAR SUNSTOP T Gläser öffnen Planern gestalterische Freiheitsgrade durch verschiedene neutrale oder farbig nuancierte reflektierende Akzente in der Glasfassade. Das "T" steht für "temperable", das englische Wort für "erhitzbar", also vorspannbar. Die Schichtdesigns der SUNSTOP T Produktreihe können direkt im Glasverarbeitungsbetrieb zugeschnitten, gegebenenfalls bedruckt und vorgespannt werden. Damit profitieren Planer und Architekten von kürzeren, termingenauen Lieferzeiten.

Auch bei Kälte seine Stärke zeigen

In Kombination mit einer neutralen Wärmedämmbeschichtung, die der Sonnenschutzschicht gegenüber steht, wird ein wichtiger Beitrag zur Begrenzung der Wärmeverluste geleistet. Dies ist nicht nur ausschlaggebend im Hinblick auf den Umweltschutz – Verringerung des Ausstoßes von klimaschädlichem Kohlendioxid – sondern auch für eine ganzheitliche Maßnahme zur Kostenminimierung. Die hochwärmedämmende Funktionsschicht erklärt sich in einem großen Behaglichkeitsempfinden, sogar in unmittelbarer Nähe der Glasoberfläche.

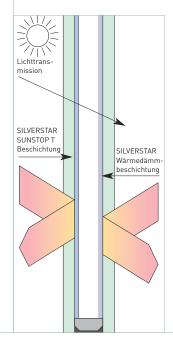
Wirkungsvoll der Sonne entgegen

Die Realisierung zeitgemäßer Glasprojekte steht in direkter Verbindung mit einem umweltgerechten Energiesparkonzept. Daher wird großen Wert auf das perfekte Zusammenspiel von Energiedurchlass und Lichtdurchlässigkeit gelegt. Der niedrige Gesamtenergiedurchlass, g-Wert, trägt zu einer deutlichen Reduktion des Kühlenergiebedarfs bei, da die Wärmelast im Gebäude erheblich vermindert wird.

Die Notwendigkeit, Energiekosten für Klimaanlagen nachhaltig zu senken und trotzdem ein angenehmes Temperaturniveau in Innenräumen zu schaffen, ist heute individuell planbar. Hochwirksamer Sonnenschutz befähigt somit zu einer naturgetreuen Übernahme der Lichtführung. Eine hohe Arbeitsplatzqualität mit optimaler Tageslichtausnutzung reduziert zudem den Einsatz von künstlichen Lichtquellen.

Effektvolles Farben-Spiel mit Sonnenenergie

Um Glasfassaden eine besondere Charakteristik zu verleihen, wird die Akzentuierung durch Farbreflexionen als individuelles Gestaltungsmittel eingesetzt. Die farbige Ästhetik einer Gebäudehülle aus Glas vermittelt selbstbewusst eine eigene Identität. Farbliche Glasreflexionen sind ein adäquates Stilmittel städtische Bilder zu prägen oder die moderne Gegenwartsarchitektur zu unterstreichen. Eine Komplettierung des homogenen Erscheinungsbildes wird durch passende Brüstungsplatten ermöglicht.



Referenzen mit SILVERSTAR® SUNSTOP T Gläsern.











Linke Seite: Carl Zeiss AG, Oberkochen (D)
SILVERSTAR SUNSTOP T Blau 50

Nycomed, Konstanz (D) SILVERSTAR SUNSTOP T Neutral 50

Chong Hing Finance Center, Shanghai SILVERSTAR SUNSTOP T Neutral 50

Al Safat Tower, Kuwait SILVERSTAR SUNSTOP T Irish 22/18

Royal Village CRC Building, Amman SILVERSTAR SUNSTOP T Silber 20

Al-Salam Commercial Building, Amman SILVERSTAR SUNSTOP T Blau 30

SILVERSTAR® COMBI-Beschichtung Die technischen Daten auf einen Blick.

Zwei in einem

Die Vereinbarkeit von Sonnenschutz, Wärmedämmung, Lichttransmission, Transparenz und Optik zählt zu unseren Kernkompetenzen. Somit entsprechen die SILVERSTAR COMBIBeschichtungen funktionalen Spezifikationen bei vielfältigen Planungsaufgaben als auch ästhetischen Ansprüchen der Planer.

Isoliergläser mit SILVERSTAR COMBI-Beschichtungen für den Scheibenaufbau SILVERSTAR COMBI 6 mm / SZR 16 mm Argon / Float 4 mm haben folgende technische Werte:

	SILVERSTAR COMBI Neutral 41/21	SILVERSTAR COMBI Neutral 51/26	SILVERSTAR COMBI Neutral 61/32	SILVERSTAR COMBI Neutral 70/35	SILVERSTAR SELEKT ¹⁾	SILVERSTAR COMBIT Silber 48 ²⁾
Lichttransmissionsgrad	41 %	51 %	61 %	70 %	72 %	48 %
Lichtreflexionsgrad außen	18 %	16 %	13 %	14 %	12 %	46 %
Direkter Strahlungstransmissionsgrad	20 %	25 %	31 %	35 %	39 %	33 %
Strahlungsreflexionsgrad	32 %	35 %	28 %	33 %	28 %	45 %
Strahlungsabsorptionsgrad	48 %	40 %	40 %	32 %	33 %	22 %
Sekundäre Wärmeabgabe nach innen	3 %	3 %	3 %	2 %	3 %	3 %
Gesamtenergiedurchlassgrad nach EN 410	22 %	28 %	34 %	37 %	42 %	35 %
b-Faktor (g-Wert nach EN 410 / 0,8)	28	35	43	46	53	44
Selektivitätskennzahl	1,86	1,82	1,79	1,89	1,71	1,37
Farbwiedergabeindex Ra in Transmission	86	87	94	95	96	96
Ug-Wert nach EN 673	1,1 W/m ² K	1,1 W/m ² K	1,1 W/m²K	1,1 W/m²K	1,1 W/m²K	1,1 W/m ² K
Empfohlenes Brüstungsglas	BD 70	BD 70	BD 62 S	BD 70	BD 72	BD 77

SILVERSTAR SELEKT ist auch als vorgespanntes Glas erhältlich – SILVERSTAR SELEKT T. Die technischen Werte des vorgespannten SILVERSTAR SELEKT T sind dem SILVERSTAR SELEKT angepasst. SILVERSTAR SELEKT ist identisch mit der Produktbezeichnung SILVERSTAR COMBI Neutral 70/40.

Die hier aufgeführten technischen Daten entsprechen dem aktuellen Stand bei Drucklegung. Stand 06/2009

- Ausgezeichnete Wärmedämm-Eigenschaften durch niedrige
 Ug-Werte
- Hohe Reflexion aufheizender Sonnenenergie für einen optimalen Sonnenschutz
- Maximale Lichtdurchlässigkeit sorgt für viel natürliches Tageslicht
- Zusätzliche Wärmegewinnung durch passivsolare Sonnenenergienutzung
- Dkonomisches und ökologisches Gesamtenergiemanagement
- Brillante Optik, höchste Transparenz und natürliche Farbwiedergabe
- Logistische Flexibilität und Lieferzeitverkürzung im ESG-Werk durch Vorspannbarkeit von SILVERSTAR SELEKT T und SILVERSTAR COMBI T Silber 48
- Kombinierbar mit Sicherheits- und Schalldämmfunktionen
- SILVERSTAR COMBI-Beschichtungen müssen für Structural Glazing und Stufengläser randentschichtet werden. Dies kann zu einer optischen Beeinträchtigung im Randbereich der Verglasung führen.

²⁾ SILVERSTAR COMBI T Silber 48 ist vorspannbar.

SILVERSTAR® SUNSTOP T Die technischen Daten auf einen Blick.

Die Sonne im Griff

Durch die Entwicklung der hochwirksamen Sonnenschutzschichten SILVERSTAR SUNSTOP T eröffnen sich bezüglich des sommerlichen Wärmeschutzes weitere neue planerische Freiheitsgrade. Die farbliche Akzentuierung von Glasfassaden verleiht der Gebäudehülle eine besondere Charakteristik.

soliergläser mit SILVERSTAR SUNSTOP T-Beschichtungen für den Scheibenaufbau SILVERSTAR SUNSTOP T 6 mm / SZR 16 mm Argon / SILVERSTAR ENplus 4 mm haben folgende technische Werte:

naben lotgenae teeninsene werte.				
	SILVERSTAR SUNSTOP T Neutral 50	SILVERSTAR SUNSTOP T Blau 50	SILVERSTAR SUNSTOP T Blau 30	SILVERSTAR SUNSTOP T Silber 20
Lichttransmissionsgrad	45 %	44 %	27 %	18 %
Lichtreflexionsgrad außen	14 %	21 %	28 %	29 %
Direkter Strahlungstransmissionsgrad	29 %	28 %	17 %	12 %
Strahlungsreflexionsgrad	16 %	20 %	25 %	25 %
Strahlungsabsorptionsgrad	55 %	51 %	58 %	63 %
Sekundäre Wärmeabgabe nach innen	6 %	6 %	5 %	5 %
Gesamtenergiedurchlassgrad nach EN 410	36 %	34 %	22 %	16 %
b-Faktor (g-Wert nach EN 410 / 0,8)	45	43	28	20
Selektivitätskennzahl	1,25	1,29	1,23	1,13
Farbwiedergabeindex R _a in Transmission	96	95	92	93
Ug-Wert nach EN 673	1,1 W/m ² K	1,1 W/m ² K	1,1 W/m ² K	1,1 W/m²K
Empfohlenes Brüstungsglas	BD 66 S	BD 62 S	BD 60 S	BD 64 S

Die hier aufgeführten technischen Daten entsprechen dem aktuellen Stand bei Drucklegung. Stand 06/2009

- Logistische Flexibilität und Lieferzeitverkürzung im ESG-Werk durch Vorspannbarkeit des SUNSTOP T beschichteten Glases
- Planerischer Freiheitsgrad durch Kombinationsmöglichkeit vorgespannter und unvorgespannter Gläser mit guter Farbhomogenität
- Hervorragender Sonnenschutz durch niedrige g-Werte
- Definierte Fassadengestaltung durch farbig und elegant reflektierende Akzente der Sonnenschutzgläser SILVERSTAR SUNSTOP T Blau 50, Blau 30 und Silber 20
- Bestechende Farbneutralität von SILVERSTAR SUNSTOP T Neutral 50, passend zu Wärmedämmgläsern oder unbeschichteten Gläsern
- Enormes Einsparpotenzial bei den Klimatisierungskosten
- Hochenergetische Eigenschaften mit einer SILVERSTAR Wärmedämmbeschichtung
- Zum g-Wert optimierte Lichttransmission

Referenzen mit SILVERSTAR® COMBI Gläsern.









Casino, St. Etienne (F) SILVERSTAR COMBI Neutral 61/32 Voith Paper, Heidenheim (D)
SILVERSTAR COMBI Neutral 40/21 und 61/32

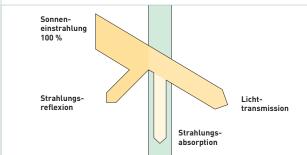
Rechte Seite: St. Jakob-Turm, Basel (CH) SILVERSTAR COMBI Neutral 40/21

Antony Parc 2, Paris (F) SILVERSTAR COMBI Neutral 61/32 Großer Burstah, Hamburg (D) SILVERSTAR COMBI Neutral 70/35



Mit Durchblick zur Verwirklichung architektonischer Ideen.





Lichttransmissionsgrad

Natürliches Tageslicht ist nicht nur für das menschliche Auge angenehmer als Kunstlicht, Tageslicht beeinflusst auch unseren Stoffwechsel und den Hormonhaushalt. Der Lichttransmissionsgrad einer Verglasung bezeichnet den prozentualen Anteil der Sonnenstrahlung im Bereich des sichtbaren Lichtes, der von außen nach innen durchgelassen wird. Der LT-Wert ist unter anderem von den Beschichtungssystemen abhängig. Insbesondere SILVERSTAR COMBI-Beschichtungen sind darauf optimiert die Sonnenstrahlung nach Licht und aufheizender Energie zu selektieren.

b-Faktor (SC = Shading Coefficient)

Der b-Faktor ist der Quotient aus dem Gesamtenergiedurchlassgrad einer Verglasung und dem Gesamtenergiedurchlassgrad eines unbeschichteten Isolierglases. Der b-Faktor ist also ein Maß für die Sonnenschutzwirkung. Der g-Wert des unbeschichteten Zweischeiben-Isolierglases wird hierbei als Konstante mit 80 % angesetzt.

Beispiel: SILVERSTAR SUNSTOP T Blau 30 hat einen Gesamtenergiedurchlassgrad von 22 % nach EN 410.

b-Faktor =
$$\frac{0,22}{0,80}$$
 = 0,28

Strahlungsabsorption

Unter dem Strahlungsabsorptionsgrad oder Energieabsorptionsgrad versteht man den Anteil Strahlung im gesamten Bereich des Sonnenspektrums, der durch die Verglasung aufgenommen wird.

Hoher Strahlungsabsorptionsgrad

Für Glaskombinationen, die einen Strahlungsabsorptionsgrad von mehr als 50 % aufweisen, sollte das Sonnenschutzglas generell vorgespannt werden.

UV-Transmission

SILVERSTAR COMBI und SILVERSTAR SUNSTOP T Sonnenschutzgläser weisen im Gegensatz zu normalem Glas wesentlich geringere UV-Transmissionswerte auf.

Allgemeiner Farbwiedergabeindex Ra in Transmission

Mit dem Farbwiedergabeindex werden Farbveränderungen von Gegenständen, die sich hinter dem beschichteten Wärmeschutzglas befinden, verglichen. Für die technische Prüfung wird eine Normlichtquelle verwendet. Die Skala für Rareicht bis 100. Der maximal mit einer Verglasung erreichbare Ra-Wert ist 99.

Selektivitätskennzahl S

Mit der Selektivitätskennzahl wird das Verhältnis Lichtdurchlässigkeit zu Gesamtenergiedurchlassgrad gekennzeichnet. Diese Kennzahl S bewertet die Sonnenschutzgläser in Bezug auf eine erwünschte hohe Lichtdurchlässigkeit im Verhältnis zu dem jeweils angestrebten niedrigen Gesamtenergiedurchlassgrad. Eine hohe Selektivitätskennzahl drückt ein günstiges Verhältnis aus.

S = Lichttransmissionsgrad Gesamtenergiedurchlassgrad

Brüstungsplatten

Zur harmonischen Gestaltung von Ganzglasfassaden werden passende SWISSPANEL Brüstungsplatten empfohlen. Diese eignen sich für Warm- und Kaltfassaden-Konstruktionen. Die Brüstungsplatten sind in der Regel thermisch vorgespannt, ihre minimale Größe beträgt daher 30 x 80 cm.

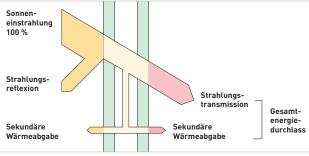
Chamäleon-Effekt

Die Reflexionsfarbe von beschichteten Sonnenschutzgläsern wird maßgebend vom einfallenden Licht beeinflusst, deshalb können unterschiedliche Lichtverhältnisse – beziehungsweise bedeckter oder klarer Himmel – die Farbentwicklung des Glases verändern. Ebenso spielt die Farbe der Umgebung eine wichtige Rolle.

Ausschreibungsunterlagen

Zur exakten Erstellung des Angebotes von Sonnenschutzgläsern halten wir detaillierte Ausschreibungsunterlagen für Architekten und Planer bereit. Diese können bei uns angefordert werden.





Gesamtenergiedurchlassgrad

Der g-Wert gibt an, wie viel Energie von der auftreffenden Sonneneinstrahlung durch die Verglasung ins Rauminnere gelangt. Er setzt sich aus zwei Teilen zusammen, aus der direkten Strahlungstransmission und der sekundären Wärmeabgabe. Die sekundäre Wärmeabgabe ergibt sich aus der Tatsache, dass sich das Glas als Folge der Sonneneinstrahlung erwärmt und nun seinerseits Wärme gegen innen und außen abgibt.

Kontaktadressen

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Glas Trösch Alsace S.A. - Silverstar, F-68520 Burnhaupt le Haut Tel. +33 (0)389/83 12 12, Fax +33 (0)389/83 10 06 silverstarburnhaupt@glastroesch.com

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Euroglas Vertriebs-GmbH, D-52078 Aachen Tel. +49 (0)241/92 03 03-0, Fax +49 (0)241/92 25 26 aachen@euroglas.com

Euroglas GmbH, D-39340 Haldensleben Tel. +49 (0)3904/638-0, Fax +49 (0)3904/638-1100 haldensleben@euroglas.com

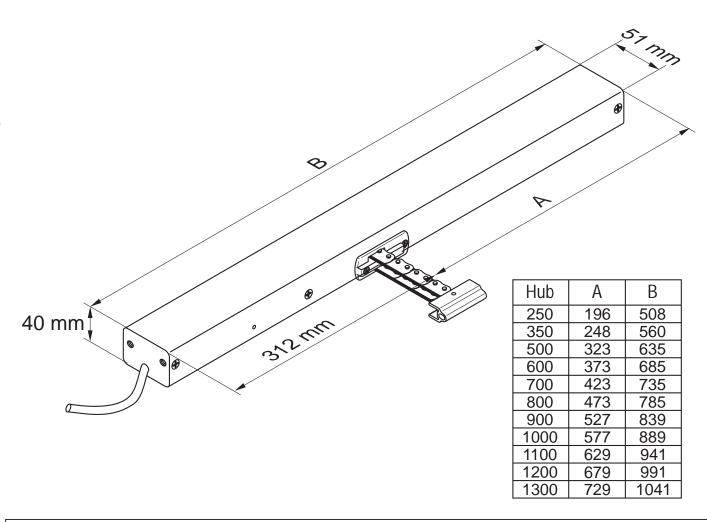
Euroglas S.A., F-68490 Hombourg Tel. +33 (0)389/83 35 00, Fax +33 (0)389/83 35 38 hombourg@euroglas.com

www.euroglas.com

überreicht durch:

D+H=

Kettenantrieb KA 34/54-BSY+-K -Set



Leistungsmerkmale

- Kettenantriebe ausgestattet mit mikroprozessorgesteuerter Motor- und Synchronelektronik BSY+ für einen sicheren und präzisen Synchronlauf
- Antriebsfunktionen und Leistungsmerkmale individuell programmierbar (über Software SW-BSY+)
- Integriertes 3-stufiges Klemmschutzsystem
 - passiver Klemmschutz durch reduzierte Laufgeschwindigkeit beim Schließvorgang
 - aktiver Klemmschutz mit Sicherheitsabschaltung und Reversierfunktion beim

- Schließvorgang, wenn Antriebszugbelastung größer 150 N im Schließbereich II
- direkter Anschluss einer zusätzlichen Schließkanten-Klemmschutzleiste am Antrieb möglich (Option -SKS)
- Dichtungsentlastung nach Schließvorgang
- bis zu 2 Antriebe an einem Fenster sind möglich.
- Antriebsets können zusammengeschaltet werden.

Inhalt

Sicherheitshinweise, Lieferumfang, Garantie, Drucklastdiagramm	2
Technische Daten, Laufgeschwindigkeiten und Kräfte	
Aderbelegung Stecker, Montagehinweise	
Funktionsbeschreibung, Soft-Close-Funktion, Störungssuche	
Nullabgleich	6
Anschlusspläne	

Sicherheitshinweise

Betriebsspannung 230 VAC!

L + N nicht vertauschen und den PE anschliessen, ansonsten Fehlfunktion und Zerstörung des Antriebes möglich!

Ein Wechseln der Kabeleinführung von links auf rechts ist nicht möglich. Sicherheitsbestimmungen beachten. Montage nur von Elektrofachkräften durchführen lassen.

Maximale Drucklast der Kette beachten (siehe Diagramm unten)!

Nur für die Innenmontage geeignet, bei Gefahr von Regen (z.B. an Lichtkuppel oder Dachflächenfenster) grundsätzlich Regenmelder verwenden.

Beiliegenden roten Sicherheitszettel beachten!



Quetschgefahr im handzugänglichen Bereich!

Lieferumfang

Antriebseinheit(en) mit 2,5 m PVC-Kabel. Abhängig vom Fenstertyp sind verschiedene Konsolensätze erhältlich. **Die Konsolensätze sind gesondert zu bestellen!**

Garantie

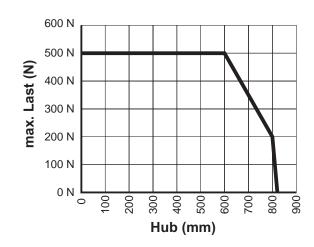
Auf alle D+H-Artikel erhalten Sie 2 Jahre Garantie ab belegter Übergabe der Anlage bis max. 3 Jahre nach Auslieferungsdatum, wenn die Montage bzw. Inbetriebnahme durch einen von D+H autorisierten Service- und Vertriebspartner durchgeführt wurde.

Bei Anschluss von D+H-Komponenten an Fremdanlagen oder Vermischung von D+H-Produkten mit Teilen anderer Hersteller erlischt die D+H-Garantie.

Kettenbelastbarkeit in Druckrichtung

Um eine sichere und zuverlässige Funktion des Kettenantriebes zu gewährleisten, ist unbedingt die maximale Drucklast der Kette zu beachten!

Hinweis: Die maximale Drucklast der Kette entspricht nicht automatisch der maximalen Druckkraft des Antriebes!

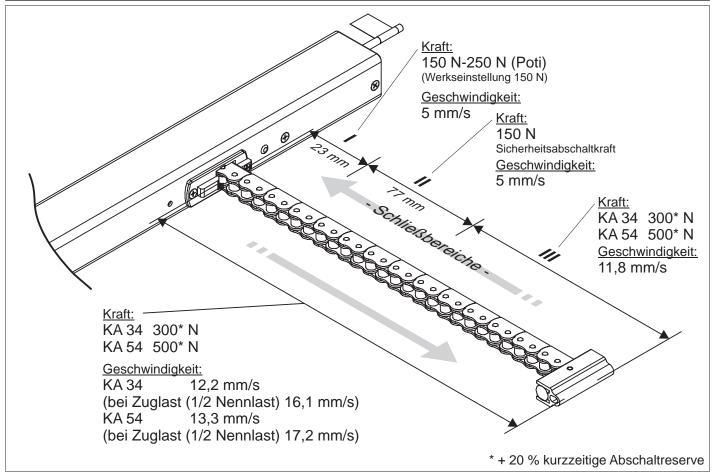


Technische Daten je Antrieb

	KA34-BSY+-K	KA54-BSY+-K	
Versorgung	230 V AC, ±15%, 30 VA	230 V AC, ±15%, 35 VA	
Nenn-Verriegelungskraft	1000 N		
Lebensdauer Einschaltdauer Gehäuse Schutzart Temp. Bereich	>10 000 Doppelhübe 70 % (bei Spielzeit 10 Minuten) Aluminium eloxiert IP 32 (Nur in Verbindung mit eingesetzten Abdeckstopfen, die den Konsolensätzen beiliegen) 5 (-5 +75°C)		
Temp. Standsicherheit Anschluss Hublänge	30 min / 300°C 2,5 m PVC-Kabel siehe Typenschild		
Auslieferungszustand aktiver Klemmschutz Dichtungsentlastung	aktiviert* (Auslieferzustand: 3° aktiviert*	Wiederholungshübe)	

^{*} programmierbar mittels Software SW-BSY+

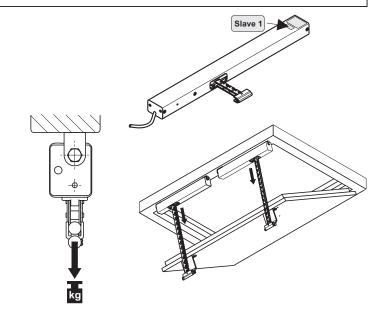
Laufgeschwindigkeiten und Kräfte je Antrieb



99.823.97 Rev.: 1.0 3/8

Montagehinweise

- Das Antriebsset ist vom Werk aus eingestellt.
- Falsche Stromversorgung kann zur Zerstörung der Antriebe führen! Tabelle für Leitungslängen und Querschnitte (siehe Anleitung der Zentrale) beachten.
- Bei vertikal wirkender Zuganwendungen (z. B. Dachluke) müssen ggf. die Kräfte mittels Software SW-BSY+ angepasst werden.
- Alle Antriebe sollten mechanisch spannungsfrei montiert werden. Hierdurch wird eine gleichmäßigere Lastverteilung auf alle Antriebe gewährleistet.



Funktionsbeschreibung der Synchronsteuerung

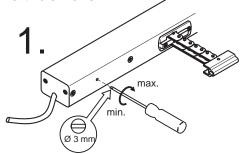
Eine KA-BSY+-Synchrongruppe besteht aus bis zu 8 Antrieben, welche über einen Bus kommunizieren. Evtl. entstehende Hub- und Kraftdifferenzen zwischen den Antrieben einer Synchrongruppe werden durch eine intelligente Kraft- und Positionsregelung ausgeglichen. Bei Störung bzw. Ausfall eines Antriebes werden alle Antriebe automatisch abgeschaltet.

Schliesskraft (Soft-Close-Funktion)

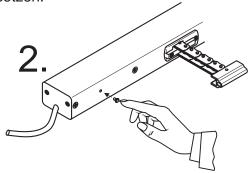
im Schliessbereich I

Sollte die werkseitige Einstellung der Schließkraft im Schließbereich I, ca. 150 N, nicht ausreichen um das Fenster zu schließen, so kann sie stufenlos bis auf ca. 250 N erhöht werden.

1. Abdeckstopfen herausziehen. Schraubendreher einstecken und nach rechts drehen, um die Schließkraft zu erhöhen.



2. Nach der Einstellung Abdeckstopfen wieder einsetzen.



Störungssuche

Falls die Antriebe einer Synchrongruppe trotz sachgemäßer Verdrahtung gemäß Anschlussplan und einwandfreier Spannungsversorgung durch eine D+H-RWA oder Lüftungszentrale dennoch nicht funktionieren, kontrollieren Sie bitte die folgenden Punkte:

Verdrahtung:

Ist die Gruppe ordnungsgemäß verdrahtet? Siehe dazu Anschlusspläne.



Nullabgleich:

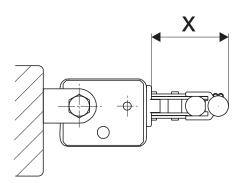
Es sollte ein Nullabgleich durchgeführt werden. Siehe Seite 6.



D+H-Service anrufen!

Es ist eine Konfigurierung der Antriebe erforderlich. Hierzu wird die Software SW-BSY+ benötigt.

Nullabgleich



Wenn das Maß x nach der Montage größer gleich 23 mm ist, so ist ein Nullabgleich notwendig. Die Schließbereiche verschieben sich relativ zum jeweils neuen Nullpunkt.

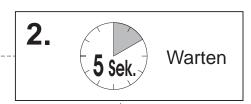


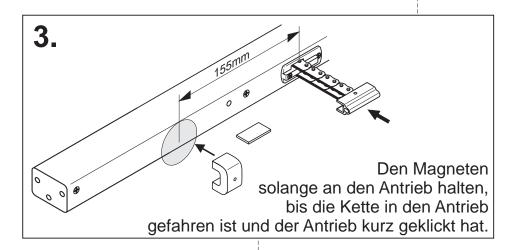
Achtung! Um Glasbruch und andere Schäden zu vermeiden, niemals einen Nullabgleich im montierten Zustand durchführen!

1. Spannung anschließen:

Mot. a (weiss) = -Mot. b (braun) = +

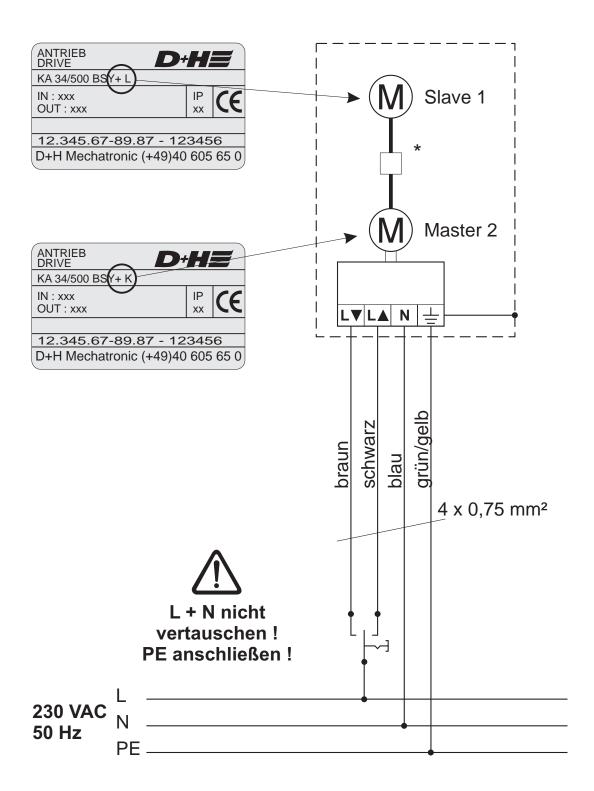
Antriebe fahren in ZU-Richtung oder sind bereits eingefahren.





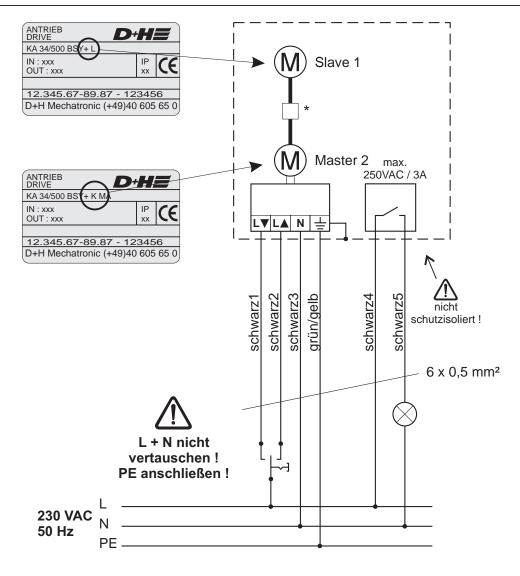
- **4.** Der Antrieb hat jetzt einen neuen Nullpunkt bekommen!
 Zur Kontrolle des Nullabgleiches kann der Magnet noch einmal an den
 Antrieb gehalten werden. Wenn kein leises Klicken im Antrieb zu hören ist, ist der
 Nullabgleich erfolgreich durchgeführt worden.
- Schritt 3-4 mit allen Antrieben wiederholen.

Es müssen immer alle Antriebe eines Sets neue Nullpunkte bekommen.

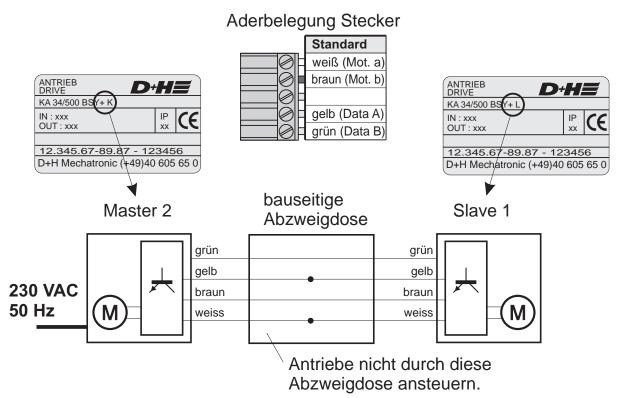


99.823.97 Rev.: 1.0 7/8

Anschluss KA 34/54-BSY+-K-MA/-MZ



Anschluss (Verbindung Antriebe)



99.823.97 1.0/07/08



Hausgeräte/Kochgeräte / Dunstabzugshauben/Kochfelder/Autarke Kochfelder/Geräteübersicht





Auf Wunsch bis zu 10 Jahre Miele Garantie

KM 5944

Design

Flächenbündig Dekor basaltgrau

Kochzonenausstattung 4 Induktionskochzonen mit Ankoch-Automatik

Alle als Vario-Kochzonen mit Topf-/Topfgrößenerkennung und Warmhaltefunktion
Alle mit Booster, 1 mit TwinBooster
Vorne links 140-200 mm Ø, 1850 Watt, Booster 2900 Watt
Hinten links 100-160 mm Ø, 1400 Watt, Booster 1800 Watt
Hinten rechts 160-230 mm Ø, 2300 Watt, TwinBooster 3000/3700 Watt
Vorne rechts 100-160 mm Ø, 1400 Watt, Booster 1800 Watt
Gesamtanschlusswert: 7,40 kW

Bedienkomfort

Frontbedienung über Sensortasten Eine Plus/Minus-Taste pro Kochzone Leistungsstufen von 1-9 Individuelle Einstellmöglichkeiten für die Bedienung (z. B. Stop and Go) Kurzzeitwecker

4 zeitgleich nutzbare Timer zur Einstellung der Kochzeit bis 9,5 Stunden mit Abschaltautomatik

Ankochautomatik

Booster-Funktion für jede Kochzone

Topf-/Topfgrößenerkennung bei allen Induktionskochzonen

Anzeigen

Restwärmeanzeige für jede Kochzone im Bedienfeld Digitale Anzeige der Leistungsstufen 1-9 Anzeigen für EIN/AUS, Verriegelungsfunktion, Inbetriebnahmesperre und Ankoch-Automatik Anzeigen für die Booster-Funktion und bei nicht aufgesetztem Topf

Sicherheit

Sicherheitsausschaltung Verriegelungsfunktion Inbetriebnahmesperre Fehlerüberwachung Überhitzungsschutz bei Induktions-Kochzonen integriertes Kühlgebläse mit Nachlauf-Automatik

Pflegekomfort

Leicht zu reinigende Glaskeramik

Maße

Ausschnittmaß B x T: 596 mm x 496 mm Gerätemaß B x T: 592 mm x 492 mm

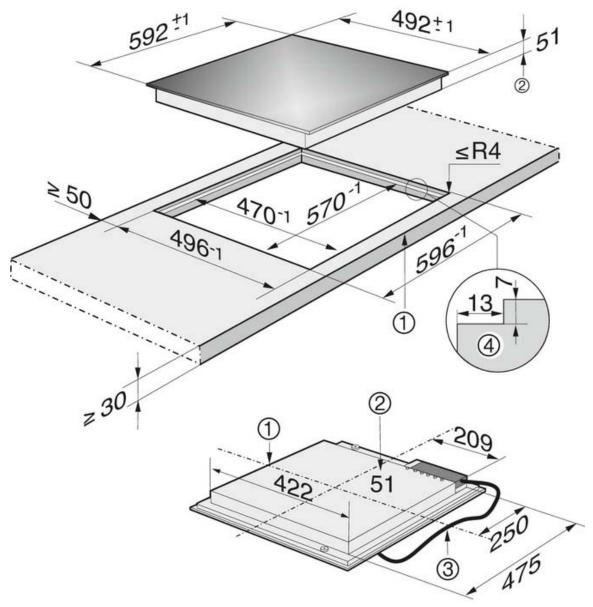
Mitgeliefertes Zubehör

Glasschaber Vormontiertes Anschlusskabel Induktions-Topfset bestehend aus: 1 beschichtete Bratpfanne, 1 Stielkasserolle mit Deckel 1,5 Liter, 1 Topf mit Deckel 2,5 Liter und 1 Topf mit Deckel 4,0 Liter, Glasschaber

Nachkaufbares Zubehör

Technisch bedingte Änderungen und Irrtümer bleiben vorbehalten!

Einbauskizzen

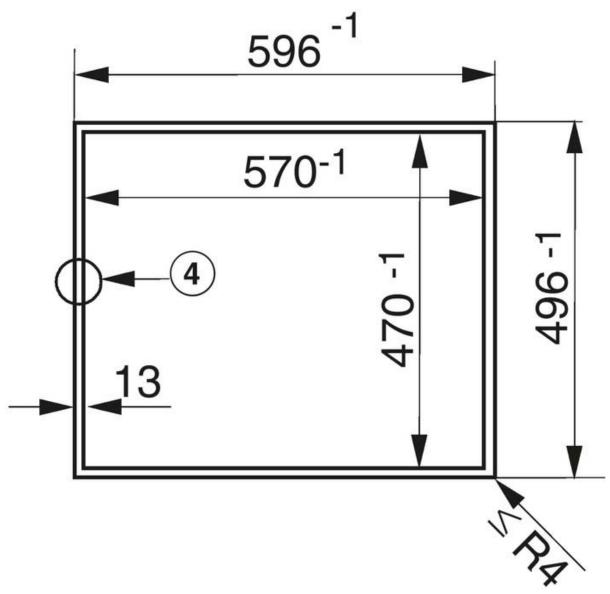


Fußnote:

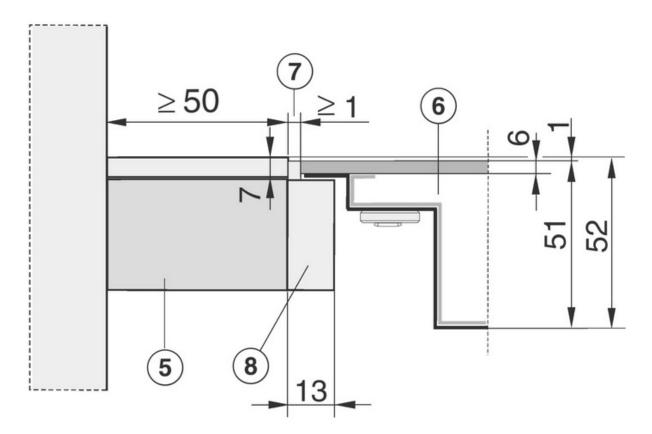
- 1. vorn
- 2. Einbau-Höhe
- 3. Netzanschlussleitung, L = 1440 mm lang
- 4. Stufenfräsung
- Einbauhinweis:

Dieses Glaskeramik-Kochfeld ist nur für den Einbau in Massivholz, Naturstein und gefliesten Arbeitsflächen geeignet. Aus Servicegründen muss das Kochfeld von unten zugänglich sein

Da die Ceran-Glasscheibe und der Arbeitsplattenausschnitt einer gewissen Maßtoleranz unterliegen, kann die Fugenbreite variieren (mind. 1 mm).

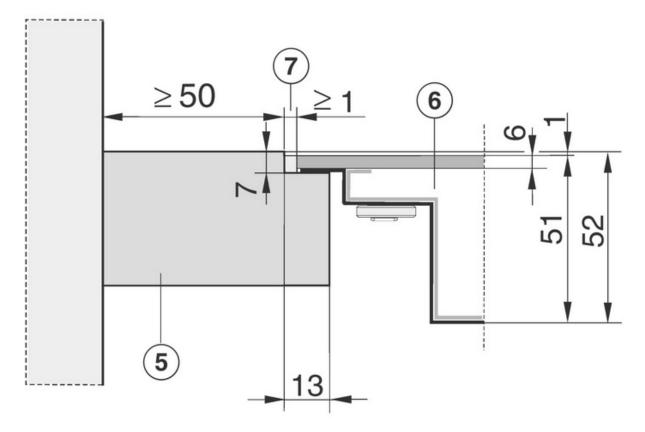


Ausschnittmaße der Naturstein-Arbeitsplatte 4. Stufenfräsung



Fußnote:

- 5. Arbeitsfläche
- 6. Kochfeld
- 7. Fugenbreite
- 8. Holzleiste (nicht im Lieferumfang enthalten)



Fußnote:

- 5. Arbeitsfläche
- 6. Kochfeld7. Fugenbreite



Hausgeräte/Kochgeräte / Dunstabzugshauben/Herde/Backöfen/Geräteübersicht







Auf Wunsch bis zu 10 Jahre Miele Garantie



H 5681 BL

Genussvorteile

Genaue elektronische Temperaturregelung von 30°C bis 300°C 13 Betriebsarten

Heißluft plus für gleichmäßige Backergebnisse auf bis zu 3 Ebenen Klimagaren für saftige und optimal gebräunte Speisen Bratautomatik zum automatischen Anbraten von Fleisch Automatikprogramme für über 100 Speisen und zum Niedertemperaturgaren

Autosensor zur Bestimmung der optimalen Garzeit zahlreicher Automatikprogramme

Elektronisch gesteuerte Feuchtereduktion für trockene Garraumluft Kabelloses Speisenthermometer zum gradgenauen Garen

Bedienkomfort

Navitronic TouchControl: Selbsterklärende Benutzerführung, großes mehrsprachiges Klartext-Display, Beleuchtung der jeweils anwählbaren Sensortasten, Werteingabe über Ziffernblock, Vorschlagstemperatur für jede Betriebsart, Anzeige der Ist-Temperatur, Speicherung von mindestens 20 Eigenen Programmen, zahlreiche individuelle Einstellmöglichkeiten für die Bedienung Tageszeitanzeige mit Uhrzeitspeicher bei Stromausfall, Kurzzeitwecker, Start-Stopp-Programmierung mit Abschaltautomatik, Restzeitanzeige bei Nutzung des Speisenthermometers

Gorătotii

Türanschlag links (nicht wechselbar) CleanGlass-Backofentür Türkontaktschalter

Garraum

Großraumbackofen mit 66 Liter Nutzvolumen und 5 Einschubebenen PerfectClean-Aufnahmegitter mit Schnellverschluss Dreifache Halogenbeleuchtung

Pflegekomfort

Edelstahlfront mit CleanSteel-Oberfläche
Garraum mit PerfectClean
Rückwand mit selbstreinigendem Katalyseemail
AirClean-Katalysator
Grillheizkörper vollständig abklappbar
Umluftgrillen mit Intervallschaltung
Flächenbündiges Glasdisplay ohne hervorstehende Bedienelemente

Sicherheit

Gerätekühlsystem mit sensorgesteuerter Nachlaufzeit Kühle Front Inbetriebnahmesperre Sicherheitsausschaltung

Wirtschaftlichkeit

Energielabel A Automatisches Schnellaufheizen für bis zu 50% schnelleres Aufheizen Restwärmenutzung Energiesparschaltung

Mitgeliefertes Zubehör

Backblech, Universalblech und Combirost jeweils mit PerfectClean 1 FlexiClip-Vollauszug mit PerfectClean Anforderungskarte für Kochbuch Rezeptheft Klimagaren Anschlusskabel mit Stecker

Nachkaufbares Zubehör

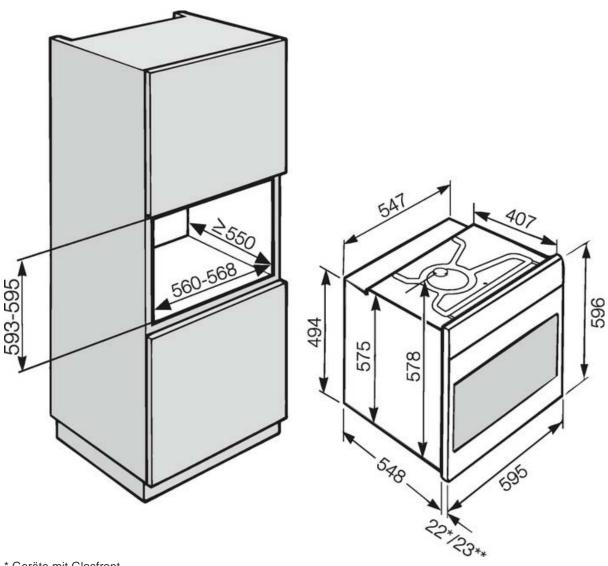
FlexiClip-Vollauszüge Bräter und Bräterdeckel Backstein Pizzaform mit PerfectClean

Miele@home

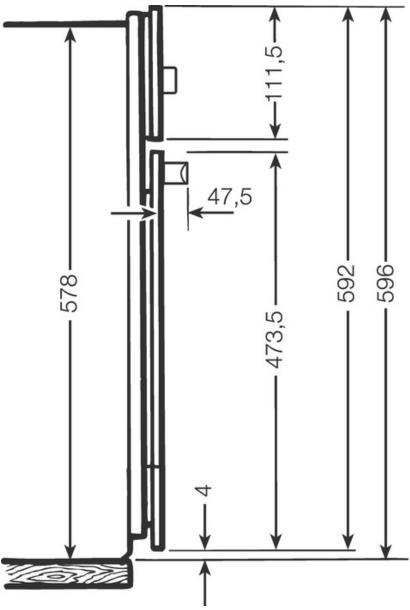
Vorrüstung für das System Miele@home mit Supervision

Technisch bedingte Änderungen und Irrtümer bleiben vorbehalten!

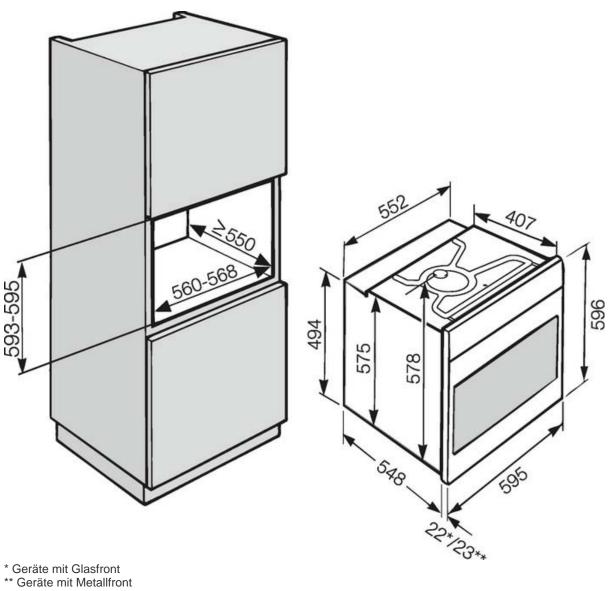
Einbauskizzen

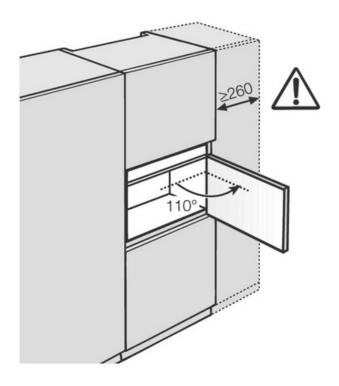


^{*} Geräte mit Glasfront ** Geräte mit Metallfront

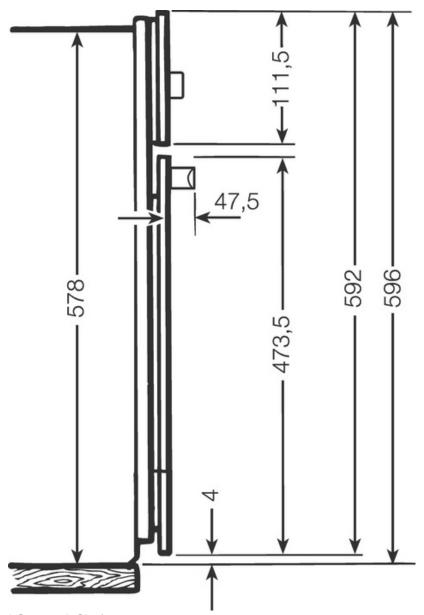


* Geräte mit Glasfront ** Geräte mit Metallfront





^{*} Geräte mit Glasfront ** Geräte mit Metallfront



^{*} Geräte mit Glasfront ** Geräte mit Metallfront



Hausgeräte/Kochgeräte / Dunstabzugshauben/Dunstabzugshauben/Dunstabzugshauben/Geräteübersicht







Auf Wunsch bis zu 10 Jahre Miele Garantie



DA 420 V Edelstahl

Bauform

Insel-Dekor-Dunstabzugshaube für Abluftbetrieb, Umluftbetrieb mit Sonderzubehör möglich (Aktivkohlefilter, Umbausatz Umluft)

Abmessung

90 cm breit

Edelstahl-Gehäuse und Kamin matt gebürstet Inselhaube zur freien Montage an der Decke

Bedienung

Tipptasten mit LED-Anzeige für EIN/AUS, Kochstellenbeleuchtung und Leistungsregelung

Betriebsstundenzähler für Fett- und Aktivkohlefilter-Sättigung (individuell programmierbar), Nachlaufzeit (5/15 Min.)

drei Leistungsstufen plus Intensivstufe

automatische Intensivstufen-Abschaltung auf Stufe 3 (10 Min.) programmierbar

zwei Tipptasten zur Betätigung der motorischen Höhenverstellung Vorbereitung für Con@ctivity

Ausstattung

Elektronische Leistungsregelung

Rückstauklappe

drei herausnehmbare, spülmaschinengeeignete Edelstahl-

Metallfettfilter

Abluftanschluss nach oben durch die Decke

Abluftstutzen 150 mm Ø

Halogen-Beleuchtung, 4 x 20 Watt mit Lichtdimmer-Funktion

doppelseitig saugendes Gebläse

Schalldämmmatten im Innenraum

"Schwimmende Kaminaufhängung" als Montagehilfe

Gebläseleistung

Abluftbetrieb 150 mm Ø nach EN 61591

Int. 700 m³/h, 67 dB(A) re 1 pW (54 dB(A) re 20 μ Pa Schalldruck) Max. 480 m³/h, 59 dB(A) re 1 pW (46 dB(A) re 20 μ Pa Schalldruck)

Umluftbetrieb 150 mm Ø nach EN 61591

Int. 500 m³/h, 71 dB(A) re 1 pW (58 dB(A) re 20 μ Pa Schalldruck) Max. 400 m³/h, 65 dB(A) re 1 pW (52 dB(A) re 20 μ Pa Schalldruck)

Sicherheit

Sicherheitsausschaltung

Nachkaufbares Zubehör

Aktivkohlefilter DKF 12-1

Umbausatz Umluft DUI 31

Mauerrohr MR 100-150

Abluftschlauch DAS 100-150

Dachdurchführung DDF 125/150

Kondenswassersperre DKS 150/DKS 125

Steuermodul DSM 400

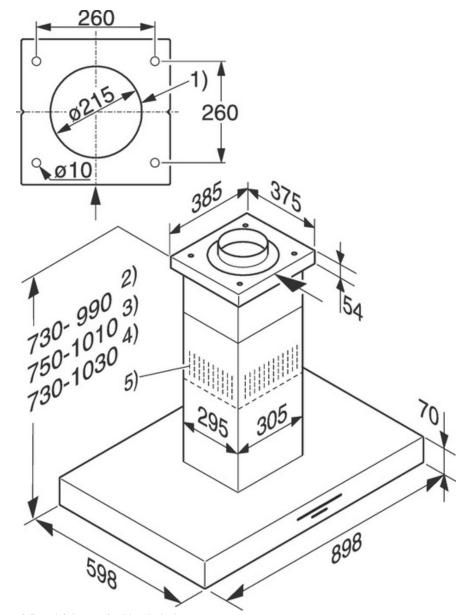
Schalldämpfer DASD 150

Sonderhinweise

Sonderanfertigungen möglich

Technisch bedingte Änderungen und Irrtümer bleiben vorbehalten!

Einbauskizzen



- 1) Durchführung für Netzkabel, EXT-Kbel und Abluftanschluss
- 2) Abluft (Auslieferungszustand)
- 3) Intervallmöglichkeit bei Umluft
- 4) intervallmöglichkeit bei Abluft5) Luftaustritt bei Umluft nach oben montiert



Hausgeräte/Kaffeevollautomaten/Geräteübersicht



ш

CVA 3660

Modellbezeichnung

Einbau-Kaffeevollautomat CVA 3660

Flexible Verwendung als Einbaugerät in einen 60 cm breiten Ober-,

oder Aufsatzschrank

Weitere Platzierungsmöglichkeiten siehe "Nachkaufbares Zubehör"

Genussvorteile

4 Portionsgrößen: Espresso, Kaffee, doppelter Espresso, doppelter Kaffee

Komfortable Zubereitung von Cappuccino, Latte Macchiato, Milchschaum,

heißer Milch und Heißwasser

Vorrat von 20 Kapseln in bis zu fünf verschiedenen

Geschmacksvariationen

Bedienkomfort

Mehrsprachiges Display mit selbsterklärender Benutzerführung Beleuchtung des Bedienbereiches über wartungsfreie LEDs

Einstellen von Ein- und Abschaltzeiten

Programmierung der gewünschten Wassermenge pro Tasse Programmierung von bis zu 10 individuellen Genießerprofilen

Zwei leistungsstarke Pumpen (19 bar)

Zwei Edelstahl-Durchlauferhitzer (Bezug von Kaffee und Dampf ohne Wartezeit)

Parallele Zubereitung von Espresso/Kaffee und heißer

Milch/Milchschaum

Kaffeeauslauf für bis zu 9 cm hohe Tassen

Wassertank 1,5 I

Entnehmbares Kapselmagazin für 20 Kapseln

Restebehälter für bis zu 25 gebrauchte Kapseln

Restwasserschale mit Wellenbrecher für sicheren Transport

Gerätetür

Türanschlag links (nicht wechselbar)

Versteckter Türgriff

Pflegekomfort

Edelstahlfront mit CleanSteel

Flächenbündiges Glas-Display ohne hervorstehende Bedienelemente

Nachfüllanzeigen für Kapseln und Frischwasser

Hinweise für die Entleerung des Restebehälters und der

Restwasserschale

Automatische Spül- und Reinigungsprogramme

Sicherheit

Inbetriebnahmesperre

Mitgeliefertes Zubehör

Cappuccinatore CVC (Gefäß zur Zubereitung von heißer Milch und Milchschaum)

40 Nespresso-Kapseln

Zwei Espresso-Tassen mit Untertasse

Zwei Cappuccino-Tassen mit Untertasse

Entkalkungsmittel und Reinigungsmittel

Teststreifen zur Bestimmung der Wasserhärte

Werkzeug für Kapselkäfig

Adapter für Cappuccinatore

Anschlusskabel

Nachkaufbares Zubehör

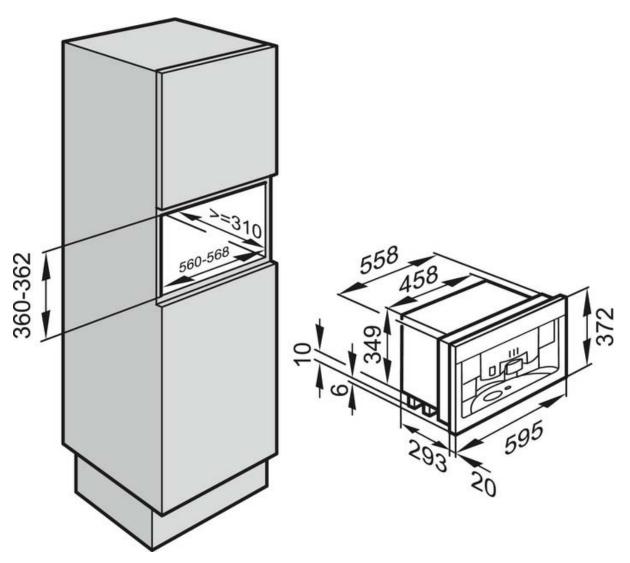
Kombileiste HKL 60 Cappuccinatore CVC Geschirrspülereinsatz für Cappuccinatore GCEO Einbau-Systemschublade ESS 3060 Einbau-Geschirrwärmer EGW 3060 Ausgleichsblenden AB 36/38-1/42-1/45-9 Entkalkungs- und Reinigungsmittel

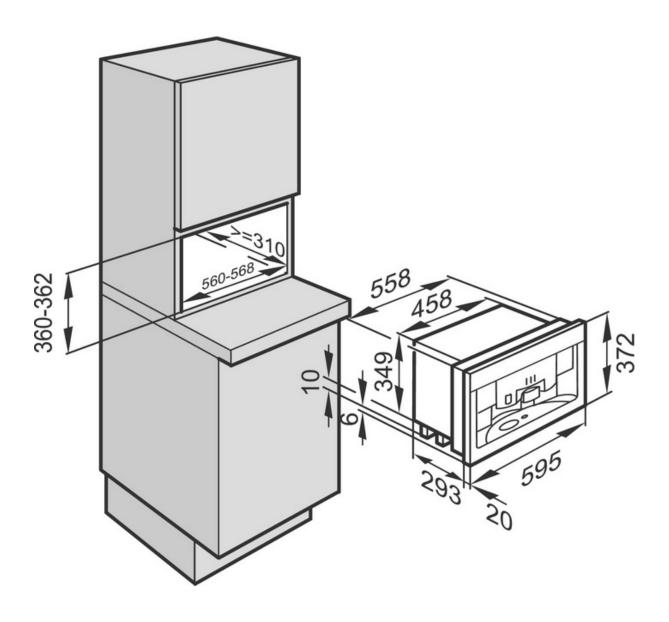
Planungsflexibilität

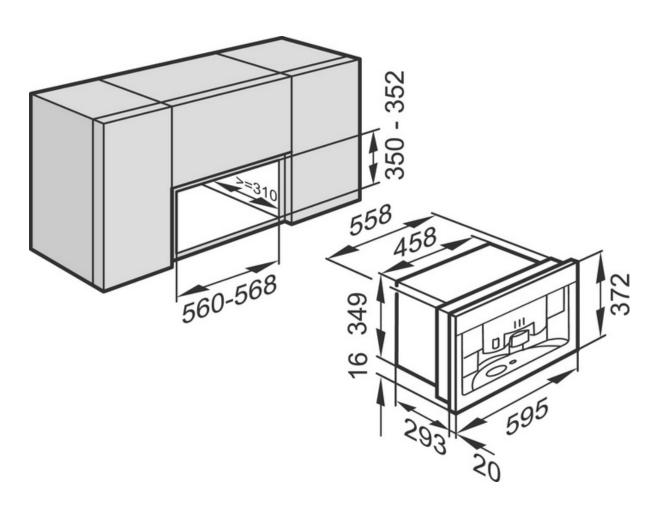
Geeignet für die haushaltsübliche Nutzung

Technisch bedingte Änderungen und Irrtümer bleiben vorbehalten!

Einbauskizzen







Funktionen

ICBP 3166 PremiumPlus BioFresh

Technische Daten Fassungsvermögen

Ausstattung Kühlteil Ausstattung Gefrierteil

Bedienungsanleitungen

Nischenmasse HBT 177,2 ÷ 178,8/56 ÷ 57/55

Energieeffizienzklasse A++
Energieverbrauch in 365 Tagen [kWh] 222
Kompressoren 1
Regelbare Kältekreisläufe 2
BioFresh ✓
NoFrost -

Abtauverfahren Kühlteil automatisch Abtauverfahren Gefrierteil manuell Klimaklasse SN-T Lagerzeit bei Störung [h] 32 Gefriervermögen in 24 h [kg] 10 Sternekennzeichen 4 Türmontage Festtür Türöffnungswinkel 115°



Dieses Modell ist erhältlich in: Deutschland

1 von 1 02.09.2009 09:41

Miele IMMER BESSER

Hausgeräte/Geschirrspüler/Geräteübersicht



Klassifizierung

L

Energieeffizienz

Reinigungswirkung A

Trockenwirkung



Auf Wunsch bis zu 10 Jahre Miele Garantie

Α





G 1562 SCVi

Bauform

Vollintegrierbares Gerät mit Edelstahl-Bedienleiste

Steuerung

Vollelektronische Steuerung

Programmwahl

Bedienungsfreundliche Programmwahl-Taste

Spülprogramme

Automatic, Fein, Intensiv 75°C, Schnell 40°C, Leicht 50°C, EnergieSpar

Verbrauch

EnergieSpar: 9 I Wasser, 0,8 kWh Strom

Wirtschaftlichkeit

ThermoSpar für niedrigsten Energieverbrauch Wechselspül-System und Beladungserkennung Bedarfsgerechter Salzverbrauch Elektronisch kontrollierte Wassermenge Ab 8 I Wasser und ab 0,90 kWh Strom im Automatic-Programm

Geschirr- und Gläserschonung

Allbereichsenthärter bis 70°dH Perfect GlassCare Sensor-Enthärter GlasPflege LED

Trocknung

Sensortrocknung Umluft-Turbothermic-Trocknung

Betriebsgeräusch

Sehr niedrig, nur 44 dB (A) re1pW

Fassungsvermögen

9 Maßgedecke Tellergröße bis zu 31 cm Ø

Korbgestaltung

Einzigartige Besteckschublade Höhenverstellbarer Oberkorb mit 1 Tassenauflage Unterkorb mit klapp-/herausnehmbarem Spike-Einsatz, herausnehmbarem Comfort-Einsatz mit Tassenauflage, Flaschenhalter

Komfort

24 Stunden Startvorwahl mit Restzeitanzeige Kombi-Tab-Taste Zeitspar-Konzept: z.B. Turbo-Taste

Zusatzfunktionen

Nachfüll-Anzeigeleuchten für Salz und Klarspüler 24 Stunden Startvorwahl mit Restzeitanzeige

Sicherheitssysteme

Optische und akustische Funktionskontrolle Kontrollanzeige Wasserzu-/-ablauf Waterproof-System Kontrolle des mittleren Sprüharms (LED) Sieb-Kontroll-LED

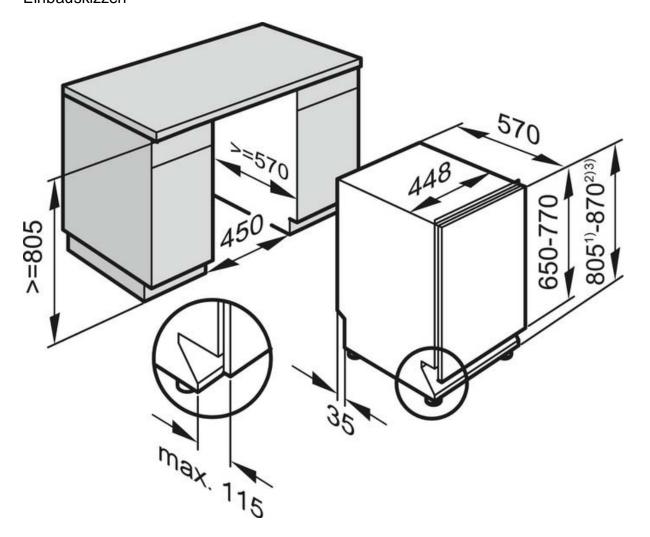
Technisch bedingte Änderungen und Irrtümer bleiben vorbehalten!







Einbauskizzen



2 von 3 01.09.2009 17:17

3 von 3 01.09.2009 17:17



Hausgeräte/Waschmaschinen / Trockner /

Rügelmaschinen/Maschmaschinen/Frontlader/Geräteijhersicht



Softtronic W 5841 WPS EcoComfort

Trommel

Patentierte Schontrommel Beladung 1-7 kg

Intelligentes Waschen

Kalt- und Warmwasseranschluss oder Anschluss für alternative Wasser (Nicht-Trinkwasser) Mengenautomatik zur automatischen Energie- und Wassereinsparung Elektronische Schaumregulierung

Wassermengenzähler

Schleudern

Schleuderwahl: 400 bis 1600 U/min

Spülstop

Funktion "ohne Schleudern"

Unwuchtkontrolle

Unübertroffen leise durch Geräuschdämmung und besonderen Antrieb

Design

Attraktives Gerätedesign mit schräger Blende Blendenfarbe lotosweiß

Programmwahl

Programmwahl durch Drehwahlschalter und Display Programmablauf-Anzeige im Display Niedrigtemperaturwaschen ("Kalt" und 20°C")

Bedienkomfort

Restzeitanzeige Startvorwahl bis zu 24 Std. Memory Funktion

Summer

AutoClean Einspülkasten

Waschprogramme

Automatic plus

Baumwolle

Pflegeleicht

Synthetic

Express 20

Dunkles/Jeans

Handwasch-Wolle

Intensiv plus

Oberhemden

Imprägnieren

Pumpen/Schleudern

Extraspülen/Stärken

Programm-Optionen

Vorwäsche mit Einweichfunktion

Kurz

Wasser plus

Extra leise

Sicherheit

Waterproof-System

Kindersicherung

PIN-Code Verriegelung

Kundendienst-Testprogramm

Anzeige verschiedener Kontrollfunktionen im Display

Optische Schnittstelle

Klassifizierung

Energieeffizienz

Waschwirkung

Schleuderwirkung



Auf Wunsch bis zu 10 Jahre Miele Garantie

Α

Α





Qualität - Made in Germany

Hochwertige Chromring-Tür Emaillierte Gerätefront

Bauform

Säulenfähig Unterschiebbar (Nischenhöhe 85 cm) unterbaubar (Unterbausatz erforderlich)

Abmessung H x B x T: 85 x 59,5 x 61,5 cm

Verbrauchswerte

55 I Wasser, 1,05 kWh Strom = 20% sparsamer als Energieeffizienzklasse A

Technisch bedingte Änderungen und Irrtümer bleiben vorbehalten!



Hausgeräte/Waschmaschinen /
Trockner /
Rügelmaschinen/Trockner/Geräteijhersicht



Klassifizierung

Energieeffizienzklasse A



Auf Wunsch bis zu 10 Jahre Miele Garantie





Softtronic T 8627 WP EcoComfort

Intelligentes Trocknen

Kondenstrockner mit Wärmepumpentechnologie Patentierte Schontrommel mit 1-6 kg Beladung PerfectDry-Trockensystem für schonendes und energiesparendes Trocknen Update-Optische Schnittstelle

Design

Großes Display zur Anzeige und Einstellung diverser Funktionen Attraktives Gerätedesign mit schräger Blende Emaillierte Front Blendenfarbe lotosweiß

Programmwahl

Programmwahl durch Drehwahlschalter mit Ringbeleuchtung und Display Variable Trockenstufen Zeitwahl Programmablauf-Anzeige im Display

Trockenprogramme

Automatic plus
Baumwolle
Pflegeleicht
Synthetic
Oberhemden
Jeans
Sportwäsche
Finish Wolle
Finish Seide
Kopfkissen/groß
Outdoor
Glätten bügelleicht

Korbprogramm

Lüften

Extras Schonen plus Knitterschutz Summer Auffrischen

Zusatzfunktion

Startvorwahl bis zu 24 Std.
Restzeitanzeige
Tageszeitanzeige
Intelligente Trommelreversierung
Trommelbeleuchtung
Sicherheit
Anzeige verschiedener Kontrollfun

Anzeige verschiedener Kontrollfunktionen im Display Kundendienst-Testprogramm

Trockensystem

Großer Kondensatbehälter Integrierte Kondenswasserableitung mit Schlauchaufwicklung

Bauform

Säulenfähig

unterbaubar (Unterbausatz erforderlich)

 $\begin{array}{l} \textbf{Abmessung} \\ \textbf{H} \textbf{ x} \textbf{ B} \textbf{ x} \textbf{ T: } 85 \textbf{ x} 59,5 \textbf{ x} 59,6 \textbf{ cm} \end{array}$

Verbrauchswerte

1000 U/min Strom (neue Norm): 1,80 kWh 1400 U/min Strom: 1,55 kWh

Technisch bedingte Änderungen und Irrtümer bleiben vorbehalten!

Connect 32 Media Full-HD+ 100 Willkommen im Zeitalter vernetzter Unterhaltung.

- Loewe LCD-TV mit 80 cm Bilddiagonale und hochauflösender Full-HD-100Hz-Technologie.
- Internetradio mit über 8.000 Sendern weltweit empfangen.
- Direkter Zugriff auf alle Multimediainhalte im heimischen Netzwerk. PhotoViewer und MusicBox via USB







Technische Daten

- 24p Kinofilmdarstellung
- Auflösung (in Pixel): 1.920 x 1.080
- Automatic Movie Detection (AMD)
- Betrachtungswinkel horizontal/vertikal: 178°/178°
- Bildformat: 16:9
- Bildkorrektur Vertikal
- Bildschirmdiagonale in cm: 80
- Bildwechselfrequenz 100Hz
- Down-/Upscaling
- Formatumschaltung: 16: 9, 4: 3, Panorama, Cinema, Zoom
- Full-HD-LCD-Technologie
- HD ready
- HDTV-Empfang integriert
- Image+ Active
- Kontrastsensor
- Kontrastverhältnis dynamisch: 10.000: 1
- Kontrastverhältnis statisch: 1.300 : 1
- Leuchtdichte cd/m²: 500
- PIP (A\/)
- Raumlichtabhängige Kontrastregelung (OPC)
- Responsetime: 6 ms
- Split Screen TV/Videotext [1]
- Volldigitalisierte Signalverarbeitung

- Anzahl der Lautsprecher: 4
- Audio Out geregelt
- Geschlossene 2-Wege Boxen
- Leistung Tonendstufen in Watt: 2 x 20
- PRX-Soundsystem
- Stereo-Zweikanal-Ton
- Subwoofer Out
- Toneffekte: Stereo, Panorama, 3D Surround

- Automatische Sendererkennung
- EPG [2]
- Radiofunktion: bei DVB-C/DVB-S [3]

Bedienung:

- Abschaltautomatik
- Automatic Signal Switch (ASS)
- Automatische Lautstärkeanpassung (AVC) [4]
- Bordbedienung: 5 Tasten
- Digital Link

- Digital Link HD
- Digital Link Plus
- Electronic Program Guide (EPG): (analog/digital) [2]
- Elektronische Bedienungsanleitung
- Fernbedienung: Assist 2
- Inhaltsbezogene Hilfe
- Kindersicherung
- I-Link
- Media-Network für den Zugriff auf Multimediainhalte im
- MusicBox
- Netzschalter
- NexTView-Link [2]
- On Screen Display (OSD) in Sprachen: D-E-I-F-NL-GB-P-PL-CZ-DK-S-HU-FIN-SLN-TR-SK-RS-GR
- Persönlicher Videotext mit Direktzugriff auf
- "Favoriten/Bookmarks'
- **PhotoViewer**
- Programmplatz bezogene Lautstärkeanpassung
- Programmspeicherplätze (inkl. AV und Radio): 4.000
- Senderkennung
- Stichwortverzeichnis
- TV-Aktuell [2]
- Videotext: TOP-/FLOF-Videotext/Level 2.5
- Videotext-Seitenspeicher: 2.000
- Videotimer
- Vollautomatische Senderprogrammierung (ACP)

Empfang:

- Decoding-System: Audio: MPEG
- Decoding-System: Video: MPEG 2/MPEG 4
- Farbnorm: PAL, SECAM, NTSC, NTSC-V, PAL-V (60Hz)
- Fernsehnorm: B/G, D/K, I, L, M, N
- Tonnorm: FM-Zweikanalton/AM, Nicam
- Tuner: DVB-T, DVB-C; analog: Kabel, Antenne

Anschlüsse:

- Antenne (analog/digital): 1x
- Audio In (Cinch)
- Audio Out geregelt (Cinch)
- Common Interface (CI+): 1
- Component (YUV) In Digital-Audio In (Cinch)
- Digital-Audio Out (Cinch)
- Ethernet-Anschluss RJ45
- Euro-AV/Scart davon Component Video Input-tauglich: 1

- Euro-AV/Scart davon RGB-tauglich: 1
- Euro-AV/Scart davon S-VHS/Hi8-tauglich: 2
- Euro-AV/Scart gesamt: 2
- HDMI inkl. HDCP: 2x Kopfhörer: 3,5 mm
- Kopierfunktion Euro-AV <-> Euro-AV
- Kopierfunktion Front-AV --> Euro-AV
- S-Video In
- Side AV Video-/S-VHS, Hi-8 tauglich USB In: 2
- VGA
- Video In (Cinch) Wireless-LAN-Antennen

Funktionserweiterungen optional:

- DVB-S 2 (Single-Tuner)
- Dolby Digital / dts [5]
- Motorsteuerung / RS 232 C / IR-Link

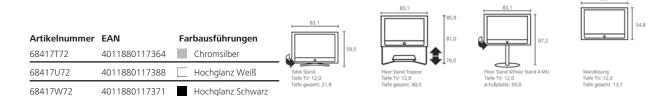
- Aufstelllösungen: Floor Stand Trapeze (in drei Stufen höhenverstellbar); manuelle Drehfunktion: Floor Stand 4; motorische Drehfunktion: Floor Stand 4 MU
- Equipmentboard für Floor Stand Trapeze
- Serienmäßige Ausstattung: Table Stand (inkl. manueller
- VESA-Adapter: VESA C 32
- Wandhalterung: WM 56, Wall Mount Flex 32 L [6]

Sonstiges:

- Gewicht (ca.) in kg: 18.8
- Leistungsaufnahme Ein in Watt nach EN 62087 (2009): 130
- Leistungsaufnahme bei ausgeschaltetem Gerät in Watt: 0
- Leistungsaufnahme im Stand-by-Betrieb in Watt: 0,9
- Netzspannung: 220 240 V / 50/60 Hz
- VDE-Sicherheitsnorm (Prüfzeichen)

Technische Änderungen, Liefermöglichkeiten sowie

- Nicht bei MPEG 4
- Setzt den Empfang eines Senders voraus, welcher Service Informations-/NexTView-Daten überträgt.
- DVB-S nur bei integriertem DVB-S 2 (Tuner). Funktion abhängig von der Signalausstrahlung des Senders.
- Dolby ist ein eingetragenes Warenzeichen der Dolby Laboratories Licensing Corporation. Nur in Verbindung mit entsprechendem, separat zu beziehenden





Connect 32 Media Full-HD+ 100 Welcome to the age of networked entertainment.

- Loewe LCD-TV with 80 cm screen diagonal and high definition Full-HD-100Hz-technology.
- Receive Internet radio, with over 8.000 stations worldwide.
- Direct access to all multimedia content on the home network. PhotoViewer and MusicBox via USB







Technical information

Image:

- 24p motion picture display
- Automatic Movie Detection (AMD)
- Brightness cd/m²: 500
- Contrast adjustment depending on ambient light (OCP)
- Contrast ratio dynamic: 10.000: 1
- Contrast ratio static: 1.300 : 1
- Contrast sensor
- Downscaling/upscaling
- Format options: 16 : 9, 4 : 3, Panorama, Cinema, Zoom Full-HD LCD technology
- Fully digitised signal processing
- HD ready
- HDTV-ready
- Horizontal and vertical viewing angle: 178°/178°
- Image resolution: 1.920 x 1.080
- Image+ Active
- PIP (AV)
- Picture format: 16:9
- Picture frequency 100 Hz
- Response time: 6 ms
- Screen diagonal in cm: 80 Split Screen TV/Teletext [1]
- Vertical image correction

- Audio Out, controlled
- Audio output power in Watts: 2 x 20
- Closed 2-way speakers
- Number of speakers: 4 PRX sound system
- Subwoofer Out
- Tone effects: Stereo, Panorama, 3D Surround
- Two-channel stereo sound

Radio:

- Automatic station identification
- EPG [2]
- Radio function: with DVB-C/DVB-S [3]

Operation:

- Assist+
- Automatic Channel Programming (ACP)
- Automatic Signal Switch (ASS)
- Automatic Volume Control (AVC) [4]
- Automatic shut-off
- Channel identification

- Channel-specific volume adaptation
- Content-sensitive help
- Current TV Programme [2]
- Digital Link, Digital Link Plus, Digital Link HD
- Electronic Instruction Manual
- Electronic Program Guide (EPG): (analogue/digital) [2]
- Favourites lists: 6
- Index
- I-Link
- Media network for accessing multimedia content in the network
- MusicBox
- NexTView-Link [2]
- On Screen Display (OSD) in foreign languages: D-E-I-F-NL-GB-P-PL-CZ-DK-S-HU-FIN-SLN-TR-SK-RS-GR Parental Lock
- Personalised teletext with direct access to bookmarked pages
- PhotoViewer
- Power switch
- Programme positions (incl. AV and radio): 4.000
- Remote control: Assist 2
- Teletext: TOP-/FLOF-Videotext/Level 2.5
- Teletext page memory: 2.000
- Video Timer
- via control unit: 5 Buttons

Reception:

- Audio standard: Two-Channel FM/AM, Nicam
- Colour standard: PAL, SECAM, NTSC, NTSC-V, PAL-V (60Hz)
- Decoding System Audio: MPEG
- Decoding System Video: MPEG 2/MPEG 4
- Television standard: B/G, D/K, I, L, M, N
- Tuner: DVB-T, DVB-C; analogue: cable, antenna [5]

Connectors:

- Antenna (analogue/digital): 1x
- Audio In (Cinch)
- Audio Out, controlled (Cinch)
- Common Interface (CI+): 1
- Component (YUV) input
- Copy function Euro-AV <-> Euro-AV
- Copy function Front-AV --> Euro-AV
- Digital-Audio In (Cinch)

- Digital-Audio Out (Cinch)
- Ethernet port RJ45
- Euro-AV/Scart total: 2

- Euro-AV/Scart, of which the following number are Component Video Input-ready: 1
- Euro-AV/Scart, of which the following number are RGB-ready: 1
- Euro-AV/Scart, of which the following number are S-VHS/Hi8-ready: 2
- HDMI including HDCP: 2x
- Headphones: 3,5 mm
- S-Video In
- Side AV Video-/S-VHS, Hi-8 ready
- USB: 2
- VGA
- Video In (cinch)
- Wireless-LAN antennae

Optional function upgrades:

- DVB-S 2 (Single-Tuner) [7]
- Dolby Digital / dts [6]
- Motor control / RS 232 C / IR-Link

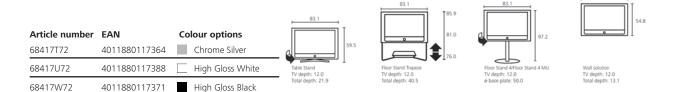
- Equipment board for Floor Stand Trapeze
- Set-up solutions: Floor Stand Trapeze (can be adjusted to three heights); manual rotation: Floor Stand 4; rotary motor function: Floor Stand 4 MU
- Standard feature: Table Stand (manual rotation incl.)
- VESA adapter: VESA C 32
- Wall Mount: WM 56, Wall Mount Flex 32 L [8]

Miscellaneous:

- Mains voltage: 220 240 V / 50/60 Hz
- Power consumption in standby mode in watts: 0,9
- Power consumption in watts when the set is turned off: 0
- Rated wattage to EN 62087 (2009): 130
- VDE-safety standard (inspection seal)
- Weight (approx.) in kg: 18,8

Technical specifications, delivery conditions, and other information are subject to change without notice. [1] Not with MPEG4.

- Works only with channels broadcasting service information/NexTView data.
- DVB-S only with integrated DVB-S 2 (Tuner)
- Function depends on signal format emitted by station. Freeview variants available for UK Dolby is a registered trademark of the Dolby Laboratories Licensing
- Corporation
- Not available with Freeview interactivity in UK.
 Only in conjunction with a corresponding adapter, to be ordered





purSonic Soundboard 300 - 40 PW

Beschreibung:

Flächenlautsprecher zur Verwendung an Stelle von Gipskarton in der Wand. Vollbereichs-Biegewellenwandler mit polymerer Spezialmembran und HE-Absorber >90% B1

Funktionsprinzip DM-PUL

min. Einbautiefe min. 45 mm

Panelgewicht ca. 1750 g

Versandgewicht

VPE 1 Stück

Abmessung 800 x 625 mm

Spezifikation:

Belastbarkeit 40 Watt *

Impedanz 4 Ohm

Empfindlichkeit 85 dB / 1W / 1m ** Übertragungsbereich 80 Hz - 19 KHz **

100 / 70 Volt optional passives Entzerrer-Netzwerk optional

* empf. 36dB/60 Hz

** anwendungsabhängig

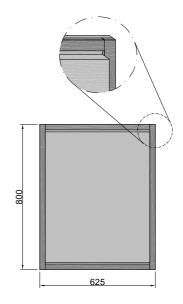
Referenz:

Model 300 - 40 PW

ID-Nummer 106 332

Output 40 W

Anwendung Wand















Individual Sound Das haben Ihre Ohren noch nie gesehen.

- Lautsprechersystem für Stereo- oder Surroundsound. Optimale Funktion in Verbindung mit Audioanlage Auro.
- Individuelles Design durch frei wählbare Farben. Perfekte Ergänzung zu Individual TV durch identische Farben und Materialien.
- Zusätzlicher Center-Speaker entfällt: Nutzung der Loewe TV-Lautsprecher.



Technische Daten

Standlautsprecher

Allgemeines:

- Impedanz: 4-8 Ohm
- Nenn-/Musikbelastbarkeit (Sinus/max.): 75 W/120 W
- Prinzip: 3 Wege Bassreflex (d'Appolito-Anordnung)
- Übertragungsbereich: 65 Hz-22 kHz (-6 dB)

Ausstattung:

- Anschlüsse: vergoldete Schraubklemmen mit Feder für konstanten Anpressdruck
- Bestückung: 2 Bass-Lautsprecher, 2 Breitband-Lautsprecher, 1 Hochton-Lautsprecher

Zubehör:

- Intarsie ab Werk Alu Silber (Abmessungen B x L in cm: 8,3 x
- Intarsien: Ebenholz (89645A80), Palisander (89645C80), Eiche hell (89645H80), Chrom verspiegelt (89645Q80), Alu Silber (89645R80), Schwarz Hochglanz (89645W80), Rubin (89645N80), Orange (89645J80), Apfelgrün (89645G80)
- Lautsprecherkabel: 2x 6 m, 1,5 mm²

Satellitenlautsprecher

Allgemeines:

- Impedanz: 8 Ohm
- Nenn-/Musikbelastbarkeit (Sinus/max.): 30 W/45 W
- Prinzip: 1 Weg geschlossen
- Übertragungsbereich: 160 Hz 20 kHz (-6 dB)

Ausstattung:

- Anschlüsse: Federklemmen
- Bestückung: 2 Breitband-Lautsprecher

- Aufstelllösungen: Individual Sound S-Stand (2 Stück im Set, Aluminium/89644B00), Individual Sound Wandhalter (2 Stück im Set, Platin/89649T00; Anthrazit/89649L00) optional erhältlich
- Intarsie ab Werk Alu Silber (Abmessungen B x L in cm: 5,5 x 5.5) [1]
- Lautsprecherkabel: 2x 6 m, 0,5 mm²/2x 15 m, 0,5 mm²

Subwoofer

Allgemeines:

- Nenn-/Musikleistung (Sinus/max.): 100 W/170 W
- Prinzip: 1 Weg Bassreflex, aktiv
- Übertragungsbereich: 35 Hz-250 Hz (-6 dB)

Ausstattung:

- Anschlüsse: 5 Lautsprecherklemmen (max. 1,5mm²)
- Audio-Link
- Bassintensity Regler +/- 12 dB
- Bestückung: 1 Bass-Lautsprecher
- Cinch-Anschlüsse: vergoldet
- Endstufen: 5 digitale Endstufen (Class D) für Satelliten: je 50W. 6 Ohm
- Netzschalter
- Phasenschalter
- Tiefbass-Filter: 50 Hz-250 Hz

Zubehör:

- Audio-Link-Kabel: 6 m
- Elektronikabdeckung Floor Stand Subwoofer: optional
- Lautsprechergitter

Technische Änderungen, Liefermöglichkeiten sowie Irrtümer vorbehalten.

[1] Bei Gehäuse in Cream Hochglanz: Chrom verspiegelt

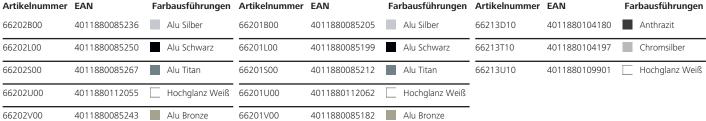




	Satellitenlautsprecher auf S-Stand (optional) øFußplatte: 20,1	Satellitenlauts Wandlösung Tiefe: 6,2	orecher
en	Artikelnummer	EAN	Farbausführungen
	66201B00	4011880085205	Alu Silber
	66201L00	4011880085199	Alu Schwarz
	66201S00	4011880085212	Alu Titan
Slie	66201U00	4011880112062	Hochglanz Weiß







6,2 15,0



Individual Sound Your ears won't believe your eyes.

- Speaker system for stereo or surround sound. Perfect functionality in combination with Auro audio system.
- A wide selection of colours for customising your own design. Perfect compliment to Individual TV due to matching colours and materials.
- No additional centre speaker required as Loewe TV speakers are used.



Technical information

Column speakers

General:

- Frequency response: 65 Hz-22 kHz (-6 dB)
- Impedance: 4-8 ohms
- Nominal music power (sine/max.): 75 W/120 W
- Principle: 3-way bass reflex (d'Appolito grouping)

Features:

- Connectors: gilded, spring-loaded terminal screws for constant contact pressure
- Speaker complement: 2 woofers, 2 full-range speakers, 1

Accessories:

- Insets: Ebony (89645A80), Rosewood (89645C80), Light Oak (89645H80), Metallised Chrome (89645Q80), Aluminium Silver (89645R80), High Gloss Black (89645W80), Ruby (89645N80), Orange (89645J80), Apple Green (89645G80)
- Speaker cables: set of 2: 6m. 1.5 mm²
- Standard insets Aluminium Silver (Dimensions W x D in cm:

Satellite speaker

General:

- Frequency response: 160 Hz 20 kHz (-6 dB)
- Impedance: 8 ohms
- Nominal music power (sine/max.): 30 W/45 W
- Principle: 1-way closed

Features:

- Connectors: Spring clips
- Speaker complement: 2 full-range speakers

- Set-up solutions: Individual Sound S-Stand (2 per set, Aluminium/89644B00)), Individual Sound Wall Mount (2 per set, Platinum/89649T00; Anthracite/89649L00) optional
- Speaker cables: set of 2: 6 m, 0.5 mm²/2x 15 m, 0.5 mm²
- Standard insets Alu Silver (Dimensions in cm: 5.5 x 5.5) [1]

Subwoofer

General: Frequency response: 35 Hz-250 Hz (-6 dB)

- Nominal music power (sine/max.): 100 W/170 W
- Principle: 1-way bass reflex, active

Features:

- Audio Link
- Bass control +/- 12 dB
- Cinch connectors: Gold-plated
- Connectors: 5x speaker terminals (max. 1.5 mm²)
- Power amps: 5 digital power amps (class D) for satellites: 50 watts, 6 ohms each
- Power switch
- Speaker complement: 1 woofer
- Sub-sonic filter: 50Hz-250Hz

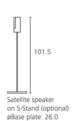
Accessories:

- Audio Link cable: 6 m
- Flectronics cover
- Floor Stand Subwoofer: optional
- Loudspeaker grille

Technical specifications, delivery conditions, and other information are subject to change without notice. [1] If enclosure is High Gloss Cream: Metallised Chrome







Satellite speake wall-mounted solution Depth: 6.2



Depth: 34.0

Depth: 34.0

4011880104180

4011880104197



Colour options

Chrome Silver

Anthracite

Article number	EAN	Colour options
66202B00	4011880085236	Aluminium Silver
66202K00	4011880085274	High Gloss Cream
66202L00	4011880085250	Aluminium Black
66202S00	4011880085267	Aluminium Titanium
66202V00	4011880085243	Aluminium Bronze

Article number EAN Colour options Article number EAN 66201B00 4011880085205 Aluminium Silver 66213D10 66201K00 4011880085229 High Gloss Cream 66213T10 66201L00 4011880085199 Aluminium Black 66201S00 4011880085212 Aluminium 66201V00 4011880085182 Aluminium Bronze



Apple Store

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Artikel in Ihrem Einkaufswagen



17-inch MacBook Pro Versandfertig in: 24 Std. Teilenummer: MC024D/A

1.889,92 €

1.

1.889,92 €

Konfiguration

2.53GHz Intel Core i5 4GB 1066MHz DDR3 SDRAM – 2X2GB 500GB Serial ATA Drive @ 5400 rpm SuperDrive 8x (DVD±R DL/DVD±RW/CD-RW)

MacBook Pro 17-inch Hi-Resolution Glossy Widescreen Display Beleuchtete Tastatur (Deutsch) & Benutzerhandbuch (Deutsch) Accessory kit

> Zwischensumme Kostenfreie Lieferung Mehrwertsteuer

1.889,92 € 0,00 € 359,08 €

Gesamtbetrag der Bestellung

2.249,00 €

Netgear DG834GB Wireless ADSL Firewall Router

K&M Artikelnummer: 5201

Dieser All-In-One-Router mit integriertem ADSL-Modem bietet Schnelligkeit und Sicherheit. Der Router ermöglicht eine problemlose Netzwerk-Administration mit echtem, Hardwarebasiertem Firewall-Schutz und Filterfunktionen für den Internetzugang. Der Zugang zur fragwürdigen Online-Inhalten kann kontrolliert und eingeschränkt werden. Durch die Firewall- Funktionalität wird das Netzwerk oder der PC vor unberechtigtem Zugriff über das Internet geschützt. Dank VPN-Pass-Through kann von zuhause aus sicher auf das Büronetzwerk zugegriffen und VPN-Dienste bereitgestellt werden. Der integrierte 802.11g Access Point macht die Anbindung von neuen Benutzern einfach, diese bleiben mobil und haben trotzdem einen schnellen und sicheren Zugriff auf das Netzwerk bei hohen Datentransferleistungen.





Schreiben Sie eine Bewertung für dieses Produkt und teilen Sie Ihre Meinung anderen Kunden mit!

Verfügbarkeit/Filialbestände

Versandzentrale: vorrätig Stand: 27.04.2010 08:30 Uhr

In 31 Filialen vorrätig! Bestände anzeigen

K&M Preis Online-Preis Filial-Preis 59.99 € 59,⁹⁹ € in den Warenkorb Inkl. MwSt. + ab 6,99 € bei Versand Finanzierungen sind ab 100 € Warenwert in unseren Filialen möglich. Der effektive Jahreszins beträgt 9,90% bei 12 Monaten Laufzeit für Finanzierungen bis 1.000 € Bonität vorausgesetzt.

Beschreibung Details Bewertungen Vergleich Hersteller

Seite drucken

Produktbeschreibung	NETGEAR DG834GB 54 MBit/s Wireless ADSL Firewall Router - Wireless Router
K&M Artikelnummer	5201
Herstellerartikelnummer	DG834GBGR
K&M Produktgruppe	Netzwerk / WLAN Router + Modem
Gerätetyp	Wireless Router + 4-Port-Switch (integriert)
Formfaktor	Extern
Abmessungen (Breite x Tiefe x Höhe)	17.5 cm x 12 cm x 2.8 cm
Gewicht	300 g
Lokalisierung	Deutsch / Deutschland
Datenübertragungsrate	54 Mbps
Frequenzband	2.4 GHz
Routing Protocol	RIP, statisches IP Routing
Data Link Protocol	Ethernet, Fast Ethernet, IEEE 802.11b, IEEE 802.11g
Netzwerk/Transportprotokoll	TCP/IP, PPTP, UDP/IP, L2TP, IPSec, PPPoE, PPPoA
Remoteverwaltungsprotokoll	HTTP
Digital Signaling Protocol	ADSL, ADSL2, ADSL2+
Zubehör	Vertikales Gestell
Leistungsmerkmale	Firewall, DMZ port, Abtastautomatik pro Gerät, dynamische IP-Adressenzuordnung, DHCP Support, NAT Support, VPN-Support, Auto-Negotiation, Auto-Uplink (Auto MDI/MDI-X), Stateful Packet Inspection (SPI), Schutz vor DoS-Angriffen, E-Mail-Meldung, VPN-Passthrough, URL-Filterung
Produktzertifizierungen	IEEE 802.11b, IEEE 802.11g, Wi-Fi CERTIFIED
Systemanforderungen	UNIX, Apple MacOS, Novell NetWare, Linux, Microsoft Windows 98/ME/NT/2000/XP

Bitte beachten Sie, dass Abbildungen ähnlich sein können und wir für die Produktinformationen keine Haftung übernehmen. Irrtum und Änderungen vorbehalten, Abbildungen sind ähnlich und können von der Originalware abweichen. Falls in der Bezeichnung des Produktes "Bulk" enthalten ist, kann das mitgelieferte Zubehör variieren. Alle unsere Endkundenpreise verstehen sich inkl. der gesetzlichen Mehrwertsteuer zuzüglich Versandkosten bei Versandbestellungen. Logos und Markenzeichen sind Eigentum der jeweiligen Hersteller.

- » Drucken (STRG + P)
- « Zurück

WD TV Live Media Player LAN/HDMI/Composite/USB2.0

K&M Artikelnummer: 25023

Geben Sie durch den WD TV Live Mediaplayer HD-Medien über Ihren Fernseher wieder.

HD-Videos, Fotos und Musik - dies alles ist auf Ihrem Computer, Ihren USB-Laufwerken und im gespeichert.

Durch dem netzfähigen WD TV Live-HD-Mediaplayer können Sie eine ganze Welt von Full-HD-1080p-Medien über Ihren Fernseher wiedergeben.







Schreiben Sie eine Bewertung für dieses Produkt und teilen Sie Ihre Meinung anderen Kunden mit!

Verfügbarkeit/Filialbestände Versandzentrale: vorrätig Stand: 27.04.2010 08:13 Uhr In 29 Filialen vorrätig! Bestände anzeigen



Beschreibung Details Bewertungen Vergleich Hersteller Seite drucken

Produktbeschreibung	WD TV Live WDBAAP0000NBK - Digitaler Multimedia-Receiver
K&M Artikelnummer	25023
Herstellerartikelnummer	WDBAAP0000NBK-EESN
K&M Produktgruppe	Festplatten / MediaPlayer
Produkttyp	Digitaler Multimedia-Receiver
Abmessungen (Breite x Tiefe x Ho	bhe) 12.6 cm x 10 cm x 4 cm
Gewicht	303 g
Lokalisierung	Mittlerer Osten, Afrika, Europa
Digital Player (Recorder)	Digital Player
Audio	Stereo
Fernbedienung	Fernbedienung
Stromversorgung	Wechselstrom 120/230 V (50/60 Hz)

Bitte beachten Sie, dass Abbildungen ähnlich sein können und wir für die Produktinformationen keine Haftung übernehmen. Irrtum und Änderungen vorbehalten, Abbildungen sind ähnlich und können von der Originalware abweichen. Falls in der Bezeichnung des Produktes "Bulk" enthalten ist, kann das mitgelieferte Zubehör variieren. Alle unsere Endkundenpreise verstehen sich inkl. der gesetzlichen Mehrwertsteuer zuzüglich Versandkosten bei Versandbestellungen. Logos und Markenzeichen sind Eigentum der jeweiligen Hersteller.

- » Drucken (STRG + P)
- « Zurück

1000GB IOCELL NetDisk NAS USB/eSATA/LAN

K&M Artikelnummer: 24587

Die NetDisk 351UNE 1 TB von IOCELL ist eine NDAS-Festplatte (Network Direct Attached Storage). Wenn sie in ein Netzwerk eingebunden ist, kann jeder Rechner auf sie wie auf eine lokale Festplatte zugreifen. Das hat den Vorteil, dass Sie die NetDisk 351UNE mit einem beliebigen Dateisystem formatieren können. Außerdem sind höhere Datenraten möglich, da die NDAS-Festplatte kein Netzwerkprotokoll wie TCP/IP oder FTP einsetzt. Der Nachteil von NDAS: Auf jedem Rechner, der auf die Festplatte zugreifen will, muss ein passender Treiber installiert sein. Ist das Netzwerk nicht zugänglich, lässt sich die IOCELL NetDisk 351UNE per USB 2.0 oder eSATA am PC oder Notebook anschließen.







Versandbestellungen. Logos und Markenzeichen sind Eigentum der jeweiligen Hersteller.

Schreiben Sie eine Bewertung für dieses Produkt und teilen Sie Ihre Meinung anderen Kunden mit!

Verfügbarkeit/Filialbestände Versandzentrale: vorrätig Stand: 27.04.2010 08:30 Uhr In 30 Filialen vorrätig! Bestände anzeigen



Beschreibung Details Bewertungen Vergleich Hersteller Produktbeschreibung 1000GB IOCELL NetDisk NAS USB/eSATA/LAN K&M Artikelnummer 24587 Herstellerartikelnummer 351UNE1TB K&M Produktgruppe Festplatten / Festplatten NAS Farbe Grau (das Bild des gezeigten Produktes kann eine andere Farbe haben) Kapazität Bitte beachten Sie, dass Abbildungen ähnlich sein können und wir für die Produktinformationen keine Haftung übernehmen. Irrtum und Änderungen vorbehalten, Abbildungen sind ähnlich und können von der Originalware abweichen. Falls in der Bezeichnung des Produktes "Bulk" enthalten ist, kann das mitgelieferte Zubehör variieren. Alle unsere Endkundenpreise verstehen sich inkl. der gesetzlichen Mehrwertsteuer zuzüglich Versandkosten bei

- » Drucken (STRG + P)
- « Zurück

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Portable generators

S Series

P Inverter Series

P Series

ES Series

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PRAMAC E 5000

Item code: PA432SHI000



(purely indicative picture)

Technical specifications Standard equipment, options and accessories

Main specifications

Single-phase maximum power (LTP)	n.a.
Single-phase maximum power (LTP).	n.a.
Single-phase prime power (PRP)	n.a.
Single-phase prime power (PRP).	n.a.
Single-phase continuous power (COP)	n.a.
Single-phase continuous power (COP)	n.a.
Rated maximum power (LTP)	5,11 kVA
Rated maximum power (LTP)	4,6 kW
Rated prime power (PRP)	4,62 kVA
Rated prime power (PRP)	4,3 kW
Rated continuous power (COP)	4,2 kVA
Rated continuous power (COP)	3,91 kW
Rated current at COP	18,3 A
Phases	1
Voltage	230 V
Rated power factor	0,9 PF
Frequency	50 Hz
Battery charger voltage	n.a.

PRAMAC - E 5000 Page 2 of 3

Battery charger current n.a.

Panel location On alternator
Frame type Tubular
Compliancy certification CE

Engine specifications

Engine manufacturer Honda
Model GX270
Stroke 4

Fuel Gasoline

Number of cylinders and disposition 1, inclination and

Displacement 270 cm³ Air intake Natural Starting system Recoil Nominal operating speed 3000 rpm Speed governor Mechanical Continuous power COP 4,6 kW Prime power PRP 5,1 kW Standby power LTP 5,6 kW Lube oil capacity 1,1 I Fuel consumption at 75% load 1,63 l/h Electric circuit voltage n.a.

Alternator specifications

Alternator manufacturer NSM
Model SE 100 E

Poles 2

Revolution speed 3000 rpm
Voltage 230 V
Frequency 50 Hz
Efficiency at 75% load 73,0 %

Maximum admitted overload 10% for 1 hour & Voltage regulation system Capacitor

Protection grade IP 23

Additional information

Skid mounting No Fuel tank location On engine Fuel tank capacity 6 I Automatic supplementary tank VV.FF. No Running time at 75% COP 3,68 h Measured acoustic power (LWA) at 4 mt 96,5 dBA 71,5 dBA Noise level at 7 m 97 dBA Guaranteed noise level (LWA) -15 ~ +40 °C Operating conditions

Dimensional data

Length 715 mm
Width 540 mm
Height 490 mm
Dry weight 61 kg

Technical specifications are subject to change without notice. Consult y

PRAMAC - E 5000 Page 3 of 3

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H 1001



ähnliche Werkstoffe

- » Thermisch behandeltes Holz (Eiche)
- » Eiche 3-Schichtplatte

Anbieter für

Dielen

» joerke Holz & Massivholzfussboden



Eiche

Kurzinfo

Laubholz

Beschreibung

Unter dem Namen Eiche werden im deutschsprachigen Raum die zwei botanischen Arten Stieleiche und Traubeneiche zusammengefaßt. Da ihre Holzeigenschaften aber sehr ähnlich sind, wird nur von Eichenholz gesprochen. Die Eiche kommt in ganz Europa und bis nach Kleinasien vor mit Ausnahme der sehr nördlichen und südlichen Bereiche. Besonders in Frankreich gibt es sehr große Bestände. Insgesamt gehört die Eiche zu den europaweit wichtigsten Baumarten.

Eichen können ein Alter von einigen hundert Jahren erreichen. Sie werden 20 bis 40 Meter, teilweise bis zu 50 Meter hoch. Die Bäume wachsen am Anfang sehr schnell in die Höhe, aber insgesamt ist ihr Zuwachs an Masse verglichen mit anderen Baumarten eher gering.

Das Holz der Eiche unterscheidet sich in Splint- und Kernholz: der schmale Splint ist grauweiß, das Kernholz gelbbraun bis mittelbraun gefärbt und dunkelt stark nach. Durch die großen Poren sind die Frühholzzonen gut erkennbar. Im Längsschnitt bilden sich die großen Gefäße als Rillen ab.

Rohdichte

0.69 g/cm3

Technische Daten

Eichenholz ist schwer und hart. Dabei ist es durchaus elastisch. Das Kernholz ist sehr dauerhaft, unter Wasser sogar beinahe unbegrenzt haltbar.

Verarbeitung

Eiche trocknet langsam, daher sollte auch eine technische Trocknung entsprechend vorsichtig durchgeführt werden um ein Reißen und Werfen zu vermeiden. Eiche schwindet wenig und hat ein gutes Stehvermögen.

Es läßt sich mit allen Maschinen und Werkzeugen gut bearbeiten. Eiche läßt sich gut spalten, auch die Herstellung von Furnieren ist sehr gut möglich. Nägel und Schrauben halten gut. Die Oberflächenbehandlung bereitet im Allgemeinen keine Probleme. Wegen einem hohen Anteil an Gerbsäuren kann es bei Kontakt mit Eisenteilen zu Verfärbungen infolge chemischer Reaktionen kommen.

Lieferbare Größen

Eiche wird als Rund- und Schnittholz, sowie als Furnier gehandelt.

Kurzzeichen: EI

Anwendungen

- Konstruktion
- Möbelbau, Innenausstattung
- Fässer und Bottiche
- Fußböden und Parkett
- Wasserbau, Brückenbau

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Samples collection and product database for wood based panels

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H 1001



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Oak

Short Description

Deciduous wood

Description

Oak is commonly used to describe the two most common Northern European botanical variants: holm and pedunculate oak. Their properties are however so similar that their wood is simply known as oak wood. Oak grows commonly throughout Europe and Asia Minor, with the exception of the very northern and southern areas. Oak is particularly widespread in France. It is one of the most important European trees altogether.

Oaks can often be several hundred years old and can reach a height of up to 50 metres, though 20m to 40m is more common. Oak grows rapidly in height but its body is not as extensive as other kinds of trees.

Oak wood can be differentiated between sapwood and heartwood: the thin sapwood is grey-white in colour, the heartwood is coloured yellow-brown to mid-brown and darkens considerably with time. The springwood can easily be identified by its larger pore structure. When cut longitudinally the vertical pores have a grooved structure.

Density

0.69 g/cm3

Properties

Oak wood is hard and heavy, but nonetheless elastic. The heartwood is very resilient, and durable even under water.

Usage

Oak wood dries slowly. This means that artificial drying should be undertaken with care to avoid cracking and warping. Oak shrinkage is negligible and stability is good. It can be worked easily with most tools and machinery, it can be split easily and is well suited for use as a veneer. Nails and screw-fixings are straightforward. Surface finishing is generally not a problem. Its high tannic acid content can lead to coloration when in contact with iron due to chemical

reactions.

Dimensions

Oak is available as round or sawn timber, or as a veneer.

Applications

- Construction
- Furniture and interior furnishing
- Barrels and tubs
- Floor boarding and parquet
- Hydraulic engineering, Bridge building

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Edelstahl

Edelstahl gilt als klassisches Material für zeitloses Möbeldesign. Nicht umsonst heißt es edel.

Edel ist insbesondere das Zusammenspiel mit erlesenem Massivholz.

Durch ausgesuchte Legierungszusätze erhält der Stahl seinen speziellen Eigenschaften.

Die allgemein bekannten Bezeichnungen V2A und V4A sind mittlerweile von präziseren Einteilungen abgelöst worden. Wir verwenden die Legierung 1.4301.



stainless steel

Stainless steel is considered one of the most classic and noble materials for use in creating ageless furniture design. Especially elegant is the combination of stainless steel with selected solid wood. By adding selected alloys to steel, the metal takes on very special characteristics. The commonly used older classifications V2A and V4A have now been replaced by a more detailed grading system. We employ the 1.4301 alloy.



MIRA- X Stoffe AG presents COLLECTION 2009

VOYAGE

Traum

Träume bewegen, wecken Hoffnung und eröffnen Horizonte. Während sie tagsüber häufig der rastlosen Hektik weichen, verstärkt sich in der Konsequenz das Bedürfnis nach Raum, Intimität und Geborgenheit, nach sinnlichem Erleben und Vergnügen. Mira-X möchte dazu einen Beitrag leisten. Bedeutend und dezent zugleich.

Zauber

Durch textile Gestaltung wird das Zuhause zu einer Oase der Ruhe und Erholung. Inneneinrichtungsstoffe sind Wohnbestandteile wie das Bett und der Stuhl. Sie sind funktional, schützen, dämmen, trennen, schliessen. Stoffe von Mira-X haben einen zusätzlichen Anspruch. Sie sind ästhetisch, verzaubern, entrücken, verklären, berühren. Mira-X kreiert dreidimensionale Gemälde aus Raum, Licht, Materie, Farbe und Design. Jedem Betrachter eröffnen sie neue Sichtweisen, Ein- und Ausblicke, Bilderbögen aus Sinnlichkeit.

Reise

Die Collection VOYAGE baut auf Bewährtem auf, denkt es weiter und zeigt Neues. Sie trägt die charakteristische Handschrift von Mira-X, steht ein für unaufdringliche Individualität. VOYAGE nimmt Sie mit auf eine Weltreise durch drei Zeitzonen und lässt Sie Eindrücke sammeln, welche vielfältiger nicht sein könnten.

Inspiration

Die in der Collection VOYAGE umgesetzten Ideen entspringen den kreativen Quellen aus drei ganz unterschiedlichen Zonen. Die Reise führt von der Antarktis über Paris nach San Francisco. VOYAGE beinhaltet transparente Kreationen, Ausbrenner-, dessinierte und uni gewebte Stoffe.

Anspruch

Dank dem übergreifenden Farbkonzept sind die Stoffe miteinander kombinierbar. Mira-X unterstreicht mit der Collection VOYAGE ihre moderne, klare und reduzierte Designsprache. Geschmeidig im Griff, aussagekräftig in der Optik und unverfälscht im Qualitätsanspruch.



MIRA- X Stoffe AG presents COLLECTION 2009

VOYAGE

San Francisco

Dichte Gewebe und bunte Farben betreten in geometrisch strenger Anordnung die textile Bühne. Durch die Eingliederung variantenreicher Linien tragen die minimalistischen Designs eine besonders aussagekräftige, grafische Handschrift. Sie erinnern beispielsweise an Zebrastreifen oder Strassen. Lebendigkeit wird durch den Einsatz von natürlich verspielten, fröhlichen Farben vermittelt. Harmonische Regenbogenfarben wie helle Grün-, Lilaund Blautöne setzen Akzente in den Designs und bieten in Kombination mit den Uni-Stoffen variantenreiche Einrichtungsmöglichkeiten.



PLAIN 6882 39 COLORITS 140 CM 100% PES TREV CS

Plain ist unsere seit Jahren bewährte junge und freche Uni-Basicqualität. Die bestehende Farbpalette wurde für dieses Jahr mit 17 neuen, aktuellen Farben aufgefrischt. Die Farbpalette bietet 39 Colorits an, davon sind 22 bestehende Farben.

Plain liefert die Grundqualität für die Designs Alex, Amy und Alamo. Aus diesem Grund sind diese drei Designs sehr gut mit Plain kombinierbar.



AMY 7177 140 CM 100% PES TREV CS

6 COLORITS

Die grafischen Blockstreifen treten mit Entschiedenheit auf. Das Spiel der Farben auf weisser Kette bringen die Streifen zum Leuchten und werden für den Betrachter zum sinnlichen Vergnügen.

Die Streifenanordnung soll das Strassenspiel von einer Landkarte wiederspiegeln.

Amy kann sehr gut mit dem Uni-Artikel Plain kombiniert werden.



ALEX 7178 140 CM 100% PES TREV CS

6 COLORITS

Die dynamische, geordnete Anordnung der feinen und breiten Streifen im Artikel Alex wirken durch das Wechselspiel, abwechslungsreich und aufmunternd. Ein einfacher Fussgängerstreifen auf den Strassen von San Francisco und verschiedene Fassanden-Kontraste verliehen diesem Design die

Wie auch Amy kann Alex sehr gut mit dem Uni-Artikel Plain kombiniert werden und ermöglicht einem Raum die spezielle Note zu verleihen.





Minimaxol-Feuerlöscher WS 6 nG und WS 9 nG

- Minimaxol-Feuerlöscher werden überall dort eingesetzt, wo Brände fester Stoffe organischer Natur oder flüssiger bzw. flüssig werdender Stoffe zu bekämpfen sind.
- Minimaxol löscht optimal, wenn ein gleitfähiger, abdeckender und überaus beständiger
- - Industriebereiche
 - Büroräume und Praxen
 - Verkaufsflächen
 - öffentliche Bereiche
 - Flughäfen
 - nahezu der komplette Privatbereich

Einsatz

- Schaum gefordert ist.
- Typische Einsatzgebiete sind:
 - Verwaltungs- und

- Neuartiges, benutzerfreundliches Bedienungslayout: Einheitliche Bedienung und sofort erkennbare Funktionsweise
- Armatur aus schlagfestem Hochleistungskunststoff: hohe Korrosionsbeständigkeit und Robustheit
- ► Leichte Handhabung durch Gewichtsvorteil gegenüber anderen Armaturvarianten
- Gesichert gegen unbeabsichtigtes Betätigen
- Optimaler Löschmittelstrahl und konstante Löschleistung durch patentierte CO₂-Überladung
- Hohe Löschwirkung durch Kombination mehrerer Löscheffekte
- Schaum-Wasser-Gemisch mit besonders effektiven Additiven
- Keine Rückzündung bei Flüssigkeitsbränden
- Geringe, leicht entfernbare Löschmittelrückstände
- Gute Dosierbarkeit durch jederzeit abstellbaren Löschmittelstrahl
- ➤ Rilsanbeschichtete CO₂-Treibgasflasche
- Unbedenklich für Mensch, Tier und Umwelt
- Löschmittelbehälter aus qualitativ hochwertigem Stahl. Die auf dem Markt einzigartige, hochresistente, duroplastische Innenbeschichtung garantiert höchstmöglichen Korrosionsschutz. Außenseite Kunststoff, pulverbeschichtet
- Serienmäßige Standnocken
- Hohe Betriebssicherheit
- Wartungsfreundlich



Produkt

Schaum-Feuerlöscher sind das

der Brandklassen A und B.

Minimaxol ist ein spezielles

bildnern und Additiven.

schicht, die ein erneutes

mittels in das Brandgut.

Nasslöschsystem aus Schaum-

Bei der Brandklasse A wirkt die

Sperreffekt: Das Wasser senkt

die Temperatur unter den Ent-

zündungspunkt und beim Ver-

dampfen bildet sich eine Schmelz-

Aufflammen unmöglich macht.

Die hohe Netzwirkung ermög-

licht das Eindringen des Lösch-

Bei der Brandklasse B unterbin-

den ein gleitfähiger Film und

eine Schaumschicht die Sauer-

stoffzufuhr; Rückzündungen und das Aufsteigen giftiger

Dämpfe werden verhindert.

Kombination von Kühl- und

ideale Instrument zur Bekämp-

fung von Entstehungsbränden







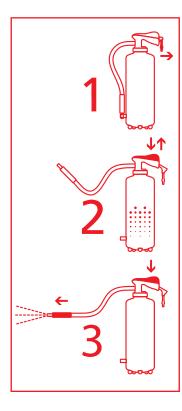




Cool down. Fire Protection by

MINIMAX

Ihre Vorteile



Sicherung ziehen

Nehmen Sie im Brandfall den Feuerlöscher aus seiner Halterung und ziehen Sie mit Schwung die gelbe Sicherung am Handgriff nach hinten weg.

Hebel drücken, dann loslassen

Fassen Sie den Schlauch, drücken Sie den Auslösehebel ganz durch und lassen Sie diesen wieder los. Der Feuerlöscher baut über eine innenliegende CO2 - Gasflasche Druck auf und ist sofort einsatzbereit.

Hebel drücken zum Löschen

Richten Sie die Löschdüse auf den Brand und drücken Sie den Auslösehebel erneut. Beginnen Sie dann gezielt mit dem Löschen.

- Um Bedienungsfehler zu vermeiden, empfiehlt die BGR 133 (Ausrüstung von Arbeitsstätten mit Feuerlöschern) innerhalb eines Betriebes alle Feuerlöscher mit gleicher Bedienungsarmatur bereitzustellen. Minimax bietet Feuerlöscher für alle Einsatzbereiche und Brandklassen mit durchgängiger Einhebelbedienung und garantiert daher besondere Sicherheit.
- Nach dem Herausziehen der Sicherung ist der Löscher einsatzbereit. Beim Betätigen des Druckhebels senkt sich die Spindel auf die Verschlussschraube des Treibgasbehälters und bricht sie auf. Das Treibgas strömt in den Löschmittelbehälter, drückt das Löschmittel durch Steigrohr und Löschschlauch und stößt es unter Beimengung von Luft aus der Sprühdüse.
- Der Löschmittelstrom wird unterbrochen, wenn der Druckhebel losgelassen wird. Durch wiederholtes Betätigen des Druckhebels können Brände fester Stoffe unter Kontrolle gebracht werden. Flüssigkeitsbrände sind in einem Zug zu löschen.



Wartung

- Feuerlöscher müssen regelmäßig von legitimierten Sachkundigen nach DIN 14 406, Teil 4, instand gehalten werden und gemäß Betriebssicherheitsverordnung durch eine befähigte Person nach TRBS 1203-2 geprüft werden.
- Nach dem Löscheinsatz müssen Feuerlöscher auch bei nur teilweiser Entleerung – unverzüglich wiederbefüllt werden, um die Betriebsbereitschaft wiederherzustellen.
- Sämtliche Instandhaltungs- und Fülldienste übernimmt Ihr Minimax Service.
- Geeignet bis 1.000 Volt bei 1 m Mindestabstand.

Zulassung

EN 3 ◎ **(€**





Technische Daten

Тур	Amtliches	Bauart	Lösch-	Löschmittel	Treibmittel	Prüf-	Betriebs-	Funk-	Wurf-	Temperatur-	Leistungskla			Maße		Gewicht
	Zulassungs-		mittel-			über-	überdruck	tions-	weite		Löschmittele	inheiten**	Höhe	Breite	ø	ohne
	kennzeichen		menge			druck	bei +60 °C	dauer		bereich						Halter
			I			bar	ca. bar	ca. s	ca. m	°C	A	(<u>)</u> □	mm	mm	mm	ca. kg
WS 6 nG	EN3-08/136	S 6 H - 0	6	Minimaxol +	Kohlen-	30	13,0	34	5	0 bis	34 A	183 B	545	312	160	11,4
					dioxid					+60	10 LE	12 LE				
WS 9 nG	EN3-08/137	S 9 H - 0	9	Minimaxol +	Kohlen-	30	10,0	50	5	0 bis	43 A	233 B	545	320	190	15,4
					dioxid					+60	12 LE	15 LE				

* Nach EN 3. ** Nach BGR 133.

Technische Änderungen vorbehalten

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Tel.: +43 (0)1 8658161-0 Fax: +43 (0)1 8658161-59 E-Mail: mobil@minimax.at

www.minimax.at

www.minimax-mobile.com





GRUNDFOS SOLOLIFT+

Abwasserentsorgung in Gebäuden

Elegantes Design in jeder Situation: SOLOLIFT+

Neue Abwasserhebeanlagen SOLOLIFT+.

Bei den neuen Grundfos SOLOLIFT+
Hebeanlagen handelt es sich um eine
komplette Baureihe zur Entsorgung von
Abwässern innerhalb von Gebäuden.
SOLOLIFT+ wird eingesetzt, um Abwasser aus Badezimmern, Waschräumen
und Küchen abzuführen. SOLOLIFT+
kann überall dort eingesetzt werden,
wo das Abwasser nicht über das
Freigefälle in die Kanalisation ablaufen
kann. Als Ergänzung zu den SOLOLIFT+
Hebeanlagen gibt es weiterhin die
Produkte Liftaway B und Liftaway C.

Einsatzmöglichkeiten der neuen SOLOLIFT+ Hebeanlagen:

- > WC
- Waschbecken
- > Bidet
- Waschmaschine
- > Dusche im Badezimmer
- > Installationen im Kellergeschoss
- > Renovierungen
- SOLOLIFT+ sind Hebeanlagen nach DIN EN 12050 und DIN EN 12056.

SOLOLIFT+ - sechs Modelle für verschiedene Aufgaben

Die komplette Grundfos SOLOLIFT+ Baureihe umfasst sechs Hebeanlagen für die verschiedenen Aufgaben der Abwasserentsorgung in Gebäuden. Die ersten vier Hebeanlagen mit dem Namenzusatz WC werden für die Entwässerung von Schwarzwasser (Abwasser mit Fäkalien) eingesetzt. Die beiden übrigen Hebeanlagen mit dem Namenszusatz C-3 und D-3 werden für die Entwässerung von Grauwasser (Abwasser ohne Fäkalien) genutzt. Alle SOLOLIFT+ Hebeanlagen sind durch ihr attraktives und diskretes Design leicht in bestehende und neue Bauvorhaben zu integrieren.

SOLOLIFT+ WC für Toilette





Die Vorteile der Grundfos SOLOLIFT+ Hebeanlagen:

- Einfache Installation durch Druckanschluss an der Seite
- > Diskretes und attraktives Design
- Preiswerte Lösung durch komplette Baureihe
- Vorwand-Installation
- geprüfte Sicherheit durch externes Institut (LGA)

GRUNDFOS HEBEANLAGEN



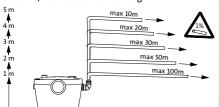
SOLOLIFT+ WC-1



für Toilette und 1 Anschluss



Vertikale/horizontale Rohrführung



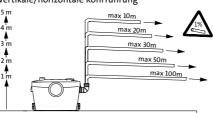
SOLOLIFT+ WC-3



für Toilette und 3 Anschlüsse



Vertikale/horizontale Rohrführung



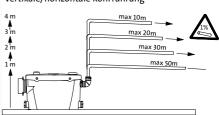
SOLOLIFT+ CWC-3





Vertikale/horizontale Rohrführung

SOLOLIFT+ D-3



SOLOLIFT+ C-3

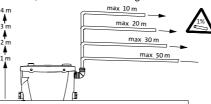


für Waschmaschine und 3 Anschlüsse

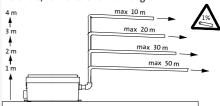




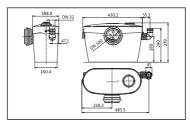
Vertikale/horizontale Rohrführung





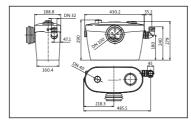






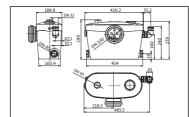
Zulaufstutzen WC (DN 100) Leistungsaufnahme 400 W Spannung 1 x 220 - 240 V, 50 Hz Gewicht 5,4 kg Max. Medientemperatur 40°C Produktnummer 96 17 69 09





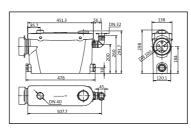
Zulaufstutzen WC (DN 100) + 1 (DN 40) Leistungsaufnahme 400 W Spannung 1 x 220 - 240 V, 50 Hz Gewicht 5,4 kg Max. Medientemperatur 40°C Produktnummer 96 17 69 10





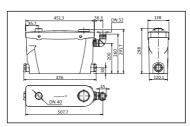
Zulaufstutzen WC (DN 100) + 3 (DN 40) Leistungsaufnahme 400 W Spannung 1 x 220 - 240 V, 50 Hz Gewicht 5,5 kg Max. Medientemperatur 40°C Produktnummer 96 17 69 11





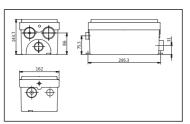
Zulaufstutzen WC (DN 100) + 3 (DN 40) Leistungsaufnahme 350 W Spannung 1 x 220 - 240 V, 50 Hz Gewicht 4,9 kg Max. Medientemperatur 40°C Produktnummer 96 17 69 12





Zulaufstutzen 3 (DN 40) Leistungsaufnahme 300 W Spannung 1 x 220 - 240 V, 50 Hz Gewicht 4,7 kg Max. Medientemperatur 40°C kurzfristig 70°C (für 10 Minuten) Produktnummer 96 17 69 13





Zulaufstutzen 3 (DN 40) Leistungsaufnahme 270 W Spannung 1 x 220 - 240 V, 50 Hz Gewicht 3,5 kg Max. Medientemperatur 40°C Produktnummer 96 17 69 15

JP Hydrojet

Jetpumpen 50 Hz



10.6

Jetpumpen

Allgemein Anwendung Fördermedien Betriebsbereich	Seite 10.6-1 10.6-1 10.6-1
Pumpe Motor Werkstoffe Ejektoreinstellung Kennlinien JP 5 Kennlinien JP 6 Elektrische Daten Presscontrol Membrandruckbehälter	10.6-1 10.6-1 10.6-2 10.6-2 10.6-2 10.6-2 10.6-3 10.6-3
Technische Daten	
Werkstoffausführung A Werkstoffausführung B JP Booster Presscontrol Gewichte Explosionszeichnung Service Kits	10.6-4 10.6-4 10.6-4 10.6-4 10.6-5 10.6-5
Weitere Produktdokumentation WebCAPS	10.6-6
WinCAPS	10.6-7



Anwendung

Ausgelegt auf eine lange, störungsfreie Lebensdauer, ist die kleine, handliche Grundfos Jetpumpe geeignet für zahlreiche Aufgaben in der Wasserversorgung und Wasserförderung im Bereich Haus, Garten und Hobby sowie in der Landwirtschaft und im Gartenbau.

In Verbindung mit einer Drucksteuereinheit oder einem Druckbehälter für eine bedarfsabhängige Regelung ist die Grundfos Jetpumpe bestens geeignet für kleine Wasserversorgungssysteme.

Fördermedien

Reine, dünnflüssige, nicht-aggressive und nicht-explosive Flüssigkeiten ohne feste und langfaserige Bestandteile. Die Pumpe darf nicht zur Förderung von Dieselöl oder anderen ölhaltigen Medien verwendet werden.

Betriebsbereich

Förderstrom Q: bis 5 m³/h
Förderhöhe H: max. 48 m
Betriebsdruck: max. 6 bar

Saughöhe: max. 8 m, einschließlich Druck-

verluste in der Saugleitung bei einer Medientemperatur von

+20 °C

Medientemperatur: Werkstoffausführung A:

0 °C bis +40 °C

Werkstoffausführung B:

0 °C bis +55 °C

Umgebungstemp.: max. +40 °C

Pumpe

Die Jetpumpe ist eine selbstansaugende, einstufige Kreiselpumpe mit axialem Saugstutzen und radialem Druckstutzen mit einem Gewindeanschluss G 1 oder Rp 1. Die Pumpe hat einen eingebauten Ejektor mit Leitschaufeln für optimale Selbstansaugeigenschaften.

JP-Pumpen sind in zwei Werkstoffausführungen lieferbar:

Werkstoffausführung A: Abdeckplatte, Motorlaterne und Grundplatte bilden eine Einheit. Der Handgriff ist quer montiert. Beide Komponenten sind aus einem Kompositwerkstoff gefertigt.

Werkstoffausführung B: Die Abdeckplatte ist aus Edelstahl, die Motorlaterne aus Aluminium und die Grundplatte aus Edelstahl gefertigt. Alles sind Einzelkomponenten. Dank der robusten Bauweise ist die Pumpe für eine Festinstallation geeignet. Der aus Komposit gefertigte Handgriff ist längs montiert.

Weitere Informationen zu den für den Bau der Pumpe verwendeten Werkstoffen finden sie unter dem Abschnitt "Werkstoffe".

Motor

Die Pumpe ist direkt mit einem lüftergekühlten Grundfos Asynchronmotor verbunden, der speziell an die Pumpenleistung angepasst ist. Die einphasigen Motoren haben einen eingebauten Thermoschalter und benötigen keinen weiteren Motorschutz. Dreiphasige Motoren benötigen einen externen Motorschutz.

Schutzart: IP 44 (spritzwassergeschützt).

Wärmeklasse: F.

Werkstoffe

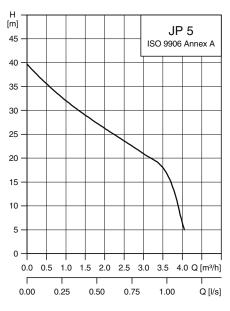
Gleitringdichtung	Werkstoff	DIN WNr.	AISI	
Stationärer Dichtungsring	Kohlenstoff			
Gleitring	Keramik			
Feder	Edelstahl	1.4301	304	
Gleitringgehäuse	Edelstahl	1.4301	304	
O-Ringe	NBR-Elastomer			
Sonstige Bauteile				
Welle	Stahl St52			
Laufrad	Edelstahl	1.4301	304	
Pumpenmantel	Edelstahl	1.4301	304	
Spannband	Edelstahl	1.4301	304	
Ejektor	Komposit			
Dichtungsring	PPE-Komposit			
O-Ringe	NBR-Elastomer			
Werkstoffausführung A				
Motorlaterne mit Grundplatte	Komposit			
Lagerplatte	Edelstahl	1.4301	304	
Werkstoffausführung B				
Motorlaterne	Aluminium			
Grundplatte	Edelstahl	1.4301	304	
Abdeckplatte	Edelstahl	1.4301	304	

Jetpumpen

Ejektoreinstellung

Die JP-Pumpe verfügt über einen eingebauten Ejektor, der mit einem Stopfen bestückt ist.

Kennlinien JP 5

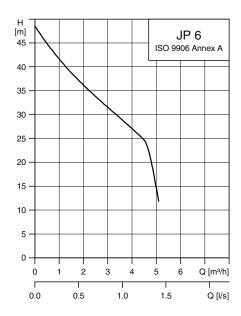


Elektrische Daten

JP 5, 50 Hz	P ₁ [W]	n [min ⁻¹]	Cos φ	I _n [A]	I _{St} I _{1/1}
1 x 220-230 V	775	2650	0,99	3,7	3,5
1 x 230-240 V	775	2650	0,98	3,4	3,4
3 x 220-240 V	780	2830	0,87	2,4	2,9
3 x 380-415 V	780	2830	0,87	1,4	5,0

JP 6, 50 Hz	P ₁ [W]	n [min ⁻¹]	Cos φ	I _n [A]	$\frac{I_{St}}{I_{1/1}}$
1 x 220-240 V	1350	2800	0,90	6,2	4,2
3 x 220-240 V	1325	2850	0,81	4,1	3,9
3 x 380-415 V	1325	2850	0,81	2,4	6,8

Kennlinien JP 6



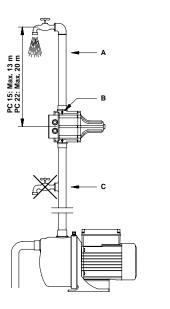
TM00 7475 1401

TM00 7474 1401

Presscontrol

Die Drucksteuereinheiten Presscontrol PC 15 und PC 22 mit einem voreingestellten Einschaltdruck von 1,5 bzw. 2,2 bar werden für den automatischen Betrieb von Pumpen in kleinen Wasserversorgungssystemen eingesetzt.

Ein eingebautes Strömungsventil und ein eingebauter Druckschalter sorgen für einen kontinuierlichen Förderstrom unabhängig vom Wasserverbrauch und ohne Druckstöße. Die Presscontrol schaltet die Pumpe bedarfsabhängig ein und aus. Zusätzlich schaltet der integrierte Trockenlaufschutz die Pumpe nach 10 Sekunden ab, wenn die Pumpe ohne Wasser läuft.



FM00 5589 1696

Α

Es wird empfohlen, die Drucksteuereinheit so zu installieren, dass der Höhenunterschied zwischen der Presscontrol und der höchsten Entnahmestelle den in der Abbildung angegebenen Wert nicht überschreitet.

В

Die Pfeile auf der Presscontrol zeigen die Durchflussrichtung an. Die Presscontrol ist so zu installieren, dass die Pfeile immer nach oben zeigen.

С

Zwischen der Pumpe und der Drucksteuereinheit dürfen keine Entnahmestellen angeordnet sein.

Membrandruckbehälter

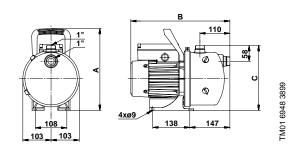
Der Einsatz von Membrandruckbehältern in Verbindung mit JP-Pumpen wird empfohlen, wenn ein nahezu konstanter Druck im Wasserversorgungssystem sichergestellt werden muss.

Grundfos bietet eine Reihe von kleinen Druckerhöhungsanlagen an, die komplett mit Jetpumpe und einer der folgenden Druckbehälter ausgestattet sind:

- · Horizontaler Druckbehälter, 24 Liter
- · Horizontaler Druckbehälter, 60 Liter
- · Horizontaler Druckbehälter, 18 Liter (Edelstahl)

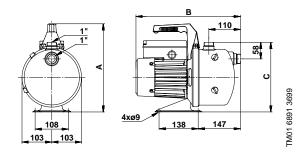
Jetpumpen

Werkstoffausführung A



Pumpentyp	Abmessungen [mm]					
rumpemyp	Α	В	С			
JP 5, Werkstoffausführung A	300	364	240			
JP 6, Werkstoffausführung A	300	401	240			

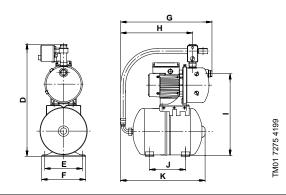
Werkstoffausführung B



Pumpentyp	Abmessungen [mm]						
rumpentyp	Α	В	С				
JP 5, Werkstoffausführung B	306	364	240				
JP 6, Werkstoffausführung B	306	401	240				

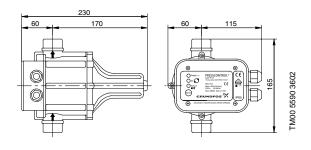
HYDROJET

JP mit horizontalem Membrandruckbehälter



_	Behälter- größe [I]	Abmessungen [mm]							
Pumpentyp		D	Е	F	G	Н	ı	J	K
JP 5, JP 6	24	660	250	278	540	330	415	265	515
JP 5, JP 6	60	750	341	376	610	400	510	302	600
JP 5, JP 6	18 (Edelstahl)	650	234	263	510	399	490	200	480

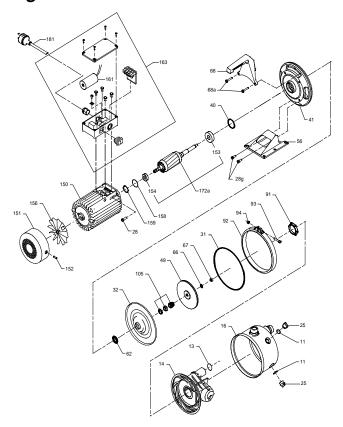
Presscontrol



Gewichte

T	Anschluss	Behälter-	Gewicht [kg]			
Тур	Anschiuss	größe [I]	Netto	Brutto		
		18	14,3	16,3		
JP 5	G 1 / Rp 1	24	17,1	19,1		
		60	22,8	24,8		
		18	17,5	19,5		
JP 6	G 1 / Rp 1	24	20,4	22,4		
		60	25,8	27,8		
Presscontrol	G 1	-	-	1,2		

Explosionszeichnung



Service Kits

DELAICE IVITA		
Teilenr. O-Ring-Kit 96768180	Position	Stückzahl
96654296 STOPFEN ³ / ₈ " JP5/6	25	2
96654590 Gehäuse O-Ring D194X4,5/3 für JP5/6	31	1
96654591 O-ring EPDM (EP1/1/5) 16x2.5	31	2
96654594 O-ring EPDM (EP1/1/5) 30x2.5	13	1
Teilenr. Gleitringdichtung 96768182		
460011 SPALTDICHTUNG JP5 MOD.D	91	1
460211 SPALTDICHTUNG JP6 MOD.D	91	1
460485 DICHTUNG D18/11,5X1,5 (JP "D") NITRIL 65	105	1
96603940 GLRD feststehendes Teil	105	1
96616253 GLRD rotierendes Teil	105	1
96654590 Gehäuse O-Ring D194X4,5/3 für JP5/6	31	1
Teilenr. Hyraulik-Kit JP5 96768184		
410026 SPANNSCHEIBE CR(N)4	66	1
460011 SPALTDICHTUNG JP5 MOD.D	91	1
465002 LAUFRAD JP5 MOD.D 6 SCHAUFELN	49	1
465031 EJEKTOR JP5 STANDARDAUSF.	14	1
96645028 Lock nut , YR M8 with Dry lube	67	1
Teilenr. Hydraulik-Kit JP6 96768185		
410026 SPANNSCHEIBE CR(N)4	66	1
465202 LAUFRAD JP6 MOD.D 10 SCHAUFELN	49	1
465208 EJEKTOR JP6	14	1
96645028 Lock nut , YR M8 with Dry lube	67	1
Teilenr. Spannbandsatz JP5/6 96957810		
465001 Spannband für Pumpenkappe JP5/6	92	1
00ID1569 MUTTER M6 A4 SELBSTSICHERND DIN 985	94	1
00ID6987 SCHRAUBE M6X30 A2 DIN 912	93	1

Jetpumpen

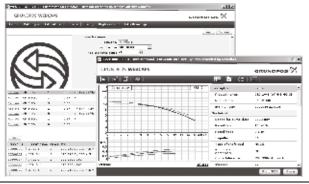


Auslegung



Über die verschiedenen Anwendungen und Installationsbeispiele kann der Anwender in diesem Abschnitt Schritt für Schritt

- die am besten geeignete und effizienteste Pumpe für seine Installation auswählen,
- weitergehende Berechnungen auf Basis des Energieverbrauchs, der Amortisationszeiten, der Belastungsprofile, Lebenszykluskosten, usw. durchführen,
- die Energieeffizienz der ausgewählten Pumpe mit Hilfe des integrierten Moduls zur Ermittlung der Lebenszykluskosten be-
- · die Strömungsgeschwindigkeit in Abwasseranwendungen er-



Austausch (



In diesem Abschnitt finden Sie die Austauschdaten von vorhandenen Pumpen, die Sie zum Auswählen und Vergleichen benötigen, um diese durch eine effizientere Grundfos-Pumpe zu ersetzen Dieser Abschnitt enthält auch Austauschdaten zu zahlreichen Produkten anderer Hersteller.

Durch das Programm Schritt für Schritt geführt, können Sie die Grundfos-Pumpen mit der installierten Pumpe vergleichen. Nachdem Sie die installierte Pumpe identifiziert haben, schlägt das Programm eine Reihe von Grundfos-Pumpen vor, deren Bedienkomfort und Effizienz erheblich größer ist.



CAD-Zeichnungen (m)



Über diesen Abschnitt können Sie zweidimensionale (2D-) und dreidimensionale (3D-) Zeichnungen von den meisten Grundfos-Pumpen herunterladen.

Folgende Formate sind in WebCAPS verfügbar:

2D-Zeichnungen:

- .dxf, Strichzeichnungen
- · .dwg, Strichzeichnungen.

3D-Zeichnungen:

- · .dwg, Drahtmodelle (ohne Oberflächen)
- .stp, Volumenmodelle (mit Oberflächen)
- · .eprt, E-Zeichnungen.

WinCAPS



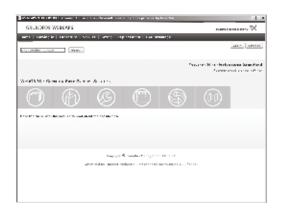
Abb. 1 WinCAPS CD-ROM

WinCAPS (Windows-based Computer Aided Product Selection) ist ein Pumpen-Auslegungsprogramm, das Informationen zu mehr als 185.000 Grundfos-Produkten in mehr als 20 Sprachen enthält.

Das Programm verfügt über die selben Funktionen wie WebCAPS und ist die ideale Lösung, falls kein Internetanschluss verfügbar ist.

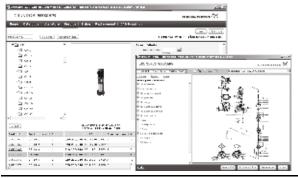
WinCAPS ist auf CD-ROM erhältlich und wird einmal im Jahr aktualisiert.

WebCAPS



general action in the section in the





WebCAPS (Web-based Computer Aided Product Selection) ist ein modernes Pumpen-Auslegungsprogramm, das über unsere Website www.grundfos.de verfügbar ist.

WebCAPS enthält umfassende Informationen zu mehr als 185.000 Grundfos-Produkten in mehr als 20 Spra-

Die in WebCAPS verfügbaren Informationen zu unserem Produktprogramm sind in 6 verschiedene Abschnitte untergliedert:

- Katalog
- Unterlagen
- Service
- Auslegung
- Austausch
- CAD-Zeichnungen.

Katalog (

Über die Anwendungen und Pumpentypen gelangt der Anwender zu den in diesem Abschnitt bereitgestellten Informationen, wie z.B.

- · Technische Daten
- Kennlinien (QH, Eta, P1, P2, etc), die an die Dichte und Viskosität des Fördermediums angepasst werden können und auch die Anzahl der in Betrieb befindlichen Pumpen anzeigen
- Produktabbildungen
- Massskizzen
- Schaltpläne
- Ausschreibungstexte, usw.

Unterlagen (



Über diesen Abschnitt erhalten Sie Zugang zur aktuellen Dokumentation einer bestimmten Pumpe, wie z.B.

- Datenhefte
- · Montage- und Bedienungsanleitungen
- · Service-Unterlagen, wie z.B. Kataloge und Anleitungen zu Service-Kits
- schnelle Auswahlhilfen
- · Prospekte, usw.

Service (3)

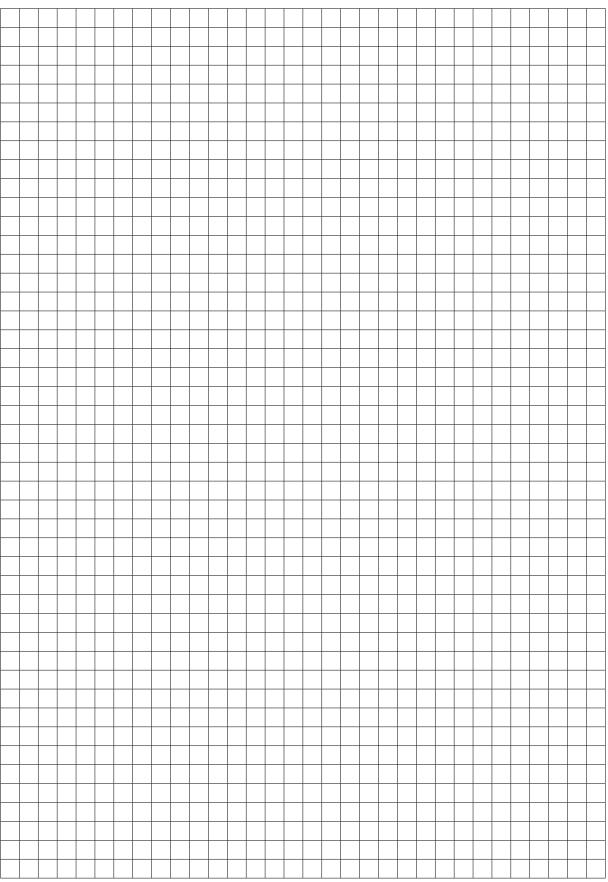


Dieser Abschnitt beinhaltet einen einfach zu nutzenden, interaktiven Service-Katalog. Hier finden Sie Ersatzteile für aktuelle und frühere

Weiterhin enthält dieser Abschnitt Service-Videos, die den Austauch von Ersatzteilen zeigen.

Notizen

Für Ihre Notizen



GRUNDFOS ALPHA

Umwälzpumpen

GRUNDFOS ALPHA Umwälzpumpen zur Förderung von Medien in Heizungsanlagen und Brauchwasseranlagen.

Maximaler Betriebsdruck: 10 bar

Mediumstemperaturen: +2°C bis +110°C

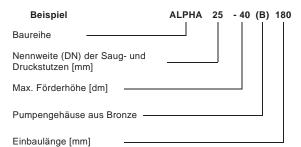
50 Hz



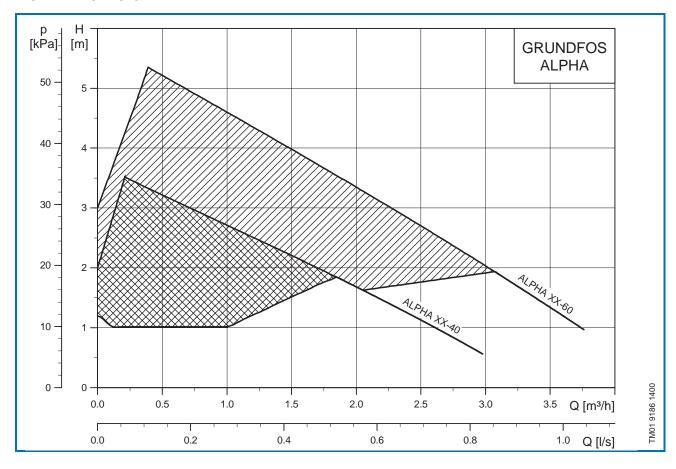
Umwälzpumpen

GRUNDFOS ALPHA ist eine komplette Reihe von Umwälzpumpen mit integrierter Differenzdruckregelung, die eine Anpassung der Pumpenleistung an den tatsächlichen Bedarf der Anlage ermöglicht. In vielen Anlagen bewirkt dies eine wesentliche Energieeinsparung, eine Reduktion der Strömungsgeräusche in Ventilen u.ä. sowie eine bessere Regelung der Anlage.

Typenschlüssel



Kennlinienfeld



Fördermedien

Reine, dünnflüssige, nicht aggressive und nicht explosive Medien ohne feste oder langfaserige Bestandteile sowie Beimengungen von mineralischen Ölen.

Die Pumpe darf **nicht** für die Förderung von feuergefährlichen Medien wie z.B. Dieselöl und Brennstoff eingesetzt werden.

Medientemperatur

Graugußpumpen: +2°C bis +110°C

Bronzepumpen: Dauerbetrieb: +15°C bis +60°C.

Zur Verhinderung von Kondenswasserbildung im Klemmenkasten und im Stator muß die Medientemperatur immer höher als die Umgebungstemperatur sein. Siehe nachstehende Tabelle:

Umgebungstemperatur [°C]	Mediente	emperatur
Onigebungstemperatur [C]	Min. [°C]	Max. [°C]
0	2	110
10	10	110
20	20	110
30	30	110
35	35	90
40	40	70
60*	60*	70*

^{*} Bei diesen Temperaturen ist mit einer reduzierten Lebensdauer der Pumpe zu rechnen.

Systemdruck

PN 10: Max. 1,0 MPa (10 bar).

Eintrittsdruck

Um Kavitationsgeräusche und Beschädigung der Pumpenlager zu vermeiden, sind an der Ansaugöffnung der Pumpe die folgenden minimalen Drücke erforderlich:

Medientemperatur								
75°C	75°C 90°C 110°C							
mWS	mWS	mWS						
0,5	2,8	11,0						

Elektrische Daten

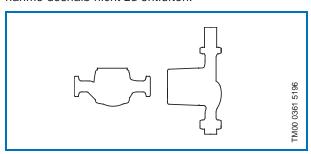
Versorgungsspannung:	1 x 230 V +6%/-10%,50 Hz, PE.
Motorschutz:	Ein externer Motorschutz ist nicht erforderlich.
Schutzart:	IP 42.
Wärmeklasse:	F.
Relative Luftfeuchtigkeit:	Max. 95%.
Umgebungstemperatur:	0°C bis +40°C.
Temperaturklasse:	TF110 nach CEN 335-2-51.
EMV (elektromagnetische Verträglichkeit):	EN 50 081-1. EN 50 082-1.
Schalldruckpegel:	≤ 43 dB(A).

Einbau

Die Pumpe muss immer mit horizontaler Motorwelle eingebaut werden.

Vor der Inbetriebnahme muß die Anlage mit dem Fördermedium aufgefüllt und entlüftet werden. Weiterhin muß der erforderliche Zulaufdruck am Saugstutzen der Pumpe vorhanden sein. Die Anlage kann nicht durch die Pumpe entlüftet werden.

Die Pumpe ist selbstentlüftend und bei der Inbetriebnahme deshalb nicht zu entlüften.



Anwendungen

GRUNDFOS ALPHA sind Pumpen zur Förderung von Medien in Heizungsanlagen. Pumpen mit Bronzegehäuse können weiterhin in Brauchwasseranlagen eingesetzt werden.

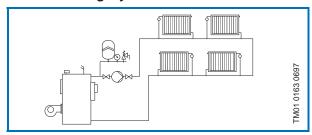
GRUNDFOS ALPHA eignet sich zur Verwendung in:

- Anlagen mit konstanten oder variablen Förderströmen, in denen eine optimale Einstellung des Betriebspunktes gewünscht wird.
- Anlagen mit variablen Vorlauftemperaturen.

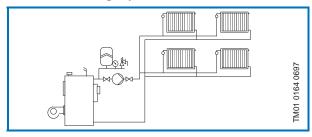
GRUNDFOS ALPHA eignet sich besonders für:

- Einbau in bestehenden Anlagen, in welchen der Differenzdruck der bestehenden Pumpe bei abnehmendem Förderstrom zu hoch ist.
- Einbau in neuen Anlagen, wo eine vollautomatische Anpassung des Förderstroms ohne kostspielige Bypassventile und dergleichen erforderlich ist.
- Einbau in Anlagen mit einem Vorlauftemperaturregler und einem Gerät zur automatischen Steuerung der Umschaltung zwischen Normalbetrieb und Nachtabsenkung.

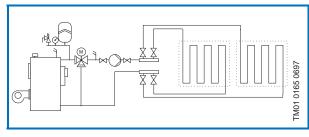
Einrohrheizungssystem



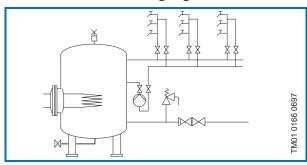
Zweirohrheizungssystem



Bodenheizungssystem



Hauswarmwasserversorgung



Regelung von Heizungssystemen

Der Heizbedarf eines Gebäudes schwankt im Lauf des Tages zufolge veränderlicher Aussentemperaturen, Sonneneinstrahlung und Wärmeabgabe von Personen, Elektroapparaten, usw., beträchtlich.

Zudem kann eine unterschiedliche Heizung in verschiedenen Gebäudeabschnitten erforderlich sein und es kommt vor, dass die thermostatischen Regelventile einiger Radiatoren von den Benutzern tiefer eingestellt werden.

Diese Umstände können dazu führen, dass eine ungeregelte Pumpe bei niedrigem Heizbedarf einen zu hohen Differenzdruck erzeugt. Mögliche Folgen sind:

- zu hoher Energieverbrauch,
- · unregelmässige Regelung des Systems,
- Geräusche in thermostatischen Ventilen und ähnlichen Armaturen.

Die GRUNDFOS ALPHA regelt den Differenzdruck automatisch durch Anpassen der Pumpenleistung an den tatsächlichen Heizbedarf, ohne dass dazu äussere Komponenten nötig sind.

GRUNDFOS ALPHA bietet eine Vielzahl von Vorteilen:

Energieersparnis Automatische Regelung von dem

Differenzdruck.

Flexibilität Für den Einbau in bestehende

Systeme geeignet.

Komfort Geräuscharmer Betrieb. Unver-

zügliche Umstellung auf Maximalkurvenbetrieb im Zusammenhang

mit Warmwasserpriorität.

Sicherheit Eingebauter elektrischer und ther-

mischer Pumpenschutz.

Benutzer-

freundlichkeit Einfache Bedienung und Einstel-

lung.

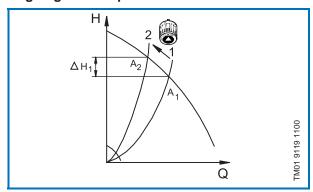
Vorteile der Pumpenregelung

GRUNDFOS ALPHA regelt durch Anpassung des Differenzdruckes an den Förderstrom (Proportionaldruckregelung).

Im Gegensatz zu einer ungeregelten Pumpe reduziert die GRUNDFOS ALPHA bei Proportionaldruckregelung den Differenzdruck, wenn der Leistungsbedarf sinkt.

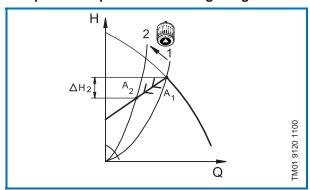
Bei sinkendem Wärmebedarf (z.B. bei Sonneneinstrahlung) schließen die Thermostatventile und der Strömungswiderstand der Anlage steigt z.B. von A1 auf A2. Bei einer ungeregelten Pumpe würde dies eine Druckerhöhung in der Anlage von ΔH1 bewirken.

Ungeregelte Pumpe



Bei einer GRUNDFOS ALPHA wird es eine Druckabsenkung von $\Delta H2$ bewirken.

Pumpe mit Proportionaldruckregelung



In einer Anlage mit einer ungeregelten Pumpe kann eine Druckerhöhung oft Strömungsgeräusche in den Thermostatventilen verursachen. Diese Tendenz wird mit der GRUNDFOS ALPHA wesentlich vermindert.

Automatische Nachtabsenkung

Wenn die Nachtabsenkungsautomatik eingeschaltet ist, schaltet die Pumpe in Abhängigkeit der Nachtabsenkung der Heizungsanlage auf die min. Kennlinie um. Wenn die Nachtabsenkungsperiode aufgehört hat, schaltet die Pumpe auf Normalbetrieb zurück.

Die Umschaltung der Anlage zwischen Normalbetrieb und Nachtabsenkung wird durch Messung der Vorlauftemperatur mit Hilfe eines integrierten Temperatursensors erfaßt.

Die automatische Umschaltung auf Nachtabsenkung wird durch fallende Vorlauftemperatur ausgelöst. Sie erfolgt, wenn der Temperatursensor einen Temperaturrückgang von 10±5°C. erfaßt.

Um immer eine ausreichende Pumpenleistung sicherzustellen, erfolgt die Umschaltung mit einer gewissen Verzögerung - typisch um 30 Minuten bis 2 Stunden. Die Umschaltung auf Normalbetrieb erfolgt ohne Verzögerung, wenn die Temperatur um 5°C gestiegen ist

Einstellung der Förderhöhe

Die Regelung der Pumpe erfolgt elektronisch und läßt sich mit Hilfe eines Umschalters auf 5 verschiedene Proportionaldruckkennlinien einstellen. Der Umschalter befindet sich außen am Klemmenkasten.

Werkseitige Einstellung

Der Wahlschalter auf dem Pumpen-Klemmenkasten steht werkseitig:

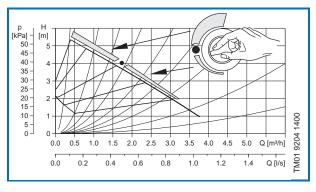
- in Mittelstellung
- die automatische Nachtabsenkung ist nicht aktiv.

Diese Einstellung eignet sich für 80-90% aller Einfamilienhäuser.

Änderung der Einstellung

Zur Änderung der Förderhöhe wird der Umschalter am Klemmenkasten gemäß der folgenden Tabelle gedreht:

Richtung	Ergebnis	Wird z.B. in den folgenden Fällen verwendet
Links	Die Förderhöhe wird reduziert.	Geräusche in der Anlage.
Recht	Die Förderhöhe wird vergrößert.	kalte Heizkörper in einigen Räumen des Gebäudes.



Aktivierung der automatischen Nachtabsenkung

Zur Aktivierung der automatischen Nachtabsenkung wird der Knopf an der Unterseite des Klemmenkastens in Stellung 👺 gedreht.

Konstruktion

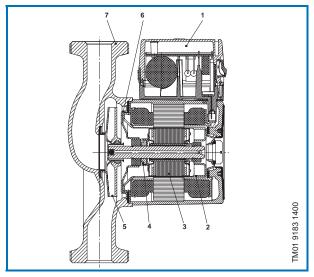
Die Pumpen der Baureihe GRUNDFOS ALPHA sind nach dem Naßläuferprinzip aufgebaut, d.h. Pumpe und Motor bilden eine integrierte Einheit ohne Wellenabdichtung mit nur zwei Dichtungen. Die Lager werden vom Fördermedium geschmiert.

Die mechanische Konstruktion basiert auf der Baureihe UP Serie 100.

Die Pumpe hat folgende Merkmale:

- · integrierte Proportionaldruckregelung
- · Welle und Radiallager aus Keramik
- · Axiallager aus Kohle
- Spaltrohr, Lagerplatte und Rotorkappe aus nichtrostendem Stahl
- Laufrad aus Compositwerkstoff
- · Pumpengehäuse aus Grauguß oder Bronze.

Schnittzeichnung



Materialspezifikation

Pos.	Bestandteil	Material	DIN WNr.	AISI/ASTM
1	Steuereinheit komplett			
2	Spaltrohr	Nichtrostender Stahl	1.4301	304
_	Radiallager	Keramik		
	Welle	Keramik		
3	Rotorkappe Nichtrostender Stahl		1.4301	304
	Stopring	Compositwerkstoff, PES		
	Axiallager	Kohle		
4	Halter für Axiallager	Nichtrostender Stahl/ EPDM Gummi		
5	Laufrad	Compositwerkstoff, PES		
6	Lagerplatte	Nichtrostender Stahl	1.4301	304
7	Pumpen- gehäuse	Grauguß GG 15/20 Bronze	0.6020 2.1176.01	ASTM 30 B
	Dichtungen	EPDM Gummi		

Motor und Klemmenkasten

Der Motor ist ein 2-poliger Asynchron-Kurzschlußläufermotor mit Funkschutz nach VDE 0875. Der Klemmenkasten und die Motor-Pumpeneinheit sind gemäß VDE 0700 geprüft.

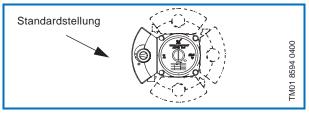
Der Motor der GRUNDFOS ALPHA ist impedanzgeschützt und benötigt deshalb keinen externen Motorschutz.

Die Steuereinheit der Pumpe ist im Klemmenkasten plaziert, der mit einem Umschalter und einer Meldeleuchte versehen ist. Die Meldeleuchte leuchtet, wenn die Pumpe unter Spannung steht.

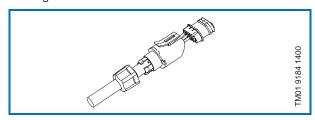
Die Steuereinheit entspricht EN 50 082-1 und EN 50 081-1.

Der Klemmenkasten ist durch Schrauben am Statorgehäuse befestigt und durch einen Terminalstecker mit dem Stator verbunden.

Der Motorkopf mit Klemmenkasten kann grundsätzlich in die folgende gezeigten Stellungen installiert werden:



Die Kabelverschraubung ist mit eingebauter Kabelentlastung versehen.



Kennlinienbedingungen

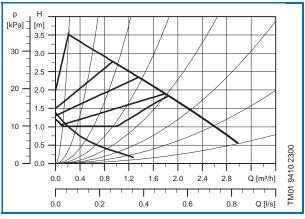
Für die Kennlinien der Datenblätter gilt folgendes:

- 1. Die fettgedruckten Teile der Kennlinien geben den **empfohlenen** Leistungsbereich an.
- 2. Medium: Luftfreies Wasser.
- 3. Die Kennlinien gelten für eine Dichte von ρ = 983,2 kg/m³ und einer Medientemperatur von 60°C.
- Alle Kennlinien geben Mittelwerte an und dürfen nicht als Garantiekurven verwendet werden.
 Falls angegebene Mindestleistungen erforderlich sind, müssen individuelle Messungen vorgenommen werden.
- 5. Die Kennlinien gelten für eine kinematische Zähigkeit von υ = 0,474 mm²/s (0.474 cSt).
- Die Umrechnung zwischen Förderhöhe H (m) und Druck p [kPa] gilt für Wasser mit einer Dichte von 1000 kg/m³. Bei einer vom Wasser abweichenden Dichte, z.B. heißes Wasser, ist der gelieferte Druck mit der Dichte proportional.

ALPHA 25-40, 32-40

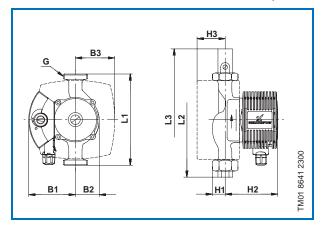


1 x 230 V, 50 Hz



	P ₁ [W]	I _n [A]
Min.	25	0,19
Max.	60	0,28

Der Motor ist gegen thermische Überlast geschützt.



Anschlüsse: Siehe "Verbindungs- und Ventilbausätze"

Seite 10.

Systemdruck: Max. 10 bar.

Medientemperatur: +2°C bis +110°C (TF 110).

Auch erhältlich als: Bronze-Gehäuse, Typ B.

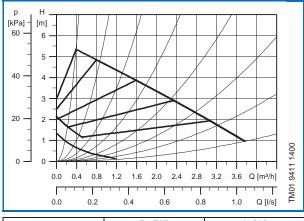
	_		Masse [mm]								Gewic	ht [kg]*	Versand-	
	Pumpentyp	L1	L2	L3	H1	H2	Н3	B1	B2	В3	G	Netto	Brutto	volumen [m³]
Α	LPHA 25-40	180	236	290	32	103	57	92	51	77	1½	2,6	3,0	0,00432
Α	LPHA 32-40	180	244	302	39	103	57	92	51	77	2	2,7	3,1	0,00432

^{*} Gewicht für Bronze-Ausführungen ist ca. 10% höher.

ALPHA 25-60, 32-60

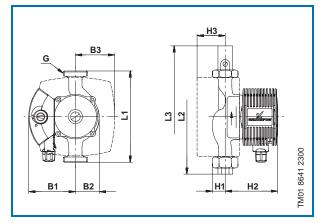
180

1 x 230 V, 50 Hz



	P ₁ [W]	I _n [A]
Min.	35	0,21
Max.	90	0,40

Der Motor ist gegen thermische Überlast geschützt.



Anschlüsse: Siehe "Verbindungs- und Ventilbausätze"

Systemdruck: Max. 10 bar.

Medientemperatur: +2°C bis +110°C (TF 110).

Auch erhältlich als: Bronze-Gehäuse, Typ B.

_		Masse [mm]								Gewicht [kg]*			Versand-
Pumpentyp	L1	L2	L3	H1	H2	Н3	B1	B2	В3	G	Netto	Brutto	volumen [m³]
ALPHA 25-60	180	236	290	32	103	57	92	51	77	1½	2,6	3,0	0,00432
ALPHA 32-60	180	244	302	39	103	57	92	51	77	2	2,7	3,1	0,00432

^{*} Gewicht für Bronze-Ausführungen ist ca. 10% höher.

Verbindungs- und Ventilbausätze

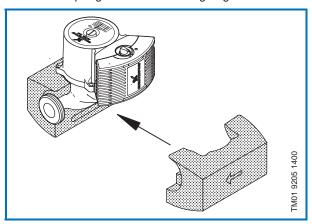
Pumpentyp	Bezeichnung	Material	Produkt- nummer
	3/4" Verbindung	Grauguß	52 99 21
ALPHA 25-40,	1" Verbindung	Grauguß	52 99 22
25-60,	¾" Ventile	MS	51 98 05
	1" Ventile	MS	51 98 06
	3/4" Verbindung	MS	52 99 21
ALPHA 25-40B,	1" Verbindung	Bronze	52 99 72
25-60 B	¾" Ventile	MS	51 98 05
	1" Ventile	MS	51 98 06
ALPHA 32-40,	1" Verbindung	Grauguß	50 99 21
32-60	11/4" Verbindung	Grauguß	50 99 22

Isolationsbausätze

GRUNDFOS ALPHA können mit zwei Isolationsschalen ausgerüstet werden.

Die Isolationsdicke des Isolationsbausatzes entspricht dem Nenndurchmesser der Pumpe.

Der Isolationsbausatz ist genau an den einzelnen Pumpentyp angepasst und umschliesst das ganze Pumpengehäuse. Die beiden Schalen können einfach um das Pumpengehäuse herum angelegt werden.



Pumpentyp	Produktnummer
ALPHA 25-40, 32-40, 25-60, 32-60	50 58 21

V7 16 29 14 08 00 D

Technische Änderungen vorbehalten.



Fax: + 01-806 81 15

http://www.grundfos.com



Serie 2000

Umwälzpumpen

Grundfos-MAGNA-Umwälzpumpen der UPE-Serie 2000 und TPE-Serie 2000 zur Umwälzung von Flüssigkeiten in Heizanlagen, Brauchwarmwasseranlagen und Klimaanlagen.

Maximaler Anlagendruck: 16 bar

Flüssigkeitstemperatur: -25°C bis +140°C.



Inhaltverzeichnis

Allgemeine Daten

Serie 2000	Seite	4
Anwendungen	Seite	4
Auswahl von Pumpen der Serie 2000	Seite	5
Leistungsbereich	Seite	6
Produktpalette	Seite	8
Betriebsbedingungen	Seite	9
Elektrische Daten	Seite	10
Typenschlüssel	Seite	10

Funktionen

Tabelle: Funktionen	Seite	12
Steuerungsarten (Werkseinstellung)	Seite	13
Zusätzliche Steuerungs- und Betriebsarten	Seite	14
Anzeigen und Einstellungen an der Pumpe	Seite	15
Datenaustausch	Seite	15

Konstruktion

Serie 2000	Seite	18
Werkstoffe	Seite	19

Einbau

Mechanischer Einbau	Seite	20
Elektrischer Anschluss	Seite	20
Kabel	Seite	20
Anschlussbeispiele	Seite	24

Technische Daten

Kurvenbedingungen	Seite	25
UPE xx-40	Seite	26
UPE xx-80	Seite	28
MAGNA UPE xx-120 F	Seite	30
MAGNA UPE 50-60 F	Seite	32
UPE 50-120 F	Seite	33
MAGNA UPE 65-60 F	Seite	34
UPE xx-120 F	Seite	35
UPE 100-60 F	Seite	37
TPE xx-60	Seite	38
TPE xx-120	Seite	43
TPE xx-180	Seite	49
TPE xx-240	Seite	55

Zubehör

Seite 60

Bestelldaten

UPE-Serie 2000, Gusseisenausführung	Seite	65
UPE-Serie 2000, Bronzeausführung	Seite	65
TPE-Serie 2000	Seite	66

Serie 2000

Merkmale

- Proportionaldruck
- Konstantdruck
- · Betrieb bei Maximal- oder Minimalkurve
- · Parallelanschluss der Pumpen mittels PMU
- Kein externer Motorschutz f
 ür die Pumpen erforderlich.

Vorteile

- Energiesparend
- Geräuscharm
- Sichere Auswahl
- · Einfacher Einbau.

Anwendungen

Heizanlagen

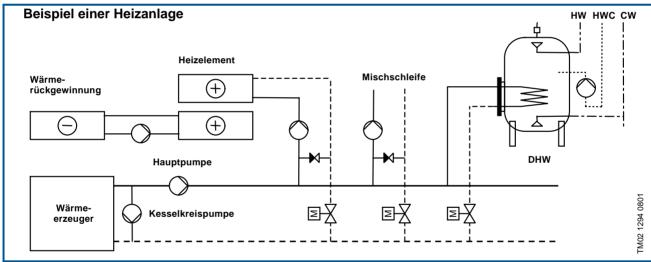
Hauptpumpe	Kesselkreis- pumpen	Mischschleifen	Heizflächen	Wärmerück- gewinnung	BWW-Umwälzung	BWW-Erzeugung
•		•	•			
•		•	•	•		
O	O			0	O	O
	•	•	• •	• • •	• • • •	• • • •

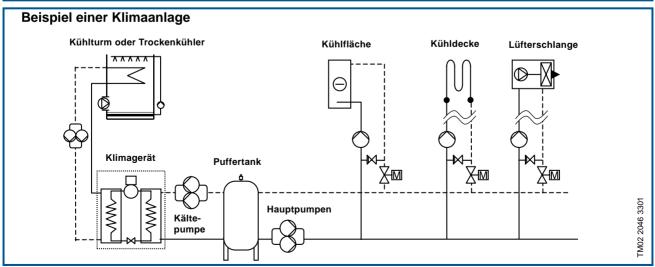
O Siehe separates Datenheft.

Klimaanlagen

Pumpentypen/Anlagen	Kältepumpen	Kühltürme	Trockenkühler	Hauptpumpe	Kühlflächen	Kühldecken	Lüfterschlangen
UPE/MAGNA Serie 2000							
TPE Serie 2000				•		•	•
TPE, LME, LPE, CLME	O	O	O	O	0	O	O

O Siehe separates Datenheft.





Auswahl von Pumpen der Serie 2000

Pumpengröße

Die Pumpengröße sollte auf folgender Grundlage ausgewählt werden:

- · Erforderlicher maximaler Fluss
- · Maximale Verlusthöhe in der Anlage.

Betriebsbedingungen

Es sollte überprüft werden, ob die Betriebsbedingungen erfüllt werden.

Die auf Seite 9 angegebenen Grenzwerte dürfen hinsichtlich folgender Parameter nicht überschritten werden:

- Flüssigkeitstemperatur und Umgebungsbedingungen
- Minimaler Eingangsdruck
- · Maximaler Betriebsdruck.

Wellendichtung

Die TPE-Reihe ist mit einer Grundfos-Wellendichtung ausgestattet.

Bei der Auswahl der Wellendichtung müssen die folgenden drei Schlüsselparameter berücksichtigt werden:

- Typ der Förderflüssigkeit
- Flüssigkeitstemperatur
- · Maximaler Druck.

Grundfos bietet eine breite Palette an Wellendichtungsvarianten für besondere Anforderungen (siehe "Flüssigkeitstemperatur", Seite 9).

Datenaustausch

Die Anforderungen für externe Steuerung oder Überwachung der Pumpe sollten in Betracht gezogen werden, wie z.B. Zugang zu folgenden Punkten

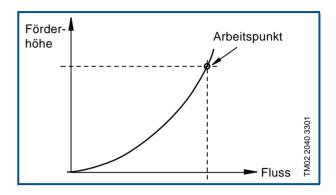
- Geschwindigkeitssteuerung der Pumpe oder Änderung des Sollwertes
- Anzeige der Pumpendaten
- Start/Stop, Fehleranzeige oder Zwangssteuerung auf die Maximal- oder Minimalkurve.

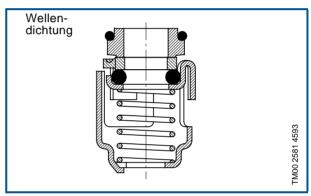
Hinweis: Die Möglichkeiten des Datenaustausches hängen vom Pumpentyp ab.

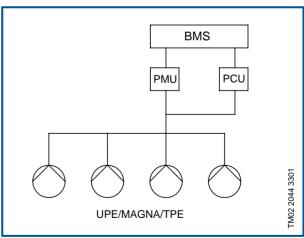
Steuerungsart

Allgemein empfiehlt Grundfos folgendes:

- Die Werkseinstellung eignet sich für die meisten Installationen.
- Proportionaldrucksteuerung in Anlagen mit relativ großen Verlusthöhen.
- Konstantdrucksteuerung in Anlagen mit relativ kleinen Verlusthöhen.







UPE-Serie 2000

Die Produkte der UPE-Serie 2000 sind insbesondere bestimmt für:

- Heizanlagen von bis zu 2100 kW ($\Delta t = 20$ °C)
- Brauchwarmwasseranlagen (Pumpengehäuse in Bronzeausführung).

Lastbereich

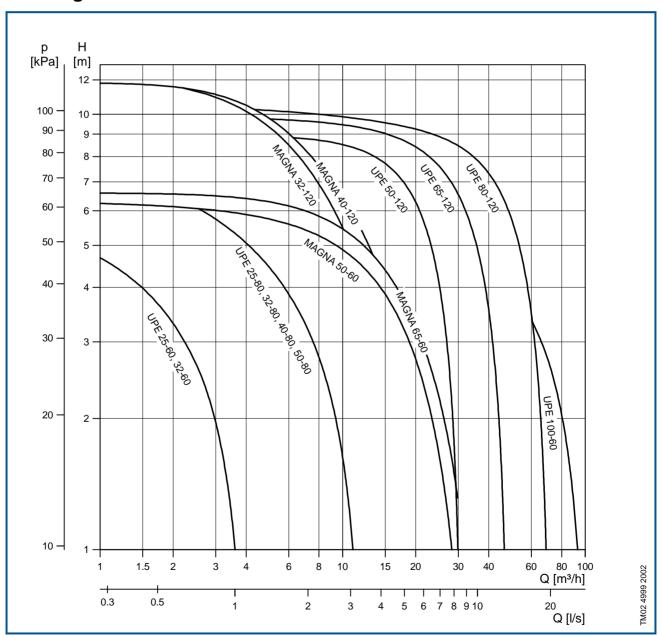
Max. Anlagendruck: 10 bar.

Flüssigkeitstemperatur: +15°C bis +110°C.

Max. Fluss Q: 90 m³/h. Max. Förderhöhe H: 12 m.



Leistungsbereich



TPE-Serie 2000

Die Produkte der TPE-Serie 2000 sind insbesondere bestimmt für:

- Heizanlagen von bis zu 3000 kW (Δt = 20°C),
- · Brauchwarmwasseranlagen
- Klimaanlagen von bis zu 750 kW ($\Delta t = 5$ °C).

Lastbereich

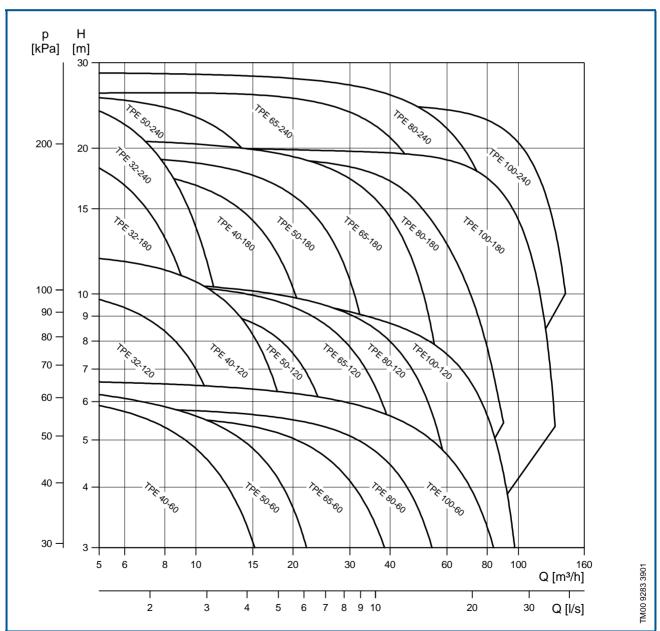
Max. Anlagendruck: 16 bar.

Flüssigkeitstemperatur: -25°C bis +140°C.

Max. Fluss Q: 130 m³/h. Max. Förderhöhe H: 28 m.



Leistungsbereich



Produktpalette

	Versorgung	jsspannung	Länge von	Rohi	Rohranschluss			Flansch	anschluss	
Pumpentyp	1 x 230-240 V	3 x 400-415 V	Öffnung zu Öffnung [mm]	1"	1½"	2"	PN 6/PN 10	PN 6	PN 10	PN 16
UPE 25-40 (B)	•		180		•					
UPE 25-40 A	•		180		•					
UPE 32-40	•		180			•				
UPE 25-60 (B)	•		180		•					
UPE 25-60 A	•		180		•					
UPE 32-60	•		180			•				
UPE 25-80	•		180		•					
UPE 32-80 (B)	•		180			•				
UPE 32-80 F (B)	•		220				•			
UPE 40-80 F (B)	•		250				•			
UPE 50-80 F	•		280				•			
MAGNA UPE(D) 32-120 F (B)	•		220				•			
MAGNA UPE(D) 40-120 F (B)	•		250				•			
MAGNA UPE(D) 50-60 F (B)	•		280				•			
UPE(D) 50-120 F (B)		•	280				•			
MAGNA UPE(D) 65-60 F (B)	•		340				•			
UPE(D) 65-120 F (B)		•	340				•			
UPE(D) 80-120 F (B)		•	360					•	•	
UPE(D) 100-60 F (B)		•	450					•	•	
TPE 40-60	•		250				•			
TPE 50-60	•		280				•			
TPE 65-60	•		340					•	•	
TPE 80-60	•		360					•	•	
TPE 100-60		•	450					•	•	
TPE 32-120	•		220				•			
TPE 40-120	•		250				•			
TPE 50-120	•		280				•			
TPE 65-120	•		340				•			
TPE 80-120		•	360					•	•	
TPE 100-120		•	450					•	•	
TPE 32-180	•		280				•			
TPE 40-180	•		250				•			
TPE 50-180		•	280				•			
TPE 65-180		•	340				•			
TPE 80-180		•	525							•
TPE 100-180		•	550							•
TPE 32-240	•		280				•			
TPE 50-240		•	425							•
TPE 65-240		•	475							•
TPE 80-240		•	525							•
TPE 100-240		•	550							•

Betriebsbedingungen

Förderflüssigkeiten

Saubere, dünne, nicht-aggressive, nicht-explosive Flüssigkeiten, die keine Festpartikel, Fasern oder Mineralöl enthalten.

Ob sich eine Pumpe für eine bestimmte Flüssigkeit eignet, hängt von einer ganzen Reihe von Faktoren ab, z.B. Kalkgehalt, pH-Wert, Temperatur und Anteil an Lösungsmitteln, Ölen usw.

Allgemeine Empfehlungen

	UPE-Serie 2000	TPE-Serie 2000		
Wasser in Heizanlagen	Wasserqualität gemäß vor Ort gültiger Standards, wie z.B. deutsche Norm VDI 20			
Brauchwarmwasser	Härtegrad bis 14 d°H			
Glykolhaltiges Wasser	Viskosität ≤ 10 mm²/s			

Flüssigkeitstemperatur

UPE-Serie 2000						
Maximaler Betriebsbereich						
Pumpen im allgemeinen Kurzzeitig: Max. +110°C Langzeitig: +15°C bis +95°C						
Pumpen in Brauchwarm- wasseranlagen	Langzeitig: +15°C bis +60°C					

Um ein Kondensieren im Klemmenkasten und im Stator der UPE-Serie 2000 zu vermeiden, muss die Flüssigkeitstemperatur grundsätzlich höher sein als die Umgebungstemperatur.

TPE-Serie 2000						
Typ Wellen- dichtung	Werkstoff Gummi- teile		Maximaler Betriebsbereich			
BUBE/BBUE	Wolframkarbid (U) / Kohlenstoff (B)		0°C bis +140°C*			
AUUE	Wolframkarbid (U) / Worlframkarbid (U)	EPDM (E) FKM (V)	0°C bis +90°C			
RUUE	Wolframkarbid (U) / Worlframkarbid (U)		-25°C bis +90°C**			

^{*} Ein Betrieb bei Temperaturen im Bereich von +120 °C bis +140 °C verkürzt die Lebensdauer der Wellendichtung.

Die Wellendichtung muss abhängig von der Flüssigkeitstemperatur und dem Flüssigkeitstyp ausgewählt werden.

Bei anderen Flüssigkeiten als Wasser muss die Chemikalienbeständigkeit der Werkstoffe, einschließlich Dichtungsfläche, Sitz und Gummibestandteile der Wellendichtung, berücksichtigt werden.

Auf Anfrage sind TPE-Pumpen mit ölbeständigen Gummiteilen erhältlich.

Umgebungsbedingungen

Umgebungstemperatur im Betrieb:

UPE-Serie 2000: 0°C bis +40°C. TPE-Serie 2000: -20°C bis +40°C.

Umgebungstemperatur bei

Lagerung/Transport: -40°C bis +60°C. Relative Luftfeuchtigkeit: Maximal 95%.

Max. Betriebsdruck

UPE-Serie 2000: 10 bar

TPE xx-60, TPE xx-120,

TPE 32-180, 40-180, 50-180, 65-180,

TPE 32-240: 10 bar

TPE 80-180, 100-180,

TPE 50-240, 65-240, 80-240, 100-240: 16 bar.

Min. Eingangsdruck

Im Betrieb müssen die folgenden relativen Mindestdrücke am Pumpeneingang vorhanden sein:

	Flüssigkeitstemperatur			
Pumpentyp	20°C	75°C	90°C	120°C
	Eingangsdruck H [bar]			ar]
UPE 25-40, 25-60, 32-60, 25-80, 32-40, 32-80 (F), 40-80 F, 50-80 F		0,05	0,28	
MAGNA UPE(D) 32-120 F MAGNA UPE(D) 40-120 F MAGNA UPE(D) 50-60 F		0,15	0,45	
UPE(D) 50-120 F		0,40	0,70	
MAGNA UPE(D) 65-60 F		0,15	0,45	
UPE(D) 65-120 F		0,90	1,20	
UPE(D) 80-120 F		1,60	1,90	
UPE(D) 100-60 F		0,95	1,25	
TPE 40-60	0,05	0,15	0,45	1,75
TPE 50-60	0,05	0,05	0,35	1,65
TPE 65-60	0,20	0,55	0,85	2,10
TPE 80-60	0,85	1,20	1,50	2,75
TPE 100-60	0,60	0,95	1,25	2,55
TPE 32-120	0,15	0,50	0,80	2,10
TPE 40-120	0,05	0,30	0,70	2,00
TPE 50-120	0,20	0,55	0,85	2,15
TPE 65-120	0,55	0,90	1,20	2,45
TPE 80-120	1,25	1,60	1,90	3,15
TPE 100-120	1,90	2,25	2,55	3,85
TPE 32-180	0,00	0,10	0,42	1,73
TPE 40-180	0,50	0,85	1,15	2,45
TPE 50-180	0,40	0,75	1,05	2,35
TPE 65-180	0,90	1,25	1,55	2,85
TPE 80-180	0,20	0,55	0,85	2,15
TPE 100-180	0,10	0,45	0,75	2,05
TPE 32-240	0,00	0,10	0,42	1,73
TPE 50-240	0,00	0,35	0,65	1,95
TPE 65-240	0,00	0,35	0,65	1,95
TPE 80-240	0,30	0,65	0,95	2,25
TPE 100-240	0,40	0,75	1,05	2,35

Hinweis: Der tatsächliche Eingangsdruck + Pumpendruck gegen ein geschlossenes Ventil muss unter dem maximal zulässigen Anlagendruck liegen.

^{**} Glykolhaltiges Wasser.

Elektrische Daten

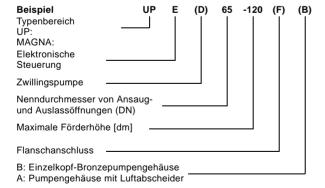
UPE-Serie 2000

UPE-Serie 2000	UPE 1~	MAGNA 1~	UPE, UPED 3~		
	1 x 230-240 V, -10%/+6%, 50 Hz	, PE.	3 x 400-415 V, -10%/+10%, 50 Hz, PE.		
Spannungsversorgung	Für die Pumpe ist kein externer Motorschutz erforderlich.				
Erdableitstrom	I _{ableit} < 3,5 mA Die Ableitströme werden gemäß I	bleit < 3,5 mA le Ableitströme werden gemäß EN-60 355-1 gemessen.			
EMC	EN 61 800-3.				
Gehäuseklasse	IP 42.	IP 42 (IEC85).	IP 42.		
Isolierstoffklasse	H.	F.	H.		
Schalldruckpegel	≤ 43 dB(A).	≤ 54 dB(A).	≤ 54 dB(A).		
Externer Start/Stop- Eingang	MC 40/60 und MC 80* MB 40/60 und MB 80*	Externer potentialfreier Schalter. Kontaktlast: Max. 5 V, 10 mA. Abgeschirmtes Kabel. Schleifenwiderstand: Maximum 130 Ω/km. Logische Pegel: Null: U < 1,5 V. Eins: U > 4,0 V.	Externer potentialfreier Schalter. Abgeschirmtes Kabel. Maximale Kontaktlast: 5 V/2,7 mA. Logische Pegel: Null: U < 1,5 V. Eins: U > 4,0 V.		
Sollwertsignale	MC 40/60 und MC 80* MB 40/60 und MB 80*	GENI-Modul*	Minimal- und Maximalkurveneingang Externer potentialfreier Schalter. Abgeschirmtes Kabel. Maximale Kontaktlast: 5 V/2,7 mA. Logische Pegel: Null: U < 1,5 V. Eins: U > 4,0 V. Eingang für Analogsignal, 0-10 V Externes Signal: 0-10 VDC. Max. Kontaktlast: 0,1 mA.		
Signalausgang	MC 40/60 und MC 80*	Potentialfreier Wechselkontakt. Max. Kontaktlast: 250 VAC, 2 A. Min. Kontaktlast: 5 VDC, 1 mA. Abgeschirmtes Kabel.	Interner potentialfreier Umschaltkontakt. Abgeschirmtes Kabel. Max. Kontaktlast: 250 VAC, 2 A. Min. Kontaktlast: 5 VDC, 1 mA.		
Buseingang	MB 40/60 und MB 80*	GENI-Modul* LON-Modul *	Grundfos-GENIbus-Protokoll,RS-485. Abgeschirmtes Kabel. Steigungsquerschnitt: 0,25 bis 1 mm². Kabellänge: max. 1200 m.		

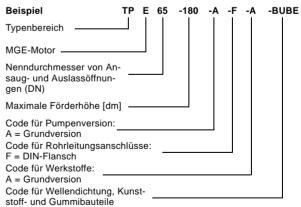
^{*} Erweiterungsmodule, siehe Seite 61 ff.

Typenschlüssel

UPE-Serie 2000



TPE-Serie 2000



Electrical data

TPE-Serie 2000

TPE-Serie 2000	TPE 1~		TPE 3∼	
Snannungevoreeraur	1 x 200-240 V -10%/+10%, 50-60 Hz, PE.	3 x 380-4	115 V -10%/+10%, 50-60 Hz,	PE.
Spannungsversorgung	Für die Pumpe ist kein externer Motorschutz erforderlich.			
		ı	Motorleistung [kW]	Ableitstrom [mA]
Erdableitstrom	Farth leakage current: L 3.5 mA		1,1 bis 3,0	< 3,5
	Earth leakage current: I _{ableit} < 3,5 mA. Die Ableitströme werden gemäß EN-60 355-1 gemessen.	4,0 to 5,5		< 5
		5,5	kW, 1400-1800 min ⁻¹	< 10
	EN 61 800-3.		7,5	< 10
EMV	Motoren mit 0,37 bis 5,5 kW: Elektromagnetische Störungen - Umgebung erster Klasse CISPR 11, Klasse B, Gruppe 1. Motoren mit 7,5 kW: Elektromagnetische Störungen - Umgebung erster Klasse Störfestigkeit gegen elektromagnetische Störungen - Umg Verbreitung, gemäß CISPR 11, Klasse A, Gruppe 1. Hinweis: Werden Pumpen mit 7,5-kW-Motoren in Umgebudes Zustands gemäß Klasse B, Gruppe 1, ein zusätzliche der Pumpe enthalten.	(Wohnge gebung zw ungen erst	biete) - eingeschränkte Verb veiter Klasse (Industriegebiet er Klasse (Wohngebiete) ein	reitung. e) - uneingeschränkte gebaut, ist zur Erzielung
Gehäuseklasse	Standard: IP 55. (IEC 34-5).			
Isolierstoffklasse	F (IEC 85).			
	V	Motor [kW]	Auf dem Typenschild angegebene Geschwindigkeit [min ⁻¹]	Schalldruckpegel [dB(A)]
		1,1	1400-1500	52
Ì		4.5	2800-3000	63
	≤ 70 dB(A).	1,5	3400-3600	68
Schalldruckpegel			2800-3000	64
		2,2	3400-3600	68
		3,0	2800-3000	64
		4,0	3400-3600	73
		5,5	2800-3000	68
		5,5	3400-3600	73
		7,5	2800-3000	74
Externer Start/Stop- Eingang	Externer potentialfreier Kontakt. Maximale Kontaktlast: Spannung 5 VDC, Strom < 5 mA. Abgeschirmtes Kabel. Externer potentialfreier Kontakt.			
Digitaleingang	Maximale Kontaktlast: Spannung 5 VDC, Strom < 5 mA. Abgeschirmtes Kabel.	T		
Sollwertsignale	 Potentiometer 0-10 VDC, 10 kΩ (über interne Spannungsversorgung). Abgeschirmtes Kabel. Maximale Kabellänge: 100 m. Spannungssignal 0-10 VDC, R_i > 50 kΩ. Toleranz: +0%/-3% bei maximalem Spannungssignal. Abgeschirmtes Kabel. Maximale Kabellänge: 500 m. Stromsignal DC 0-20 mA/4-20 mA, R_i = 175 Ω. Toleranz: +0%/-3% bei maximalem Stromsignal. Abgeschirmtes Kabel. Maximale Kabellänge: 500 m. 	 Potentiometer 0-5 VDC, 10 kΩ (via internal voltage supply). Abgeschirmtes Kabel. Maximale Kabellänge: 100 m. Spannungssignal 0-5 VDC/0-10 VDC, R_i > 50 kΩ. Toleranz: +0%/-3% bei maximalem Spannungssignal. Abgeschirmtes Kabel. Maximale Kabellänge: 500 m. Stromsignal DC 0-20 mA/4-20 mA, R_i = 250 Ω. Toleranz: +0%/-3% bei maximalem Stromsignal. Abgeschirmtes Kabel. Maximale Kabellänge: 500 m. 		
Signalausgang	Potentialfreier Umschaltkontakt. Maximale Kontaktlast: 250 V AC, 2 A. Minimale Kontaktlast: 5 V DC, 1 mA. Abgeschirmtes Kabel: 0,5-2,5 mm². Maximale Kabellänge: 500 m			
Buseingang	Grundfos-BUS-Protokoll, GENIbus-Protokoll, RS-485. Abgeschirmtes zweiadriges Kabel, 0,5-1,5 mm². Maximale Kabellänge: 500 m			

Tabelle: Funktionen

	UPE 1~	MAGNA 1~	UPE 3~	TPE 1~	TPE 3~
Steuerungsarten (Werkseinstellung)	l .		I	I	I
Proportionaldrucksteuerung	•		•	•	•
AUTO		•			
Zusätzliche Steuerungs- und Betriebsa	rten		•	•	•
Proportionaldrucksteuerung	•	•	•	•	•
Konstantdrucksteuerung	•	•	•	•	•
Konstantkurvenbetrieb	•	•	•	•	•
Betrieb bei Maximal- oder Minimalkurve	O	•	•	•	•
Automatischer Nachtbetrieb		•			
Zusätzliche Betriebsarten bei Zwillings	pumpen		•	•	•
Alternierender Betrieb		•	•		
Standby-Betrieb		•	•		
Anzeigen und Einstellungen an der Pun	npe		•	•	•
Betriebsanzeige	•	•	•	•	•
Flussanzeige		•			
Sollwert	•	•	•	•	•
Steuerungsmodus	•	•	•	•	•
Fehleranzeige	•	•	•	•	•
Datenaustausch	•		•	•	•
Drahtlose Fernsteuerung, R100	•	•	•	•	•
Externer Digitaleingang/Digitalausgang	O	•	•	•	•
Externer Analogeingang	0	0	•	•	•
BUS über GENIbus-Protokoll, RS-485	O	0	•	•	•
BUS über LonTalk®Protokoll, FTT 10	O*	0	*	*	*

Funktion integriert.
 Erweiterungsmodul erforderlich.
 \$\pm\$ G10-Lon-Schnittstelle erforderlich.

Steuerungsarten (Werkseinstellung)

Die Werkseinstellung der Pumpen ist wie folgt:

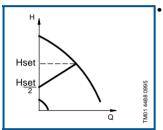
- · Proportionaldruck (UPE und TPE).
- · AUTO (MAGNA).

Der werkseitig voreingestellte Sollwert beträgt den halben Wert der maximalen Pumpenförderhöhe.

Die Werkseinstellung eignet sich für die meisten Installationen.

Proportionaldrucksteuerung

Die Pumpenförderhöhe wird kontinuierlich an die Anlagenwassererfordernisse angepasst.

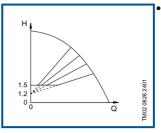


Die Förderhöhe gegen ein geschlossenes Ventil beträgt die Hälfte des Sollwertes.

Die Proportionaldrucksteuerung wird bei Anlagen mit relativ großen Verlusthöhen empfohlen.

AUTO

Im Betrieb reduziert die Pumpe automatisch den werkseitig eingestellten Sollwert und stellt ihn auf den tatsächlichen Kennwert der Anlage ein.



Hinweis: Der Sollwert kann manuell nicht verstellt werden.

Nach Aktivierung der Steuerungsart AUTO startet die Pumpe mit der eingestellten Förderhöhe entsprechend 50% der maximalen Förderhöhe (H_{set1}) und stellt dann die Leistung auf A_1 ein.

Erkennt die Pumpe einen niedrigeren Druck auf der Maximalkurve (A_2) , wird mit der Funktion AUTO automatisch eine entsprechend niedrigere Steuerungskurve ausgewählt (H_{set2}) . Wenn das Heizungsventil schließt, stellt die Pumpe die Leistung auf A_3 ein.

A₁: Ursprünglicher Arbeitspunkt.

A₂: Niedrigerer erkannter Druck auf der Maximal-

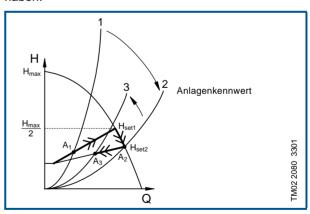
A₃: Neuer Arbeitspunkt nach AUTO-Steuerung.

H_{set1}: Ursprüngliche Sollwerteinstellung.

H_{set2}: Neuer Sollwert nach AUTO-Steuerung.

 $\frac{H_{\text{max}}}{2}$: Werkseinstellung.

Die Steuerungsart AUTO ist eine Proportionaldrucksteuerung, bei der die Steuerkurven einen festen Fuß haben.



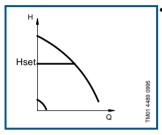
Zusätzliche Steuerungs- und Betriebsarten

Für spezielle Anforderungen bietet Grundfos zusätzliche Steuerungs- und Betriebsarten an.

Die verfügbaren Funktionen hängen vom Pumpentyp und vom gewählten Erweiterungsmodul ab (siehe "Tabelle: Funktionen" auf Seite 12).

Konstantdrucksteuerung

Die Pumpenförderhöhe bleibt konstant, unabhängig von den Wasseranforderungen.



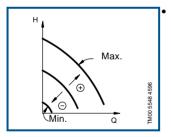
Konstantdruck.

Die Konstantdrucksteuerung wird bei Anlagen mit relativ geringen Verlusthöhen empfohlen.

Konstantkurvenbetrieb

Die Pumpe kann so eingestellt werden, dass sie wie eine ungesteuerte Pumpe gemäß einer Konstantkurve betrieben werden kann.

Ist ein externes Steuergerät eingebaut, kann die Pumpe, abhängig vom Wert des externen Signals, von einer Konstantkurve zu einer anderen Konstantkurve wechseln.

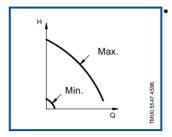


Konstante Pumpengeschwindigkeit zwischen Maximal- und Minimalkurve.

Für diese Funktion ist die R100 erforderlich.

Betrieb bei Maximal- oder Minimalkurve

Die Pumpe kann so eingestellt werden, dass sie wie eine ungesteuerte Pumpe gemäß der Maximal- oder Minimalkurve betrieben werden kann.



Konstante Pumpengeschwindigkeit bei Maximal- oder Minimalkurve.

Der Modus **Maximalkurve** ist zum Beispiel in folgenden Fällen geeignet:

 Entlüftung und Abgleich während der Installation oder in Zeiträumen mit sofortiger Brauchwarmwasserpriorität.

Der Modus **Minimalkurve** kann in folgenden Fällen eingesetzt werden:

 In Zeiträumen, die einen minimalen Fluss erfordern. Diese Betriebsart eignet sich zum Beispiel bei manuellem Nachtbetrieb.

Automatischer Nachtbetrieb

Nach Aktivierung des automatischen Nachtbetriebs schaltet die Pumpe automatisch zwischen Normalbetrieb und Nachtbetrieb um. Die Umschaltung zwischen Normalbetrieb und Nachtbetrieb geschieht abhängig von der Temperatur des Strömungsrohres ab, die von einem integrierten Temperaturfühler gemessen wird.

Die automatische Umschaltung auf Nachtbetrieb findet statt, wenn der Temperaturfühler einen Abfall in der Temperatur des Strömungsrohres von mehr als 10°C bis 15°C innerhalb von ca. 2 Stunden erkennt. Der erforderliche Temperaturabfall beträgt mindestens 0,1°C/min.

Die Umschaltung auf Normalbetrieb findet ohne Zeitverzögerung statt, wenn die Temperatur um ca. 10°C angestiegen ist.

Zusätzliche Betriebsarten bei Zwillingspumpen

Für Zwillingspumpen sind die folgenden Betriebsarten verfügbar:

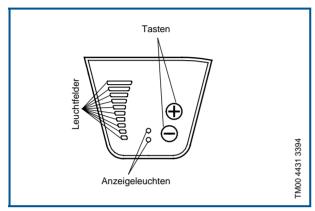
Alternierender Betrieb: Die beiden Pumpen laufen abwechselnd für eine Zeitdauer von 24 Betriebsstunden. Tritt ein Fehler bei der in Betrieb befindlichen Pumpe auf, beginnt die andere Pumpe zu laufen.

Standby-Betrieb: Eine Pumpe befindet sich im Konstantbetriebszustand. Die Reservepumpe startet regelmäßig alle 24 Betriebsstunden und läuft für einen kurzen Zeitraum, um ein Blockieren zu verhindern. Tritt ein Fehler bei der in Betrieb befindlichen Pumpe statt, beginnt die Reservepumpe zu laufen.

Anzeigen und Einstellungen an der Pumpe

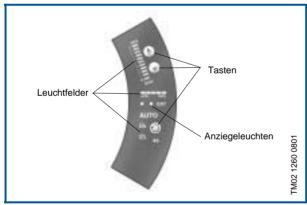
In der Steuertafel auf dem Klemmenkasten der Pumpe sind die Grundfunktionen für Anzeigen und Einstellungen integriert.

UPE und TPE



- Tasten zum Starten/Stoppen der Pumpe, Einstellen des Sollwertes, Steuerungsmodus, Minimal- und Maximalkurve.
- Leuchtfelder zur Anzeige des Steuerungsmodus und des Sollwertes.
- Anzeigeleuchten für Betriebs- und Fehlerzustände.

MAGNA



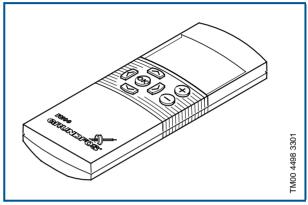
- Tasten zum Starten/Stoppen der Pumpe und Einstellen des Sollwertes, Steuerungsmodus, Minimalund Maximalkurve.
- Leuchtfelder zur Anzeige des Steuerungsmodus und des Sollwertes.
- Leuchtfelder zur Anzeige des Flusses.
- · Anzeigeleuchte für externes Signal.
- Anzeigeleuchten für Betriebs- und Fehlerzustände.

Datenaustausch

Abhängig vom Pumpentyp der Serie 2000 ist Datenaustausch folgendermaßen möglich:

- Drahtlose Fernbedienung R100
- · Anschluss an ein externes Meldegerät
- · Digitaleingang/Digitalausgang
- Analogeingang.

R100



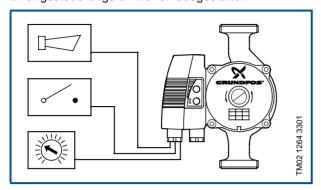
Die Serie 2000 ist für den drahtlosen Datenaustausch mit der Grundfos-Fernbedienung R100 ausgelegt.

Die R100 bietet zusätzliche Möglichkeiten für Einstellungen und Zustandsanzeigen der Pumpe:

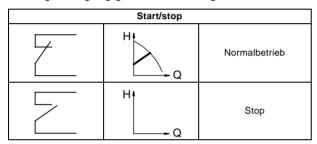
- · Lesen von Betriebsdaten.
- · Lesen von Fehleranzeigen.
- Einstellen der Betriebsart.
- Auswahl des externen Sollwertsignals.
- Zuordnung der Pumpennummer, die eine Unterscheidung der Pumpen in Verbindung mit einem Parallelbetrieb über den Bus ermöglicht.
- Auswahl der Funktion für den Digitaleingang.

Digitaleingang

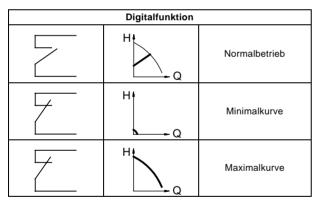
Die Serie 2000 ist mit Eingängen für externe Signale für Zwangssteuerungsfunktionen ausgestattet.



Externes Start/Stop-Signal: Die Pumpe kann über den Digitaleingang gestartet oder angehalten werden.



Externes Signal für erzwungene Maximal- oder Minimalkurve: Die Pumpe kann über den Digitaleingang zur Maximal- oder Minimalkurve gezwungen werden.



Die Funktion für den Digitaleingang wird mit der R100 ausgewählt. TPE-Pumpen der Serie 2000 werden werkseitig mit Minimalkurve geliefert.

Digitalausgang

In der Pumpe ist ein Fehlersignalrelais mit potentialfreiem Umschaltkontakt für externe Fehleranzeige integriert.

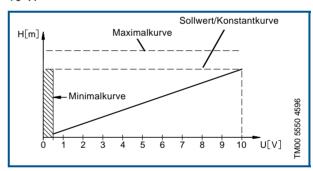
In der folgenden Tabelle sind die Funktionen des Fehlersignalrelais beschrieben:

Fehler- signal- relais	Funktion
	Die Stromversorgung ist abgeschaltet.
	Die Pumpe ist in Betrieb.
C NONC	Die Pumpe ist auf Stop eingestellt.
C NONC	 Die Pumpe hat wegen eines Fehlers angehalten. Es wird ein Neustart versucht (möglicherweise muss die Pumpe durch Rücksetzen der Fehleranzeige neu ge- startet werden).
0 110110	Die Pumpe ist in Betrieb, ist aber wegen eines Fehlers angehalten worden.
	Die Pumpe ist auf Stop eingestellt, ist aber wegen eines Fehlers angehalten worden.

Der tatsächliche Funktionsstatus wird über die Anzeigeleuchten gelesen.

Analogeingang

Externe Analogsteuerung: Sollwert- oder Geschwindigkeitssteuerung durch ein externes Signal von 0 bis 10 V.



Der Analogeingang ermöglicht die folgenden Steuerungsarten:

Im **Modus Konstantkurve** kann die Pumpe abhängig vom Werts des externen Signals von einer Konstantkurve zu einer anderen Konstantkurve umschalten.

In diesem Modus ist die interne Steuerung nicht aktiviert.

Im **Modus Drucksteuerung** kann der Sollwert innerhalb des Bereichs vom Sollwert bis zur Minimalkurve extern eingestellt werden.

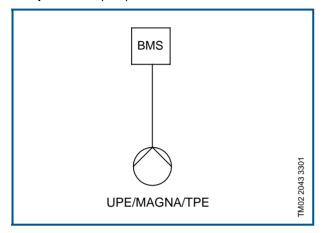
In diesem Modus ist die interne Steuerung aktiviert.

Bei einer Eingangsspannung unter 0,5 V wird die Pumpe gemäß der Minimalkurve betrieben.

Buskommunikation über GENIbus

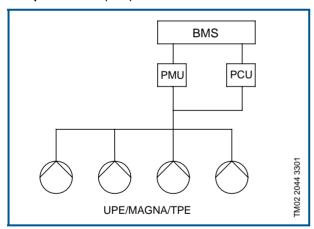
Mit diesem Bus ist die Steuerung und Überwachung der Pumpen von einem Pumpenmanagementsystem 2000 von Grundfos auf ein Baumanagementsystem (BMS) oder ein anderes externes Steuerungsssytem möglich.

Beispiel: Einzelpumpenbetrieb.



Pumpentyp	Erforderlich	Siehe Seite
UPE 1~	 MB 40/60 oder MB 80 	62
MAGNA	GENI-Modul	63
UPE 3~		
TPE 1~		
TPE 3~		

Beispiel: Parallelpumpenbetrieb.

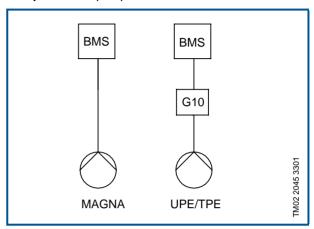


Pumpentyp	Erforderlich	Siehe Seite
UPE 1~	MB 40/60 oder MB 80PMU oder PCU	62 64
MAGNA	GENI-Modul PMU oder PCU	63 64
UPE 3~		
TPE 1~	PMU oder PCU	64
TPE 3~		

Buskommunikation über LON

Über den Buseingang kann die Pumpe an ein Netz mit LonWorks®-Technik angeschlossen und so mit anderen Einheiten verknüpft werden, die auf diesem Kommunikationsstandard basieren.

Beispiel: Einzelpumpenbetrieb.



Pumpentyp	Erforderlich	Siehe Seite
UPE 1~	MB 40/60 oder MB 80G10-LON-Schnittstelle	62 64
MAGNA	LON-Modul	63
UPE 3~	G10-LON-Schnittstelle	64
TPE 1~	G10-LON-Schnittstelle	64
TPE 3~	G10-LON-Schnittstelle	64

Konstruktion

UPE-Serie 2000

Die Pumpen der UPE-Serie 2000 sind Pumpen mit gekapseltem Rotor, d.h. Pumpe und Motor bilden eine integrierte Einheit ohne Wellendichtung und lediglich zwei Dichtungen. Die Lager werden durch die Förderflüssigkeit geschmiert.

Die Pumpe zeichnet sich durch folgende Merkmale aus:

- Steuerung im Klemmenkasten integriert.
- · Steuertafel auf dem Klemmenkasten.
- Klemmenkasten bereit für optionale Module.
- · Erfassung von Differenzdruck und Temperatur.
- Pumpengehäuse in Gusseisen- oder Bronzeausführung.
- · Zwillingsversionen.
- Pumpengehäuse mit Luftabscheider, Type UPE 25-40 A und UPE 25-60 A.
- Kein externer Motorschutz f
 ür den Motor erforderlich.

UPE-Motor und elektronische Steuerung

Der Motor **UPE 1**~ ist ein zweipoliger asynchroner Käfigläufermotor mit Funkstörfilter gemäß VDE 0875. Der Klemmenkasten und die Motor-Pumpen-Einheit sind einem Test gemäß VDE 0700 unterzogen worden.

Im Klemmenkasten ist eine Steuerung integriert. Die Pumpengeschwindigkeit wird über eine eingebaute Induktionsspule auf der Statorwicklung berechnet.

Der Motor **MAGNA UPE 1~** ist ein 4- oder 8-poliger synchroner Dauermagnetmotor. Dieser Motortyp zeichnet sich durch einen höheren Wirkungsgrad als ein konventioneller asynchroner Käfigläufermotor aus.

Die Pumpengeschwindigkeit wird durch einen Frequenzumrichter gesteuert.

Der Motor **UPE 3~** ist ein 2-poliger asynchroner Käfigläufermotor mit integriertem Frequenzumrichter.

Der Differenzdruck- und Temperaturfühler bildet eine integrierte Einheit. Dieser Fühler befindet sich im Pumpengehäuse in einem Kanal zwischen Ansaugund Auslassseite. Zwillingspumpen sind mit zwei Fühlern ausgestattet.

UPE-Pumpenanschlüsse

Gewindeanschlüsse für Pumpen gemäß ISO 228/1.

Flanschabmessungen gemäß ISO 7005-2/BS4501.

UPE-Oberflächenbehandlung

Die Pumpen der UPE-Serie 2000 sind nasslackiert, Farbe gemäß NCS40-50R.

TPE-Serie 2000

Die TPE-Pumpen sind vertikale, nicht-selbstansaugende, einstufige Zentrifugalpumpen mit Ein- oder Dreiphasen-MGE-Motor.

Die Pumpe zeichnet sich durch folgende Merkmale aus:

- · Steuerung im Klemmenkasten integriert.
- · Steuertafel auf dem Klemmenkasten.
- Differenzdruckfühler.
- Pumpenrad aus Edelstahl und doppelt gekrümmten, extrem glatten Schaufeln.
- · Mit starrer Kupplung ausgestattet.
- Ablassstopfen im Boden des Pumpengehäuses eingelassen.
- · Mechanische Wellendichtung.
- Kein externer Motorschutz f
 ür den Motor erforderlich.

TPE-Motor und elektronische Steuerung

Der Grundfos-MGE-Motor ist ein vollkommen geschlossener asynchroner Motor mit Abmessungen gemäß IEC-Publikation 72.

Die integrierte Steuerung ist mit einem Frequenzumrichter (PID-Steuerung) und einem RFI-Filter (RFI = Funkstörfestigkeit) versehen.

TPE-Pumpenanschlüsse

Die Flanschabmessungen von Ansaug- und Auslassöffnungen sind identisch.

Flanschabmessungen gemäß ISO 7005-2/BS4504.

Wellendichtung

Die TPE-Pumpen sind mit einer einzelnen unausgewuchteten Wellendichtung aus:

- Wolframkarbid/Kohlenstoff (BUBE, BBUE) oder
- Wolframkarbid/Wolframkarbid (AUUE, RUUE)

mit Abmessungen gemäß DIN 24 960 ausgestattet. Version NU (BS 5257).

TPE-Oberflächenbehandlung

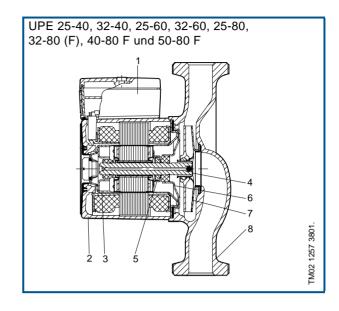
Die Pumpen der TPE-Serie 2000 sind elektrotauchlakkiert. Diese Behandlung umfasst:

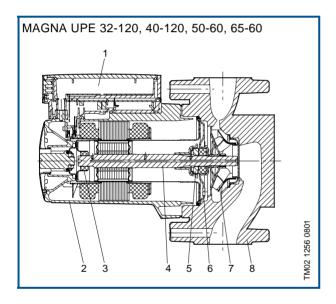
- 1. Alkalische Reinigung.
- 2. Vorbehandlung mit Zinkphosphatbeschichtung.
- Kathodische Elektrotauchlackierung (Epoxid).
 Beschichtungsdicke: 15 bis 20 μm.
- 4. Aushärten der Lackschicht bei 200 bis 250°C.

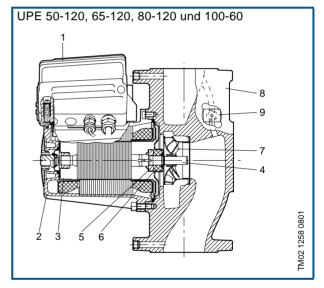
Konstruktion

Werkstoffe, UPE

Pos.	Bezeichnung	Werkstoff	DIN WNr.
1	Klemmenkasten	Aluminium/ Verbundwerkstoff	
2	Statorgehäuse	Aluminium AlSi 10Cu ₂	
	O-Ringe	EPDM-Gummi	
3	Äußerer Lagerring	Aluminiumoxid Al ₂ O ₃	
3	Rotorkapselung	Edelstahl	1.4301
4	Welle	Edelstahl oder Aluminiumoxid	
5	Drucklager	Kohlenstoff MY 106	
6	Lagerplatte	Edelstahl	1.4301
0	Innerer Lagerring	Aluminiumoxid Al ₂ O ₃	
7	Pumpenrad	Edelstahl oder Verbundwerkstoff	
8	Pumpengehäuse	Gusseisen EN-GJL150/-200/-250 oder Bronze	
9	Differenzdruck- und Temperaturfühler	Verbundwerkstoff PES	

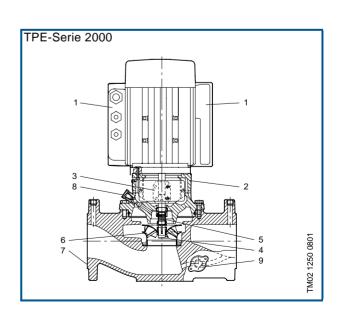






Werkstoffe, TPE

Pos.	Bezeichnung	Werkstoff	DIN WNr.
1	Klemmenkasten	Aluminium/ Verbundwerkstoff	
2	Motorschemel	Gusseisen EN-GJL-250	EN-JL1040
3	Kupplung	Gusseisen EN-GJS-400-15 oder Sintermetall HPXPNC45	EN- JS1030
4	Welle	Edelstahl	1.4305
5	Mechanische Wellendichtung	Wolframkarbid/Kohlenstoff oder Wolframkarbid/Wolf-ramkarbid	
6	Pumpenrad	Edelstahl	1.4301
7	Pumpengehäuse	Gusseisen EN-GJL-250	EN-JL1040
8	Entlüftungsschraube	MS	
9	Differenzdruckfühler		
	O-ring	EPDM oder FKM-Gummi	



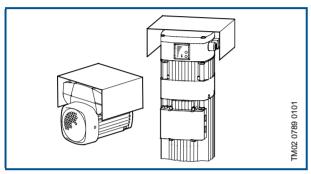


Mechanischer Einbau

Die Pumpen der **UPE-Serie 2000** sind für Inneneinbau bestimmt. Die Pumpen müssen mit horizontaler Motorwelle eingebaut werden.

Die Pumpen der **TPE-Serie 2000** sind sowohl für Inneneinbau als auch für Außeneinbau geeignet. Die Pumpen können mit horizontaler und vertikaler Motorwelle eingebaut werden.

Wenn Pumpen der TPE-Serie 2000 in Außenbereichen eingebaut werden, muss der Motor mit einer geeigneten Abdeckung versehen werden, um Kondenswasser auf den elektronischen Bauteilen zu vermeiden.



Die Pumpen der Serie 2000 können sowohl in waagerecht als auch senkrecht verlaufenden Rohren eingebaut werden.

Pfeile auf dem Pumpengehäuse zeigen die Strömungsrichtung der Flüssigkeit durch die Pumpe an. Abhängig von der Lage des Klemmenkastens kann die Strömungsrichtung der Flüssigkeit waagerecht oder senkrecht sein.

Abhängig vom Pumpentyp kann die Lage des Klemmenkastens auf der Pumpe in vielen Richtungen verändert werden. Die entsprechenden Beschreibungen sind in den Einbau- und Gebrauchsanweisungen enthalten.

Die Pumpen müssen so eingebaut werden, dass Formänderungen aus dem Rohrleitungsnetz nicht auf das Pumpengehäuse übertragen werden können.

Die Pumpe kann direkt in den Rohren aufgehängt werden, falls das Rohrleitungsnetz die Pumpe tragen kann. Ist dies nicht der Fall, muss die Pumpe auf einem Montagebügel oder einer Grundplatte befestigt werden.

Um eine ausreichende Kühlung von Motor und Elektronik zu gewährleisten, müssen folgende Punkte beachtet werden:

- Positionieren Sie die Pumpe so, dass eine ausreichende Kühlung gewährleistet ist.
- Die Temperatur der Kühllüft darf 40°C nicht überschreiten.
- Die Kühlrippen des Motors, die Löcher in der Lüfterabdeckung und die Lüfterflügel müssen sauber bleihen

UPE-Einzelkopfpumpen können mit Isolierschalen montiert werden (siehe "Isoliersets" auf Seite 61).

Elektrischer Anschluss

Der elektrische Anschluss und die elektrische Absicherung sollten gemäß örtlicher Vorschriften durchgeführt werden.

- Die Pumpe muss an einen externen Netzschalter angeschlossen werden.
- Die Pumpen der Serie 2000 m\u00fcssen immer ordnungsgem\u00e4\u00df geerdet sein.
 - **Hinweis:** Wegen des 3,5 mA übersteigenden Erdableitstroms müssen Motoren mit 4,0 bis 7,5 kW an besonders zuverlässige und widerstandsfähige Erdungsanschlüsse angeschlossen werden.
- Für die Pumpe ist kein externer Motorschutz erforderlich. Der Motor ist mit einem Übertemperaturschutz gegen langsames Überlasten und Blockieren versehen (IEC 34-11: TP 211).
- Nachdem die Pumpe über das Netz eingeschaltet worden ist, läuft sie nach ca. 5 Sekunden an.

Hinweis: Die Pumpe darf über die Netzspannung höchstens 4 mal pro Stunde gestartet und gestoppt werden.

Der Netzanschluss der Pumpe muss wie in den Diagrammen auf den folgenden Seiten abgebildet hergestellt werden.

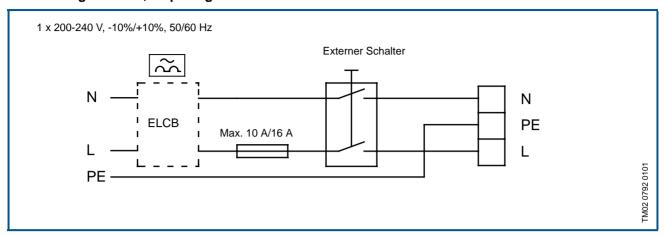
Kabel

Für externe Signale (Ein/Aus-Schalter, Digitaleingang, Sensor und Sollwert) sind abgeschirmte Kabel (min. 0,25 bis 1,5 mm²) zu verwenden.

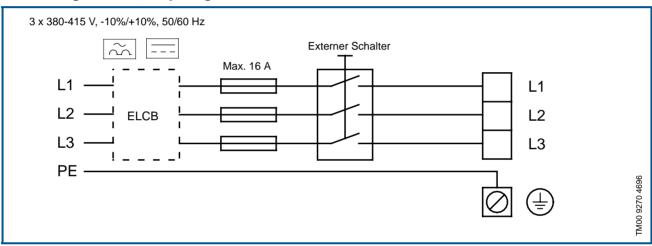
- Alle eingesetzten Kabel müssen bis mindestens +85°C hitzebeständig sein.
- Alle Kabel müssen gemäß EN 60 204-1 verlegt werden.



Verdrahtungsschema, einphasig



Verdrahtungsschema, dreiphasig



Zusätzliche Absicherung

Wenn die Pumpe an eine elektrische Anlage angeschlossen ist, in der ein Fehlerstrom-Schutzschalter als zusätzliche Absicherung eingesetzt ist, müssen die Fehlerstrom-Schutzschalter mit den folgenden Symbolen gekennzeichnet werden.

• Einphasig:



Die Fehlerstrom-Schutzschalter **müssen** auslösen, wenn Erdschlussströme mit Gleichstromanteil (pulsierender Gleichstrom) auftreten.

· Dreiphasig:

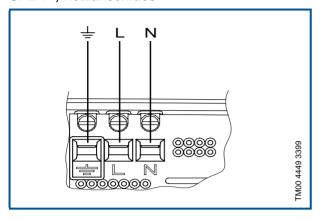




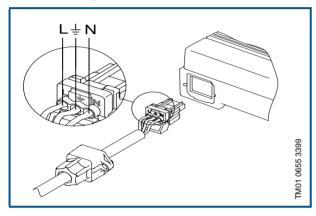
Die Fehlerstrom-Schutzschalter **müssen** auslösen, wenn Erdschlussströme mit Gleichstromanteil (pulsierender Gleichstrom) und Erdschlussströme mit geglättetem Gleichstrom auftreten.

Einbau

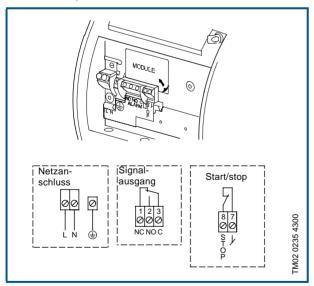
UPE 1~, Netzanschluss



UPE xx-80 1~, Netzanschluss



MAGNA 1~, Netzanschluss

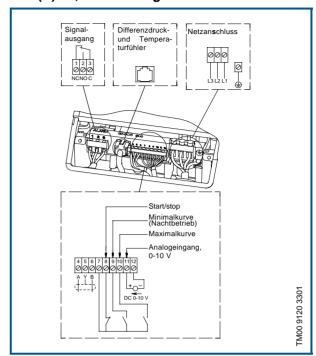


Die Anschlüsse von **Einzelkopfpumpen** sind wie abgebildet auszuführen. Bei Zwillingspumpen müssen beide Pumpen an das Netz angeschlossen werden.

Hinweis:

 Ist kein externer Ein/Aus-Schalter angeschlossen, sollte der Anschluss über die Klemmen STOP und \(\nu\) aufrecht erhalten bleiben.

UPE(D) 3~, Verdrahtungsschema



Die Anschlüsse von **Einzelkopfpumpen** sind wie abgebildet auszuführen. Bei Zwillingspumpen müssen beide Pumpen an das Netz angeschlossen werden.

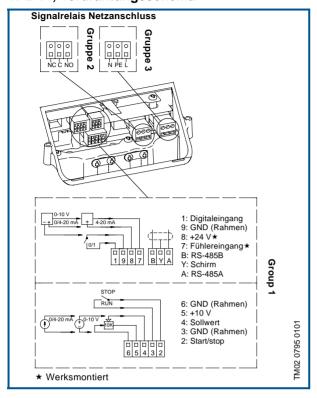
- Ist kein externer Ein/Aus-Schalter angeschlossen, sollte der Anschluss über die Klemmen 7 und 8 aufrecht erhalten bleiben.
- Wird der Eingang 0-10 V eingesetzt (Klemmen 11 und 12), muss eine Verbindung über Klemmen 7 und 9 vorhanden sein (der Eingang für die Minimalkurve muss geschlossen sein).

Zwillingspumpen:

- Ein möglicherweise vorhandenes externes Steuergerät muss an die Hauptpumpe angeschlossen werden (Klemmen 7 bis 12).
- Soll die Zwillingspumpe an eine PMU oder PCU 2000 angeschlossen werden, muss sie auf Einzelpumpenbetrieb eingestellt werden.
 Die Busverbindung zwischen Haupt- und Nebenpumpe kann entfernt werden. Sowohl die Hauptpumpe als auch die Nebenpumpe müssen an das BUS-System angeschlossen sein.

<u>Einbau</u>

TPE 1~, Verdrahtungsschema



Weitere Anschlüsse

Das Verdrahtungsschema zeigt die Anschlüsse der externen potentialfreien Kontakte für Start/Stop und Digitalfunktion, externes Sollwertsignal und Fehlersignal.

Die Kabel können an die folgenden Anschlussgruppen angeschlossen werden:

Gruppe 1: Eingänge (externer Start/Stop, Digitalfunktion, Sollwert- und Fühlersignale, Klemmen 1 bis 9 und Busverbindung, A, Y, B).

Alle Eingänge sind von netzführenden Teilen durch verstärkte Isolierung getrennt (PELV-Isolierung).

Gruppe 2: Ausgang (Signalrelais).

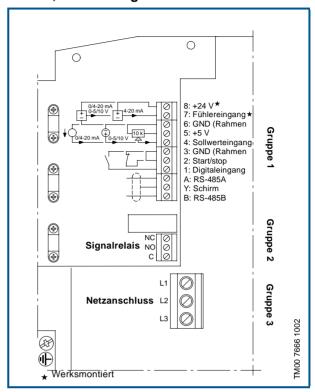
Der Ausgang (Klemmen C, NO und NC) ist von anderen Schaltkreisen elektrisch getrennt. Aus diesem Grund kann die Versorgungsspannung oder eine Schutzkleinspannung nach Bedarf an den Ausgang angeschlossen werden.

Gruppe 3: Netzversorgung.

Hinweis:

 Ist kein externer Ein/Aus-Schalter angeschlossen, muss die Verbindung über Klemmen 2 und 3 aufrecht erhalten bleiben.

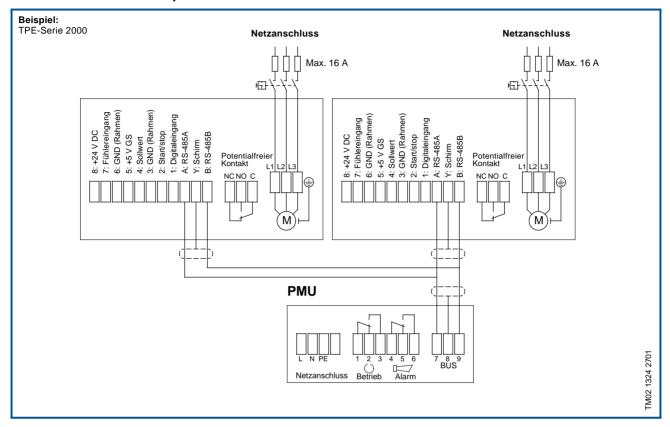
TPE 3~, Verdrahtungsschema



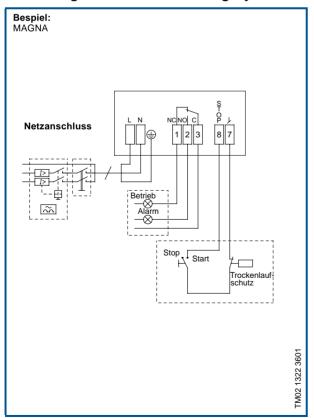


Anschlussbeispiele

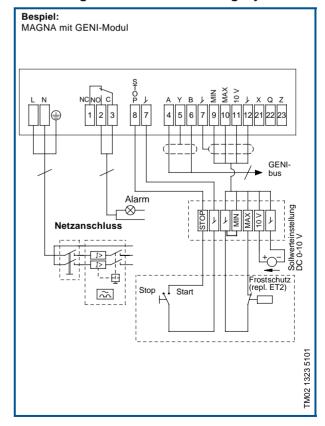
Anschluss mehrerer Pumpen an die PMU



Verbindung zu externem Steuerungssystem



Verbindung zu externem Steuerungssystem



Kurvenbedingungen

Die folgenden Richtlinien gelten für die Leistungskurven auf den Seiten 26 bis 59:

- 1. Die Kurven gelten für die tatsächlichen Geschwindigkeiten der angegebenen Motortypen bei 50 Hz.
- Die fett gedruckten Teile der Kurven zeigen den empfohlenen Leistungsbereich.
- 3. Testflüssigkeit: luftfreies Wasser.
- 4. Die Kurven gelten für eine Flüssigkeitstemperatur von

UPE/MAGNA: 60°CTPE: 20°C.

- Alle Kurven zeigen Durchschnittswerte an und sollten nicht als Garantiekurven übernommen werden. Ist eine angegebene Mindestleistung erforderlich, müssen Einzelmessungen vorgenommen werden.
- 6. Die Kurven gelten für eine kinematische Viskosität von

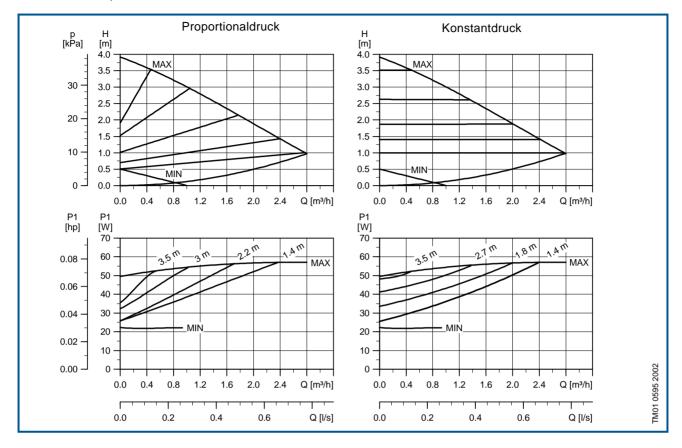
 $\begin{array}{ll} - \mbox{ UPE/MAGNA:} & \nu = 0,474 \mbox{ mm}^2/s \mbox{ } (0,474 \mbox{ cSt}). \\ - \mbox{ TPE:} & \nu = 1 \mbox{ mm}^2/s \mbox{ } (1 \mbox{ cSt}) \end{array}$

7. Die Umrechnung zwischen Förderhöhe H [m] und Druck p [kPa] wurde für Wasser mit einer Dichte von ρ = 1000 kg/m³ vorgenommen. Bei Flüssigkeiten mit anderer Dichte, z.B. Warmwasser, ist der Förderdruck proportional der Dichte.

Die Pumpen sollten nicht benutzt werden, wenn die Mindestflussrate außerhalb der durch die **fett** gedruckten Kurven angezeigten Bereiche liegt, da ansonsten die Gefahr einer Überhitzung der Pumpen besteht.

25

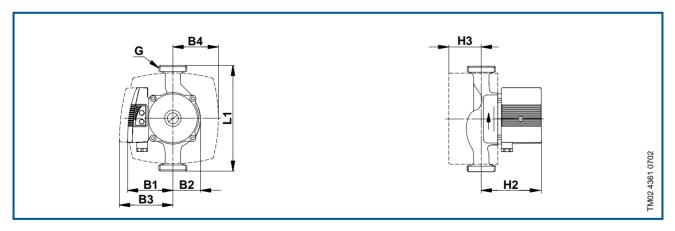
UPE 25-40, UPE 32-40



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	20	0,18
1 X 230-240 V	Max.	60	0,26

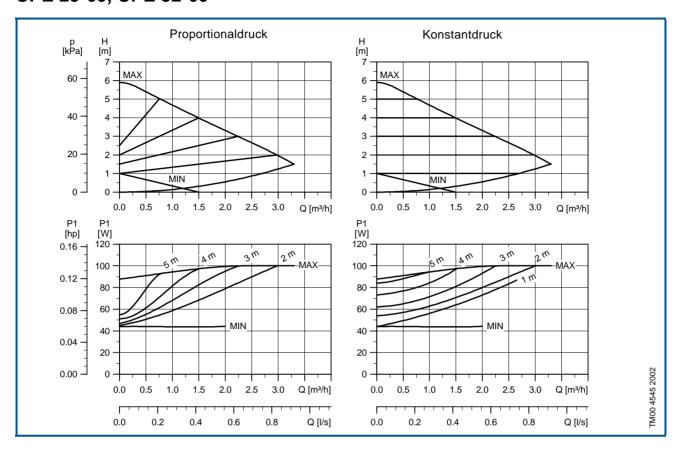
UPE 25-40 ist auch mit Bronzegehäuse, Typ B, erhältlich.



_						-	Abme	ssun	gen [ı	nm]							Gewi	cht [kg]★	Versand-
Pumpentyp	L1	В1	В2	В3	В4	В7	В8	В9	H2	НЗ	D1	D2	D3	D4	D5	G	Netto	Brutto	volumen [m³]
UPE 25-40	180	85	47	105	77				102	57						1½	3,0	3,8	0,0061
UPE 32-40	180	85	47	105	77				102	57						2	2,7	3,5	0,0061

 $[\]star$ Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

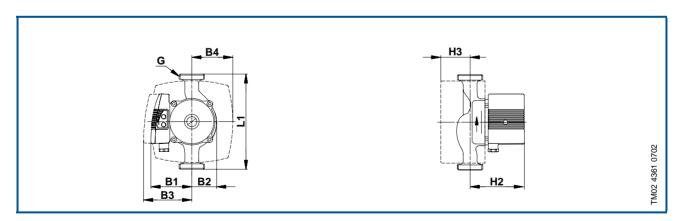
UPE 25-60, UPE 32-60



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	40	0,28
1 X 230-240 V	Max.	100	0,44

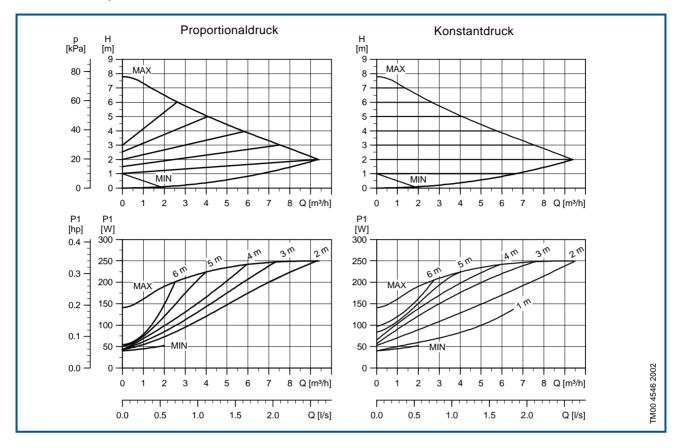
UPE 25-60 ist auch mit Bronzegehäuse, Typ B, erhältlich.



							Abme	essun	gen [r	nm]							Gewi	cht [kg]★	Versand-
Pumpentyp	L1	В1	B2	В3	В4	В7	В8	В9	H2	НЗ	D1	D2	D3	D4	D5	G	Netto	Brutto	volumen [m³]
UPE 25-60	180	85	47	105	77				102	57						1½	2,6	3,0	0,0061
UPE 32-60	180	85	47	105	77				102	57						2	2,7	3,1	0,0061

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

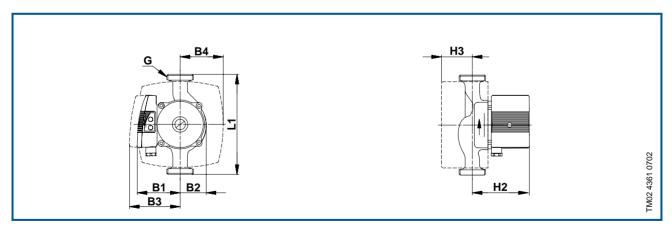
UPE 25-80, UPE 32-80



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	40	0,50
1 X 230-240 V	Max.	250	1,08

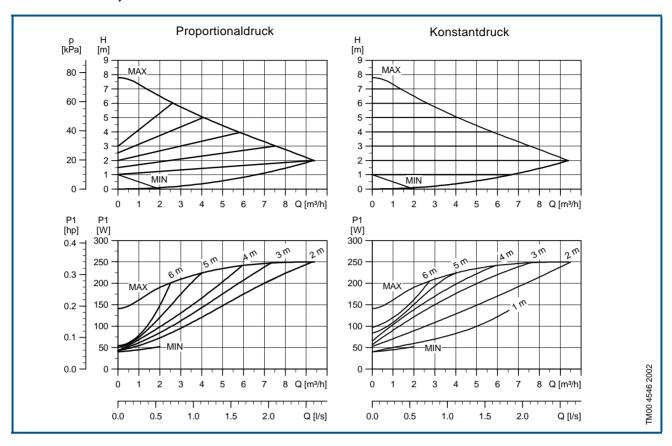
UPE 32-80 ist auch mit Bronzegehäuse, Typ B, erhältlich.



_						Al	omes	sung	en [m	m]							Gewi	cht [kg]★	Versand-
Pumpentyp	L1	В1	В2	В3	В4	В7	В8	В9	H2	НЗ	D1	D2	D3	D4	D5	G	Netto	Brutto	volumen [m³]
UPE 25-80	180	106	60	117	86,6				130	74						1½	5,8	6,3	0,0111
UPE 32-80	180	106	60	117	86,6				130	71						2	5,1	5,6	0,0111

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

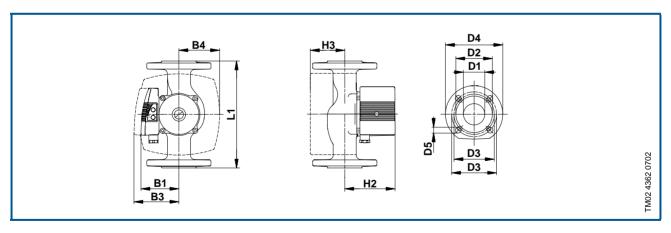
UPE 40-80 F, UPE 50-80 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	40	0,50
1 X 230-240 V	Max.	250	1,08

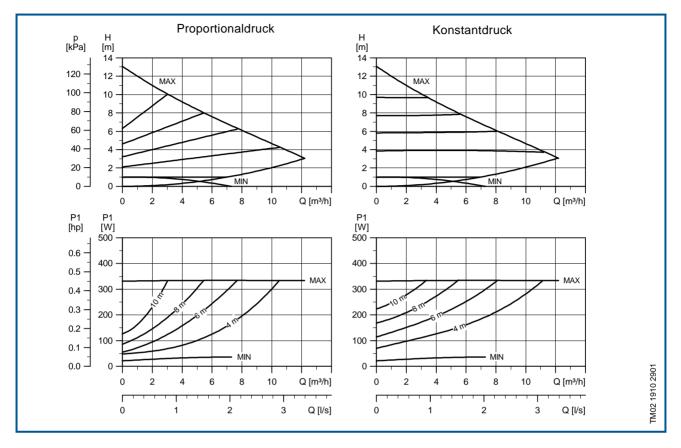
UPE 40-80 F ist auch mit Bronzegehäuse, Typ B, erhältlich.



Pumpentyp								Abm	essur	ngen [r	nm]						Gewi	cht [kg]★	Versand-
PN 6 / PN 10	L1	В1	В3	В4	В7	В8	В9	H1	H2	Н3	D1	D2	D3	D4	D5	М	Netto	Brutto	volumen [m³]
UPE 40-80 F	250	106	116	95				65	130	75,5	40	88	100/110	150	14/19	M12	8,7	9,2	0,0122
UPE 50-80 F	280	112	116	95				-	130	79	50	99	110/125	165	14/19	M12	8,7	9,2	0,0122

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

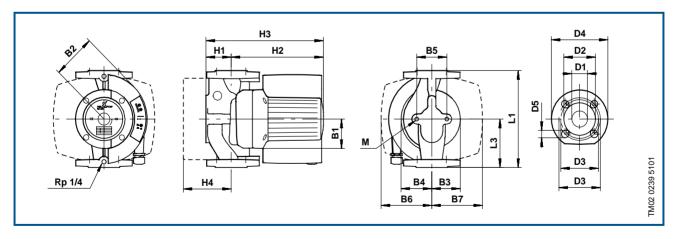
MAGNA UPE 32-120 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	22	0,15
1 X 230-240 V	Max.	345	1,55

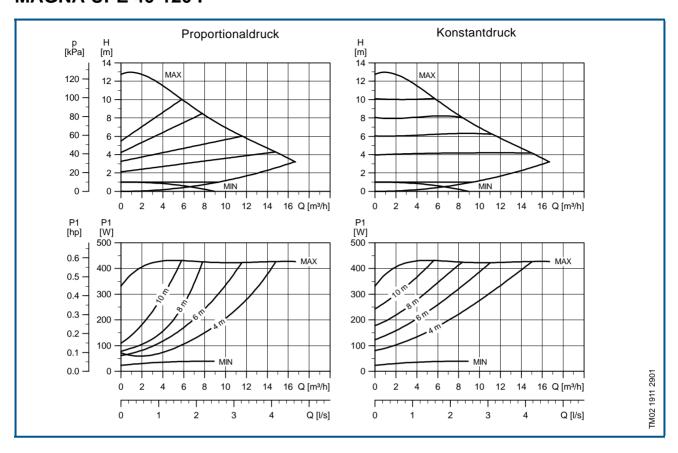
MAGNA UPE 32-120 F ist auch mit Bronzegehäuse, Typ B, erhältlich.



Pumpentyp									Abm	essu	nger	[mm]							Gewic	ht [kg]★	Versand-
PN 6 / PN 10	L1	L3	В1	B2	ВЗ	В4	В5	В6	В7	H1	Н2	НЗ	Н4	D1	D2	D3	D4	D5	М	Netto	Brutto	volumen [m³]
MAGNA UPE 32-120 F	220	110	77	115	75	83	96	110	110	66	232	298	86	32	78	90/100	140	14/19	M12	14,3	16,0	0,03

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

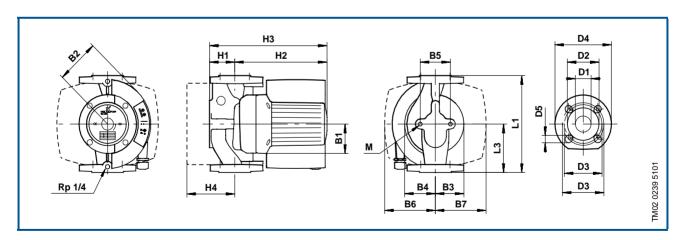
MAGNA UPE 40-120 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	25	0,16
1 X 230-240 V	Max.	445	2,0

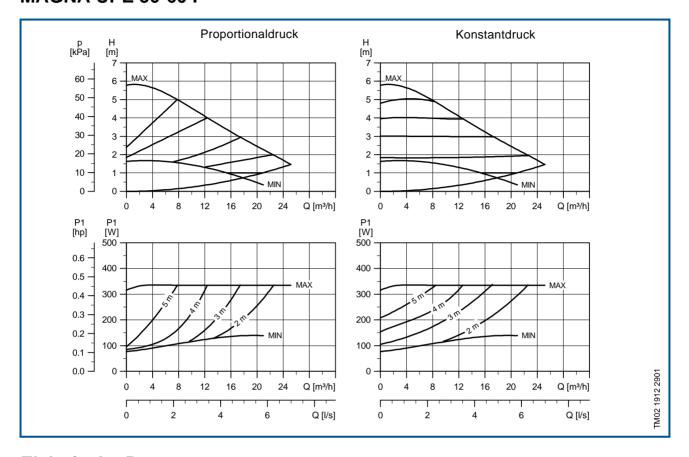
MAGNA UPE 40-120 F ist auch mit Bronzegehäuse, Typ B, erhältlich.



Pumpentyp									Abn	ness	unge	en [m	m]							Gewich	nt [kg]★	Versand-
PN 6 / PN 10	L1	L3	В1	В2	ВЗ	В4	В5	В6	В7	Н1	Н2	НЗ	Н4	D1	D2	D3	D4	D5	М	Netto	Brutto	volumen [m³]
MAGNA UPE 40-120 F	250	125	77	115	75	97	96	115	115	66	240	306	102	40	88	100/110	150	14/19	M12	15,7	17,7	0,03

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

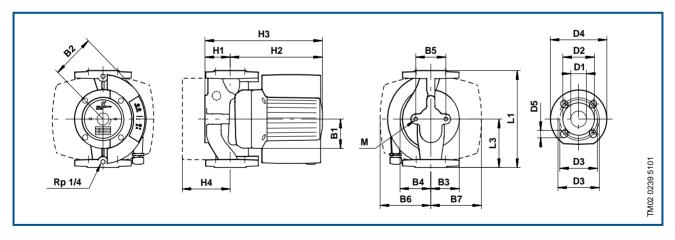
MAGNA UPE 50-60 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	32	0,2
1 X 230-240 V	Max.	335	1,51

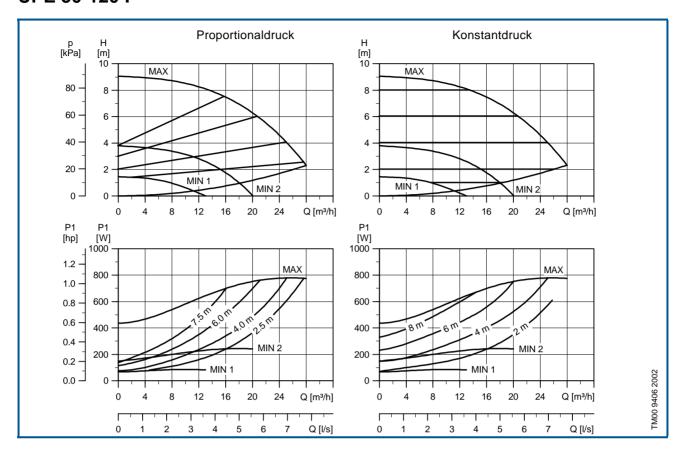
MAGNA UPE 50-60 F ist auch mit Bronzegehäuse, Typ B, erhältlich.



Pumpentyp									Abn	ness	unge	en [m	m]							Gewich	nt [kg]★	Versand-
PN 6 / PN 10	L1	L3	В1	В2	вз	В4	В5	В6	В7	Н1	H2	Н3	H4	D1	D2	D3	D4	D5	М	Netto	Brutto	volumen [m³]
MAGNA UPE 50-60 F	280	140	77	115	79	102	96	130	130	75	245	320	113	50	102	110/125	165	14/19	M12	19,2	21,1	0,04

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

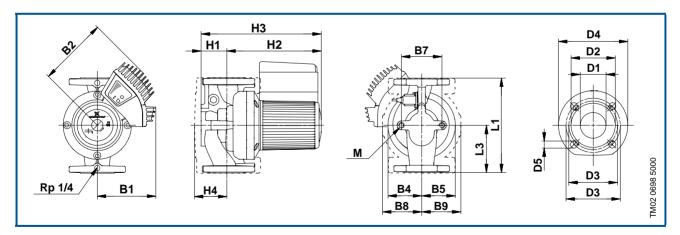
UPE 50-120 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
3 x 400-415 V	Min.	65	0,20
3 X 400-413 V	Max.	790	1,45

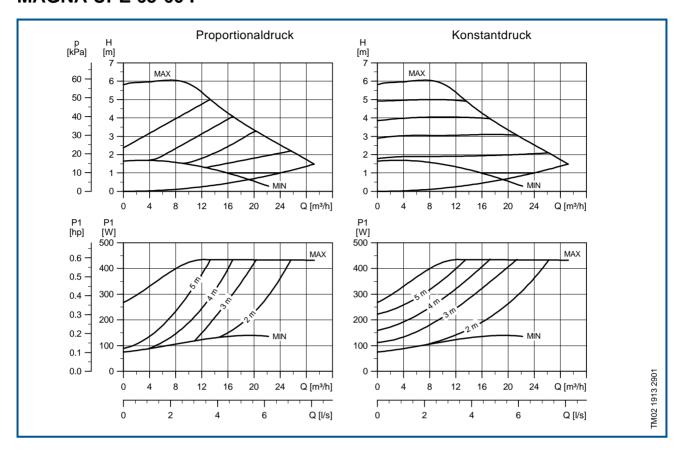
Ist auch mit Bronzegehäuse, Typ B, erhältlich.



									Ab	mes	sun	gen	[mm]								Gewic	ht★ [kg]	Versand-
	L1	L2	L3	В1	В2	В4	В5	В7	В8	В9	H1	H2	Н3	Н4	D1	D2	D3	D4	D5	М	Netto	Brutto	volumen [m³]
PN 6 / PN 10	280		140	170	205	100	100	120	155	150	75	277	352	116	50	102	100/125	165	14/19	M12	29,1	30,7	0,043

 $[\]bigstar$ Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

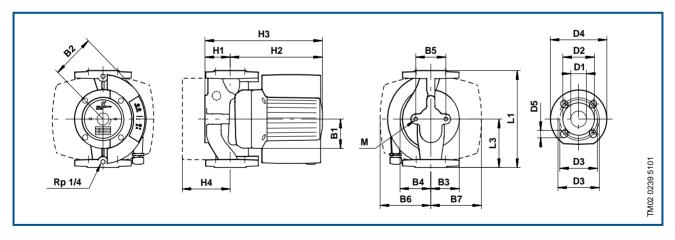
MAGNA UPE 65-60 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
1 x 230-240 V	Min.	32	0,19
1 X 230-240 V	Max.	430	1,95

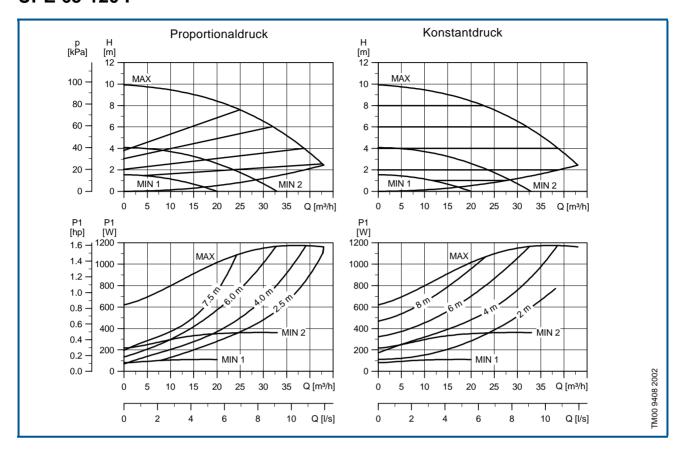
MAGNA UPE 65-60 F ist auch mit Bronzegehäuse, Typ B, erhältlich.



Pumpentyp									Abn	ness	unge	en [m	m]							Gewic	ht [kg]★	Versand-
	L1	L3	В1	В2	ВЗ	В4	В5	В6	В7	Н1	Н2	НЗ	H4	D1	D2	D3	D4	D5	М	Net	Gross	volumen [m³]
MAGNA UPE 65-60 F	340	170	77	115	79	102	96	145	145	90	245	335	128	65	122	130/145	185	14/19	M12	22,2	24,1	0,04

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

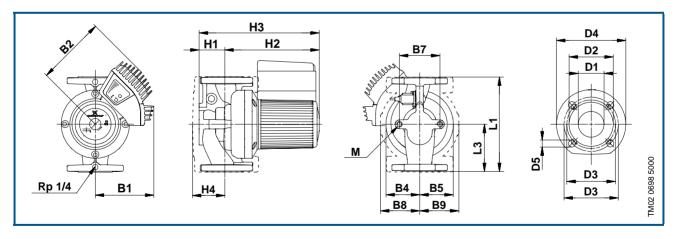
UPE 65-120 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
3 x 400-415 V	Min.	80	0,22
3 X 400-413 V	Max.	1150	2,05

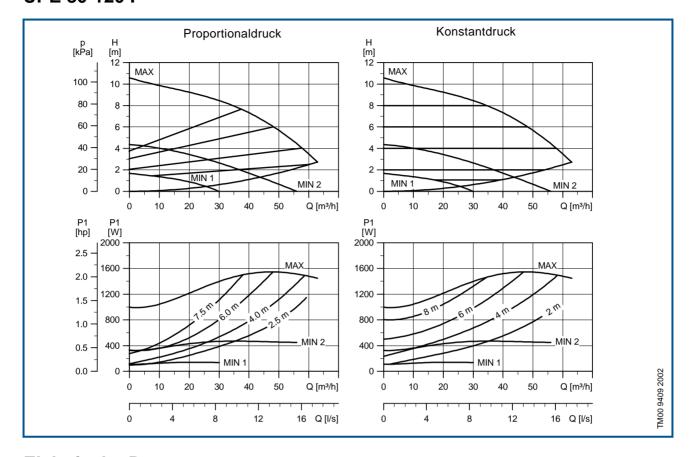
Ist auch mit Bronzegehäuse, Typ B, erhältlich.



										Abm	essi	ınge	n [mr	n]								Gewic		Versand-
	L1	L2	L3	В1	В2	В4	В5	В7	В8	В9	Н1	H2	НЗ	H4	H4	D1	D2	D3	D4	D5	М	Netto	Brutto	volumen[m³]
PN 6 / PN 10	340		170	170	205	100	100	120	180	152	82	290	372	127	116	65	122	130/145	185	14/19	M12	35,0	36,6	0,043

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

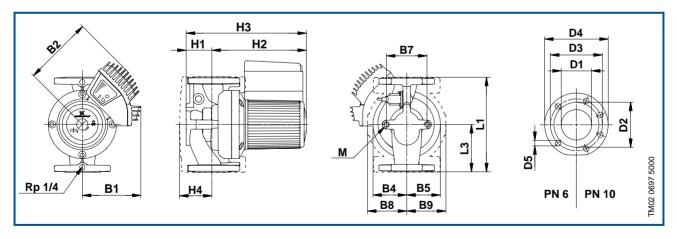
UPE 80-120 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
3 x 400-415 V	Min.	110	0,27
3 X 400-413 V	Max.	1550	2,56

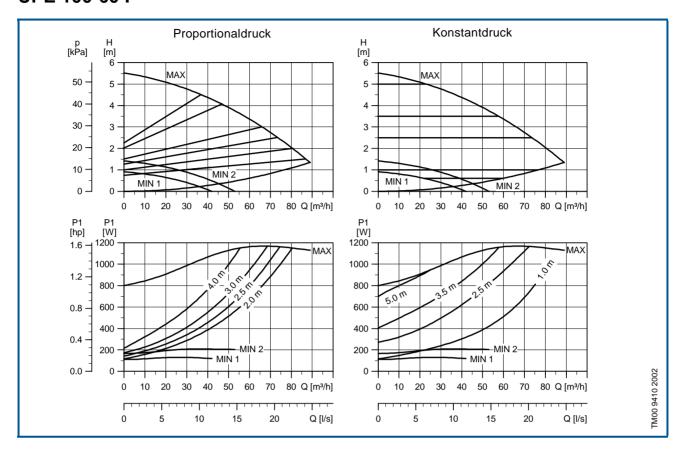
Ist auch mit Bronzegehäuse, Typ B, erhältlich.



								P	bme	ssun	gen	[mm]	1								Gewic	ht★ [kg]	Versand-
	L1	L2	L3	В1	B2	В4	В5	В7	В8	В9	H1	H2	НЗ	H4	D1	D2	D3	D4	D5	M	Netto	Brutto	volumen [m³]
PN 6	360		180	170	205	125	100	160	180	152	97	294	391	160	80	138	150	200	19	M16	41,7	43,3	0,043
PN 10	360		180	170	205	125	100	160	180	152	97	294	391	160	80	138	160	200	19	M16	40,2	41,8	0,043

[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

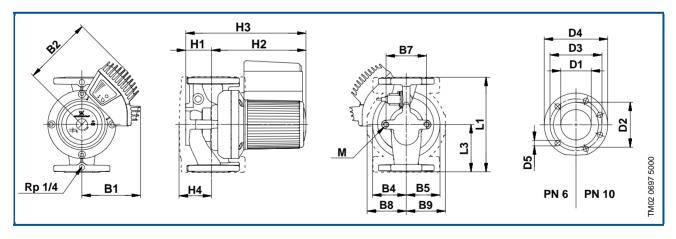
UPE 100-60 F



Elektrische Daten

U _n [V]		P ₁ [W]	I _n [A]
3 x 400-415 V	Min.	110	0,27
3 X 400-413 V	Max.	1160	2,13

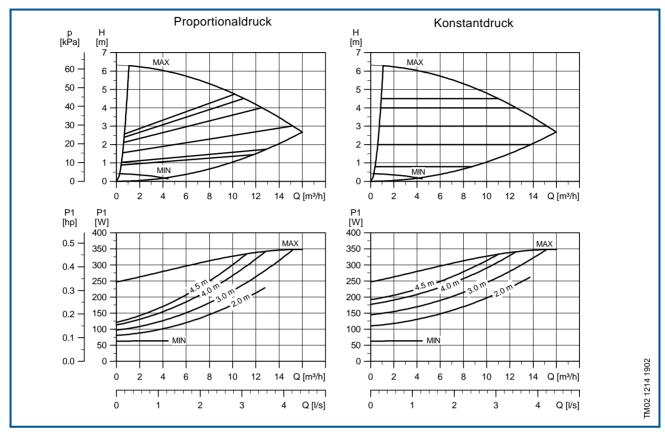
Ist auch mit Bronzegehäuse, Typ B, erhältlich.



									Abm	essu	ngen	[mm]								Gewic	ht★ [kg]	Versand-
	L1	L2	L3	В1	В2	В4	В5	В7	В8	В9	H1	H2	НЗ	H4	D1	D2	D3	D4	D5	М	Netto	Brutto	volumen [m³]
PN 6	450		225	170	205	175	125	200	217	173	122	313	435	186	100	158	170	220	19	M16	51,7	53,9	0,071
PN 10	450		225	170	205	175	125	200	217	173	122	313	435	186	100	158	180	220	19	M16	49,2	51,4	0,071

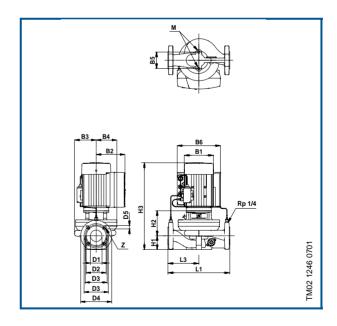
[★] Das Gewicht von Pumpen in Bronzeausführung ist um ca. 10% höher.

TPE 40-60



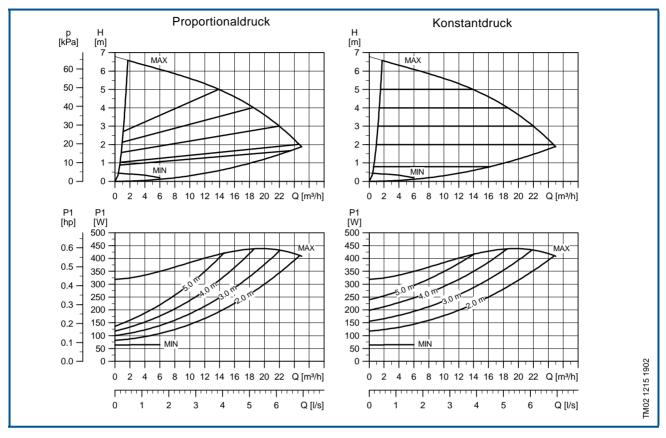
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0,1-0,4	0,37	3,00-2,50



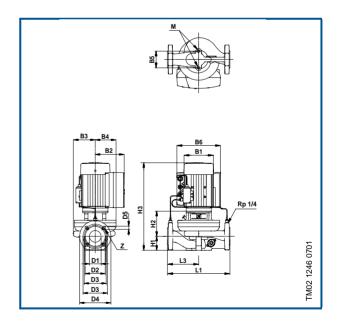
_								Al	omes	sung	en [n	nm]						Z		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	В2	ВЗ	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 40-60	6/10	250	125	141	140	75	100	80	210	68	131	395	40	88	100/110	150	14/19	4	12	22,5	23,5	0,036

TPE 50-60



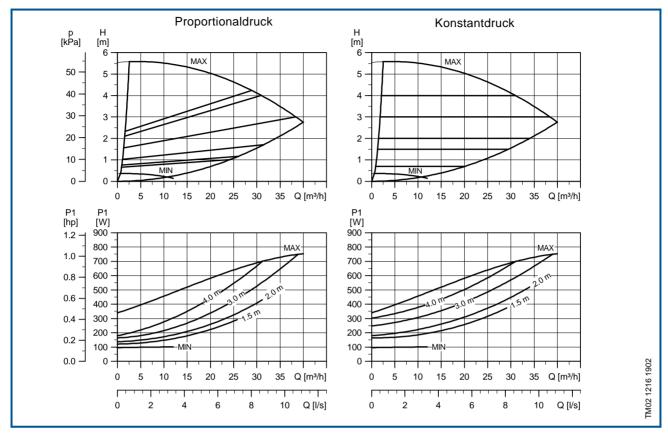
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0.1-0.5	0.37	3.00-2.50



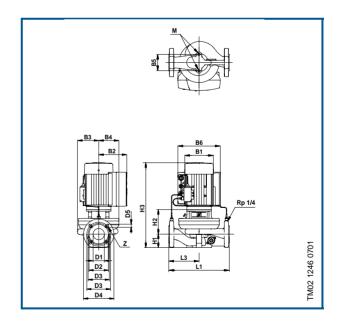
_								Al	omes	sung	en [n	nm]						z		Gewic	ht [kg]	
Pumpentyp	PN	L1	L3	В1	В2	ВЗ	В4	В5	В6	H1	Н2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 50-60	6/10	280	140	141	140	95	75	120	210	75	137	403	50	102	110/125	165	14/19	4	12	20,2	21,2	0,056

TPE 65-60



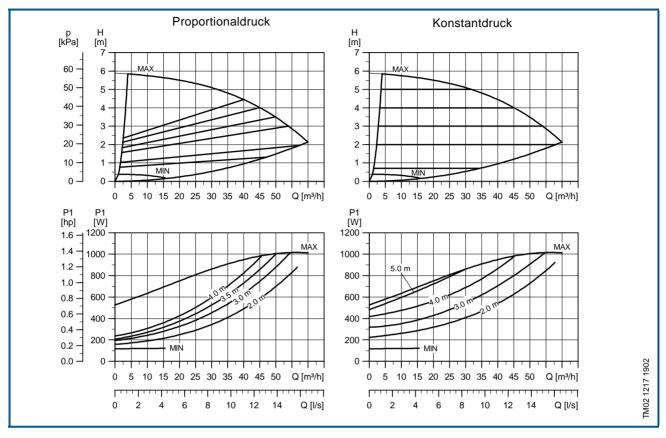
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0,1-0,8	0,55	4,40-3,60



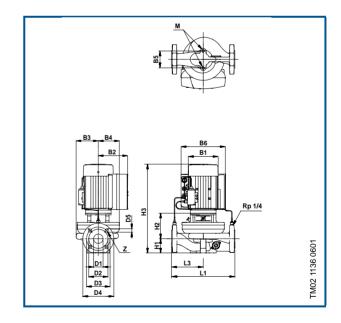
								Al	omes	sung	en [n	nm]						z		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	В2	ВЗ	В4	В5	В6	H1	Н2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 65-60	6/10	340	170	141	140	125	100	160	210	97	147	475	65	122	130/145	185	14/19	4	16	33,7	34,7	0,056

TPE 80-60



Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0.1-1.1	0.75	5,80-4,85

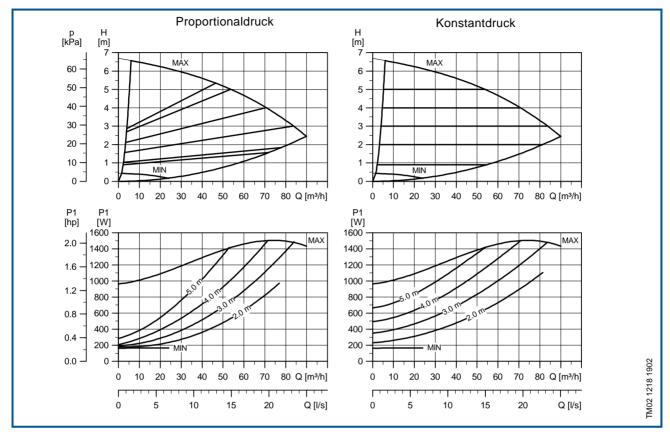


Abmessungen und Gewicht

								Al	omes	sung	en [n	nm]						z		Gewic	ht [kg]	
Pumpentyp	PN	L1	L3	В1	В2	В3	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 80-60	6	360	180	141	140	135	100	160	210	107	153	491	80	138	150	200	19	4	16	39,0	41,0	0,066
TPE 80-60	10	360	180	141	140	135	100	160	210	107	153	491	80	138	160	200	19	8	16	39,0	41,0	0,066

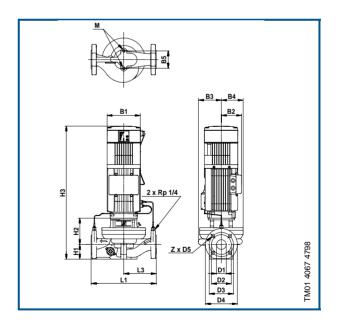
41

TPE 100-60



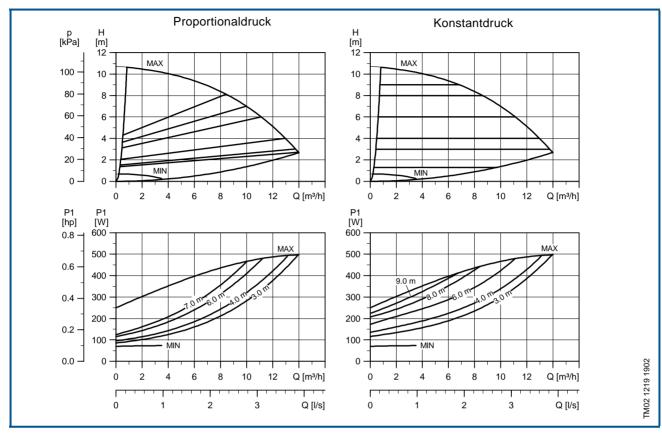
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0.1-1.6	1.1	3.20



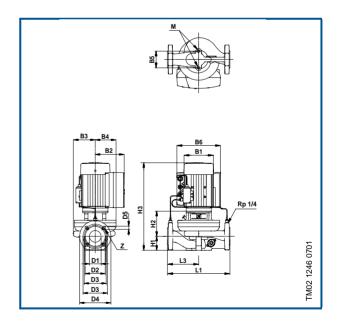
								Al	omes	sung	en [n	nm]						Z		Gewic	ht [kg]	_
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	[St.]	M	Netto	Brutto	volumen [m³]
TPE 100-60	6	450	225	178	110	122	100	200		122	182	745	100	158	170	220	19	4	16	58,6	61,6	0,120
TPE 100-60	10	450	225	178	110	122	100	200		122	182	745	100	158	180	220	19	8	16	58,6	61,6	0,120

TPE 32-120



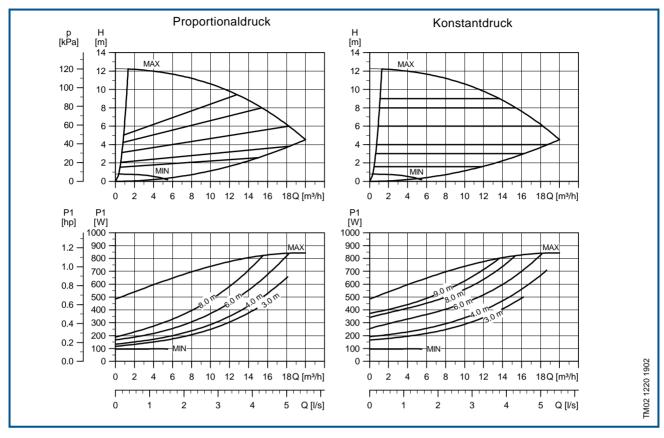
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0.1-0.5	0,37	3.00-2.50



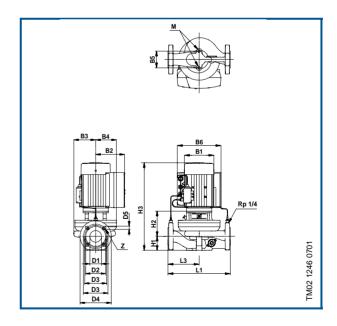
								Al	omes	sung	en [n	nm]						z		Gewic	ht [kg]	
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 32-120	6/10	220	110	141	140	75	75	80	210	68	126	385	32	78	90/100	140	14/19	4	12	21,3	22,3	0,04

TPE 40-120



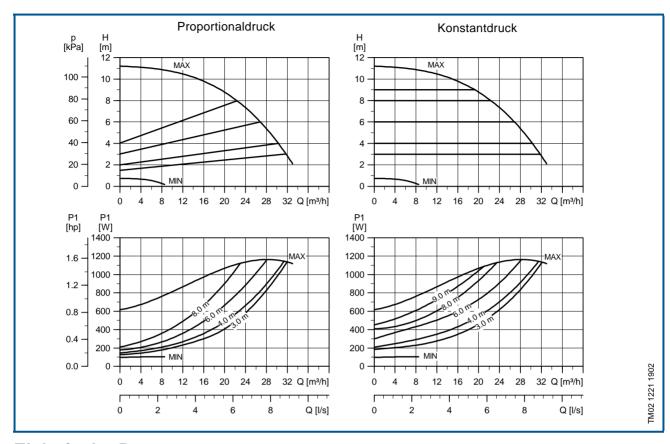
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0,1-0,9	0,55	4,30-3,60



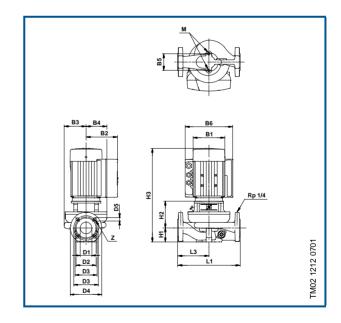
								Al	omes	sung	en [n	nm]						7		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	В2	ВЗ	В4	В5	В6	H1	Н2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 40-120	6/10	250	125	141	140	75	75	80	210	68	129	388	40	88	100/110	150	14/19	4	12	21,8	22,8	0,056

TPE 50-120



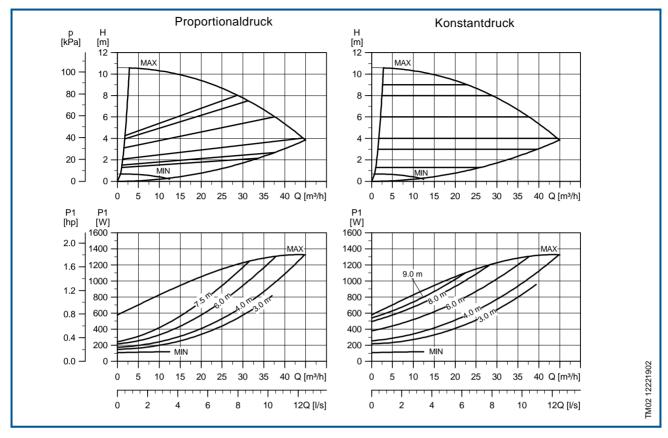
Elektrische Daten

Spannungs versorgun U _n [V]		Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240	V 0.1-1.2	0.75	5.80-4.85



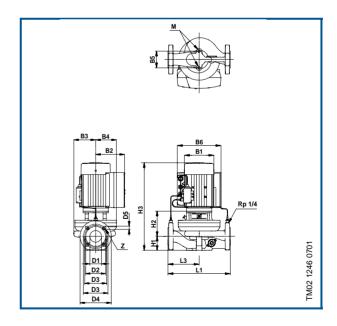
								Ab	mess	ung	en (m	m]						z		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 50-120	6/10	280	140	141	140	100	100	120	210	75	136	442	50	102	110/125	165	14/19	4	12	30,5	33,4	0,056

TPE 65-120



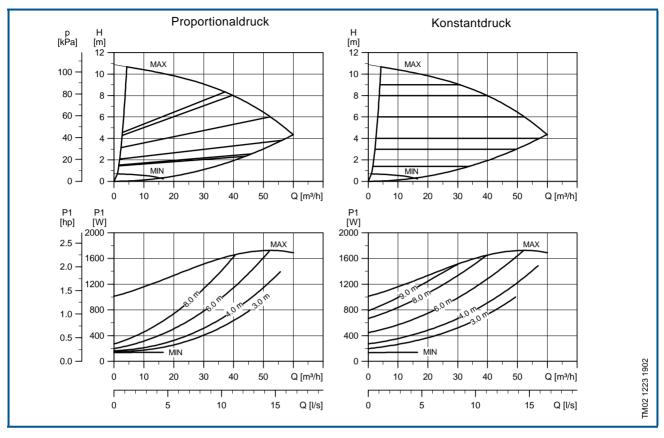
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0.1-1.4	1.1	8,20-6,80



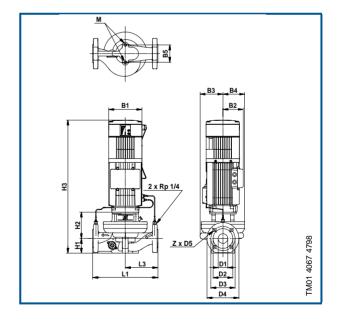
								Al	omes	sung	en [n	nm]						7		Gewic		Versand-
Pumpentyp	PN	L1	L3	В1	В2	В3	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen[m³]
TPE 65-120	6/10	340	170	141	140	100	100	120	210	82	149	462	65	122	130/145	185	14/19	4	12	33,4	36,4	0,056

TPE 80-120



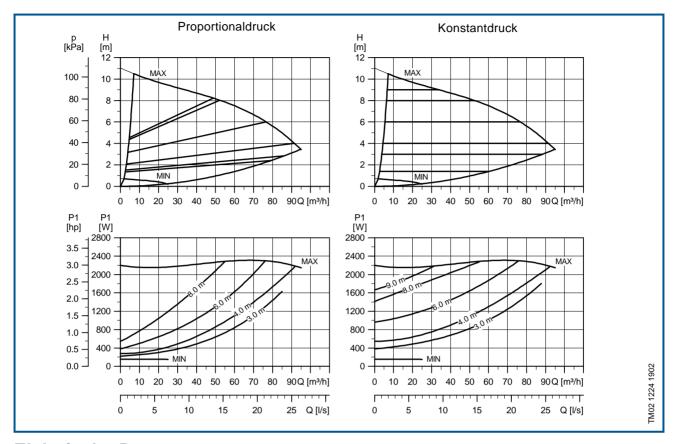
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0.1-1.6	1,5	4.00



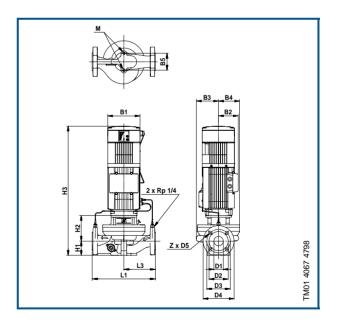
								Al	omes	sung	en [n	nm]						z		Gewic		Versand
Pumpentyp	PN	L1	L3	В1	В2	В3	В4	В5	В6	H1	Н2	НЗ	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 80-120	6	360	180	178	110	125	100	160		97	163	701	80	138	150	200	19	4	16	47,6	52,1	0,096
TPE 80-120	10	360	180	178	110	125	100	160		97	163	701	80	138	160	200	19	8	16	49,1	53,6	0,096

TPE 100-120



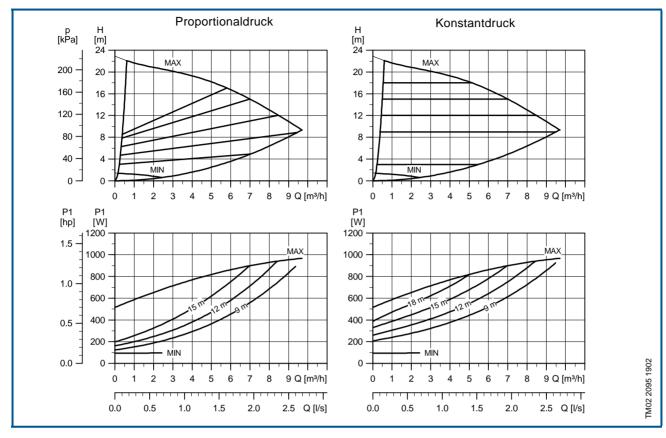
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0,2-2,2	2,2	5,35



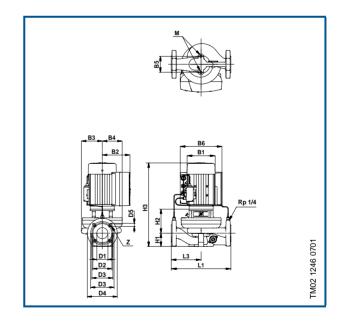
								Al	omes	sung	en [n	nm]						7		Gewic		Versand
Pumpentyp	PN	L1	L3	В1	B2	В3	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	[St.]	M	Netto	Brutto	volumen [m³]
TPE 100-120	6	450	225	178	110	125	100	160		107	185	733	100	158	170	220	19	4	16	58,6	63,6	0,120
TPE 100-120	10	450	225	178	110	125	100	160		107	185	733	100	158	180	220	19	8	16	58,6	63,6	0,120

TPE 32-180



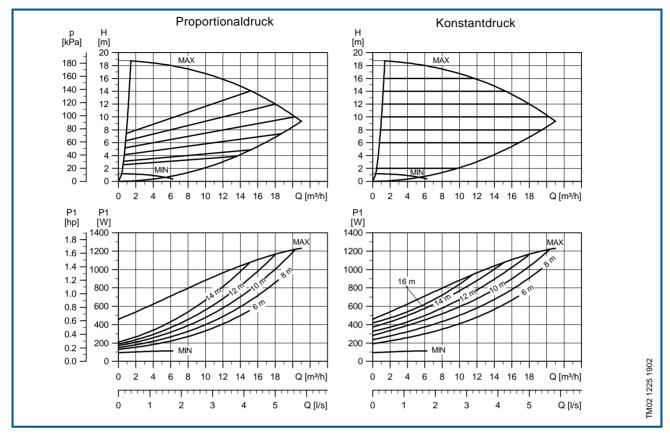
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
1 x 200-240 V	0.1-1.0	1.1	7,40-6,80



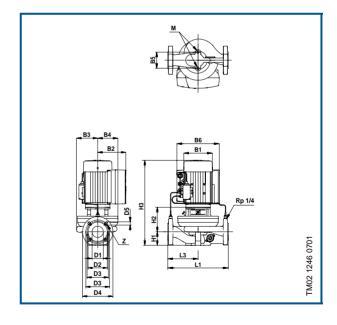
_								Al	omes	sung	en [n	nm]						z		Gewic	. 51	Versand
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	Н1	H2	Н3	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 32-180	6/10	280	140	142	140	102	102	80	210	79	137	447	36	76	90/100	140	14/19	4	12	30,6	33,8	0,064

TPE 40-180



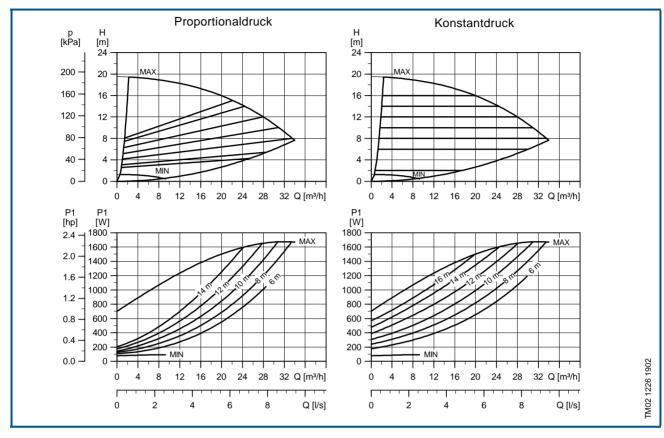
Elektrische Daten

	Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
I	1 x 200-240 V	0.1-1.3	1.1	7,80-6,60



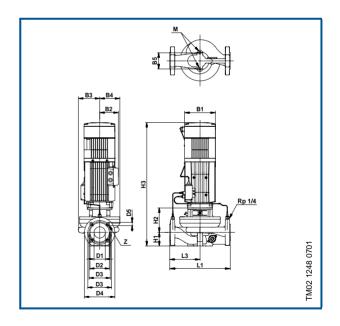
								A	bme	ssur	ngen	[mm]							Z		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 40-180	6/10	250	125	141	140	100	100	80	210	68	143	442	40	88	100/110	150	14/19		4	12	27,1	28,1	0,04

TPE 50-180



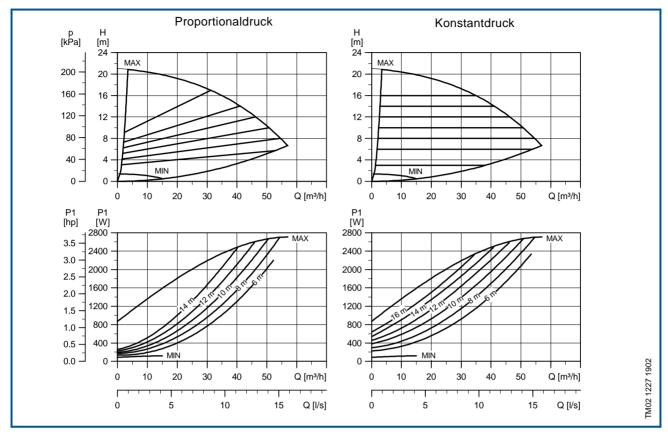
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0.1-1.7	1,5	3,90



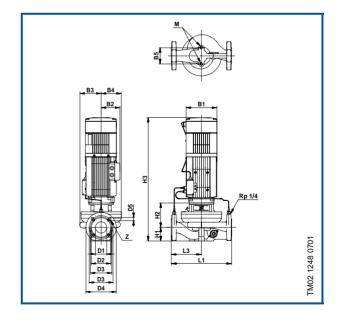
								Α	bme	essu	ngen	[mm]]						z		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	В2	В3	В4	В5	В6	Н1	Н2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 50-180	6/10	280	140	172	110	100	100	120		75	135	651	50	102	110/125	165	14/19		4	12	40,6	41,6	0,066

TPE 65-180



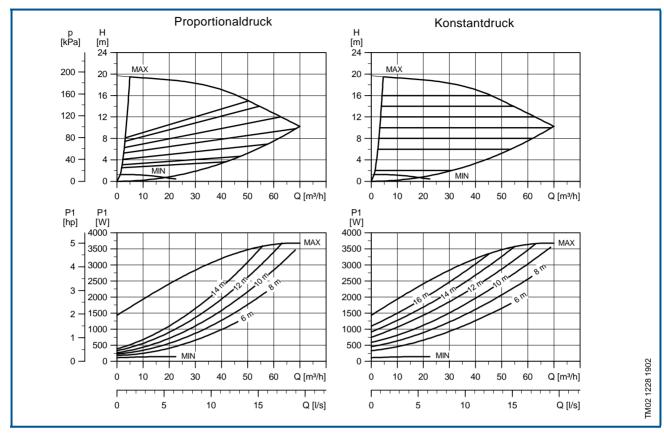
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0.1-2.8	2.2	5,45



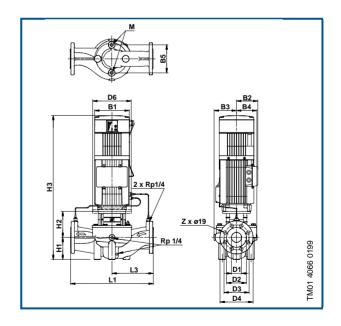
_								Α	bme	essu	ngen	[mm]						z		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 65-180	6/10	340	170	178	110	100	100	120		82	144	667	65	122	130/145	185	14/19		4	12	50,0	55,0	0,096

TPE 80-180



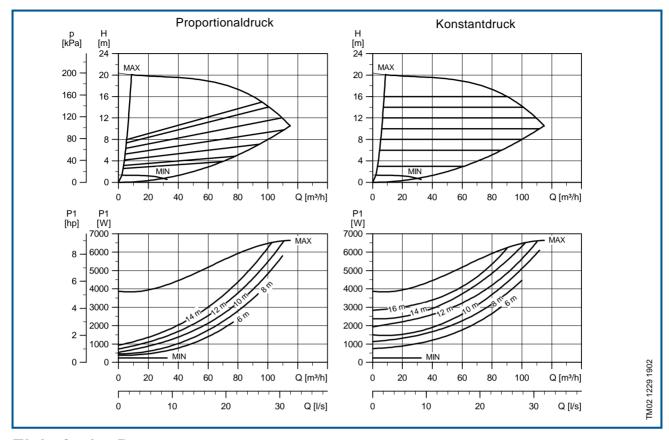
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0.2-3.8	3.0	6,80



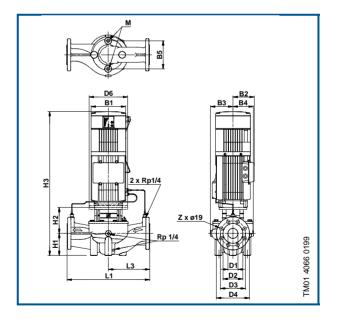
								Abm	essu	ngen	[mm]								7		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	B2	В3	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 80-180	16	525	262,5	178	110	158	123	144		132	145	772	80	140	160	200			8	16	65,0	92,0	0,230

TPE 100-180



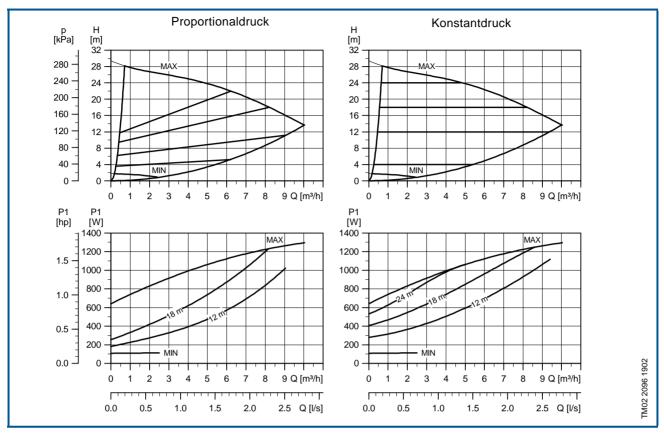
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0,3-7,0	5,5	12,0



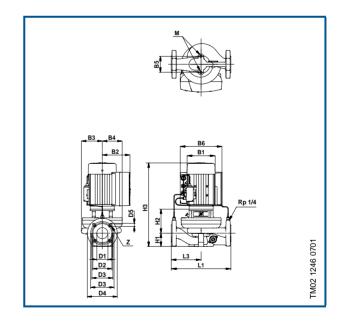
								Abı	mes	sunge	en [m	m]							7		Gewic	ht [kg]	
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 100-180	16	550	275	220	134	170	140	144		110	232	897	100	160	180	220		298	8	16	105,0	146,0	0,370

TPE 32-240



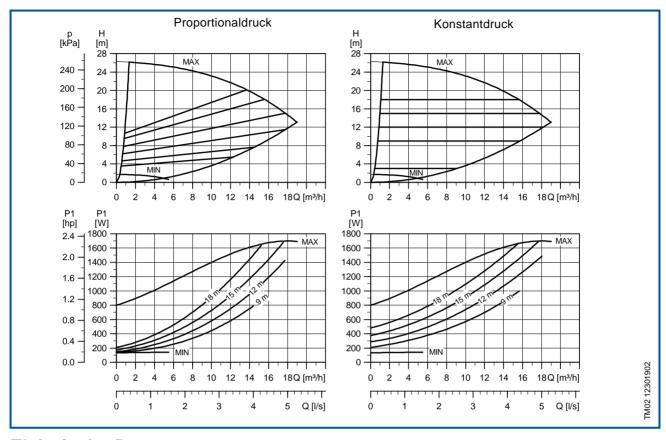
Elektrische Daten

Spannung versorgu U _n [V]		nme Motor	Volllaststrom I _{1/1} [A]
1 x 200-24	0 V 0,2-1	,3 1,1	7,40-6,80



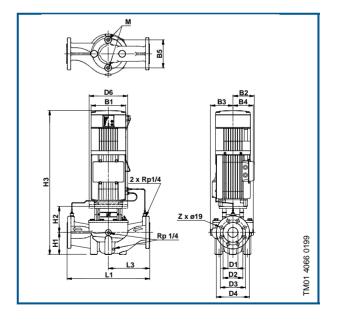
_								Al	omes	sung	en [n	nm]						z		Gewic	. 51	Versand
Pumpentyp	PN	L1	L3	В1	B2	ВЗ	В4	В5	В6	H1	H2	Н3	D1	D2	D3	D4	D5	[St.]	М	Netto	Brutto	volumen [m³]
TPE 32-240	6/10	280	140	142	140	102	102	80	210	79	137	447	36	76	90/100	140	14/19	4	12	30,3	33,5	0,064

TPE 50-240



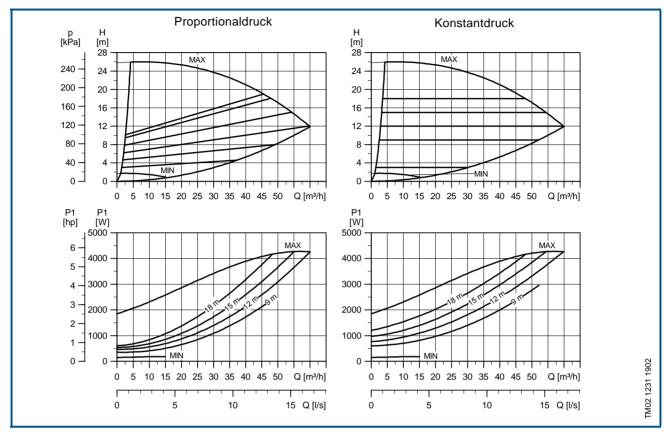
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0,1-1,7	1,5	4,00



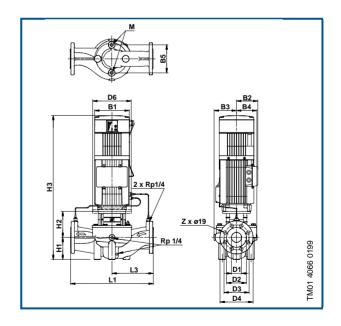
								Abm	essu	ngen	[mm]								7		Weigl	nt [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	B2	В3	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 50-240	16	425	212,5	178	110	112	100	144		110	135	686	50	102	125	165			4	16	51,0	81,0	0,210

TPE 65-240



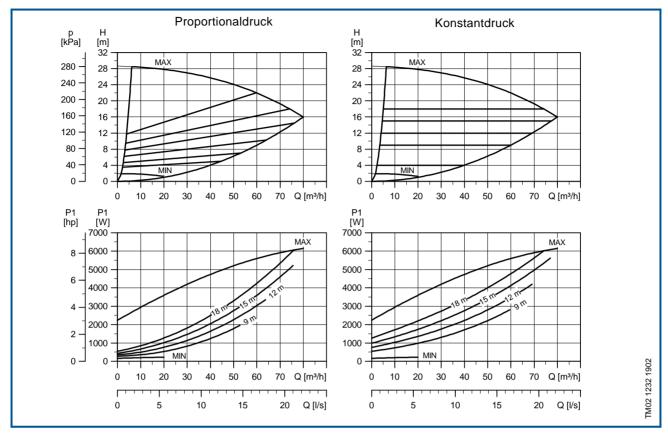
Elektrische Daten

	annungs- rsorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x	380-415 V	0.2-4.8	4.0	9.00



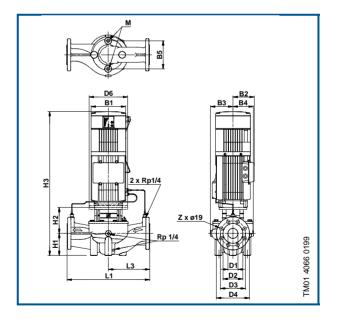
								Abm	essu	ngen	[mm]								7		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	B2	В3	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 65-240	16	475	237,5	220	134	130	110	144		117	145	798	65	122	145	185			4	16	71,0	104,0	0,340

TPE 80-240



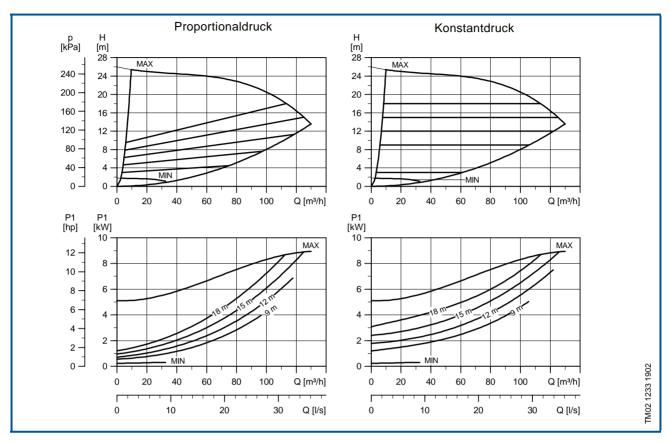
Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0,3-6,3	5,5	12.5



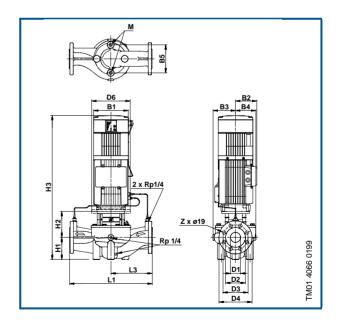
								Abm	essı	ınger	[mm]							7		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	B2	В3	В4	В5	В6	Н1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 80-240	16	525	262,5	220	134	158	123	144		132	200	887	80	140	160	200		298	8	16	96,0	129,0	0,340

TPE 100-240



Elektrische Daten

Spannungs- versorgung U _n [V]	Leistungs- aufnahme P ₁ [kW]	Motor P ₂ [kW]	Volllaststrom I _{1/1} [A]
3 x 380-415 V	0.2-8.7	7,5	15.8



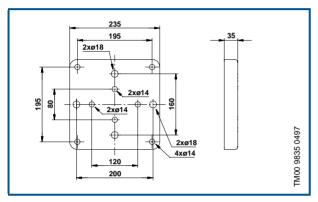
								Abı	mes	sunge	en [m	m]							Z		Gewic	ht [kg]	Versand-
Pumpentyp	PN	L1	L3	В1	В2	В3	В4	В5	В6	H1	H2	НЗ	D1	D2	D3	D4	D5	D6	[St.]	М	Netto	Brutto	volumen [m³]
TPE 100-240	16	550	275	220	134	170	140	144		110	232	897	100	160	180	220		298	8	16	111,0	141,0	0,370



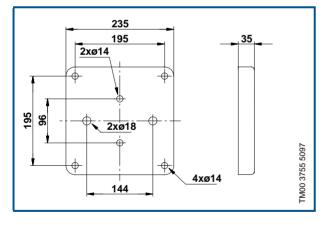
Grundplatten

Auf Anfrage sind Grundplatten einschließlich Sechskantschrauben erhältlich.

Pumpentyp	Sechskant- schrauben	Produkt- nummer
UPE 50-120 F, 65-120 F	2 x M12 x 20 mm	96 40 59 15
UPE 100-60 F UPE 80-120 F	2 x M16 x 30 mm	96 40 59 14
TPE 40-60, 50-60, TPE 32-120, 40-120, 50-120, 65-120 TPE 32-180, 40-180, 50-180, 65-180 TPE 32-240	2 x M12 x 20 mm	96 40 59 15
TPE 65-60, 80-60, 100-60 TPE 80-120 TPE 100-120	2 x M16 x 30 mm	96 40 59 14



Pumpentyp	Sechskant- schrauben	Produkt- nummer
MAGNA UPE 50-60 F, 65-60 F MAGNA UPE 32-120 F, 40-120 F,	2 x M12 x 20 mm	49 50 35
TPE 80-180, 100-180 TPE 50-240, 65-240, 80-240, 100-240	2 x M16 x 30 mm	48 50 31



Gegenflansche

Ein Set besteht aus zwei Flanschen einschließlich Dichtungen und Bolzen.

Gegenflansche gemäß ISO 7005-1.

Rp: Flansch mit Innengewinde (Dichtungsgewinde gemäß ISO).

mm: Flansch für Schweißen/Löten.

Pumpen mit Gehäuse in Gusseisenausführung

Pumpentyp	Druckstufe	Größe	Produkt- nummer
UPE(D), MAGNA, TPE 32	PN 10	Rp 11/4	53 97 03
OTE(B), MAGNA, TTE 32	11110	32 mm	53 97 04
UPE(D), MAGNA, TPE 40	PN 10	Rp 1½	53 97 01
OT E(B), WINGTON, THE 40	11410	40 mm	53 97 02
UPE(D), MAGNA, TPE 50	PN 10	Rp 2	54 98 01
OI E(B), MAGNA, II E 30	11110	50 mm	54 98 02
UPE(D), MAGNA, TPE 65	PN 10	Rp 2½	55 98 01
OI E(B), MAGNA, II E 03	11110	65 mm	55 98 02
	PN 6	Rp 3	56 99 02
UPE(D), TPE 80	1140	80 mm	56 99 01
01 E(D), 11 E 00	PN 10	Rp 3	56 98 02
	11110	80 mm	56 98 01
	PN 6	Rp 4	57 99 01
UPE(D), TPE 100	1110	100 mm	57 99 02
01 L(D), 11 L 100	PN 10	Rp 4	57 98 01
	11410	100 mm	57 98 02

Pumpen mit Gehäuse in Bronzeausführung

Pumpentyp	Druckstufe	Größe	Produkt- nummer
UPE, MAGNA, TPE 32	PN 10	Rp 11/4	96 42 70 29
OI E, WAGNA, II E 32	11010	32 mm	96 42 70 30
UPE, MAGNA, TPE 40	PN 10	Rp 1½	53 97 11
OFE, WAGNA, TEE 40	FINIO	40 mm	53 97 12
UPE, MAGNA, TPE 50	PN 10	Rp 2	54 98 11
OFE, WAGNA, TEE 30	FINIO	50 mm	54 98 12
UPE, MAGNA, TPE 65	PN 10	Rp 2½	55 98 11
OFE, WAGNA, TEE 05	FINIO	65 mm	55 98 12
	PN 6	Rp 3	96 40 57 35
UPE. TPE 80	FINO	80 mm	56 99 11
OFE, IFE 80	PN 10	Rp 3	56 98 12
	1 14 10	80 mm	56 98 11

Rohrverschraubungsund Ventilsätze

Rohrverschraubungssätze

Pumpentyp	Druckstufe	Größe	Produkt- nummer
UPE 25	PN 10	Rp ¾	52 99 21
		Rp 1	52 99 22
		Rp 11/4	52 97 24
UPE 32	PN 10	Rp 1	50 99 21
		Rp 11/4	50 99 22

Ventilsätze

Pumpentyp	Druckstufe	Größe	Produkt- nummer
UPE 25	PN 10	Rp ¾	51 98 05
		Rp 1	51 98 06
		Rp 11/4	51 98 07
UPE 32	PN 10	Rp 11/4	50 55 39

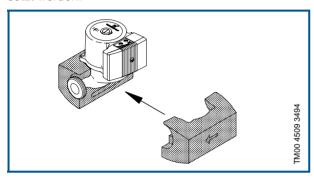
Zubehör

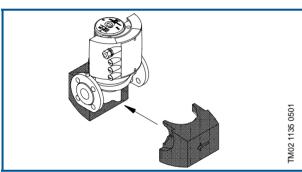
Isoliersätze

Die Einzelkopfpumpen MAGNA und UPE können mit zwei Isolierschalen versehen werden.

Die Isolierdicke des Isoliersatzes entspricht dem Nenndurchmesser der Pumpe.

Der auf den einzelen Pumpentyp zugeschnittene Isoliersatz umschließt das gesamte Pumpengehäuse. Die beiden Schalen können leicht auf die Pumpe aufgesetzt werden.





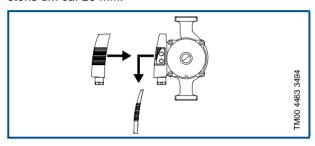
Pumpentyp	Produktnummer
UPE 15-40, 25-40, 32-40, 25-60, 32-60	50 58 21
UPE 25-80	52 52 42
UPE 32-80 (F)	52 52 42
UPE 40-80 F	52 52 43
MAGNA UPE 32-120 F	54 62 22
MAGNA UPE 40-120 F	54 62 23
MAGNA UPE 50-60 F	54 62 24
UPE 50-80 F	54 52 43
UPE 50-120 F	96 43 46 43
MAGNA UPE 65-60 F	54 62 25
UPE 65-120 F	96 43 46 44
UPE 80-120 F	96 43 46 45
UPE 100-60 F	96 43 46 46

Erweiterungsmodule für UPE 1~

Die einphasigen UPE-Pumpen können mit einem Fehlersignalmodul oder einem Busmodul ausgestattet werden.

Das Erweiterungsmodul wird auf den Klemmenkasten montiert, indem erst die bestehende Abdeckung des Klemmenkastens entfernt und dann die neue Abdekkung mit integriertem Modul auf den Klemmenkasten aufgesetzt wird.

Die neue Abdeckung erhöht die Höhe des Klemmenkastens um ca. 20 mm.



	Fehlersignalmodul		Busn	nodul
Pumpentyp	Тур	Produkt- nummer	Тур	Produkt- nummer
UPE xx-40 (A) UPE xx-60 (A)	MC 40/60	60 56 63	MB 40/60	60 55 18
UPE xx-80 (F)	MC 80	60 56 66	MB 80	60 54 97



Fehlersignalmodul MC 40/60 und MC 80

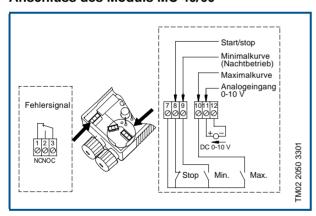
Das Fehlersignalmodul ermöglicht über ein internes Relais den Zugang zu einem potentialfreien Fehlersignal.

Neben diesem Fehlersignalausgang verfügt das Modul über vier Eingänge für folgende externe Signale:

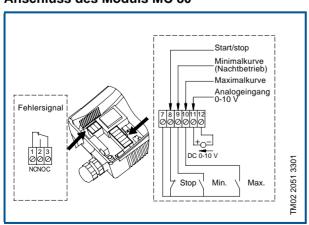
- Start/Stop der Pumpe
- Betrieb bei Maximalkurve
- · Betrieb bei Minimalkurve (Nachtbetrieb)
- Analogeingang 0-10 V.

Eingangs- und Ausgangssignale		
Externer Start/ Stop-Eingang	Externer potentialfreier Schalter. Abgeschirmtes Kabel. Maximale Kontaktlast: 5 V/2,7 mA. Logische Pegel: Null: U < 1,5 V. Eins: U > 4,0 V.	
Sollwertsignale	Min. and max. curve input Externer potentialfreier Schalter. Abgeschirmtes Kabel. Maximale Kontaktlast: 5 V/2,7 mA. Logische Pegel: Null: U < 1,5 V. Eins: U > 4,0 V. Eingang für Analogsignal, 0-10 V Externes Signal: 0-10 V DC. Maximale Kontaktlast: 0,1 mA.	
Signalausgang	Interner potentialfreier Umschaltkontakt. Abgeschirmtes Kabel. Maximale Kontaktlast: 250 V AC, 2 A. Minimale Kontaktlast: 5 V DC, 1 mA.	

Anschluss des Moduls MC 40/60



Anschluss des Moduls MC 80



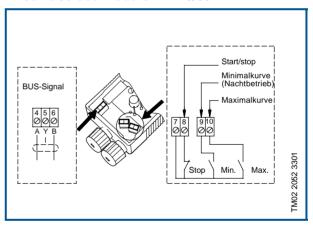
Busmodul MB 40/60 und MB 80

Das Busmodul ermöglicht den seriellen Datenaustausch mit der Pumpe über einen RS-485-Eingang. Neben dem Buseingang verfügt das Busmodul über drei Eingänge für folgende externe Signale:

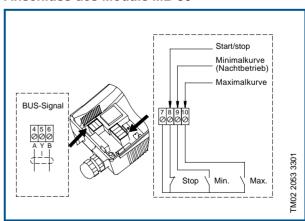
- Start/Stop der Pumpe
- Betrieb bei Maximalkurve
- · Betrieb bei Minimalkurve (Nachtbetrieb).

Eingangssignale		
Externer Start/ Stop-Eingang	Externer potentialfreier Schalter. Abgeschirmtes Kabel. Maximale Kontaktlast: 5 V/2,7 mA. Logische Pegel: Null: U < 1,5 V. Eins: U > 4,0 V.	
Sollwertsignale	Minimal- und Maximalkurveneingang Externer potentialfreier Schalter. Abgeschirmtes Kabel. Maximale Kontaktlast: 5 V/2,7 mA. Logische Pegel: Null: U < 1,5 V. Eins: U > 4,0 V.	
Buseingang	Grundfos-GENIbus-Protokoll, RS-485. Abgeschirmtes Kabel. Steigungsquerschnitt: 0,25 bis 1 mm². Kabellänge: max. 1200 m.	

Anschluss des Moduls MB 40/60



Anschluss des Moduls MB 80





Erweiterungsmodule für MAGNA

MAGNA-Pumpen können mit einem Erweiterungsmodul ausgestattet werden, das den Datenaustausch über externe Signale ermöglicht (Signaltransmitter).

Es sind zwei verschiedene Erweiterungsmodule erhältlich:

- GENI-Modul
- · LON-Modul.

Das Erweiterungsmodul wird montiert, indem die Abdeckung des Klemmenkastens geöffnet und das Modul in den Klemmenkasten eingesetzt wird.

Bezeichnung	Produktnummer
GENI-Modul	60 58 03
LON-Modul	60 58 09

GENI-Modul

Das GENI-Modul verfügt über einen Eingang für einen externen Analogsignaltransmitter von 0-10 V GS (Klemmen 10 V und ↓). Über diesen Eingang kann die Pumpe durch eine externe Steuerung gesteuert werden, wenn die Pumpe auf eine der folgenden Steuerungsarten eingestellt worden ist:

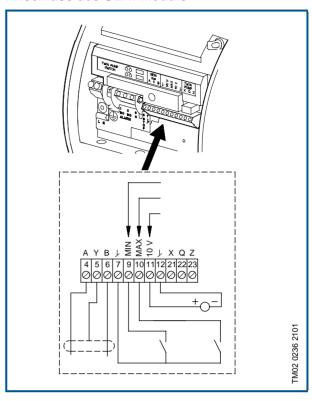
- Konstantkurve
- · Proportional- oder Konstantdrucksteuerung.

Das GENI-Modul ist überdies mit Eingängen für externe Signale für Zwangssteuerungsfunktionen ausgestattet:

- Betrieb bei Maximalkurve
- · Betrieb bei Minimalkurve.

Eingangssignale		
Sollwertsignale	Minimal- und Maximalkurveneingang Externer potentialfreier Schalter. Kontaktlast: Max. 5 V, 1 mA. Abgeschirmtes Kabel. Schleifenwiderstand: max. 130 Ω/km Logische Pegel: Null: U < 1,5 V Eins: U > 4,0 V. Eingang für Analogsignal 0-10 V Externes Signal: 0-10 V Gleichstrom. Maximale Last: 0,1 mA. Abgeschirmtes Kabel.	
Buseingang	Grundfos-GENIbus-Protokoll, RS-485. Abgeschirmtes Kabel. Steigungsquerschnitt: 0,25 bis 1 mm². Kabellänge: max. 1200 m.	

Anschluss des GENI-Moduls

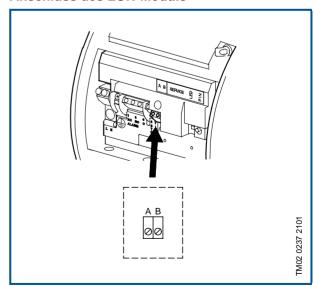


LON-Modul

Das LON-Modul bietet die Möglichkeit, die Pumpe an ein LonWorks[®]-Netz anzuschließen. Das Modul wird für die Datenübertragung zwischen einem Netz und MAGNA UPE eingesetzt.

Input signals		
Buseingang	LonTalk [®] -Protokoll, FTT 10. Nicht-abgeschirmtes verdrilltes Kabelpaar. Steigungsquerschnitt: 0,25 bis 1 mm².	

Anschluss des LON-Moduls





R100

R100 ist für den drahtlosen Datenaustausch mit der Serie 2000 bestimmt. Der Datenaustausch findet mit Hilfe von Infrarotlicht statt.

Bezeichnung	Produktnummer
R100	62 53 33

PMU 2000

PMU 2000 ist für den Datenaustausch über den Bus bestimmt und ermöglicht folgende Funktionen:

- · Parallelanschluss von bis zu acht Pumpen
- Kaskadensteuerung
- Zentrales Auslesen verschiedener Statusinformationen.

Produkt	Bezeichnung	Produktnummer
PMU 2000, IP 42	Max. 8 Pumpen	62 57 28 47
PMU 2000, IP00	Max. 8 Pumpen	62 57 28 37

PCU 2000

PCU 2000 ist für den Datenaustausch über den Bus bestimmt und ermöglicht folgende Funktionen:

- Fehleranzeige für jede Pumpe
- Externer Sollwerteinfluss
- · Start/Stop der Anlage.

Produkt	Bezeichnung	Prod. no.
PCU 2000, IP 42	Max. 2 Pumpen	62 55 22 41
PCU 2000, IP 00	Max. 2 Pumpen	62 55 22 31
PCU 2000, IP 42	Max. 4 Pumpen	62 55 24 41
PCU 2000, IP 00	Max. 4 Pumpen	62 55 24 31
Erweiterungsmodule	Für 2 Pumpen	62 50 02 11

G10-LON-Schnittstelle

Die G10-LON-Schnittstelle wird in Verbindung mit der Datenübertragung zwischen einem LonWorks®-Netz und elektronisch gesteuerten Grundfos-Pumpen eingesetzt, die das Grundfos-Busprotokoll GENIbus anwenden.

Produkt	Produktnummer
G10-LON-Schnittstelle	00 60 57 26

Vorfilter

Ein Vorfilter muss eingebaut werden, wenn die Klassifizierung der UPE-Pumpe auf Überspannungseigenschaft Klasse 1 oder 2 gemäß VDE 0160/12.90 erforderlich ist.

Für dreiphasige UPE-Pumpen sind drei Vorfilter erforderlich.

Produkt	Produktnummer
Vorfilter	62 58 22 00

EMV-Filter

Die Montage von 5,5 kW (1400-1800 min-¹) und 7,5 kW Pumpen in Wohngebieten fordert einen EMV-Filter.

Bezeichnung	Grundfos Produktnummer			
EMV-Filter	96 04 10 47			

Der EMV-Filter ist zu verwenden unter Berücksichtigung der Ansprüche der EN 61 800-3-Norm.

Der EMV-Filter ist deshalb bei der Montage von 5,5 kW 4-poligen Pumpen und 7,5 kW 2-poligen Pumpen in Wohngebieten erforderlich.



UPE-Serie 2000, Gusseisenausführung

	Produktnummern						
Pumpentyp	Rohranschlüsse			Flanschanschlüsse			
	1"	11/2"	2"	PN 6/PN 10	PN 6	PN 10	
Einzelkopfpumpen							
UPE 25-40		59 54 40 92					
UPE 32-40			59 58 44 06				
UPE 25-60 180		59 54 65 74					
UPE 32-60			59 58 65 05				
UPE 25-80		52 00 11 27					
UPE 32-80			52 05 20 28				
UPE 40-80 F				52 02 21 07			
UPE 50-80 F				52 05 20 46			
MAGNA UPE 32-120 F				99 44 12 12			
MAGNA UPE 40-120 F				99 44 12 13			
MAGNA UPE 50-60 F				99 44 12 15			
UPE 50-120 F				96 40 21 04			
MAGNA UPE 65-60 F				99 44 12 16			
UPE 65-120 F				96 40 22 81			
UPE 80-120 F					96 40 24 42	96 40 24 43	
UPE 100-60 F					96 40 26 16	96 40 26 18	

UPE-Serie 2000, Bronzeausführung

	Produktnummern					
Pumpentyp	Rohranschlüsse		Flanschanschlüsse			
	11/2"	2"	PN 6/PN 10	PN 6	PN 10	
UPE 25-40 B	59 54 40 93					
UPE 25-60 B	59 73 65 17					
UPE 32-80 B		52 05 20 38				
UPE 40-80 F B			52 05 20 39			
MAGNA UPE 32-120 F B			96 44 12 23			
MAGNA UPE 40-120 F B			96 44 12 25			
MAGNA UPE 50-60 F B			96 44 12 26			
UPE 50-120 F B			96 40 21 11			
MAGNA UPE 65-60 F B			96 44 12 27			
UPE 65-120 F B			94 40 22 88			
UPE 80-120 F B				96 40 58 29	96 40 24 46	
UPE 100-60 F B				96 40 58 30	96 40 58 32	

Bestelldaten

TPE-Serie 2000

	Produktnummern					
Pumpentyp	Wellendichtung					
	BUBE	BBUE	AUUE	RUUE		
TPE 40-60	96 45 97 27		96 45 97 29	96 45 97 28		
TPE 50-60	96 45 97 30		96 45 97 32	96 45 97 31		
TPE 65-60	96 45 97 33		96 45 97 35	96 45 97 34		
TPE 80-60	96 46 17 61		96 46 17 62	96 46 17 63		
TPE 80-60	96 45 97 36		96 45 97 38	96 45 97 37		
TPE 100-60	96 46 17 64		96 46 17 65	96 46 17 66		
TPE 100-60	96 45 97 39		96 45 97 41	96 45 97 40		
TPE 32-120	96 45 97 42		96 45 97 44	96 45 97 43		
TPE 40-120	96 45 97 45		96 45 97 47	96 45 97 46		
TPE 50-120	96 45 97 48		96 45 97 50	96 45 97 49		
TPE 65-120	96 45 97 51		96 45 97 53	96 45 97 52		
TPE 80-120	96 40 24 59		96 40 24 61	96 43 86 99		
TPE 80-120	96 40 24 60		96 40 24 62	96 43 87 01		
TPE 100-120	96 40 26 82		96 40 26 84	96 43 87 05		
TPE 100-120	96 40 26 83		96 40 26 85	96 43 87 08		
TPE 32-180	96 46 40 09		96 46 40 10	96 46 40 11		
TPE 40-180	96 45 70 61		96 45 70 63	96 45 70 62		
TPE 50-180	96 45 70 64		96 45 70 66	96 45 70 65		
TPE 65-180	96 45 70 67		96 45 70 69	96 45 70 68		
TPE 80-180	48 06 20 41		48 00 20 41	48 03 20 41		
TPE 100-180		48 06 20 51	48 00 20 51	48 03 20 51		
TP 32-240	96 46 40 12		96 46 40 13	96 46 40 14		
TPE 50-240	48 06 20 22		48 00 20 22	48 03 20 22		
TPE 65-240	48 06 28 31		48 00 28 31	48 03 28 31		
TPE 80-240		48 06 28 41	48 00 28 41	48 03 28 41		
TPE 100-240		48 06 20 52	48 00 20 52	48 03 20 52		

V7 13 12 85 05 02 Erst.: V7 13 12 85 10 98

Änderungen vorbehalten.

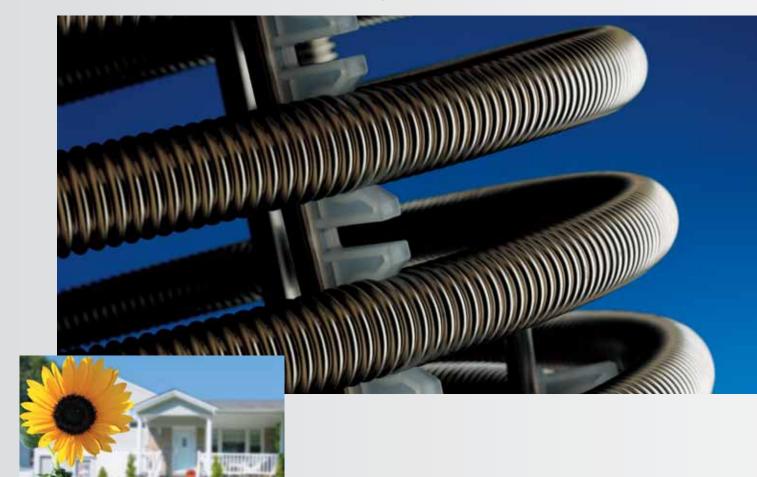
Bruggacherstrasse 10 CH-8117 Fällanden Tel: + 01-806 81 11

Fax: + 01-806 81 15

e-mail: INFO_CH@Grundfos.com http://www.grundfos.com

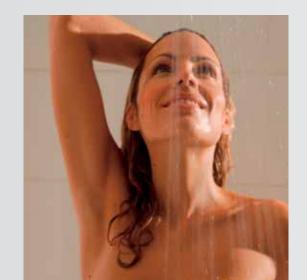


ROTEX Sanicube: Combination of Hot water storage tank and Instantaneous heater.



ROTEX Sanicube -

The hygienic hot water storage tank.





Hygienic hot water –

as much as you want.

True home comfort

Hot and fresh water is indispensable for every household. Whether for showering, bathing, cooking or hand washing. Having hot water available in the desired volume and at the desired temperature is a significant constituent of our modern life. The fact that this water is also hygienic is, of course, a prerequisite.

Conventional water heaters often fails to meet these requirements today.

Highest levels of water comfort

We have therefore placed special emphasis on water hygiene! The ROTEX Sanicube was conceived in accordance with the latest thermal technology and water hygiene requirements. Its structure is fundamentally different from normal large volume hot water storage tanks. The ROTEX Sanicube combines the advantages of the instantaneous water heater with those of a heat storage facility. Its design concept ensures that it conveniently provides, at all times, hygienic hot water.



ROTEX Sanicube The high performance hot water storage tank

- Optimum water hygiene
- **■** High comfort

Structure and function

Clear separation of Domestic hot water and storage tank water

The ROTEX Sanicube is a combination of hot water storage tank and instantaneous water heater. This means that the actual heat is not stored in the domestic water itself, but in the storage tank water which is clearly separated from it. The volume of the stored domestic water is relatively small and is 19-29 litres, depending upon the type of storage tank.

On the other hand, the total storage tank volume is 300 and 500 litres. This amount of heat that can be stored and also removed is accordingly large.

Heat storage and Instantaneous heater

The storage tank water is added at commissioning and serves only for heat storage. It is not exchanged and consumed.

The storage tank itself is made entirely of plastic, the inner and outer walls are impact-resistant polypropylene (PP), the space in-between is filled with highly heat insulating foam. This provides for very good heat insulation values and minimum surface losses.



The heating of the storage tank water, and thus the charging of the storage tank, can take place in various ways:

- a) With heating water (oil, gas, solid fuel boilers, heat pump or remote heat) via the stainless steel heat exchanger.
- b) With solar energy, direct heating of the storage tank water via the ROTEX Solaris system.
- c) With an electric immersion heater (2.4 or 6 or 12 kW).

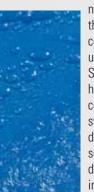
The hot water (domestic) is heated in a corrugated tube heat exchanger made of stainless steel which is immersed in the storage tank water.

Water hygiene is our principle.

The anti-legionella storage tank.

The structure of the ROTEX Sanicube ensures that it has optimum inherent water-hygienic properties since the water to be heated is ducted and heated through a stainless steel corrugated tube heat exchanger system.

Low flow sections or sections that are



not heated properly on the hot water side are completely eliminated using the ROTEX Sanicube. The domestic hot water is entirely contained in a piping system so that the deposits such as sediment, rust or other deposits which can arise in large volume tanks are not produced. Water that

is charged first is also the first to be removed (first-in first-out principle). The water hygienic advantages of the ROTEX Sanicube are thus considerable.

The outstanding water-hygienic advantages have been confirmed by an extensive test undertaken by the Hygiene Institute at the University of Tübingen.



Keyword: Legionella

Legionella bacteria
There are about 35 types of
Legionella. At least 17 of these
produce illness.
The main consequences are:
Pontiac fever: flu-like symptoms
which subside after a few days.
Legionnaire's disease: severe
bacterial lung infection.
In 15 to 20 percent of the cases the
infection leads to death.



Experience makes a good product

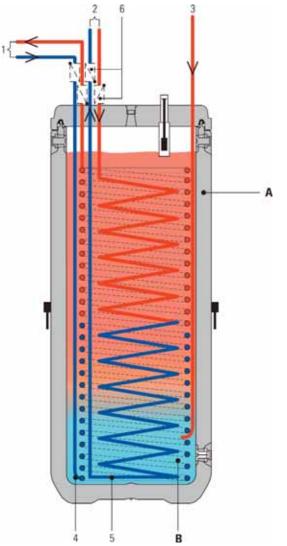
ROTEX have been making hot water storage tanks according to this principle for 25 years to provide optimum water hygiene. All generations of storage tank have been designed to ensure that the heated domestic water only stays in the storage tank for short periods of time. This means that deposits (lime, sediment or rust) can not arise in the domestic hot water.

The Sanicube was continuously developed on the basis of these intentions.



Sanicube 328 Sanicube 538





- Solaris connection 3 Domestic water heat exchanger
- (stainless steel) Storage tank primary loading heat exchanger (stainless steel)
- 6 Non Return valves (accessories)
- A Hot water stratified storage tank
- Pressure-free storage tank water
- Domestic hot water
- 2 Storage tank primary loading coil
- Domestic water heat exchanger (stainless steel)
- Storage tank primary loading heat exchanger (stainless steel)
- 5 Non return valves (accessories)

The Sanicube principle

Hot water stratified storage tank

Pressure-free storage tank water

Storage tank primary loading coil

Domestic hot water

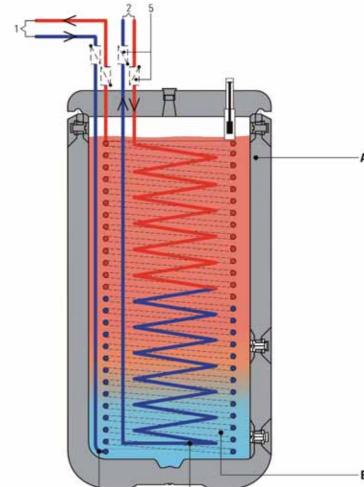
On the Sanicube INOX, the heat exchanger which contains the domestic hot water is made of stainless steel (INOX). It is the high efficiency version and operates at all times as a stratified storage tank. This means that it can produce maximum hot water at the same storage tank temperature.

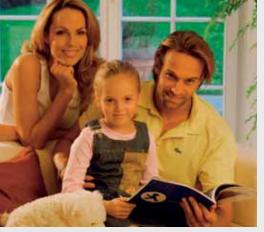
The pronounced temperature stratification makes the Sanicube Solaris INOX ideal as a stratified storage tank in combination with the unpressurised ROTEX Solaris installation.















Energy saving with a capital E.

A significant measure for the evaluation of a hot water storage tank is the surface heat loss.

The storage tank material (PP) and the all-round heat insulation using PU foam keep these heat losses to a minimum.

At an average storage tank temperature of 58 °C and an ambient temperature of 20 °C, the heat loss is just 82 W, this corresponds to a temperature loss in the storage tank water of just 3.5 degrees per day.

The heat energy consumption for hot water preparation is thus low. This saves precious energy.

Low scaling

On commissioning, the storage tank is filled with tap water without the use of additives. This water serves as the heat storage medium and is not exchanged during operation. Thus, on the storage water side, the lime contained in the water can only be deposited once. All the heat exchanger pipes in the storage tank therefore remain free of limescale,

electric immersion

as does the heater, which is available as an option.

In addition, on the inner surface of the heat exchanger pipes, there is only a low tendency to scaling because of the high flow speeds when water is removed. If you are in a very hard water area it may be advisable to fit a physical water softener in front of the Sanicube.

Modulating storage tank system

The ROTEX Sanicube can also cover larger demands for hot water. For this application several ROTEX Sanicube storage tanks can be combined together. This means that storage tank and output capacities of virtually unlimited size can be created.

On the heating and hot water side the individual Sanicube storage tanks can be combined to produce even output distribution (reverse return principle).

Further information concerning large-scale installations can be obtained from the separate brochure "ROTEX Sanicube - hygienic high-efficiency hot water systems".

ROTEX Sanicube Solaris -Solar energy for hot water and heating

In combination with the unpressurised solar system ROTEX Solaris the free power of the sun is utilised in a highly efficient manner:

- for hot water preparation
- for heating support
- with the lowest possible heat
- minimum maintenance expenditure
- with perfect water hygiene
- and practical unlimited hot water comfort.

Further information can be obtained from the brochure ROTEX Solaris.

ROTEX HybridCube® – The special heat pump storage tank

We developed the HybridCube® specially for the ROTEX HPSU air-water heat pump. It is the heart of the ROTEX heat pump system. It stores the heat obtained and then transfers it to the heating system at the required time.

> For further information. refer to the ROTEX HeatPumpSolarUnit brochure.

Long-life and safe

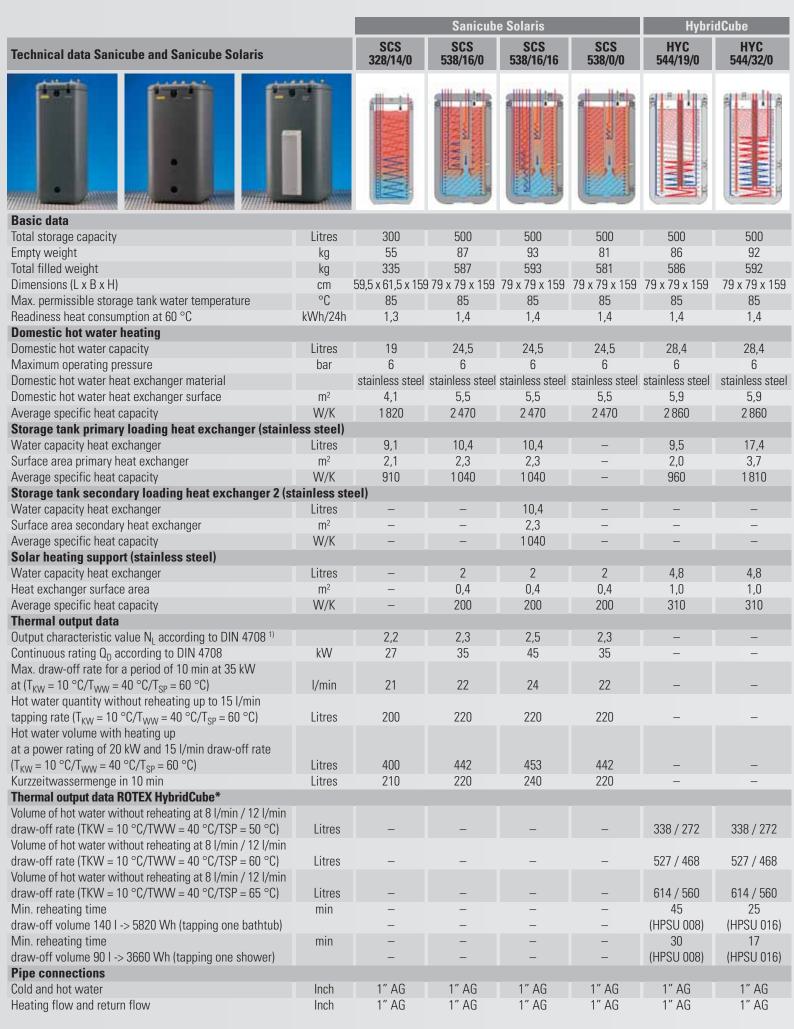
Hot water hygiene and hot water comfort are elementary requirements for us all. We should not have to compromise on these requirements.

ROTEX Sanicube meets these demands with no limitations.

The materials used (plastic and stainless steel) ensure the ROTEX Sanicube has a long life and will provide hygenic hot water for decades.



Hot water storage tank Sanicube Mini and oil condensing boiler ROTEXA1



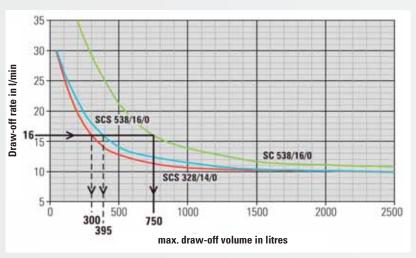
at charging with 35 kW, 80 °C flow temperature, 65 °C storage tank temperature 45 °C hot water temperature and 10 °C cold water temperature

* Definition:

DHWV = The volume of hot water available without further heating and the volume of draw-off at a mixed water temperature of 40 °C and a cold water temperature of 10 °C.

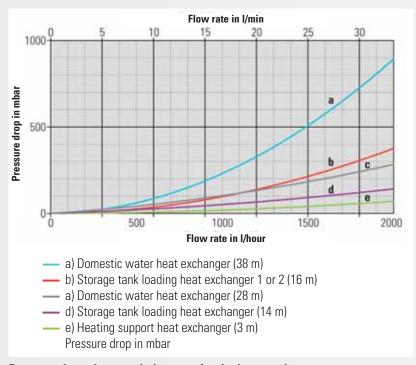
Reheating time = The time required to reheat the hot water storage tank to a storage tank temperature of 50 °C after removing a specified volume of hot water.

Sanicube				
SC 538/16/0	SC 538/16/16			
Ε00	Ε00			
500 84	500 90			
584	590			
79 x 79 x 159	79 x 79 x 159			
1,4	1,4			
24,5	24,5			
6	6			
	stainless steel			
5,5 2 470	5,5 2 470			
24/0	2470			
10,4	10,4			
2,3	2,3			
1040	1040			
_	10,4			
_	2,3			
-	1 040			
_	_			
_	_			
_	_			
4,1	4,4			
35	50			
30	31			
412	412			
712	712			
837	843			
300	310			
-	-			
-	-			
-	-			
-	-			
-	-			
1" AG	1" AG			
1" AG	1" AG			
. ,	. ,			



Hot water output with respect to draw-off rate

- Storage tank temperature 60 °C
- Draw-off temperature 40 °C
- Boiler output 20 kW
- Cold water temperature 10 °C



Pressure drop characteristic curve for the heat exchanger



Connection drawing for the ROTEX Solaris System for hot water preparation with heating support: with ROTEX A1 Oil condensing boiler



the complete heating system.

What is EcoHybrid®?

The word "hybrid" originates from Greek and means "mixed, from two different origins".

A hybrid heating system allows the different types of energy to work together, such as heat pumps and solar energy, but also allows other types of energy to be integrated, such as oil, gas, pellet, or even log burning boilers. This means you are equipped to face any contingencies in the future. Consistent use of renewable energies and efficiency that is practically impossible to surpass.

Everything from a single source

ROTEX manufactures all the important system components for the EcoHybrid® heating system itself. This means you can rely on the fact that all components are optimally made to work together and thus guarantee the greatest energy efficiency and highest level of comfort. As a system manufacturer for know-how in development and manufacturing, ROTEX stands for decades of system experience. Your heating is our profession!

ROTEX EcoHybrid® – variable and extendable

Regardless of the way in which you start using hybrid technology today, the good thing about the EcoHybrid® is that you can extend the system at a later date.

ROTEX EcoHybrid® – Safety and comfort for your future!

The entire system from a single source:

- Modern calorific value technology
- Regenerative air / water heat pump
- Thermal solar plant for heating and hot water
- Hygienic hot water storage tank
- Cosy underfloor heating system
- Odour-locked safety heating oil tank
- A plastic pipework connection system suitable for both domestic water and heating installations.

You can find additional information at www.rotex.de.













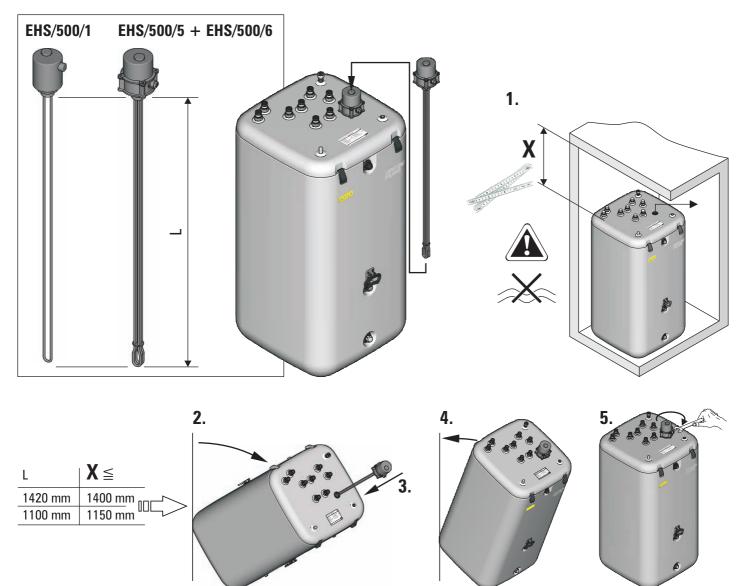
ROTEX Heating Systems GmbH Langwiesenstraße 10 · D-74363 Güglingen Fon +49(7135)103-0 · Fax +49(7135)103-200 e-mail info@rotex.de · www.rotex.de

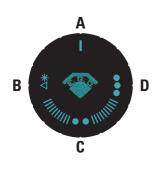






EHS/500/6 716 51 36 ~230/400 V / 2,4,6 kW L=1100 mm



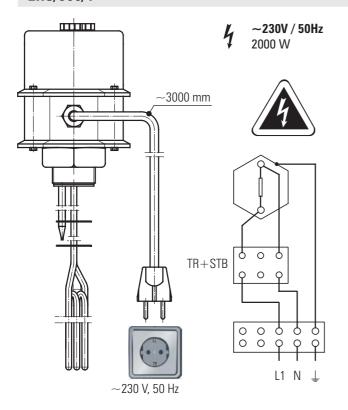


	EHS/500/1		EHS/500/5	+ EHS/500/6
Α	XX		*	
В	XX	4-18°C	**	
С	<u> </u>	~50°C	<u> </u>	~55°C
D	<u>}}}</u>	~65°C	<u>}}}</u>	~78°C



EHS/500/1

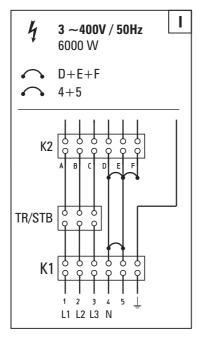
EHS/500/5 + EHS/500/6

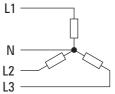


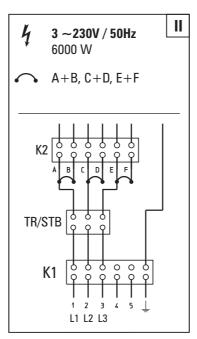


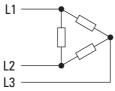
EHS/500/5 + EHS/500/6

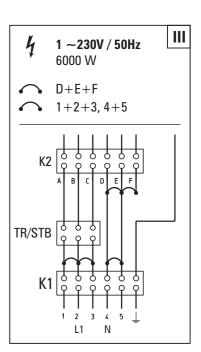












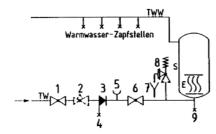


Montagehinweise für EGO Einschraubheizkörper (EHK)

Sicherheitstechnische Hinweise

Der EHK muß von einem Fachmann installiert werden, der für die Einhaltung der bestehenden Normen und Installationsvorschriften verantwortlich ist. Bei der Installation der EHK sind folgende Vorschriften zu beachten:

- Die Vorschriften des VDE und der örtlichen EVU
- Die Heizungsanlagenverordnung (HeizAnl.V)
- Bei Verwendung in Druckbehältern: Das AD-Merkblatt A3, Abschnitt 3.28
- Die Normen der Reihe DIN 1988
- Bei geschlossenen Wassererwärmern ist die Anordnung der verwendeten Armaturen und Sicherheitseinrichtungen unbedingt zu beachten.



- Absperrventil
- Druckminderventil Rückflußverhinderer
- Prüfventil
- Anschluß für Meßgerät
- Absperrventil
- Sicherheitsventi
- Entleerungsventil

- Elektro-Heizeinsatz
- Geschlossener Was rerwärmer (Speicher
- Trinkwasserleitung

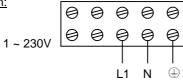
- Die verwendeten Sicherheitsventile müssen so eingestellt werden, daß der Druck im Behälter um nicht mehr als 1 bar über den Nenndruck ansteigt.
- Bei offenen Wasserbehältern müssen die Wasserauslaufsysteme so gestaltet sein, daß der Druck im Behälter den Nenndruck nicht übersteigt.
- Installationsseitig ist eine allpolige Trennung vom Netz mit einer Kontaktöffnung von mindestens 3 mm pro Pol vorzusehen.
- Der maximale Betriebsdruck darf 10 bar nicht überschreiten.
- Die Einbaulage ist waagerecht.
- Das maximale Anzugsdrehmoment für den Schraubkopf beträgt 100 Nm.
- Die empfohlene, zu erwärmende Flüssigkeitsmenge im Sinne der VDE 0700 Teil 73 §7.12.1 beträgt:

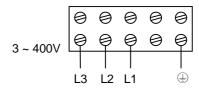
Nennaufnahme [W]	ca. Flüssigkeitsmenge [Liter]
2000	5
3000	8
4500	12
6000	16
7500	20
9000	24
12000	32

Die in der Tabelle genannten Werte sind Richtwerte, die je nach Applikation variieren können.

- Vor dem ersten Einschalten des EHK ist durch den Monteur sicher zu stellen, dass sich Flüssigkeit im Behälter befindet.
- Die Heizeinsätze dürfen nur in Systeme eingebaut werden, bei denen sich das Heizelement immer unterhalb des Wasserspiegels befindet, wie z. B. bei zisternengespeisten Behältern.

Anschlussvarianten:





08/2004

08/2004



Produktdatenblatt AFR 150

AFR 150

Flexibles, einlagig verrilltes Aluminiumrohr DN 150 als Anschlussleitung an die Hauptleitung



Technische Daten

Artikel	AFR 150
Einbauart	Unterputz
Material	Aluminium
Gewicht	2,02 kg
Geeignet für Nennweite	150 mm
Länge	10.000 mm
Umgebungstemperatur	100 °C
Sortiment	С
EAN	4012799550938
Artikelnummer	0055.0093



Product data sheet AFR 150

AFR 150

Flexible single-grooved aluminium duct DN 150, to be used as connection to the main duct

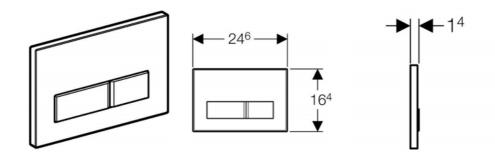


Technical Data

Article	AFR 150
Type of installation	Recessed-mounted
Material	Aluminium
Weight	2.02 kg
Suitable for nominal size	150 mm
Length	10,000 mm
Ambient temperature:	100 °C
Sortiment	С
EAN	4012799550938
Article number	0055.0093



Sigma50 Betätigungsplatte für 2-Mengen-Spülung



Verwendung

- ✓ Für 2-Mengen-Spülung
- ✓ Für Geberit UP-Spülkasten UP320
- ✓ Für Geberit UP-Spülkasten UP300

Technische Daten

Werkstoff Zinkdruckguss

Lieferumfang

- Befestigungsrahmen
- 2 Distanzbolzen
- Drückerstangen

Artikel

Artikel-Nr.	Farbe	VE3 St.	VE2 St.	VE1 St.
115.788.11.1	Kunststoff weiß-alpin / hochglanz-verchromt / chrom-gebürstet	70	5	1
115.788.DW.1	Kunststoff schwarz, RAL 9005 / hochglanz-verchromt / chrom-gebürstet		5	1
115.788.EP.1	Kunststoff pergamon / hochglanz-verchromt / chrom-gebürstet		5	1
115.788.SC.1	Glas weiß m. Ornament / hochglanz-verchromt / chrom-gebürstet		5	1
115.788.SE.1	Milchglas grün-satiniert / hochglanz-verchromt / chrom-gebürstet	70	5	1
115.788.SD.1	Rauchglas verspiegelt / hochglanz-verchromt / chrom-gebürstet		5	1
241.788.xx.1	AusstellungsplatteFarbprogramm entspricht ArtNr. 115.788.xx.1			1

- Die Oberflächen sind in der Reihenfolge Front / Rahmen / Drücker angegeben
- Nicht geeignet für Geberit UP-Spülkasten bis Ende 2001, Geberit UP-Spülkasten Duofix Pur, Kombifix Pur, UP200, UP100.

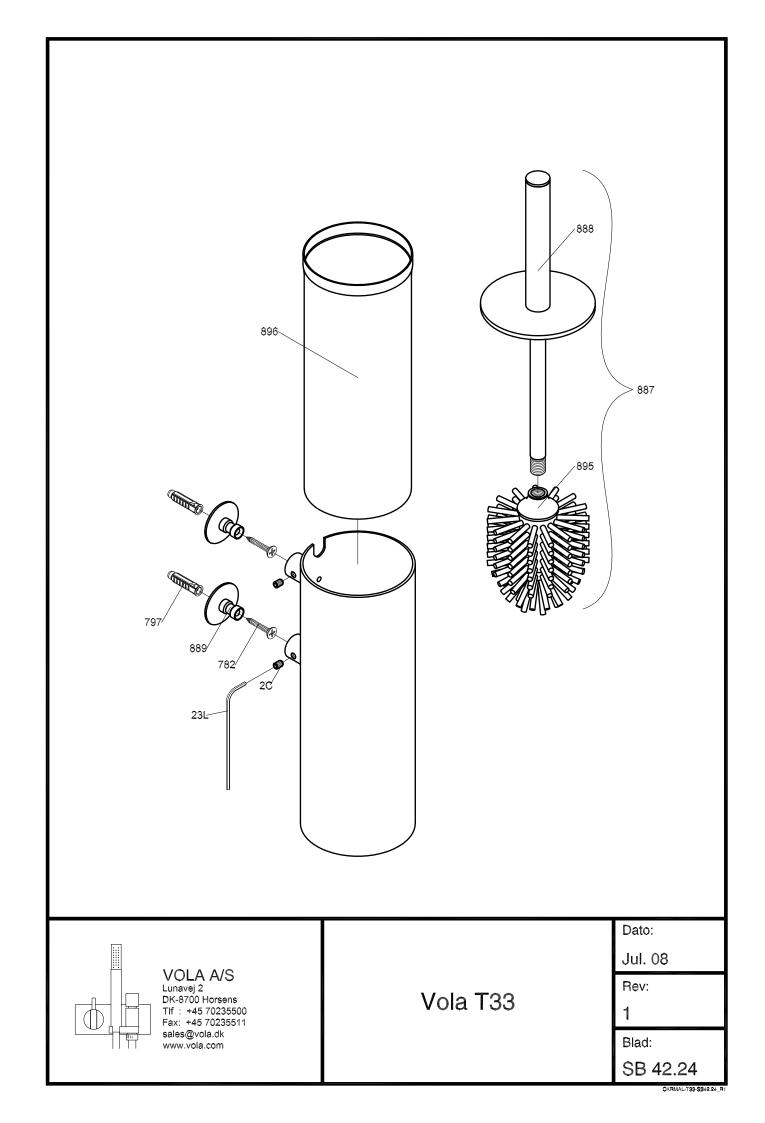
Zubehör

• Einwurfschacht für Reinigungswürfel zu UP-Spülkasten



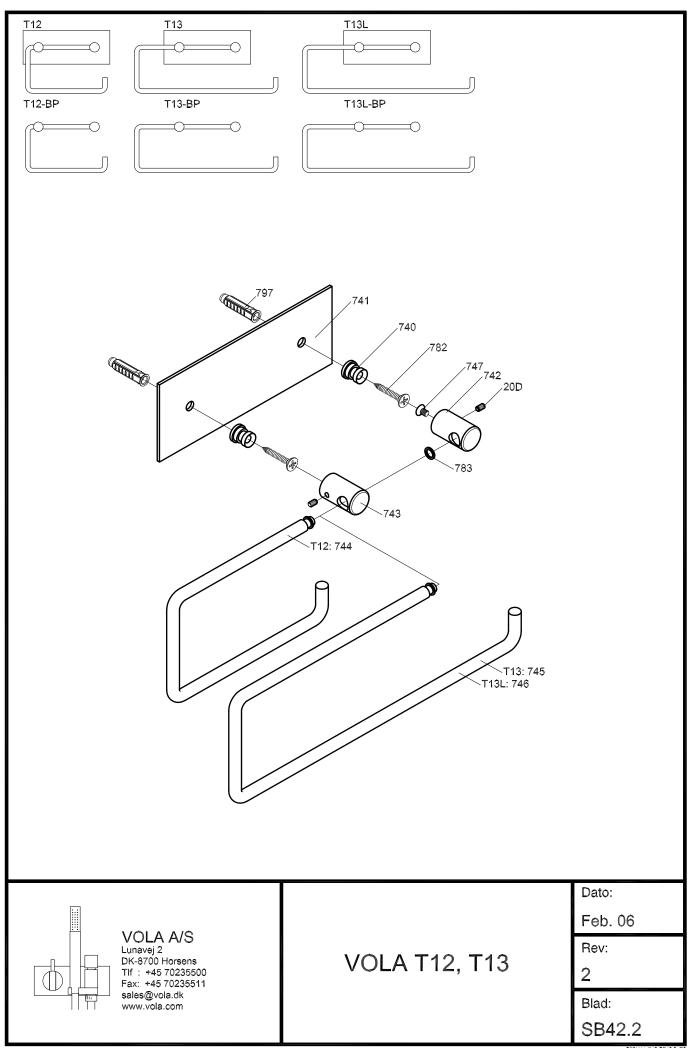
Toilet brush holder for wall mounting

133





Toilet roll holder.



590

One-handle mixer with ceramic disc techn deck-mounted, 500, with 360° double swin 090 and water saving aerator.
Hole cut out size, mixer: 40 mm, max. 43 m. Hole cut out size, spout: 21 mm, max. 29 m.



500T1

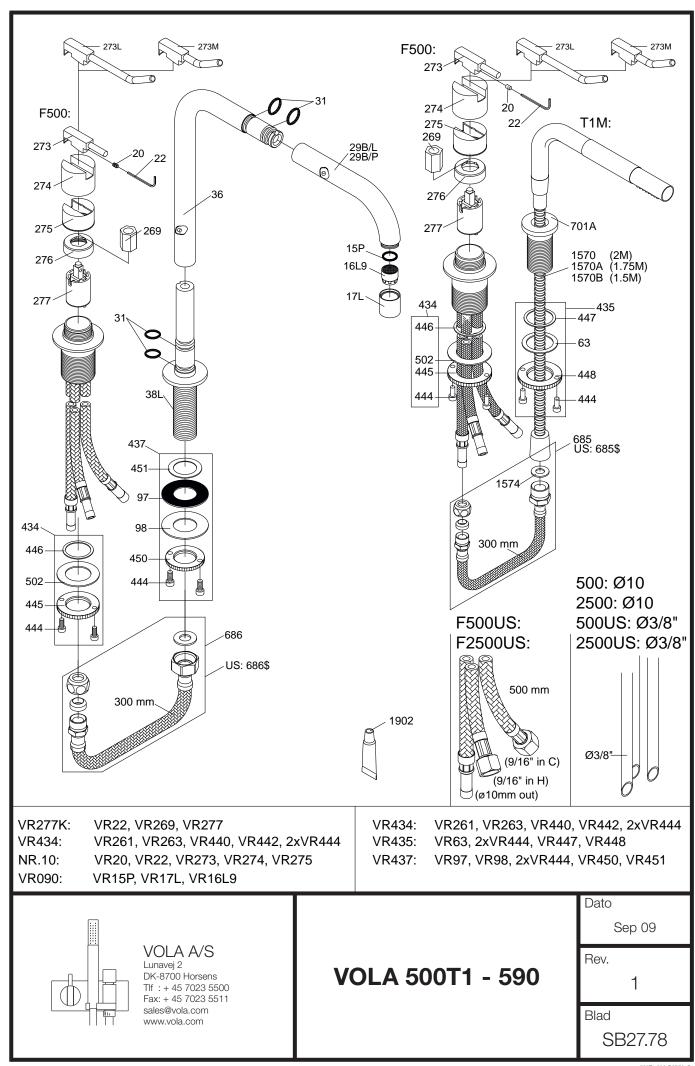
Eingriffmischer mit versenkbarer Handbrause, bes aus: Eingriffmischer 500, versenkbarer Handbrau Länge Metallbrauseschlauch 1500 mm. Lochbohrung 500: 43 mm.

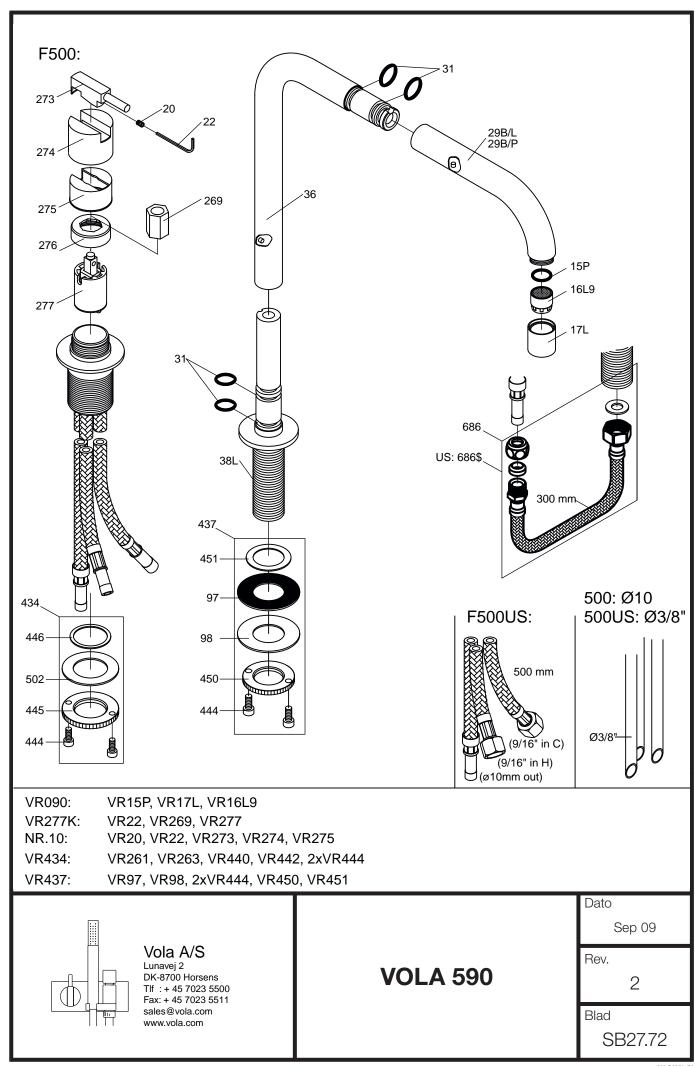
50011

One-handle mixer 500 with ceramic disc technolo for table mounting. With hand shower T1M.

Hole cut out size, mixer: 40 mm.

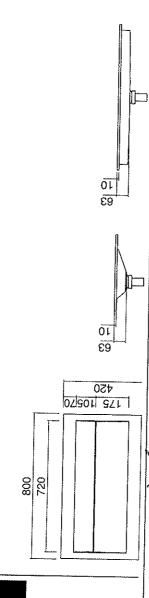
Hole cut out size, shower: 28 mm.





Armaturenempfehlung

Nur Wand-Waschtisch-Armaturen montieren. Optimales Auftreffen des Wassers ist bei Armaturen mit senkrechtem Auslauf und Perlator gegeben. Bitte die Hinweise zur Auslauflänge der Armatur auf der Seite 45 beachten.



weten Nicht empfohlen

MODIATION HAS

10 A

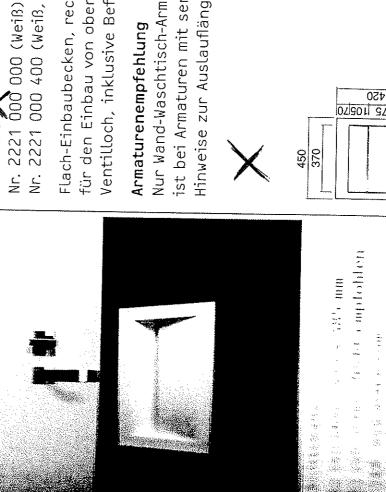
FB.RY450

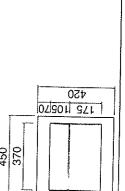
Nr. 2221 000 400 (Weiß, pflegeleicht)

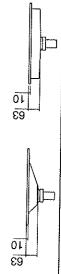
für den Einbau von oben, ohne Hahnloch und Überlauf, Ablaufprinzip ohne Flach-Einbaubecken, rechteckig, 450 x 420 mm, innen und außen glasiert, Ventilloch, inklusive Befestigungsset

Armaturenempfehlung

Nur Wand-Waschtisch-Armaturen montieren. Optimales Auftreffen des Wassers ist bei Armaturen mit senkrechtem Auslauf und Perlator gegeben. Bitte die Hinweise zur Auslauflänge der Armatur auf der Seite 45 beachten.

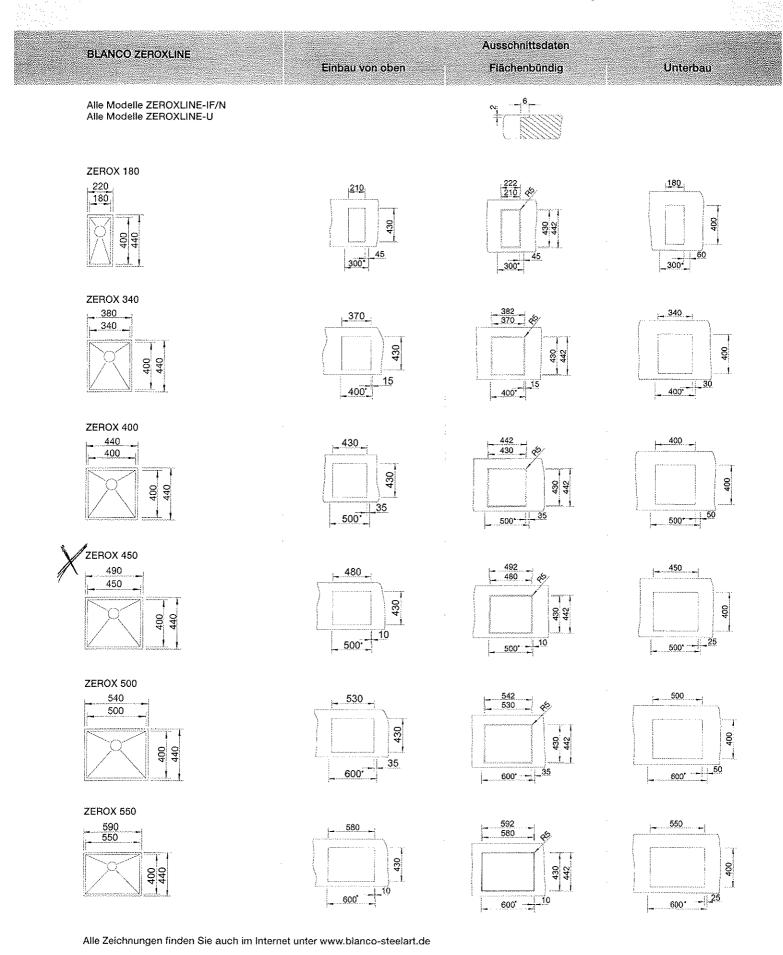






TECHNISCHE ZEICHNUNGEN

BLANCO ZEROXLINE ohne Armaturenbank-Einbau und flächenbündig, Unterbau



TECHNISCHE INFORMATIONEN

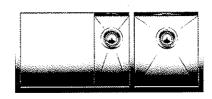
STEELART ELEMENT Modell Hinwels

IF-Spülen mit Tropffläche

BLANCOFLOW 45 S-IF und 5 S-IF BLANCODIVON 45 S-IF, 5 S-IF, 6 S-IF und 8 S-IF BLANCOCLARON 4 S-IF, 5 S-IF, 6 S-IF und 8 S-IF BLANCOZEROX 4 S-IF, 5 S-IF, 6 S-IF und 8 S-IF

Alle IF-Spülen mit integrierter Tropffläche sind erst ab einer Arbeitsplatten-Stärke von 30 mm einsetzbar.

Sonderbohrungen bei IF-Modellen



Bei allen Einbauspülen können Anzahl und Platzierung der Hahnlochbohrungen individuell ausgewählt werden. D.h. Lochbohrungen sind individuell auf der Armaturenbank platzierbar. Ihre Anzahl ist variabel. Die Lieferzeit von IF-Modellen mit Sonderbohrungen beträgt 2 Wochen. Aufpreis pro Spüle: € 59,-.

Montage von Armaturen hinter dem Überlauf



Achtung! Direkt hinter dem Überlauf ist die Montage folgender Bedienelemente nicht möglich:

 Küchenarmatur BLANCOPERISCOPE-S-F, -ELOSCOPE, -ELOS

- BLANCO Spülmittelspender, z.B.:

- BLANCOQUADRIS - BLANCOKANTOS

- BLANCOLEVOS

- BLANCOPIONA

- BLANCOTORRE

Beim Einbau der 550er Modelle in einen 60 cm breiten Unterschrank müssen die Seitenwände ausgeschnitten werden.

550er Modelle

BLANCOCLARON 550-IF/A BLANCOCLARON 550-IF/N **BLANCOCLARON 550-U**

BLANCOZEROX 550-IF/A BLANCOZEROX 550-IF/N BLANCOZEROX 550-U

Hinweis STEELART CREATION Modell Ausschnitt für flächenbündigen Einbau Ausschnitt für möglich (bitte Einbauskizze mitschicken) Einbau-Kochfeld oder -spüle \$ Ē - Bei Kochfeld-Ausschnitten wird bei Arbeitsplatten mit Randhöhe < 40 mm der Randbereich aufgedoppelt min. 40 - Der Ausschnitt bezieht sich auf den Edelstahl, nicht auf das Trägermaterial - Bitte Einbauhinweise der Gerätehersteller beachten Fasenoptik empfohlen für Fasenoptik Randstärke bis 21 mm Fasenoptik empfohlen für Randstärke > 21 - 100 mm

TECHNISCHE INFORMATIONEN

Hinweis Modell TEELART CREATION Arbeitsplatten mit 2 mm-Edelstahlauflage, .ignum vollflächig unterleimt mit beidseitig beschichteter Trägerplatte, vordere Kante 5 mm Echtholz angeleimt, vordere Kante gefast und lackiert, seitliche und hintere Kanten unbearbeitet, max. Länge 3800 mm Zusätzliche Randbearbeitung S40L an seitlichen oder hinteren Kanten möglich. 38 - Mindestabstand zu 3chraubverbindung 45° Einschweißteilen 80 mm - Mindestplattenstärke 30 mm - Mindestabstand zu Einschweißteilen 80 mm Schraubverbindung 90° - Mindestplattenstärke 30 mm - Beim Anstossen zweier Arbeitsplatten mit gegensätzlichen Schleifrichtungen kann der optische Eindruck entstehen, dass diese unterschiedliche Oberflächen haben. - Ein Höhenausgleich bei Bodenunebenheiten Wangen (+ 10 mm) ist vorhanden Die Montage der Wangen erfolgt bauseits. Wir empfehlen die Abdichtung der Unterseite 105 105 Abweichende Maße auf Wunsch möglich 100 105 50 105 - Die Fasenbreite der Wange orientiert sich an der Fasenbreite der Arbeitsplatte (2,5 mm oder 3,5 mm) 550-750 Montage durch Verschraubung mit bauseitigen Unterschränken (keine tragende Funktion) 三 - Bei freistehenden Wangen ist technische Vorabklärung notwendig

105

100___105

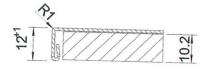
PRODUKTDATENBLATT

für Edelstahl-Arbeitsplatten 12 mm und 15 mm

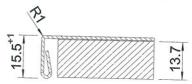
STEELART CREATION

PRODUKTSPEZIFIKATION

Arbeitsplatte aus Edelstahl für Materialstärke 12 mm (A12UR1)



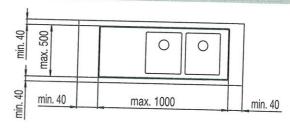
Materialstärke 15,5 mm (A15UR1)



Folgende Punkte sind bei der Planung von 12 mm / 15,5 mm starken Arbeitsplatten zu berücksichtigen:

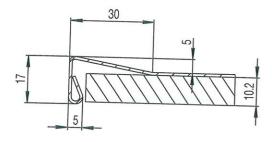
1. Integration von Profilrändern als Funktionselement

Die Profilränder P8C/P8Z sind nur als begrenzte Zone (max. 1000 mm x 500 mm) um die Becken einsetzbar.



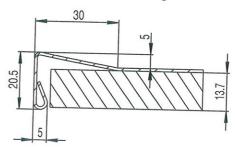
2. Auswirkungen auf die Arbeitsplattenstärke beim Einsatz von Profilrand P5

P5: 12 mm in Verbindung mit P5



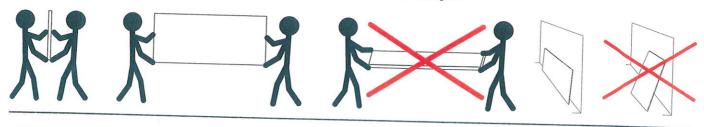
Der Profilrand P5 ist nur umlaufend einsetzbar.

P5: 15,5 mm in Verbindung mit P5



3. Transport

Der Transport und die Lagerung der Arbeitsplatte darf nur senkrecht erfolgen.



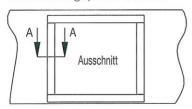
PRODUKTDATENBLATT

für Edelstahl-Arbeitsplatten 12 mm und 15 mm

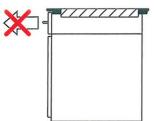
STEELART CREATION

4. Integration von Ausschnitten für Kochfelder

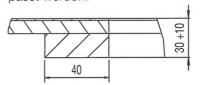
Der Kochfeldausschnitt wird generell aufgedoppelt. Diese Aufdoppelung muss je nach Unterbau-Situation bauseits angepasst werden.



Die erste Schubladeneinheit ist aufgrund des aufgedoppelten Rahmens blind zu setzen.

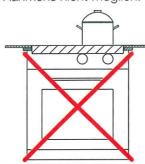


Schrank-Traversen müssen vor Ort bearbeitet und angepasst werden.



Aufdoppelung

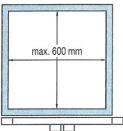
Das Einsetzen von Backöfen direkt unterhalb des Ausschnitts ist aufgrund des aufgedoppelten Rahmens nicht möglich.



Kein Backofen möglich

5. Unterbauten

Alle Unterbauten müssen



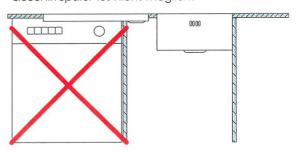
Unterbauten müssen plan 4-seitig eine Auflage bieten! ausgerichtet werden.



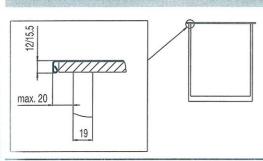
Im Auftragsfall werden detaillierte Zeichnungen inkl. der Unterbauten benötigt.

6. Geschirrspüler

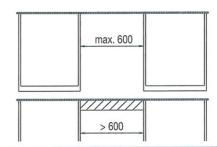
Der Einsatz von Tropfmulden direkt über einem Geschirrspüler ist nicht möglich.

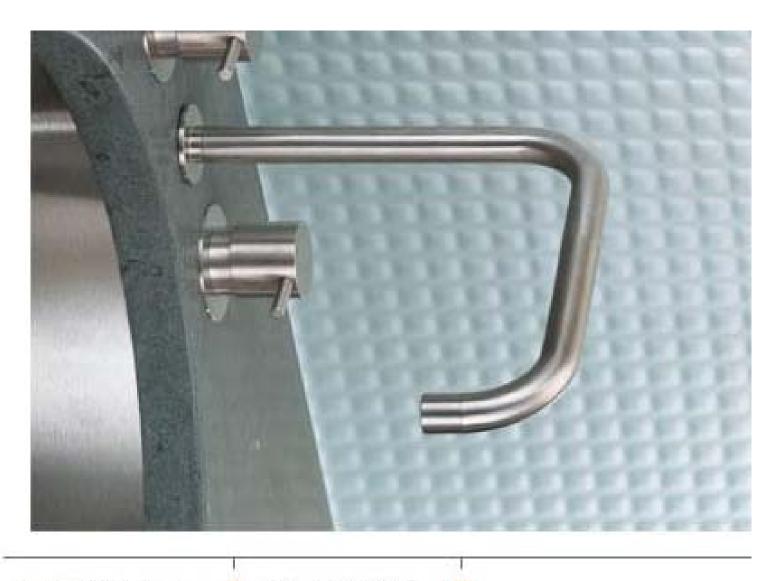


7. Maximal möglicher Überstand



8. Maximale freie Überspannung





2

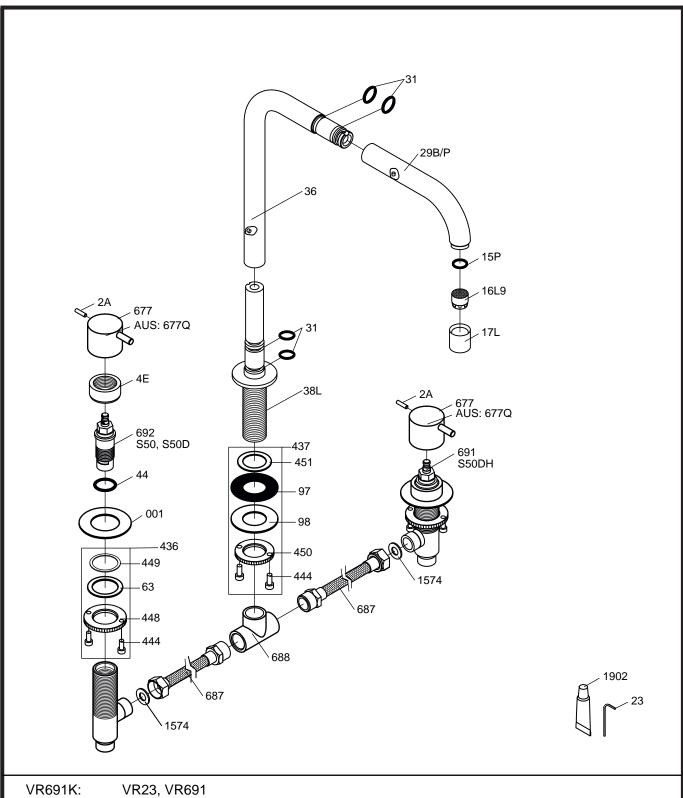
Dreilocharmatur mit Doppelschwenkauslauf, I aus: 2 Ventile S50 und einem schwenkbaren 090, ohne Ablaufgarnitur, Ausladung 200 mm Lochbohrung S50: 28 - 35 mm.
Lochbohrung 090: 21 mm (max. 29 mm).
Auch mit Ausladung 250 mm und 300 mm liefi

2

Three-hole mixer combination consisting of 2 ceramic stop valves S50, 360° double swivel with water saving aerator, 3 pcs. 60 mm circ 001.

Inlet/Outlet: 1/2".

Hole cut out size, valves: 28 mm, max. 35 mm. Hole cut out size, spout: 21 mm, max. 29 mm.

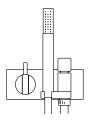


VR692K: VR23, VR692

VR436: VR63, 2xVR444, VR448, VR449

NR.7: VR2A, VR23, VR677 VR090: VR15P, VR16L9, VR17L

VR437: VR97, VR98, 2xVR444, VR450, VR451



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VOLA KV4

Dato

Sep 09

Rev.

3

Blad

SB27.6



Lüftungsgerät mit Softcool-System zur Verdunstungskühlung im Sommer und Wärmerückgewinnung im Winter.

Hochschule für Technik Stuttgart Herr Dalibard

Solar Decathlon Madrid 2010

1 St. Lüftungsgerät:

> Gehäuse Aluminium pulverbeschichtet isoliert, mit Revisionstür für Reinigung Wärmetauschers und Revision der Filter.

Technische Daten:

Luftmenge: 50-300 m3/h

Ventilator: **EC** Ventilator Volumenkonstant

Normkonfirmität: EN 60335-1,CE GOST

Zulassung: Schutzklasse:

Gegenstromwärmetauscher:

Wirkungsgrad in %: 91 / 85.6 / 81.4 Kühlleistung bei 300 m3/h: 1100 W Zulufttemperatur: 20°C / 21°C

bei 200m3/h 32°C/44% AUL

Max. externer Druckverlust AUL/ZUL: 100 Pa Max. externer Druckverlust ABL/FOL: 100 Pa

Filter

Aussenluft F7 Abluft G4

Anschlüsse Luftleitungen: NW 160 Elektrische Anschlüsse: 230 V / 50 Hz

Regelung: bauseits Temperaturfühler bauseits Frostschutzfunktion bauseits

Inkl. Anschlusskasten für Stromversorgung und Anschlüsse der externen Steuersignale (siehe Anschlussschema).

Stellantrieb Sommerbypass:

EMV Niederspannungsrichtlinie: CE gemäss89/336/EWG

CE gemäss73/23/EWG

Schutzart: IP 54

Schutzklasse: II schutzisoliert

Abwasseranschluss: 3/4" Aussengewinde Wasseranschlüsse: 3/8" VE-Wasser

Gewicht: ca. 60kg

Funktionen WRG

Kühlen aktiv mit softcool Kühlen über Sommerbypass



Ansteuerung

Volumenstrom Ventilator

0-10 V Signal 1.2 V = 50 m3/h 10 V = 300 m3/h

... $V \times 30 = m3/h$

Jeder Ventilator sollte separat angesteuert werden.

Betriebsarten

Wärmerückgewinnung (Sommerbypass geschlossen, Aktive Kühlung AUS)

Normalbetrieb Die kalte Aussenluft wird über den Gegenstromwärmetauscher aufgewärmt und als Zuluft in die Räume eingeblasen (Aussentemperatur < Raumtemperatur, Winterfall).

Falls für den Betrieb notwendig, muss ein bauseitiges Frostschutz- Elektroheizregister oder ein Erdreichwärmetauscher vorgesehen werden. Die minimale Ansaugtemperatur darf wegen dem hohen Wärmetauscher-Wirkungsgrad, 0 °C bei einer Ablufttemperatur von 22°C nicht unterschreiten.

Nachtkühlung (Sommerbypass offen, Aktive Kühlung AUS)

Relais 230 V

Um das Gebäude bei mässiger Kühllast abzukühlen (Aussentemperatur <= Raumtemperatur, Sommerfall Nachtbetrieb), besteht die Möglichkeit über den Kontakt Nachtkühlung den Wärmetauscher zu umgehen und mit kühler Aussenluft (Sommerbypass) eine Kühlung zu erzielen.

Aktive Kühlung (Sommerbypass geschlossen, Aktive Kühlung AN)

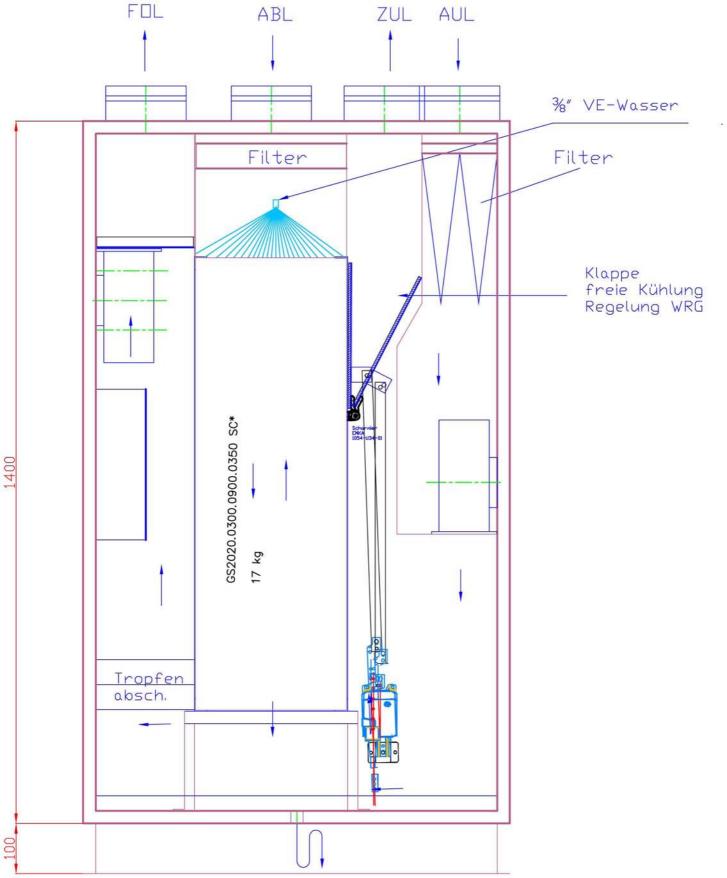
Relais 230 V

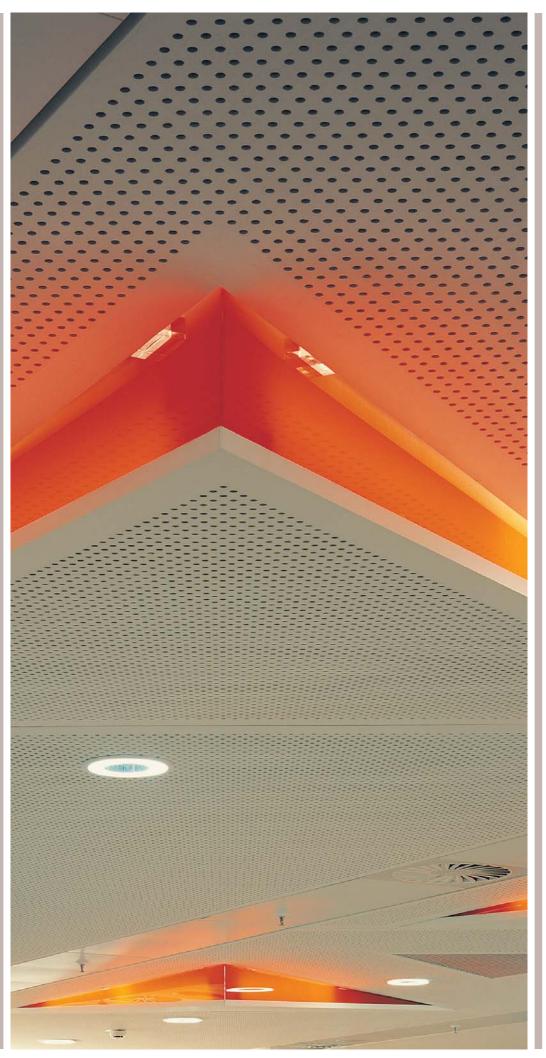
Bei starker Kühllast kann die Funktion Aktive Kühlung zugeschaltet werden (Aussentemperatur > Raumtemperatur, Sommerfall Tagbetrieb). Hierbei wird Voll Entsalztes Wasser auf der Abluftseite eingedüsst. Auf dem speziell beschichteten Wärmetauscher, verdampft das Wasser und entzieht der Aussenluft Wärme. Je höher die Aussentemperatur, umso mehr Wasser kann verdampft werden. Die aktive Kühlung sollte erst ab einer Aussentemperatur von ca.23°C in Betrieb gehen. Unter 23°C kann im Sommerfall über den Sommerbypass gefahren werden.

Kreuzgegenstrom-Plattentauscher Typ 0505.0300.0900.0300 GS aus korrosionsfestem, hydrophil beschichtetem Reinaluminium. Eine Wellplattenstruktur zwischen den Wärmetauschflächen dient als Abstandhaltung und zugleich zur Oberflächenvergösserung, Luft- Ein- und Austrittskanten mit optimaler aerodynamischer Form.

Sprühaggregat bestehend aus:

Einer feststehenden Düse. Sämtliche Teile bestehen aus Edelstahl, eloxiertem Aluminium oder Kunststoff, Sprühaggregat und Wärmetauscher sind als Einheit miteinander verschraubt. Einschliesslich Armaturenset mit Druckreduzierventil, Manometer, Magnetventil für das VE-Wasser.







ZENT-FRENGER Gesellschaft für Gebäudetechnik mbH

www.zent-frenger.de

Kühl-/Heizdecken Betonkerntemperierung Geothermisch Heizen/Kühlen

Das fugenlose Kühl-/ Heizdecken-System: VARICOOL UNI

Durch seine variablen Oberflächen bietet dieses System unbegrenzte Gestaltungsmöglichkeiten.

VARICOOL UNI ist ein wassergestütztes Kühl-/Heizdeckensystem das überwiegend nach dem Strahlungsprinzip arbeitet und sich durch vielfältige Anwendungs- und Gestaltungsmöglichkeiten auszeichnet.

Mit dieser Bauform können fuaenund richtungslose Deckenoberflächen für besondere architektonische Ansprüche geschaffen werden. Die Bauweise passt sich den Wünschen nach flexibler Raumteilung und schwierigen Raumgeometrien an. Das Aufgabenspektrum erstreckt sich von der Raumkühlung- bzw. Strahlungsheizung bis hin zur Beleuchtung und Schallabsorption.

Welche Vorteile bietet dieses System?

- Das Strahlungsprinzip führt im Kühlfall zu einer niedriger empfundenen Temperatur als die tatsächliche Raumlufttemperatur.
- Im Heizfall führt das Strahlungsprinzip zu einer höheren empfundenen Temperatur als die tatsächliche Raumlufttemperatur.
- Im Vergleich zu Systemen mit erzwungener oder überwiegend freier Konvektion, arbeiten Strahlungsdecken ohne Zuglufterscheinung und ohne Geräuschentwicklung.

- Die Nutzung von Wasser als Wärmeträgermedium senkt den Energieverbrauch im Vergleich zu luftbasierenden Systemen.
- Flächenheiz-/Kühlsysteme dieser Bauart sorgen für optimalen thermischen Komfort, Behaglichkeit sowie einer erhöhten geistigen Leistungsfähigkeit.
- Flächensysteme sind die optimale Voraussetzung zur Nutzung regenerativer Energiequellen, wie z. B.: Wärme und Kälte aus oberflächennaher Geothermie.

Zent-Frenger unterstützt Architekten und Fachingenieure bei der Konzeption und Planung ganzheitlicher Deckensysteme.

Kühl-/Heizdeckensystem mit einer Deckenverkleidung aus Gipskarton





Attribute VARICOOL UNI

- Metall-Unterkonstruktion aus verzinkten Stahlprofilen an drucksteifen Noniusabhängern befestigt.
- Kühlregister aus Kupferrohrmäandern und Aluminium Wärmeleitprofilen.
- Deckenverkleidung aus thermisch optimierten Gipskartonplatten.
- Integration von Leuchten für ein harmonisches visuelles Ambiente.

- Einbau von Luftauslässen, Leuchten, Sprinkler, Rauchmelder etc.
- Schallabsorption durch Perforation der Deckenverkleidung in Verbindung mit Akustikvlies.

Unterkonstruktion

Die Unterkonstruktion besteht aus einem Grobrost aus C-Profilen die an Noniushängern drucksteif von der Rohdecke abgehängt werden. Der Profilabstand beträgt ca. 800 – 1000 mm. Ein Feinrost aus C-Profilen, die mittels Kreuzverbindern im Abstand von ca. 30 cm am Grobrost befestigt werden.

Entsprechend der erforderlichen aktiven Deckenfläche werden an Stelle der Feinrostprofile Kühlregister mittels Schnellverbinder am Grobrost befestigt.

Thermisch aktive und inaktive Deckenflächen können mit Hilfe von Standard-C-Profilen kombiniert werden.

Querschnitt durch die Decke Deckenverkleidung aus thermisch optimierten Gipskartonplatten C-Profil für inaktiven Deckenbereich Mäanderträger Kupferrohrmäander Deckenverkleidung Wärmeleitprofil

Kühl-/Heizregister

Das Kühl-/Heizregister besteht aus hochwertigen maschinell hergestellten Kupferrohrmäandern, die in Aluminium-Wärmeleitprofilen eingepresst und mit Stabilisatorschienen fixiert sind.

Schallabsorption

Bei akustischen Anforderungen werden die Deckenplatten werksseitig gelocht und mit einem Akustikvlies belegt.

Schall-Längsdämmung

Zur Sicherstellung der Längsschalldämmung ist an der Stelle einer Raumtrennwand ein vertikales Dämmschott im Dekkenzwischenraum einzubauen.

Bei Raumtrennwänden empfehlen wir den Einbau eines Dämmschotts im Deckenzwischenraum um die Schallübertragung von Raum zu Raum zu verhindern.

Licht

Leuchten sind wichtige Komponenten des modernen Innenausbaus. Standard- und Sonderleuchten wie z.B.: Einbauund Aufbauleuchten, Deckenspots, Strahler sowie abgependelte Beleuchtung sind problemlos kombinierbar.

Luftaustausch

Zur Sicherstellung des für die gewünschte Raumlufthygiene erforderlichen Mindestluftwechsels können Luftauslässe in die Decke integrierte werden.

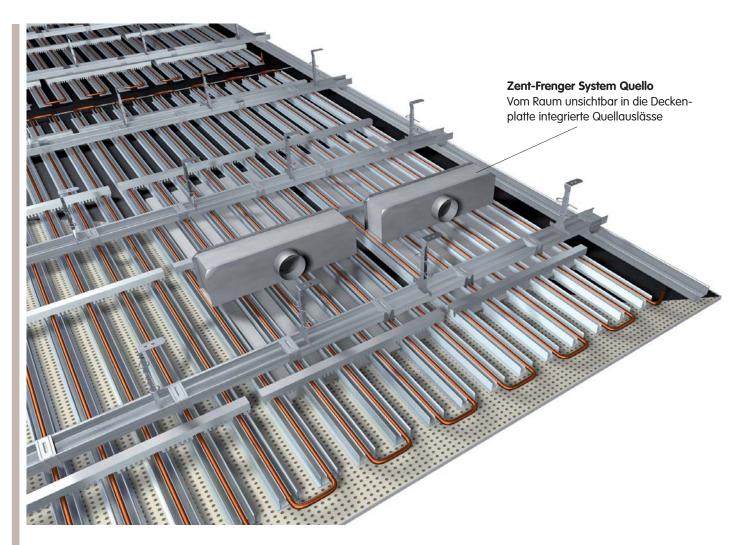
Das Zent-Frenger System QUELLO ist vom Raum aus unsichtbar. Die Zuluft wird über einen Anschlusskasten auf die zwischen den Wärmeleitprofilen liegenden Zuluftschienen aufgeteilt. So strömt die Luft mit geringer Geschwindigkeit über die Perforation der Deckenplatten in den Raum

Brandschutz

Die im Trockenbau eingesetzten Gips-Platten basieren auf dem Naturprodukt Gips. Bei relativ geringem Gewicht bietet dieser einen großen Feuerwiderstand. Den Schutz bewirkt das enthaltene Kristallwasser, das im Brandfall verdampft und auf der dem Brand zugewandten Seite einen schützenden Dampfschleier bildet. Dieser dann austretende Wasserdampf bewirkt, dass die Temperatur der Oberfläche nicht höher als 100°C ansteigen kann, solange sich Wasserdampf bildet







Montage

Die Montage erfolgt in der Schrittfolge:

- Unterkonstruktion
- Registermontage
- Hydraulischer Anschluss
- Füllen und Entlüften
- Druckprüfung
- Anschrauben der Deckenverkleidung
- Endbehandlung bzw.Verspachteln

Für Lampen oder Luftauslässe müssen die Öffnungen in den Deckenflächen durch Anpassungen der Unterkonstruktion vorbereitet werden. Für zusätzliche Einbaulasten wird eine Verstärkungskonstruktion vorgesehen.

Registermontage

Die Register werden anschlussfertig geliefert und sind durch eine zusätzliche aussteifende Stabilisatorschiene für die Montage respektive den Transport gesichert. Diese verhindert ein Verschieben bzw. Verdrehen der Profile.

Hydraulischer Anschluss

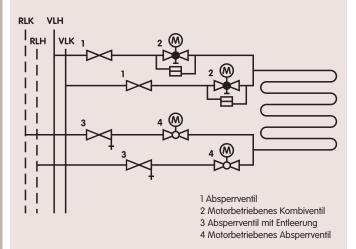
Der hydraulische Anschluss der Wasserkreise an das Heiz- und Kühlnetz ist nachfolgend für ein Zwei- sowie Vierleiternetz dargestellt.

- Die Anzahl der Register die in Serie zu einem Wasserkreis zusammengeschaltet werden richtet sich nach den im System auftretenden Druckverlusten. Diese sollten 25 kPa nicht überschreiten.
- Bei der Zusammenfassung von Wasserkreisen in einer Regelzone spricht man von einem Regelkreis.

Die Absperrventile bilden die Trennstelle der beiden Leistungsabschnitte Kühldecke und Versorgungsleitungen. Zur Einstellung des gewünschten Nennwasserstromes empfehlen wir je Regelkreis ein Kombiventil (2). Jeder Regelkreis erhält außerdem eine absperrbare Entlüftungseinrichtung (3).

Anschlussschema Raumheiz-/kühlflächen im Zweileiternetz RL VL 1 1 2 M 1 Absperrventil 2 Motorbetriebenes Kombiventil 3 Absperrventil mit Entleerung

Anschlussschema Raumheiz-/kühlflächen im Vierleiternetz



Druckprüfung, Füllen und Entlüften

Hydraulische Systeme erfordern bei der Ausführung eine große Sorgfalt. Aus diesem Grund werden Zent-Frenger Deckensysteme vor dem Beplanken durch die nachfolgend aufgeführten Arbeitsschritte auf Dichtheit geprüft:

- Dichtheitsprüfung mit Luft und einem Druck von 8 – 10 bar über einen Zeitraum von 1 h.
- Spülen des Rohrsvstems
- Dichtheitsprüfung mit Wasser und einem Druck von 6 – 8 bar über einen Zeitraum von 24 h.
- Anpassen des Betriebsdrucks
- Entlüften der Anlage

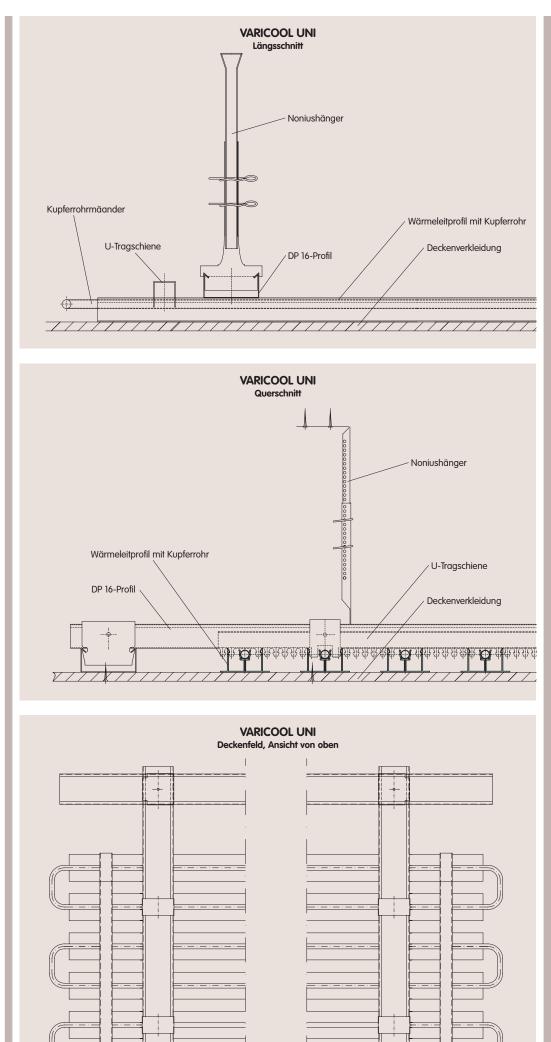
Montage der Deckenverkleidung

Die Befestigung der Deckenverkleidung erfolgt mit speziellen Schnellbauschrauben direkt am Wärmeleitprofil. Die besondere Positionierung des Rohres verhindert dessen Beschädigung bei der Montage der Deckenverkleidung.

Durch die direkte Befestigung der Deckenverkleidung am Kühlregister ergibt sich eine optimale wärmeleitende Verbindung.

Für den Anschluss der Deckenverkleidung an aufgehende Wände stehen verschiedene Ausführungsmöglichkeiten zur Auswahl.

- Aufgelegt auf Stufenwinkel
- Aufgelegt auf einfachem Wandwinkel
- Insellösung
- Optisch geschlossen mit gleitendem Wandanschluss
- Schattenfuge mit einfachem Wandwinkel und Deckenhinterlüftung
- Schattenfuge mit einfachen Wandwinkel



Ein **aufgelegter Wandanschluss** kann in zwei Varianten ausgeführt werden. Durch einen einfachen Wandwinkel oder durch einen Stufenwinkel, wobei sich Letzterer auch durch einen Abluftstufenwinkel ersetzen lässt. [Detail 1, 2]

Bei Deckeninseln ist eine aufgestellte Randabkantung möglich. Diese wird durch eine verleimte V-Nut hergestellt. [Detail 3]

Bei einer **optisch geschlossenen Deckenfläche** wird ein gleitender Wandanschluss durch Bildung einer Haarfuge herstellt, die optional mit Acryl verschlossen werden kann. [Detail 4]

Mit Hilfe eines einfachen Wandwinkels lässt sich eine Abluftfuge [Detail 5] bzw. eine Schattenfuge ausbilden. [Detail 6]

Dehnfugen

Flächen bis ca. 100 m² oder Seitenlängen kleiner 7,5 m bei Heiz-/Kühldecken (15 m bei Kühldecken) können zusam-

menhängend und ohne Dehnfuge hergestellt werden. Darüber hinaus empfehlen wir Dehnfugen einzuplanen.

Endbehandlung

Die Oberfläche ist **frei gestalt- bar**, sie kann gespachtelt, gewalzt oder dünn geputzt werden. Bei geputzten Oberflächen ist in Abhängigkeit der
Auftragdicke mit einer Leistungsminderung zu rechnen.

Oberflächengüten

Die Fugenverspachtelung ist ein wichtiges Bewertungskriterium für die Qualität von Trokkenbauarbeiten. Hinsichtlich der Verspachtelung von Dekkensystemen werden verschiedene Qualitätsstufen unterschieden, die bei der Ausschreibung berücksichtigt werden sollten. Die hier aufgelisteten Merkmale bilden nur einen Ausschnitt aller Kriterien, die in der DIN 18180 zu finden sind.

Qualitätsstufe 1 (Q1)

Für Oberflächen, an die keine besonderen Anforderungen gestellt werden, ist eine Grundverspachtelung (Q1) ausreichend. Diese beinhaltet das Füllen der Stoßfugen sowie das Verdecken der Befestigungsteile.

Qualitätsstufe 2 (Q2)

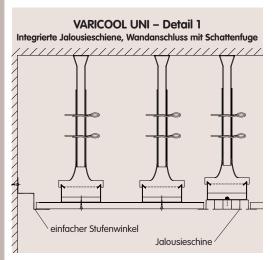
Die Verspachtelung nach Qualitätsstufe 2 entspricht der Standardverspachtelung und genügt den üblichen Anforderungen an Wand- und Deckenflächen für mittel bis grob strukturierte Wandbekleidungen oder matt füllende Anstriche und Oberputze. Sie beinhaltet eine Grundverspachtelung sowie das Nachspachteln zu einem stufenlosen Plattenübergang.

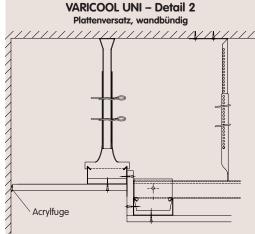
Qualitätsstufe 3 (Q3)

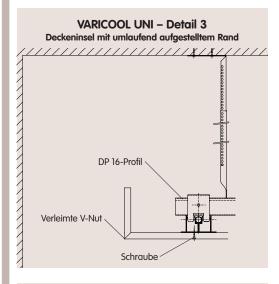
Werden erhöhte Anforderungen an die gespachtelte Oberfläche gestellt, sind zusätzliche Maßnahmen erforderlich. Die Qualitätsstufe 3 eignet sich somit für fein strukturierte Wandbekleidungen oder Oberputze mit feiner Körnung. Sie umfasst ein breiteres Ausspachteln der Fugen sowie ein scharfes Abziehen zum Porenverschluss.

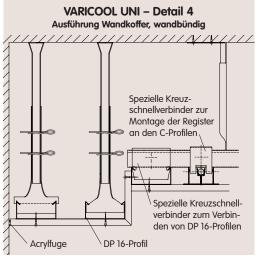
Qualitätsstufe 4 (Q4)

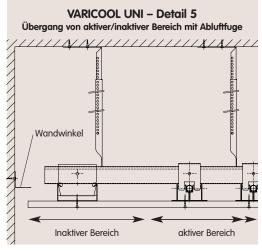
Um höchste Anforderungen an die gespachtelte Oberfläche zu erfüllen stehen eine Vollflächenverspachtelung oder ein Abstucken der gesamten Oberfläche zur Auswahl.

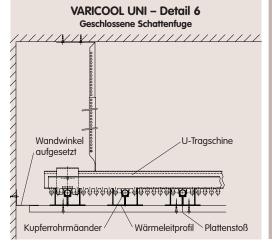












Raumakustik ist hörbar – Innovative Deckensysteme mit unbegrenzten Gestaltungsmöglichkeiten

Zent-Frenger bietet Deckenverkleidungen die viele Gestaltungsmöglichkeiten bieten.

Bei akustischen Anforderungen muss unterschieden werden, ob sich Schallquelle und Hörer in verschiedenen oder in demselben Raum befinden. Im ersten Fall wird der Schallschutz hauptsächlich durch Schalldämmung, im zweiten Fall durch Schallabsorption erreicht.

Unter Schallabsorption versteht man die Minderung der Schallenergie innerhalb eines Raumes durch deren Umwandlung in Wärme (Dissipation).

Ausführungsbeispiele

Die Deckenverkleidungen sind in einer Vielzahl unterschiedlicher Designs erhältlich. Streulochung, regelmäßige Lochung, versetzte Lochung oder quadratische Lochung sind nur einige Beispiele hierfür. Auch anspruchsvolle individuelle Lochbilder oder Muster sind auf Anfrage möglich.

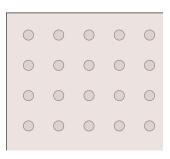
Alle gelochten Deckenverkleidungen sind mit Akustikvlies erhältlich. Ist eine glatte Oberfläche gewünscht, muss auf Schallabsorption nicht verzichtet werden, hierfür bieten wir unsichtbar gelochte Deckenplatten, die sichtseitig mit einem Akustikvlies kaschiert und mit einer schalldurchlässigen Beschichtung versehen sind.

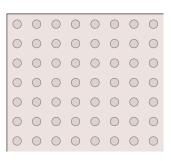
Lochung

Die Art des Lochbildes bestimmt das Schallabsorptionsverhalten der Deckenverkleidung. Für einen Lochanteil zwischen 10 und 15% werden in der Regel die höchsten Schallabsorptionsgrade erzielt.

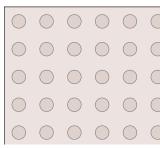
Bei Abhängehöhen unter 100 mm verschieben sich die Schallabsorptionswerte in den Hochfrequenzbereich. Große Lufthohlräume hingegen führen zu einer Erhöhung des Schallabsorptionsgrades im Tieffrequenzbereich. Ab 500 mm Lufthohlraum verändern sich die Werte nur noch sehr geringfügig.

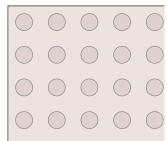
Regelmäßig gelocht (nicht maßstäblich) links 6/18 rechts 8/18



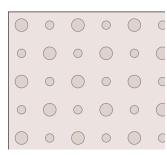


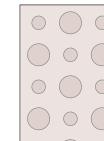
links 12/25 rechts 15/30



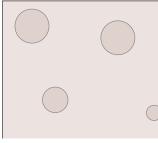


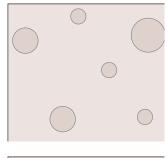
Versetzt gelocht (nicht maßstäblich) links 8-12/25 rechts 12-20/66



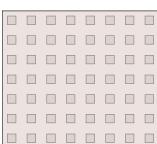


Streulochung (nicht maßstäblich) links 8-15-20 rechts 8-15-20 super





Regelmäßig quadratisch gelocht (nicht maßstäblich) links 8/18Q rechts 12/25Q





Thermoplatte UNI TP Die optimierte Deckenverkleidung für moderne Heiz- und Kühlsysteme

Die Gipskartonthermoplatten sind speziell für das Heiz-/Kühlsystem UNI entwickelt worden und gewähren eine optimale Wärmeübertragung. Eingesetzt werden können sie sowohl in Wand-, als auch in Deckenheiz- und Kühlsystemen.

Dank deren hohen Wärmeleitfähigkeit werden sehr gute flächenbezogene Heiz-/Kühlleistungen erreicht. Hinzu kommen die bewährten Vorteile von Gipskartonplatten. Sie sind nicht brennbar und gehören der Baustoffklasse A2 an. Sie können mit den herkömmlichen Trockenbauwerkzeugen wirtschaftlich und schnell verarbeitet werden.

Neben der beschriebenen Gipskartonthermoplatte stehen weitere Deckenverkleidungsvarianten (siehe ergänzende Produktinformationen) für die individuelle Beplankung der Heiz-/ Kühlregister zur Auswahl.

Oberflächenbehandlung

Vor dem Aufbringen eines Anstrichs oder einer Beschichtung werden die Platten grundiert. Wir empfehlen die folgenden Beschichtungen:

Anstriche:

- Wasch- und scheuerbeständige Kunststoff- Dispersionsfarben
- Ölfarben
- Mattlackfarben
- Alkydharzfarben
- Polymerisatharzfarben
- Polyurethanlackfarben (PUR)

Tapeten:

 Papier-, Textil- und Kunststofftapete



Übersicht technische Daten UNI:

Standard Rohrabstand 80, 90, 100, 120 mm Empfohlene Wassertemperaturdifferenzen 2 - 4 K10 mm Rohrdurchmesser Betriebsgewicht ca. 21 kg/m² Wasserinhalt ca. 1 l/m² Empfohlener Druckverlust je Wasserkreis 15 - 25 kPaKonstruktionshöhe ohne Plattenstärke 54 mm Schalldämmung nach DIN 4109 einfacher Durchgang, geschlossener Wandanschluss 30 dB

Freie Strömungsvorgänge im Raum - Symmetrische oder asymmetrische Anordnung der inneren Wärmequellen - Erhöhte Temperatur der inneren Fassadenoberfläche (Glasfassade)

Kühlluftrückströmung, freie Strömung aus Decken und Randfugen

Leistung/-steigerungen

Der Wärmeübergang an geschlossenen, ebenen Heiz-/Kühldecken unter den Prüfbedingungen nach EN 14240 (geschlossener Prüfraum, gleichmäßig verteilte Wärmequellen, adiabate Begrenzungsflächen) ist weitgehend durch Strahlungswärmeaustausch mit den Umschließungsflächen und den Wärmequellen gekennzeichnet sowie Konvektion an der Kühldeckenunterseite.

Die in der Norm festgelegten Prüfbedingungen stellen den ungünstigsten Betrachtungsfall dar. Unter praktischen Betriebsbedingungen können sich höhere flächenbezogene Kühlleistungen als unter Normbedingungen einstellen. Werte für situationsbedingte Leistungserhöhungen können dann in Ansatz gebracht werden, wenn deren Höhe nachgewiesen werden kann. Diese Effekte können in der Baupraxis auch als "stille Leistungsreserve" behandelt werden. Dabei soll darauf verwiesen werden, dass die Nichtberücksichtigung von Leistungsreserven zu einer unnötigen Verteuerung der Anlagenkosten führt.

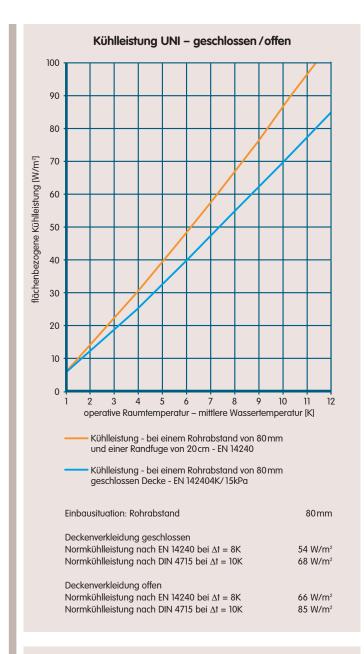
Einflussfaktoren:

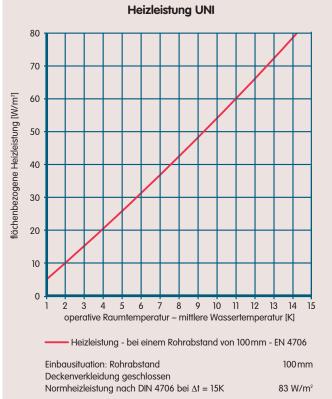
- Symmetrische oder asymmetrische Anordnung der inneren Wärmequellen
- Erhöhte Temperatur der inneren Fassadenoberfläche (Glasfassade)
- Zulufteinbringung über Deckeneinbau-Schlitz- oder Drallauslässe
- Randfuge oder Fugen zwischen den Deckenplatten
- fassadennahe Anordnung der aktiven Kühlflächen

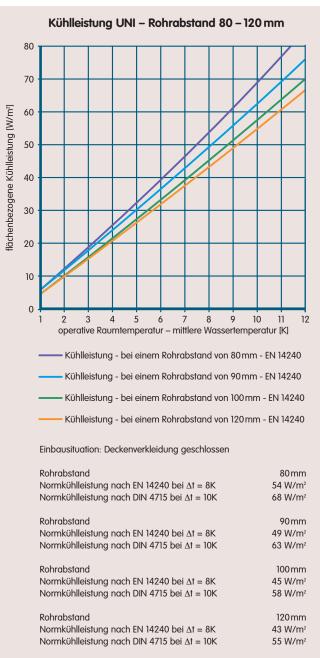
Qualitative Aussagen zu situationsbedingten Leistungssteigerungen sind, gegebenenfalls durch Laborversuche unter realen Randbedingungen, kritisch zu überprüfen.

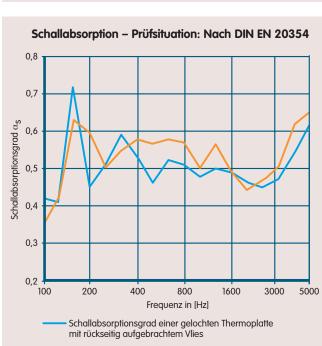
Bei einer größeren Anzahl Leistungssteigernder Faktoren dürfen diese nicht kumulativ angesetzt werden.











Schallabsorptionsgrad einer Gipskartonplatte mit

unterseitigem Vlies und schalldurchlässigem Putz



Gesellschaft für Gebäudetechnik mbH

www.zent-frenger.de

Zentrale

Schwarzwaldstraße 2 D-64646 Heppenheim Telefon 0 62 52 - 79 07 - 0 Telefax 0 62 52 - 79 07 - 31 zentrale@zent-frenger.de heppenheim@zent-frenger.de

Niederlassung Nord

Büro Hamburg Kantstraße 6 A D-21629 Neu Wulmstorf Telefon 040 - 7 00 40 17 - 0 Telefax 040 - 7 00 40 17 - 9 hamburg@zent-frenger.de

Niederlassung Mitte

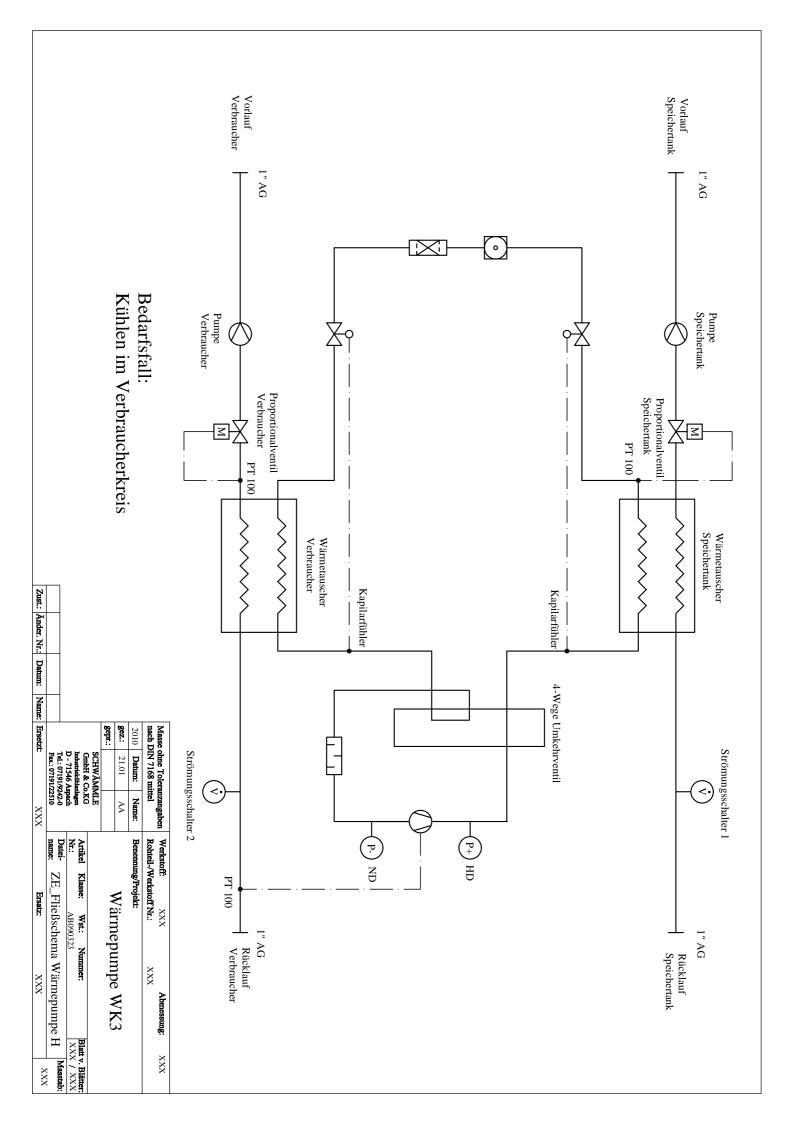
Büro Heppenheim Schwarzwaldstraße 2 D-64646 Heppenheim Telefon 0 62 52 - 79 07 - 0 Telefax 0 62 52 - 79 07 - 31 zentrale@zent-frenger.de heppenheim@zent-frenger.de

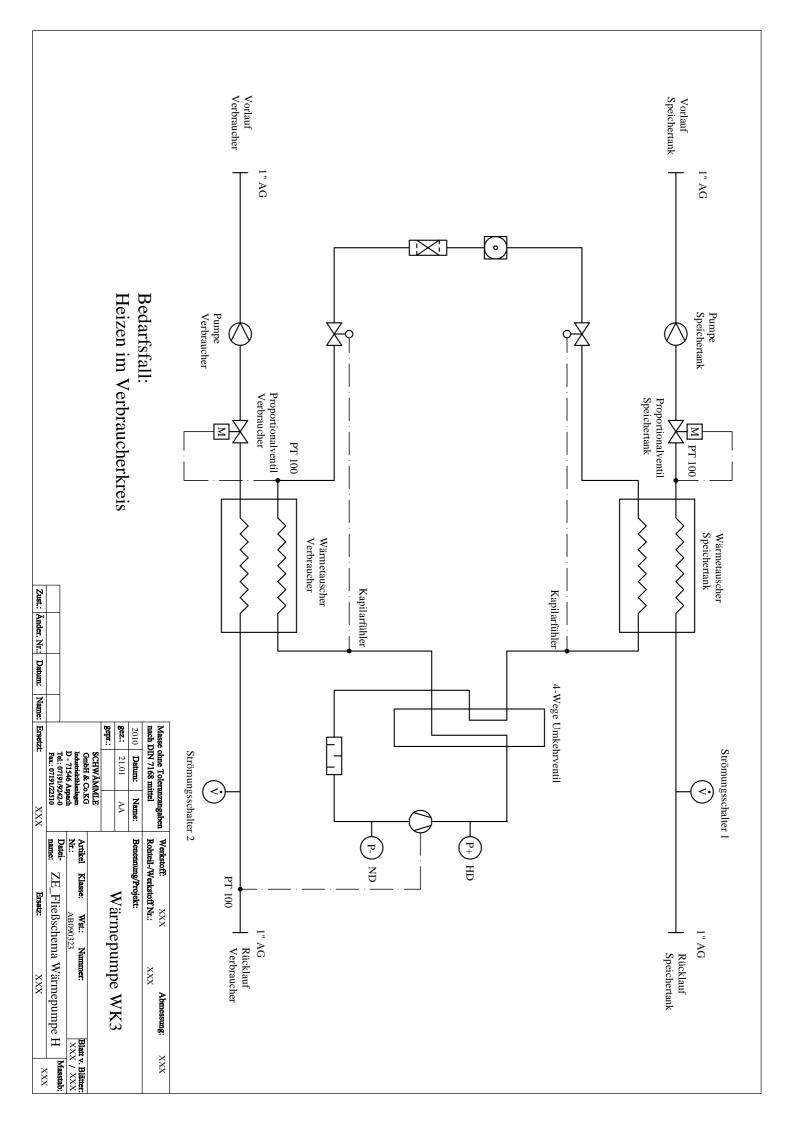
Niederlassung Süd-West

Büro Stuttgart Maybachstraße 7 D-71229 Leonberg Telefon 0 71 52 - 9 39 93 - 0 Telefax 0 71 52 - 9 39 93 - 1 stuttgart@zent-frenger.de

Niederlassung Süd-Ost

Büro München Freischützstraße 77 D-81927 München Telefon 0 89 - 99 24 98 - 0 Telefax 0 89 - 99 24 98 - 20 muenchen@zent-frenger.de







Product data sheet EW-K 200

EW-K 200

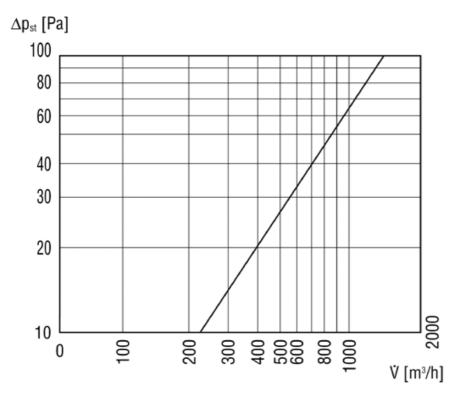
Brine-air heat exchanger for brine earth heat exchanger, DN 200.



Technical Data

Article	EW-K 200
Max. volumetric flow	250 m³/h
Brine connection nominal size	22 mm
Nominal size	200 mm
Sortiment	К
EAN	4012799924135
Article number	0192.0413

Characteristic curve

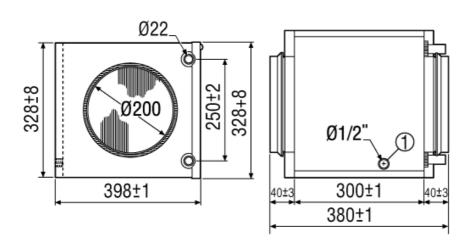




Product data sheet EW-K 200

Dimensions [mm]

① Condensation drain







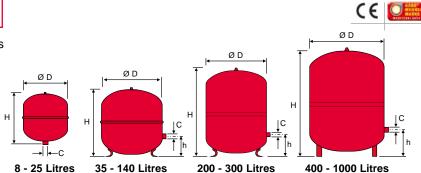
'reflex'
Expansion vessels
for heating, cooling and solar applications



'reflex' Technical Data

'reflex NG and N'

- lacktriangleright for heating and chilled water applications
- threaded connections
- ▶ non-replaceable diaphragm, according to DIN 4807 norm part 3, max. operating temperature 70 °C
- meets or exceeds EC norms for pressure vessels 97/23/CE
- colour: red or white, durable powder coating finish
- preset pressure 1.5 bar (Nitrogen)

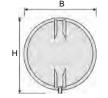


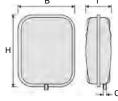
	Туре		e-No.	Ø D	н	h	С	Weight
_ 3 ba	<u>r / 120 °C </u>	red	white	mm	mm	mm		kg
	NG 8	7202505	7202805	206	285		R 3/4	1,7
	NG 12	7203306	7203505	280	275		R 3/4	2,3
	NG 18	7204305	7204405	280	345		R 3/4	2,8
	NG 25	7206305	7206405	280	465		R 3/4	3,5
	NG 35	7208405	7208505	354	460	130	R 3/4	5,7
∟ 6 ba	r / 120 °C							_
	NG 50	7001000	7001100	409	493	175	R 3/4	7,5
	NG 80	7001200	7001300	480	565	175	R 1	9,9
	NG 100	7001400	7001500	480	670	175	R 1	11,2
	NG 140	7001600	7001700	480	912	175	R 1	14,5
	N 200	7213300		634	760	205	R 1	36,7
	N 250	7214300		634	890	205	R 1	45,0
	N 300	7215300		634	1060	205	R 1	52,0
	N 400	7218000		740	1070	245	R 1	65,0
	N 500	7218300		740	1290	245	R 1	79,0
	N 600	7218400		740	1530	245	R 1	85,0
	N 800	7218500		740	1995	245	R 1	103,0
	N 1000	7218600		740	2410	245	R 1	120,0

[♠]V_n Nominal volume / Litres

'reflex F'

- ▶ flat vessel for heating (built-in boiler applications) non-replaceable diaphragm,
- according to DIN 4807 norm part 3, max. operating temperature 70 °C
- ▶ from 18 ltr with wall-hung clip
- meets or exceeds EC norms for pressure vessels 97/23/CE
- > colour: white, stove enamelled finish







8 Litres

12 - 15 Litres

18 - 24 Litres

CE

∟3 baı	•	ype <u>20 °C</u>	Article-No. white	H mm	B mm	T mm	С	Weight kg	Pre-set pressure bar
	F	8	9600011	389	389	88	G %	87,0	0,75
	F	12	9600030	444	350	108	G ½	112,0	
	F	15	9600040	444	350	134	G ¾	126,0	1,0
	F	18	9600000	444	350	158	G ¾	150,0	-
	F	24	9600010	444	350	180	G ¾	158,0	-

V_n Nominal volume / Litres

'reflex S'

- ▶ for solar, heating and chilled water applications
- suitable for anti-frost substance up to 50%
- threaded connections
- non-replaceable diaphragm, according to DIN 4807 norm part 3, max. operating temperature 70 °C
- ▶ 33 litres with wall-hung clip
- ▶ meets or exceeds EC norms for pressure vessels 97/23/CE

₩ Ø D H C C	H C	Ø D C T h
2 - 33 Litres	50 - 300 Litres	400 - 600 Litres

colour: red or white,	durable powder coating fir	nish

	Ty	ype	Artic	le-No.	Ø D	Н	h	С	Weight	Pre-set pressure
∟10 ba	r / 12	0 °C	red	white	mm	mm	mm		kg	bar
	S	2	9707700		132	260		G ¾	1,1	0,5
	S	8	9703900	9702600	206	325		G ¾	2,5	
	S	12	9704000	9702700	280	300		G ¾	3,5	
	S	18	9704100	9702800	280	380		G ¾	4,5	1,5
	S	25	9704200	9702900	280	500		G ¾	5,5	
	S	33	9706200	9706300	354	450		G ¾	6,3	
	S	50	7209500		409	505	200	R 1	13,2	_
	S	80	7210300		480	570	210	R 1	18,4	_
	S	100	7210500		480	675	210	R 1	22,7	
	S	140	7211500		480	915	210	R 1	29,0	
	S	200	7213400		634	785	235	R 1	40,0	3,0
	S	250	7214400		634	915	235	R 1	48,0	
	S	300	7215400		634	1085	235	R 1	54,0	-
	S	400	7219000		740	1070	245	R 1	78,0	-
	S	500	7219100		740	1290	245	R 1	80,0	-
	S	600	7219200		740	1530	245	R 1	103,0	-

[↑] V_n Nominal volume / Litres

reflex 'Wall hung holder' for vessels 8 - 25 litres

console with tightening strap for vertical mounting

console with multiple connections

8 - 25 I

Article-No.

8 - 25 I 7611000



Article-No.

7612000

Connection for Connection for Connection for filling Rp ½ manometer Rp ¾ deaeration Rp ¾ - 95 -DN 32 reflex Connection for expansion pipe Rp 3/4



reflex 'Digital pressure gauge'

b display range up to approx. 9 bar

Article-No.

9119198

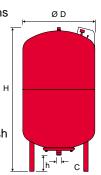


'reflex' Technical Data



'reflex G'

- lacktriangleright for heating and chilled water applications
- replaceable bladder, according to DIN 4807 norm part 3, max. operating temperature 70 °C
- meets or exceeds EC norms for pressure vessels 97/23/EC
- inspection opening
- ▶ factory-mounted pressure gauge
- colour red; durable powder coating finish
- preset pressure 3.5 bar (Nitrogen)







100 - 500 Litres

600 - 1000 (Ø 740) **Litres 1000** (Ø 1000) **- 5000 Litres** (1000-2000 Litres without upper flange)

							(1000 2000 ER
	Type	Article-No.	Ø D	Н	h	С	Weight
∟6 bar	/ 120 °C		mm	mm	mm		kg
	G 400	7521605	740	1253	146	G 1	51,0
	G 500	7521705	740	1473	146	G 1	59,0
	G 600	7522605	740	1718	146	G 1	74,0
	G 800	7523610	740	2183	146	G 1	102,0
	G 1000 Ø 740	7546605	740	2593	146	G 1	158,0
	G 1000 Ø 1000	7524605	1000	1975	305	DN 65/PN 6	248,0
	G 1500	7526605	1200	1975	305	DN 65/PN 6	297,0
	G 2000	7527605	1200	2430	305	DN 65/PN 6	370,0
	G 3000	7544605	1500	2480	335	DN 65/PN 6	640,0
	G 4000	7529605	1500	3055	335	DN 65/PN 6	828,0
	G 5000	7530605	1500	3590	335	DN 65/PN 6	905,0
լ 10 ba	r / 120 °C						
	G 100	7518000	480	856	152	G 1	16,5
	G 200	7518100	634	972	144	G 1¼	36,5
	G 300	7518200	634	1267	144	G 1¼	41,6
	G 400	7521005	740	1245	133	G 1¼	59,0
	G 500	7521006	740	1475	133	G 1¼	65,1
	G 600	7522006	740	1859	263	G 1½	128,0
	G 800	7523005	740	2324	263	G 1½	176,0
	G 1000 Ø 740	7546005	740	2604	263	G 1½	214,0
	G 1000 Ø 1000	7524005	1000	2000	290	DN 65/PN 16	355,0
	G 1500	7526005	1200	2000	290	DN 65/PN 16	410,0
	G 2000	7527005	1200	2450	290	DN 65/PN 16	505,0
	G 3000	7544005	1500	2580	320	DN 65/PN 16	870,0
	G 4000	7529005	1500	3070	320	DN 65/PN 16	1120,0

1500

3610

320

'reflex G' - Options upon request

- vessels > 5000 litres
- vessel operating pressure > 10 bar
- ▶ flanged connections: DN 150 as an option for G 1000 Ø 1000 - 5000

7530005

→ 'MBM II' diaphragm rupture detector

DN 65/PN 16

▶ German TÜV factory test certification acc. to EC norms 97/23/EC for pressure vessels

1330,0



G 5000

Reflex Winkelmann GmbH + Co. KG

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www.reflex.de

^t—V_n Nominal volume / Litres



Datenblatt SpeedUp Eco Heizelemente



Anwendung

Das SpeedUp Eco Heizsystem ist ein universelles und optimiertes Fußbodenheizsystem für alle Neuund Altbauten. Geeignet für ökologische Ein- und Mehrfamilienhäuser, Holz- und Fertighäuser, Gewerberäume und für den nachträglichen Einbau in Sanierungsobjekte aller Art.

Individuelle Leistungsanpassung durch Aufnahme des Danfoss Verbundrohres 16 x 2 mm in

die Danfoss SpeedUp Eco Heizelemente mit Verlegeabständen von 125 mm und 250 mm. Die Befestigung und Fixierung des Verbundrohres erfolgt durch die speziell geformten Rohrrillen (Ω -Form) der werksseitig aufkaschierten Aluminiumleitblechen. Voraussetzung ist ein ebener Untergrund nach DIN 18202, Tabelle 3, Zeile 4.

Stichmaße als Grenzwerte in mm bei Messpunktabständen in m

Zeile	Bezug	0,1 m	1 m	4 m	10 m	15 m
4	"Flächenfertige Böden mit erhöhten Anforderungen, z.B. mit selbstverlaufenden Spachtelmassen"	1 mm	3 mm	9 mm	12 mm	15 mm

Daten

Produkt	Тур	Abmessung [L x B x H]	Bestellnummer
SpeedUp Eco Aufenthaltszone, CZ	FH-SEA	1000 x 500 x 30 mm	088X0201
SpeedUp Eco Randzone, EZ	FH-SEB	1000 x 500 x 30 mm	088X0202
SpeedUp Eco Kopfelement, CZ	FH-SEC	250 x 500 x 30 mm	088X0203
SpeedUp Eco Kopfelement, EZ	FH-SED	250 x 500 x 30 mm	088X0204
SpeedUp Eco Übergangselement, CO	FH-SEE	250 x 375 x 30 mm	088X0205
SpeedUp Eco Randelement, BP	FH-SEF	1000 x 500 x 30 mm	088X0206
SpeedUp Eco Zuleitungselement, Einzel	FH-SEG	1000 x 125 x 30 mm	088X0207
SpeedUp Eco Zuleitungselement, CZ	FH-SEI	1000 x 500 x 30 mm	088X0209
SpeedUp Eco Zuleitungselement, EZ	FH-SEJ	1000 x 500 x 30 mm	088X0210
SpeedUp Eco 90° Winkelelement	FH-SEH	250 x 250 x 30 mm	088X0208

Material	
Grundplatte	Holzfaser 140 kPa; hergestellt und überwacht nach DIN EN 13171
Wärmeleitblech	Aluminium 0,5 mm, mit Rohrführungen (Ω-Form),gebördelt
Wärmeleitfähigkeit	0,040 W/mK
Wärmeleitwiderstand (R)	0,75 m ² K/W
Dampfdiffusionsfaktor	5
Druckspannung	≥140 kPa bei 10% Stauchung nach DIN EN 826
Baustoffklasse:	B2

Zubehör

Produkt	Тур	Abmessung [L x B x H]	Bestellnummer
Rahmenholz	FH-SFE	1000 x 45 x 30 mm	088X0134
Rahmenholz Rohrdurchgang	FH-SFF	250 x 45 x 30 mm	088X0135
Lastverteilblech Stahl	FH-SJ	800 x 200 x 1 mm	088X0111
Wärmeleitblech Aluminium	FH-SI	495 x 242 x 0,5 mm	088X0110
SpeedUp Eco Randdämmstreifen	FH-SEK	25 m x 10 mm x 140 mm	088X0123
SpeedUp Eco Systemfolie	FH-SEL	80 m x 1,25 m x 0,2 mm	088X0131

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TF25

Kabeltemperaturfühler Cable Temperature Sensor



DE - Datenblatt

Technische Änderungen vorbehalten Stand 06.03.2008

EN - Data Sheet

Subject to technical alteration Issue date 2008/03/06



Anwendung

Kabelfühler zur Temperaturmessung in gasförmigen Medien von Heizungs-, Lüftungs- und Klimaanlagen (z.B. in Zuluft-/Abluftkanälen). Ausgelegt zur Aufschaltung an Regler- und Anzeigesysteme. In Verbindung mit einer Tauchhülse auch zur Messung in flüssigen Medien (z.B. Rohrleitungssystemen) geeignet.

Application

Cable sensor for temperature measurement in gaseous media of heating, cooling or air-conditioning systems (e.g. fresh air/ exhaust air ducts). Designed for locking on to control and display systems. In conjunction with an immersion pocket, also suitable for temperature measurement in liquid fluids (e.g. pipeline systems).

Typenübersicht

TF25 passiv, mit Sensor nach Kundenwunsch* Sensor

TRA aktiv, 4...20mA TRV aktiv, 0...10V LON aktiv, FTT

*z.B.: PT100/PT1000/NI1000/NI1000TK5000/LM235Z/NTC.../PTC... und andere Sensoren auf Anfrage.

Types Available

TF25 passive, with sensor acc. to customer's need* Sensor

TRA active, 4...20mA TRV active, 0...10V LON active, FTT

*eg: PT100/PT1000/NI1000/NI1000TK5000/LM235Z/NTC.../PTC... and other sensors on request

Normen und Standards

EN60730-1 (2000) Störfestigkeit

EN60730-1 (2000) Störaussendung 2004/108/EG Elektromagnetische Verträglichkeit CF-Konformität:

Norms and Standards

EMV: EN60730-1 (2000) Interference resitance EN60730-1 (2000) Emitted interference

CE-Conformity: 2004/108/EG Electromagnetic compatibility EMV Seite 2 Page 2

Technische Daten

Sensorleitung L: 1m/2m/4m/6m, andere Längen auf

Anfrage,

TF25 400°C: nur 2m

Kabelenden standardmäßig mit

Aderend-Hülsen,

Leiterquerschnitt: 0,25mm²,

Einsatztemperatur: PVC/HT: -35...100°C Silikon: -50...180°C

-60...250°C Spez. Silikon: -50...400°C Stahlgeflechte: nur TF25 400°C

Edelstahl Mat. 1.4571 Fühlerhülse:

Durchmesser: 6mm

50mm/100mm/150mm/200mm/250mm Einbaulänge:

TF25 400°C: nur 50mm

Typ Sensor:

Allgemein:

Messelement: Sensor nach Kundenwunsch, TF25 400°C: nur Sensor

PT100-3Leiter oder PT1000 möglich Abhängig v. verwendeten Sensor, Messbereich: Abhängig v. verwendeten Sensor und der Länge der Sensorleitung Genauigkeit:

Messstrom:

Typ. <1mA 2polig (Zweileiter) 3polig (Dreileiter) Anschluss: nicht bei Spez. Silikon

4polig (Vierleiter) nicht bei Spez. Śilikon

Gewicht: ca. 30g

Typ TRA:

15-24V= (±10%) Versorgungsspannung: Leistungsaufnahme: max. 20mA/24V=

Messbereich: am Messumformer einstellbar

TRA1: -50°C...+50°C -10°C...+120°C TRA2: TRA3: 0°C...+50°C 0°C...+160°C TRA4: TRA5: 0°C...+250°C TRA8: -15°C...+35°C

4...20mA. max. Bürde 500Ω/24V= Ausgang:

Genauigkeit@21°C: Typ. ±1% v. Messbereich bei max. 2m Sensorleitung

2polig (Zweileiter) Anschlußklemmen:

Schraubklemme max. 1,5mm² Material Polyamid, Farbe weiß Gehäuse:

Schutzart: IP65 gemäß EN60529

Kabeleinführung: Einfach, M20 für Kabel mit max. D=8mm

-35...70°C Umgebungstemperatur: Transport:

-35...70°C / max. 85%rF, nicht kond..

Gewicht: ca. 145q

Typ TRV:

Gewicht:

15-24V= (±10%) oder 24V~ (±10%) Versorgungsspannung:

typ. 0,42W / 0,84VA Leistungsaufnahme: Messbereich: am Messumformer einstellbar

-50°C...+50°C -10°C...+120°C TRA1: TRA2: 0°C...+50°C TRA3: 0°C...+160°C TRA4: TRA5: 0°C...+250°C -15°C...+35°C TRA8:

0...10V, min Belastung $5k\Omega$ Ausgang: Genauigkeit@21°C: Typ. ±1% v. Messbereich

bei max. 2m Sensorleitung

3polig (Dreileiter) Anschlußklemmen:

Schraubklemme max 1,5mm² Gehäuse: Material Polyamid, Farbe weiß

Schutzart: IP65 gemäß EN60529 Kabeleinführung: Einfach, M20 für Kabel mit max. D=8mm

Umgebungstemperatur: -35...70°C

-35...70°C / max. 85%rF, nicht kond.. Transport: ca. 145g

Technical Data

General:

Sensor wire L: 1m/2m/4m/6m, other lenghts on request,

TF25 400°C: only 2m

Cable ends with conductor sleeves as

standard.

Conductor cross-section: 0,25mm² Operative temperature: PVC/HT: -35...100°C

Silicone: -50...180°C Speciale silicone: -60...250°C -50...400°C Steal braid:

only TF25 400°C

Sensor bushing: Stainless steel mat. 1.4571,

Diameter:

50mm/100mm/150mm/200mm/250mm Mounting lengths:

TF25 400°C: only 50mm

Measuring element: Sensor according to customer's,

TF25 400°C: only sensor

PT100-three-wire or PT1000 possible

Measuring range: Depending on sensor used,

Accuracy: Depending on sensor used and wire

Length

Type <1mA 2pole (two-wire) Measuring current: Connection: 3pole (three-wire),

not available with special silicone

4pole (four-wire),

not available with special silicone

Weight: approx. 30g

Type TRA:

Type Sensor:

15-24V= (±10%) Power supply: max. 20mA/24V=

Power consumption:

Measuring range: adjustable at the transducer -50°C...+50°C TRA1:

TRA2: -10°C...+120°C TRA3: 0°C...+50°C TRA4: 0°C...+160°C TRA5: 0°C...+250°C TRA8: -15°C...+35°C

4..20mA, max, load 500Ω/24V= Output: Accuracy@21°C: Typ. +/-1% of measuring range

with cable of max. 2m

Clamps: 2pole (two-wire) Terminal screw max 1,5mm²

Material Polyamide, Colour white Enclosure: IP65 according to EN60529 Protection:

Single entry, M20 for cable max. D=8mm Cable entry:

Ambient temperature: -35...70°C

Transport: -35...70°C / max. 85%rH, no condensation

approx. 145g Weight:

Type TRV:

Enclosure:

Power supply: 15-24V= (±10%) or 24V~ (±10%)

typ. 0,42W / 0,84VA Power consumption: Measuring range: adjustable at the transducer

TRA1: -50°C...+50°C TRA2: -10°C...+120°C 0°C...+50°C TRA3: 0°C...+160°C TRA4: 0°C...+250°C TRA5: -15°C...+35°C TRA8: 0...10V, min load $5k\Omega$

Output: Accuracy@21°C: Typ. +/-1% of measuring range with wire conductor of max. 2 m

Clamps: 3pole (three-wire)

Terminal screw max 1,5mm²

Material Polyamide, Colour white IP65 according to EN60529

Protection: Cable entry: Single entry, M20 for cable max. D=8mm Ambient temperature:

-35...70°C

Transport: -35...70°C / max. 85%rH, no condensation

approx. 145g Weight:

Thermokon Sensortechnik GmbH - Aarstrasse 6 - 35756 Mittenaar - Tel.: 02772/65010 - Fax: 02772/6501400 - www.thermokon.de - email@thermokon.de Produktblatt_tf25 @ 2008

Page 3

Typ LON:

15-24V= (±10%) oder 24V~ (±10%) Versorgungsspannung: Leistungsaufnahme: typ. 0,5W / 1,7VA

Messbereich: -45°C...+130°C Genauigkeit@21°C: Typ. ±0,5K 4polig (Vierleiter) Klemmen:

Schraubklemme max 1,5mm² Material Polyamid, Farbe weiß Gehäuse: Schutzart: IP65 gemäß EN60529

Einfach, M20 für Kabel mit max. D=8mm Kabeleinführung: Doppelt, M20 für 2 Kabelmit max. D=7mm

Umgebungstemperatur: -35...70°C

Transport: -35...70°C / max. 85%rF, nicht kond...

Gewicht: ca. 160g



Sicherheitshinweis

Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkrafterfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.

Montagehinweis

Der Kabelfühler wird je nach Anwendung mittels Montageflansch bzw. Klemm-Verschraubung am Lüftungskanal befestigt.

Bei Verwendung des Fühlers mit einer Tauchhülse: Wärmeleitpaste zur besseren Wärmeübertragung zwischen Fühler und Messmedium verwenden.

Bei Einsatz des Fühlers in feuchten Räumen bzw. in der Kühltechnik empfehlen wir unsere Ausführung IP67.

Bitte beachten Sie auch die allgemeinen Hinweise in unserem INFOBLATT THK.

Elektrischer Anschluss

Die Geräte sind für den Betrieb an Schutzkleinspannung (SELV) ausgelegt. Beim elektrischen Anschluss der Geräte gelten die techn. Daten der Geräte.

Speziell bei passiven Fühler (z.B. Pt100 etc.) in Zweileiter-Ausführung ist der Leitungswiderstand der Zuleitung zu berücksichtigen. Gegebenenfalls muss dieser in der Folgeelektronik korrigiert werden.

Infolge der Eigenerwärmung beeinflusst der Messstrom die Genauigkeit der Messung. Daher sollte die ser nicht größer 1mA liegen.

Bei Fühlern mit Messumformer sollte dieser in der Regel in der Messbereichsmitte betrieben werden, da an den Messbereichsendpunkten erhöhte Abweichungen auftreten können. Die Umgebungstemperatur der Messumformerelektronik sollte konstant gehalten werden

Die Messumformer müssen bei einer konstanten Versorgungsspannung betrieben werden.

Die Messbereichsumstellung erfolgt durch Umstecken der Kurzschlußbrücken (siehe Anschlußplan).

Der Ausgangswert im neuen Messbereich liegt dann nach ca. 2s vor.

Zubehör optional

Klemmverschraubung G 1/4" für D=6mm mit (KL6T) Klemmring Teflon, Material Edelstahl Klemmverschraubung G 1/4" für D=6mm mit (KL6VA) Schneidring VA, Material Edelstahl Montageflansch für D=6mm

(THMSDS) Tauchhülse mit Druckschraube für D=6mm,

Material Messing vernickelt

Tauchhülse mit Druckschraube für D=6mm, (THVADS)

Material Edelstahl

Type LON:

15-24V= (±10%) or 24V~ (±10%) Power supply:

typ. 0,5W / 1,7VA Power consumption: -45...+130°C Measuring range:

Accuracy@21°C: Typ. ±1% of measuring range

Clamps: 4pole (four-wire)

Terminal screw max 1,5mm² Polyamide, Colour white Enclosure: IP65 according to EN60529 Protection:

Cable entry: Single entry, M20 for cable max. D=8mm Double entry, M20 for 2 cable max. D=7mm

-35...70°C

Ambient temperature: -35...70°C / max. 85%rH, no condensation Transport:

Weight: approx. 160g



Security Advice

The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Mounting Advice

Depending on the application, the cable temperature sensor is assembled to the air duct by means of a mounting flange respectively a clamp screw

Operation of the sensor with an immerision pocket: Use contact fluid for better heat transfer between sensor and measuring medium.

When using our sensing elements in moist rooms or for purposes in refrigeration technology, we recommend to use version IP67.

Please also note the general remarks in our INFORMATION SHEET THK.

Electrical Connection

The devices are constructed for the operation of protective low voltage (SELV). For the electrical connection, the technical data of the corresponding device are valid.

Specially with regard to passive sensors (e.g. PT100 etc.) in 2-wire conductor version, the wire resistance of the supply wire has to be considered. Probably, the same has to be compensated by the following electronics.

Due to the self-heating, the wire current affects the accuracy of the measurement. Thus, the same should not exceed 1mA.

Sensing devices with transducer should in principle be operated in the middle of the measuring range to avoid deviations at the measuring end points. The ambient temperature of the transducer electronics should be kept constant.

The transducers must be operated at a constant supply voltage.

The adjustment of the measuring ranges is made by changing the bonding jumpers (see terminal connection diagram). The output value in the new measuring range is available after approx. 2 seconds.

Optional Accessories

Clamp screw joint G 1/4" for D=6mm with (KL6T) teflon clamping ring, material: stainless steel Clamp screw joint G 1/4" for D=6mm with (KL6VA) cutting ring VA, material: stainless steel

Mounting flange for D=6mm

(THMSDS) Immersion pocket with pressure screw for D=6mm,

material: brass nickel-plated

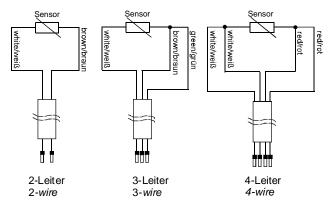
(THVADS) Immersion pocket with pressure screw for D=6mm,

material: stainless steel

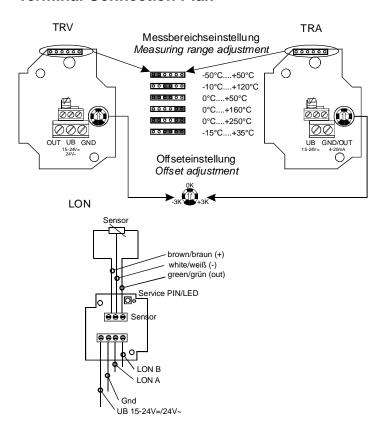
Seite 4 Page 4

Anschlussplan

Sensor

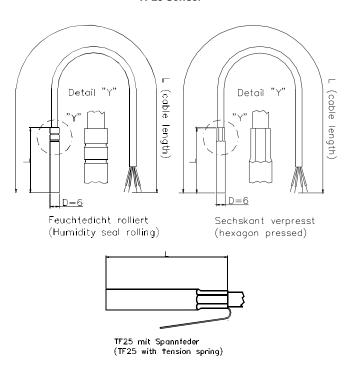


Terminal Connection Plan



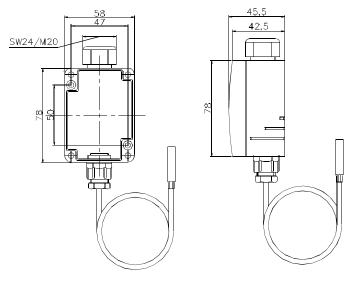
Abmessungen

TF25 Sensor



Dimensions (mm)

TF25 TRA/TRV/LON



AF25/AF50/PR25/VFG54

Anlegetemperaturfühler Contact Temperature Sensor



DE - Datenblatt

Technische Änderungen vorbehalten Stand 22.07.2008

EN - Data Sheet

Subject to technical alteration Issue date 2008/07/22



Anwendung

Zur Temperaturmessung an Rohren und gewölbten Flächen.

Ausgelegt zur Aufschaltung an Regler- und Anzeigesysteme.

Anlegefühler VFG54 direkt mit Anschlussgehäuse und Klemme.

Typenübersicht

AF25	Sensor TRA TRV	passiv, mit Sensor nach Kundenwunsch* aktiv, 420mA aktiv, 010V
AF50	Sensor TRA TRV	passiv, mit Sensor nach Kundenwunsch* aktiv, 420mA aktiv, 010V
PR25	Sensor TRA TRV	passiv, mit Sensor nach Kundenwunsch* aktiv, 420mA aktiv, 010V
VFG54	Sensor TRA TRV LON	passiv, mit Sensor nach Kundenwunsch* aktiv, 420mA aktiv, 010V aktiv, FTT

^{*}z.B.: PT100/PT1000/NI1000/NI1000TK5000/LM235Z/NTC.../PTC... und andere Sensoren auf Anfrage.

Application

For measuring temperature on pipes and arched surfaces.

Designed for locking on to control and display systems.

Contact temperature sensor VFG54 includes connection housing and clamp.

Types Available

AF25	Sensor TRA TRV	passive, with sensor acc. to customer's need* active, 420mA active, 010V
AF50	Sensor TRA TRV	passive, with sensor acc. to customer's need* active, 420mA active, 010V
PR25	Sensor TRA TRV	passive, with sensor acc. to customer's need* active, 420mA active, 010V
VFG54	Sensor TRA TRV LON	passive, with sensor acc. to customer's need* active, 420mA active, 010V active, FTT

^{*}eg: PT100/PT1000/NI1000/NI1000TK5000/LM235Z/NTC.../PTC... and other sensors on request.

Normen und Standards

CE-Konformität: 2004/108/EG Elektromagnetische Verträglichkeit

Produktsicherheit: 2001/95/EG Produktsicherheit

EMV: EN 60730-1: 2002 Produktsicherheit: EN 60730-1: 2002

Norms and Standards

CE-Conformity: 2004/108/EG Electromagnetic compatibility

Product safety: 2001/95/EG Product safety

EMC: EN 60730-1: 2002 Product safety: EN 60730-1: 2002

Seite 2

Technische Daten

Allgemein:

Sensorleitung L: 1m/2m/4m/6m, andere Längen auf

Anfrage,

Kabelenden standardmäßig mit

Aderend-Hülsen Leiterquerschnitt: AF25: 0,25mm²

0,50mm² bei PVC/HT AF50:

0,25mm² bei Silikon 0,25mm²

PR25: -35...100°C Einsatztemperatur: PVC/HT: Silikon: -50...180°C Fühlerhülse: AF25: Messing,

max. Einsatztemp. 150°C

Messing, AF50:

max. Einsatztemperatur 150°C

PR25: Aluminium,

max. Einsatztemperatur 180°C

VFG54: Messing

Polyamid, Farbe weiß Gehäuse: VFG54:

IP65 gemäß EN60529 Schutzart:

Typ Sensor:

Messelement: Sensor nach Kundenwunsch, Messbereich: Abhängig v. verwendeten Sensor,

Genauigkeit: Abhängig v. verwendeten Sensor und der

Länge der Sensorleitung

Typ. <1mA 2polig (Zweileiter) 3polig (Dreileiter) Messstrom: Anschluss:

4polig (Vierleiter)

VFG54: Schraubklemme max 1,5mm² Einfach M16 für Kabel mit Kabeleinführung: VFG54:

max. D=8mm

Umgebungstemperatur

Gehäuse: -35...+90°C

Gewicht: AF25: 30g; AF50: 50g; PR25: 35g;

VFG54: 80g

Typ TRA:

Versorgungsspannung: 15-24V= (±10%) max. 20mA/24V= Leistungsaufnahme:

Messbereich: am Messumformer einstellbar

TRA1: -50°C...+50°C TRA2: -10°C...+120°C TRA3: 0°C...+50°C TRA4: 0°C...+160°C TRA5 0°C...+250°C TRA8 -15°C...+35°C

4...20mA. max. Bürde 500 /24V Ausgang: Genauigkeit@21°C:

Typ. ±1% v. Messbereich bei max. 2m Sensorleitung

Anschlussklemmen: 2polig (Zweileiter)

Schraubklemme max 1,5mm² Einfach M20 für Kabel mit max. D=8mm

Kabeleinführung: Umgebungstemperatur

Gehäuse:

Transport: Gewicht:

-35...70°C

-35...70°C / max. 85%rF, nicht kond... AF25: 120g; AF50: 140g; PR25: 125g;

VFG54: 120g

Page 2

Technical Data

Operating temperature:

Sensor bushing:

General:

Sensor wire L: 1m/2m/4m/6m, other lengths on request

Cable ends with conductor sleeves as

standard

Conductor cross-section: AF25: 0,25mm²

AF50: 0,50mm² with PVC/HT AF50: 0,25mm² with Silicone

PR25: 0.25mm² PVC/HT: 100°C Silicone: 180°C AF25: Brass.

max. operating temp. 150°C

AF50: Brass.

max. operating temp. 150°C

PR25: Aluminium,

max. Operating temp. 180°C

VFG54: Brass

VFG54: Polyamide, Colour white Enclosure:

Protection: IP65 according to EN60529

Type Sensor:

Connection:

Cable entry:

Measuring elements: Sensor according to customer's request,

Measuring range: Depending on sensor used, Accuracy:

Depending on sensor used and wire lenath.

Typ. <1mA 2pole (two-wire) 3pole (three-wire)

4pole (four-wire) VFG54: Terminal screw max 1,5mm²

VFG54: Single entry,M16

for cable max. D=8mm

Ambient temperature

Measuring current:

enclosure: -35...+90°C

Weight: AF25: 30g; AF50: 50g; PR25: 35g;

VFG54: 80g

Type TRA:

15-24V= (±10%) Power supply: Power consumption: max. 20mA/24V=

Measuring range: adjustable at the transducer

TRA1: -50°C...+50°C TRA2: -10°C...+120°C TRA3: 0°C...+50°C TRA4: 0°C...+160°C TRA5 0°C...+250°C TRA8 -15°C...+35°C 4...20mA. max load 500 /24V

Output: Accurancy@21°C: Typ. +/-1% of measuring range

with cable of max. 2m Clamps: 2pole (two-wire)

Terminal screw max 1,5mm² Cable entry: Single entry,M20

for cable max. D=8mm

Ambient temperature

enclosure: -35...+70°C

Transport: -35...70°C / max. 85%rH, no condensation Weight: AF25: 120g; AF50: 140g; PR25: 125g;

VFG54: 120g VFG54:120g

Seite 3 Page 3

Typ TRV:

Versorgungsspannung: 15-24V= (±10%) oder24V~ (±10%)

Leistungsaufnahme: typ. 0,42W / 0,84VA

Messbereich: am Messumformer einstellbar

TRV1: -50°C...+50°C TRV2: -10°C...+120°C TRV3: 0°C...+50°C TRV4: 0°C...+160°C TRV5 0°C...+250°C TRV8 -15°C...+35°C 0...10V, min. Belastung 5k

Ausgang: Genauigkeit@21°C: Typ. ±1% v. Messbereich bei max. 2m Sensorleitung

3polig (Dreileiter) Anschlussklemmen:

Schraubklemme max 1,5mm²

Einfach, M20 für Leiter mit max. D=8mm

Kabeleinführung: Umgebungstemperatur

Gehäuse: -35...70°C

-35...70°C / max. 85%rF, nicht kond.. Transport: AF25: 120g; AF50: 140g; PR25: 125g; Gewicht:

VFG54: 120g

Typ LON:

Versorgungsspannung: 15-24V= (±10%) oder 24V~ (±10%)

Leistungsaufnahme: typ. 0,5W / 1,7VA Messbereich: -45°C...+130°C LON FTT (free topology)

Ausgang: Genauigkeit@21°C: Typ. $\pm 0,5K$ Klemmen: 4polig (Vierleiter)

Schraubklemme max 1,5mm²

Einfach, M20 für Kabel mit max. D=8mm Kabeleinführung: Doppelt, M20 für 2 Kabel mit max. D=7mm

Umgebungstemperatur

Gehäuse: -35...70°C

Transport: -35...70°C / max. 85%rF, nicht kond...

Gewicht: ca. 130a

Sicherheitshinweis

Achtung

Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.

Montagehinweis

Die Montage erfolgt mittels Spannband. Zur besseren Wärmeübertragung zwischen Fühler und Messmedium, Wärmeleitpaste verwenden. Um Eindringen von Kondensat zu vermeiden, Fühler nach Möglichkeit auf der Rohroberseite montieren.

Elektrischer Anschluss

Die Geräte sind für den Betrieb an Schutzkleinspannung (SELV) ausgelegt. Beim elektrischen Anschluss der Geräte gelten die techn. Daten der Geräte. Speziell bei passiven Fühlern (z.B. Pt100 etc.) in Zweileiter-Ausführung ist der Leitungswiderstand der Zuleitung zu berücksichtigen. Gegebenenfalls muss dieser in der Folgeelektronik korrigiert werden. Infolge der Eigenerwärmung beeinflusst der Messstrom die Genauigkeit der Messung. Daher sollte dieser nicht größer 1mA liegen.

Bei Fühlern mit Messumformer sollte dieser in der Regel in der Messbereichsmitte betrieben werden, da an den Messbereichsendpunkten erhöhte Abweichungen auftreten können. Die Umgebungstemperatur der Messumformerelektronik sollte konstant gehalten werden.

Die Messumformer müssen bei einer konstanten Betriebsspannung (±0,2V) betrieben werden. Strom-/Spannungssitzen beim Ein-/Ausschalten der Versorgungsspannung müssen bauseits vermieden werden.

Die Messbereichsumstellung erfolgt durch Umstecken der Kurzschlußbrücken (sieheAnschlußplan)

Der Ausgangswert im neuen Messbereichliegt dann nach ca. 2s vor.

Zubehör optional

(Sb2") Spannband für 2" Rohre und Spritze Wärmeleitpaste

ca. 0,5cm3

(Sb900) Spannband L=900mm und Spritze Wärmeleitpaste ca. 0,5cm³

Type TRV:

Power supply: 15-24V= (±10%) or24V~ (±10%)

Power consumption: typ. 0,42W / 0,84VA adjustable at the transducer Measuring range:

TRA1: -50°C...+50°C TRA2: -10°C...+120°C TRA3: 0°C...+50°C TRA4: 0°C...+160°C TRA5 0°C...+250°C TRA8 -15°C...+35°C 0...10V, min. load 5k

Accuracy@21°C: Typ. +/-1% of measuring range

with cable of max. 2m

3pole (three-wire) Clamps:

Terminal screw max 1,5mm²

Cable entry: Single entry,M20 for cable max. D=8mm

Ambient temperature enclosure: -35...+70°C

Transport: -35...70°C / max. 85%rH, no condensation AF25: 120g; AF50: 140g; PR25: 125g; Weight:

Type LON:

Output:

15-24V= $(\pm 10\%)$ or 24V~ $(\pm 10\%)$ Power supply:

typ. 0,5W / 1,7VA Power consumption: Measuring range: -45...+130°C

LON FTT (free topology) Output:

Typ. ±0,5K Accuracy@21°C: 4pole (four-wire) Clamps:

Terminal screw max 1,5mm²

Single entry, M20 for cable max. D=8mm Cable entry:

Double entry, M20 for 2 cable max.

D=7mm

Ambient temperature

-35...70°C enclosure:

Transport: -35...70°C / max 85%rH, no condensation

Security Advice



The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Mounting Advice

Fixing by tightening strap. Use contact fluid for better heat transfer between sensor and measuring medium. To avoid permeation of condensate, mount sensor on top of the tube, if possible.

Electrical Connection

The devices are constructed for the operation of protective low voltage (SELV). For the electrical connection, the technical data of the corresponding device are valid. Specially with regard to passive sensors (e.g. PT100 etc.) in 2-wire conductor versions, the wire resistance of the supply wire has to be considered. Probably, the same has to be compensated by the following electronics. Due to the self-heating, the wire current affects the accuracy of the measurement. Thus, the same should not exceed 1mA.

Sensing devices with transducers should in principle be operated in the middle of the measuring range to avoid deviations at the measuring end points. The ambient temperature of the transducer electronics should be

The transducers must be operated at a constant supply voltage (±0,2V). When switching the supply voltage on/off, power surges must be avoided

The adjustment of the measuring ranges is made by changing the bonding jumpers (see terminal connection diagram). The output value in the new measuring range is available after approx. 2 seconds.

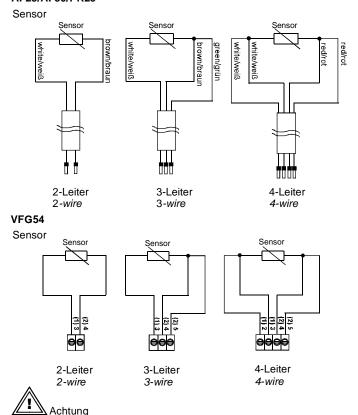
Optional Accessories

(SB2") Tightening strap for 2" pipes and syringe with contact fluid

approx. 0,5cm3

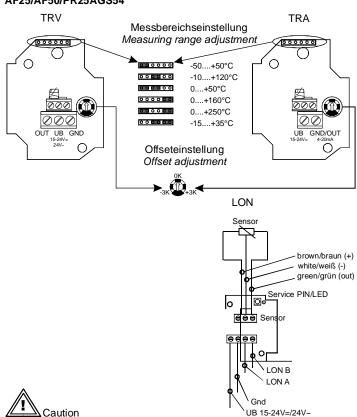
(SB900) Tightening strap L=900mm and syringe with contact fluid approx. 0,5cm3

AF25/AF50/PR25



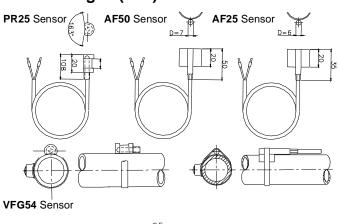
Bei eletronischen Sensoren wie z.B. **AD592, SMT160, LM235, DS1820** gilt: braun= plus (+), weiß= minus (-) , grün=out

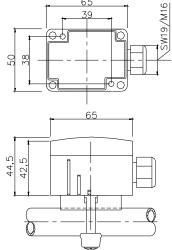
AF25/AF50/PR25AGS54



With electronic sensors such as AD592, SMT160, LM235, DS1820 the following applies: brown= plus (+), white= minus (-), green=out

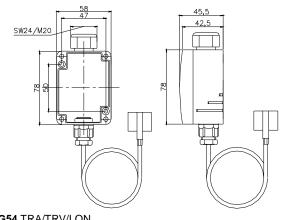
Abmessungen (mm)



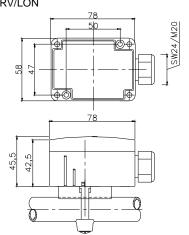


Dimensions (mm)

AF25/AF50/PR25 TRA/TRV/LON



VFG54 TRA/TRV/LON



FP/FTP

Pendelfühler relative Feuchte Pendulumsensor for relative humidity



DE - Datenblatt

Technische Änderungen vorbehalten Stand 16.03.2009

EN - Data Sheet

Subject to technical alteration Issue date 2009/03/16



FP/FTP

Anwendung

Pendelfühler zur sektionalen Messung der rel. Feuchte (Modell FP) bzw. rel. Feuchte und Temperatur (Modell FTP) in großen Räumen (z.B. Großraumbüros, Gallerien, Fertigungshallen etc.). Ausgelegt zur Aufschaltung an Regler- und Anzeigesysteme.

Application

Pendulum sensor for sectional measurement of relative humidity (model FP), respectively for sectional measurement of relative humidity and temperature (model FTP) in large rooms (e.g. open-plan offices, galleries, production plants etc.) Designed for locking-on control and display systems.

Typenübersicht

aktiv, 010V aktiv, FTT10
rel. F.: aktiv, 420mA Temp.: Sensor*
rel. F.: aktiv, 010V Temp.: Sensor*
aktiv, 420mA
aktiv, 010V
aktiv, FTT10

 $^{^{\}star}$ Z.B.: PT100/PT1000/NI1000/NI1000TK5000/LM235Z/NTC.../PTC...und andere Sensoren auf Anfrage.

Types Available

FP	A V LON		active, 420mA active, 010V active, FTT10
FTP	AS	rel. h.: Temp.: rel. h.: Temp.:	active, 420mA Sensor* active, 010V Sensor*
	VS		
	AA		active, 420mA
	VV		active, 010V
	LON		active, FTT10

^{*} eg: PT100/PT1000/NI1000/NI1000TK5000/LM235Z/NTC.../PTC... and other sensors on request

Normen und Standards

Produktsicherheit: EN60730-1 Automatische

elektr. Regel- und Steuergeräte für den Hausgebrauch und ähnliche Anwendungen

EMV: EN60730-1 (2000) Störfestigkeit EN60730-1 (2000) Störaussendung

CE-Konformität: 89/336/EWG Elektromagnetische Verträglichkeit

Norms and Standards

Product safety: EN60730-1 Automatic electr.control devices for

domestic use and similar applications EN60730-1 (2000) Interference resitance

EN60730-1 (2000) Emitted interference
CE-Conformity: 89/336/EWG Electromagnetic compatibility EMV

EMV:

Seite 2 Page 2

Technische Daten

Allgemein:

Messelement: rel. Feuchte: kapazitiv

rel. Feuchte: 5...95% (Arbeitsbereich 0...100%) Messbereich: rel. Feuchte: Typ. ±2% im Bereich 35%rF...75%rF Genauiakeit: Sensorleitung L: 1m/2m/4m/6m, andere Längen auf Anfrage

Kabelenden standardmäßig mit Aderend-Hülsen,

Leiterquerschnitt 0,25mm²

Material PVC, Farbe schwarz, Edelstahl Gewicht Fühlerhülse:

Material Teflon, Oberflächendurchlässigkeit 30% Filterelement:

Typ AS:

15-24VDC (±10%) Betriebsspannung: Stromaufnahme: max. 20mA Messstrom: Temperatur: Typ. <1mA

Messelement: Temperatur: Sensor nach Kundenwunsch,

z.B. PTC, NTC.

Temperatur: Abhängig vom verwendeten Sensor Messbereich: rel. Feuchte: 4...20mA, max. Bürde 800Ohm Ausgang:

Temperatur: passiv

Genauigkeit@21°C: Temperatur: Abhängig vom verwendeten Sensor

Gewicht: FTP AS: ca. 210g

Typ VS:

Betriebsspannung: 15-24VDC (±10%) oder 24VAC (±10%)

Leistungsaufnahme: typ. 0,1W / 0,25VA Messstrom: Temperatur: Typ. <1mA

Messelement: Temperatur: Sensor nach Kundenwunsch,

z.B. PTC, NTC..

Temperatur: Abhängig v. verwendeten Sensor Messbereich: Ausgang: rel. Feuchte: 0...10V, min. Belastung 10kOhm

Temperatur: passiv

Genauigkeit@21°C: Temperatur: Abhängig v. verwendeten Sensor

FTP VS: ca. 210g Gewicht:

Typ A,AA:

Betriebsspannung: 15-24VDC (±10%)

max. 40mA Stromaufnahme:

Temperatur (nur Modell FTP): -20°C...+80°C Messbereich: rel. Feuchte: 4...20mA, max. Bürde 800Ohm Ausgang: Temperatur: 4...20mA, max Bürde 800Ohm

Genauigkeit@21°C: Temperatur (nur Modell FTP): Typ. ±0,3% vom Messbereich

Gewicht: FP A: ca. 210g; FTP AA: ca. 210g

Typ V, VV:

15-24VDC (±10%) oder 24VAC (±10%) Betriebsspannung:

Leistungsaufnahme: typ. 0,1W / 0,25VÁ

Temperatur: (nur Modell FTP): -20°C...+80°C Messbereich: rel. Feuchte: 0...10V, min. Belastung 10kOhm Ausgang: Temperatur: 0...10V, min Belastung 10kOhm

Genauigkeit@21°C: Temperatur (nur Modell FTP):

Typ. ±0,3% v. Messbereich

FP V: ca. 210g; FTP VV: ca. 210g Gewicht:

Typ LON:

15-24VDC (±10%) oder 24VAC (±10%) Betriebsspannung:

Leistungsaufnahme: typ. 0,8W / 1,6VA

Messbereich: Temperatur (nur Modell FTP): -20°C...+80°C

Genauigkeit@21°C: Temperatur (nur Modell FTP): Typ. ±0,3% v. Messbereich

Klemmen: 4 polig (Vierleiter), Schraubklemme max 1,5mm²

Anschlusskopf: (78mm) Polyamid, Farbe weiß,

Umgebungstemp.: <70°C

IP65 gemäß EN 60529 Schutzart: Kabeleinführung: Einfach, M20 für Leiter

mit max. D=8mm Doppelt, M20 für 2 Leiter mit max. D=7mm

Gewicht: FTP LON: ca. 430g

Technical Data

General:

Measuring element: rel. humidity: capacitive

Measuring range: rel. humidity: 5...95% (working range 0...100%) rel. humidity: Typ. ±2% in the range 35%rF...75%rF Accuracy:

Mounting length: 1m/2m/4m/6m, other lengths on request Cable ends with conductor sleeves as standard,

Conductor cross-section 0,25mm²

Sensor bushing: PVC, colour black, stainless steel weight

Filter element: Teflon, permeability 30%

Type AS:

Operating voltage: 15-24VDC(±10%) Power consumption: max. 20mA

Temperature: Typ. <1mA Measuring current:

Temperature: sensor according to customer's Measuring element:

request, e.g. PTC, NTC...

Temperature: depending on sensor used Measuring range: Output:

rel. humidity: 4...20mA, max. load 800Ohm

Temperature: passive

Accuracy@21°C: Temperature: depending on sensor used

Weight: FTP AS: approx. 210g

Type VS:

15-24VDC (±10%) oder 24VAC (±10%) Operating voltage:

Power consumption: typ. 0,1W / 0,25VA Measuring current: Temperature: Typ. <1mA

Measuring element: Temperatur: sensor according to customer's

request e.g. PTC, NTC...

Measuring range: Temperature:depending on sensor used

Output: rel. humidity: 0...10V, min. load 10kOhm

Temperature: passive

Accuracy@21°C: Temperature: depending on sensor used

Weight: FTP VS: approx. 210g

Type A,AA:

Operating voltage: 15-24VDC (±10%) Power consumption: max. 40mA

Measuring range:

Output:

Temperature (only model FTP): -20°C...+80°C rel. humidity: 4...20mA, max. load 800Ohm Temperature: 4...20mA, max. load 800Ohm

Accuracy@21°C: Temperature (only model FTP):

Typ. ±0,3% of measuring range

FP A: approx. 210g; FTP AA: approx. 210g Weight:

TypeV, VV:

Operating voltage: 15-24VDC (±10%) oder 24VAC (±10%)

Power consumption: typ. 0,1W / 0,25VA

Temperature (only model FTP): -20°C...+80°C Measuring range:

rel. humidity: 0...10V, min. load10kOhm Output: Temperature: 0...10V, min. load 10kOhm

Temperature (only model FTP): Accuracy@21°C:

Typ. ±0,3% of measuring range FP V: approx. 210g; FTP VV: approx. 210g Weight

Type LON:

15-24VDC (±10%) oder 24VAC (±10%) Operating voltage:

Power consumption: typ. 0,8W / 1,6VA

Temperature (only model FTP): -20°C...+80°C Measuring range:

Accuracy@21°C: Temperature (only model FTP): Typ. ±0,3% of measuring range

Housing: 78mm) Polyamide, Colour white, Clamps 4pole (four-wire), Terminal screw max 1,5mm²

<70°C Ambient temp.:

IP65 acc. to EN 60529 Protection:

Cable entry: Single entry, M20 for wire conductor

with max. D=8mm

Double entry, M20 for 2-wire conductor

with max. D=7mm

Weight: FTP LON: approx. 430g



Sicherheitshinweis

Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.



Security Advice

The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Elektrischer Anschluss

Die Geräte sind für den Betrieb an Schutzkleinspannung (SELV) ausgelegt. Beim elektrischen Anschluss der Geräte gelten die techn. Daten der Geräte.

Speziell bei passiven Fühler (z.B. PT100 etc.) in Zweileiter-Ausführung ist der Leitungswiderstand der Zuleitung zu berücksichtigen. Gegebenenfalls muss dieser in der Folgeelektronik korrigiert werden.

Infolge der Eigenerwärmung beeinflusst der Messstrom die Genauigkeit der Messung. Daher sollte dieser nicht größer 1mA liegen.

Bei Fühlern mit Messumformer sollte dieser in der Regel in der Messbereichsmitte betrieben werden, da an den Messbereichsendpunkten erhöhte Abweichungen auftreten können. Die Umgebungstemperatur der Messumformerelektronik sollte konstant gehalten werden.

Electrical connection

The devices are constructed for the operation of protective low voltage (SELV). For the electrical connection, the technical data of the corresponding device are valid.

Specially with regard to passive sensors (e.g. PT100 etc.) in 2-wire conductor versions, the wire resistance of the supply wire has to be considered. Probably, the same has to be compensated by the following electronics.

Due to the self-heating, the wire current affects the accuracy of the measurement. Thus, the same should not exceed 1mA.

Sensing devices with transducer should in principle be operated in the middle of the measuring range to avoid deviations at the measuring end points. The ambient temperature of the transducer electronics should be kept constant.

Montagehinweise

Bitte beachten Sie auch die allgemeinen Hinweise in unserem INFOBLATTTHK.

Mounting Advices

Please also note the general remarks in our INFORMATION SHEET

Anwenderhinweise

Durch Luftumwälzungen können sich im Laufe der Zeit auf dem Filter, der die Sensoren schützt, Schmutz und Staubpartikel ansammeln, die die Funktion des Fühlers behindern können.

Nach erfolgter Demontage des Filters kann dieser durch Ausblasen mit ölfreier, gefilterter Pressluft, Reinstluft, Stickstoff oder Auswaschen mit destilliertem Wasser wieder gereinigt werden.

Zu stark verschmutzte Filter sollten getauscht werden.

Jegliche Berührung der empfindlichen Feuchtesensoren ist zu unterlassen und führt zum Erlöschen der Gewährleistung.

Beim Einsatz in aggressiven Gasen kann ein vorzeitiges Nachkalibrieren oder ein Feuchtesensortausch notwendigt werden. Eine solche Nachkalibrierung oder etwaiger Sensortausch fallen nicht unter die allgemeine Gewährleistung.

Application Notice

Due to air circulations dirt and dust particles can be piled up in the course of time on the filter which is protecting the sensor. Thus, the function of the sensor can be affected. After having dismantled the filter, the same can be cleaned by blowing it out with oil-free and filtered compressed air, super-clean air or nitrogen or by washing it out with distilled water. If the filter is too dirty, the same should be replaced.

Refrain from touching the sensitive humidity sensor. Any touch of the same will result in an expiration of the warranty.

When using the sensor in aggressive gases, an early recalibration or a change of the humidity sensor can become necessarily. Such a recalibration or a probable sensor change do not come under the general warranty.

Seite 4 Page 4

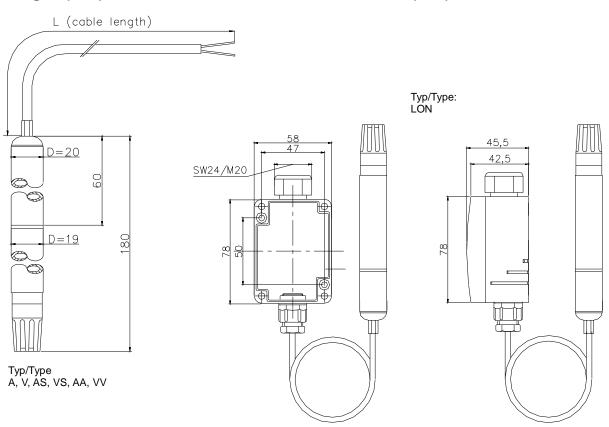
Anschlussplan

Terminal Connection Plan

GND braun brown			rH- weiss 420mA white	rH+ braun Uv 1524V= brown	•	T- gelb 420mA yellow	T+ grün Uv 1524V= green	rH- weiss 420mA white	rH+ braun Uv 1524V= brown	
FP V			FP A		ı	FTP A	Α			yelld white brow
gelb yellow	grey	brown weiss white	grün green			gelb yellow	grün green	weiss white	braun brown	yellow/gelb (Temp) white/weiß (rH) brown/braun (-) green/grün (+)
Sensor	Sensor	Out rH 010V	Uv 15-24V= 24V~			Sensor	Sensor	rH- 420mA	rH+ Uv 1524V=	Temp)
FTP VS				•		FTP A	S			Service PIN/LED
gelb yellow braun	brown weiss	grün green								(a) Sensor (a) (a) (b) Sensor
Out Temp 010V	GND Out rH	U 10V 15-24V= 24V~								15-24V= 24V~ UB Grad () LON A ()
FIPVV										FTP LON

Abmessungen (mm)

Dimensions (mm)



RPF40 / RPF100

Raumpendelfühler Room Pendulum Temperature Sensor



DE - Datenblatt

Technische Änderungen vorbehalten Stand 10.03.2008

EN - Data Sheet

Subject to technical alteration Issue date 2008/03/10



RPF100

Anwendung

Pendelfühler zur sektionalen Temperaturmessung in großen Räumen (z.B. Großraumbüros, Gallerien, Fertigungshallen etc.). Ausgelegt zur Aufschaltung an Regler- und Anzeigesysteme. Das Modell RPF40 speziell als Strahlungsfühler mit langer Zeitkonstante für Heizstrahler o.ä..

Typenübersicht

RPF40 Sensor passiv, mit Sensor nach Kundenwunsch*

TRA aktiv, 4...20mA TRV aktiv, 0...10V

LON FT

RPF100 Sensor passiv, mit Sensor nach Kundenwunsch*

TRA aktiv, 4...20mA TRV aktiv, 0...10V

LON FTT

*z.B.: PT100/PT1000/Ni1000/Ni1000TK5000/LM235Z/NTC.../PTC...und andere Sensoren auf Anfrage.

Application

Pendulum sensor for sectional temperature measurement in large rooms (e.g. open-plan offices, galleries, production plants etc.). Designed for locking on to control and display systems. Model RPF40 is specially designed as a radiation sensor with long-time constant for radiant heaters.

Types Available

RPF40 Sensor passive, with sensor acc. to customers's need*

TRA active, 4...20mA TRV active, 0...10V

LON FTT

RPF100 Sensor passive, with sensor acc. to customers's need*

TRA active, 4...20mA TRV active, 0...10V

LON FTT

 ${}^\star\text{eg: PT100/PT1000/Ni1000/Ni1000TK5000/LM235Z/NTC.../PTC...} and other sensors on request. The sensors of the sensors of$

Normen und Standards

EMV: EN60730-1 (2000) Störfestigkeit EN60730-1 (2000) Störaussendung

CE-Konformität: 2004/108/EG Elektromagnetische Verträglichkeit

Norms and Standards

EMV: EN60730-1 (2000) Interference resitance

EN60730-1 (2000) Emitted interference

CE-Conformity: 2004/108/EG Electromagnetic compatibility EMV

Seite 2 Page 2

Technische Daten

Technical Data

Allgemein:

Sensorleitung L: 1m/2m/4m/6m, andere Längen auf

Anfrage, Kabelenden standardmäßig mit

Aderend-Hülsen,

Leiterquerschnit 0,25mm²

Fühlerhülse: RPF40: Kunststoff schwarz, D=40mm RPF100: Edelstahl Mat. 1.4571,

L=100mm, D=15mm

-35...70°C Umgebungstemperatur:

Transport:

-35...70°C / max. 85%rF, nicht kond..

General:

Sensor wire L: 1m/2m/4m/6m, other lengths on request

Cable ends with conductor sleeves as

standard

Conductor cross-section 0,25mm², RPF40: Black plastic ball, D=40mm RPF100: Stainless steel grade 1.4571,

L=100mm, D=15mm

-35...70°C Ambient temperature:

-35...70°C / max. 85%rH, no condensation Transport:

Typ Sensor:

Messelement: Sensor nach Kundenwunsch

-35...70°C Messbereich:

Genauigkeit: Abhängig v. verwendeten Sensor, und der

Länge der Sensorleitung

Typ. <1mA Messstrom: Anschluss: 2polig (Zweileiter) 3polig (Dreileiter),

4polig (Vierleiter),

RPF40: 80g; RPF100: 130g Gewicht:

Type Sensor:

Sensor bushing:

Measuring element: Sensor according to customer's request

-35...70°C Measuring range:

Depending on sensor used and wire Accuracy:

length Typ. <1mA

Measuring current: Connection: 2pole (two-wire)

3pole (three-wire), 4pole (four-wire),

RPF40: 80g; RPF100: 130g Weight:

Typ TRA:

Versorgungsspannung: 15-24V= (±10%) max. 20mA/24V= Leistungsaufnahme:

Messbereich: am Messumformer einstellbar

-50°C...+50°C TRA1: -10°C...+120°C TRA2: TRA3: 0°C...+50°C TRA4: 0°C...+160°C TRA5: 0°C...+250°C TRA8: -15°C...+35°C

Ausgang: 4...20mA, max. Bürde 500Ω/24V=

Typ. ±1% v. Messbereich Genauigkeit@21°C: bei max. 2m Sensorleitung

Anschlußklemme: 2polig (Zweileiter)

Schraubklemme max. 1,5mm² Gehäuse: Material Polyamid, Farbe weiß

IP65 gemäß EN60529 Schutzart:

Kabeleinführung: Einfach, M20 für Kabel mit max. D=8mm

RPF40: 175g; RPF100: 225g Gewicht:

Type TRA:

Type TRV:

Power supply: 15-24V= (±10%) Power consumption: max. 20mA/24V=

Measuring range: adjustable at the transducer

-50°C...+50°C TRA1: -10°C...+120°C TRA2: TRA3: 0°C...+50°C TRA4: 0°C...+160°C 0°C...+250°C TRA5: -15°C...+35°C TRA8:

Output: 4..20mA, max. load 500Ω/24V= Accuracy@21°C: Typ. +/-1% of measuring range

with cable of max. 2m

Clamps: 2pole (two-wire)

Terminal screw max 1,5mm² Enclosure: Material Polyamide, Colour white IP65 according to EN60529 Protection:

Single entry, M20 for cable max. D=8mm Cable entry:

RPF40: 175g; RPF100: 225g Weight:

Typ TRV:

Versorgungsspannung: 15-24V= (±10%) oder 24V~ (±10%)

Leistungsaufnahme: typ. 0,42W / 0,84VA

Messbereich: am Messumformer einstellbar

TRV1: -50°C...+50°C -10°C...+120°C TRV2 0°C...+50°C 0°C...+160°C TRV3: TRV4: TRV5: 0°C...+250°C TRV8: -15°C...+35°C

Ausgang: 0...10V, min Belastung $5k\Omega$ Typ. ±1% v. Messbereich Genauigkeit@21°C:

bei max. 2m Sensorleitung 3polig (Dreileiter)

Anschlußklemmen:

Schraubklemme max 1,5mm² Gehäuse: Material Polyamid, Farbe weiß IP65 gemäß EN60529 Schutzart:

Kabeleinführung: Einfach, M20 für Kabel mit max. D=8mm

RPF40: 175g; RPF100: 225g Gewicht:

15-24V= (±10%) or 24V~ (±10%) Power supply:

typ. 0,42W / 0,84VA Power consumption:

Measuring range:

adjustable at the transducer TŘV1: -50°C...+50°C -10°C...+120°C TRV2: 0°C...+50°C 0°C...+160°C TRV3: TRV4: 0°C...+250°C -15°C...+35°C TRV5: TRV8:

0...10V, min load $5k\Omega$ Output:

Accuracy@21°C: Typ. +/-1% of measuring range

with wire conductor of max. 2 m

Clamps: 3pole (three-wire)

Terminal screw max 1,5mm² Material Polyamide, Colour white Enclosure: IP65 according to EN60529 Protection:

Cable entry: Single entry, M20 for cable max. D=8mm

Weight: RPF40: 175g; RPF100: 175g

Typ LON:

Versorgungsspannung: 15-24V= ($\pm 10\%$) oder 24V ~ ($\pm 10\%$)

Leistungsaufnahme: typ. 0,5W / 1,7VA Messbereich: -35...+70°C Genauigkeit@21°C: Typ. ±0,5K Anschluklemmen: 4polig (Vierleiter)

Schra ubklemme max 1,5mm²
Gehäuse: Polyamid, Farbe weiß
Schutzart: IP65 gemäß EN60529

Kabeleinführung: Einfach, M20 für Kabel mit max. D=8mm Doppelt, M20 für 2 Kabel mit max. D=7mm

Gewicht: RPF40: 185g; RPF100: 235g



Sicherheitshinweis

Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.

Montagehinweise

Ausführung mit Messumformer: Zur leichteren Montage kann der Pendelfühler vom Messumformer getrennt werden. Bei Anschluss der Sensorleitung an den Messumformer auf korrekte Befestigung achten, um elektr. Übergangswiderstand an der Klemme zu vermeiden.

Bitte beachten Sie auch die allgemeinen Hinweise in unserem INFOBLATT THK.

Elektrischer Anschluss

Die Geräte sind für den Betrieb an Schutzkleinspannung (SELV) ausgelegt. Beim elektrischen Anschluss der Geräte gelten die techn. Daten der Geräte.

Speziell bei passiven Fühler (z.B. Pt100 etc.) in Zweileiter-Ausführung ist der Leitungswiderstand der Zuleitung zu berücksichtigen. Gegebenenfalls muss dieser in der Folgeelektronik korrigiert werden.

Infolge der Eigenerwärmung beeinflusst der Messstrom die Genauigkeit der Messung. Daher sollte dieser nicht größer 1mA liegen.

Bei Fühlern mit Messumformer sollte dieser in der Regel in der Messbereichsmitte betrieben werden, da an den Messbereichsendpunkten erhöhte Abweichungen auftreten können. Die Umgebungstemperatur der Messumformerelektronik sollte konstant gehalten werden.

Die Messumformer müssen bei einer konstanten Versorgungsspannung betrieben werden.

Die Messbereichsumstellung erfolgt durch Umstecken der Kurzschlußbrücken (siehe Anschlußplan).

Der Ausgangswert im neuen Messbereich liegt dann nach ca. 2s vor.

Platzierung und Genauigkeit von Raumfühlern

Die Genauigkeit der Temperaturmessung ist abhängig von einem geeigneten representativen, der Raumtemperatur entsprechendem Montageort. Anderenfalls kommt es zu Abweichungen bei der Temperaturmessung. Zudem sollte der Temperaturfühler nicht durch Möbel etc. abgedeckt sein. Des Weiteren sollte eine Montage in Türnähe (auftretende Zugluft) oder Fensternähe (kältere Außenwand) vermieden werden.

Page 3

Type LON:

Power supply: $15-24V = (\pm 10\%) \text{ or } 24V \sim$

 $(\pm 10\%)$

Power consumption: typ. 0,5W / 1,7VA Measuring range: -35...+70°C Accuracy@21°C: Typ. ±0,5K Clamps: 4pole (four-wire)

Terminal screw max 1,5mm²
Enclosure: Polyamide, Colour white
Protection: IP65 according to EN60529
Cable entry: Single entry, M20 for cable max.
D=8mm

Double entry, M20 for 2 cable max. D=7mm

Weight: RPF40: 185g; RPF100: 235g



Security Advice

The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Mounting Advices

Model with transducer: For easier mounting, the pendulum sensor can be separated from the transducer. When connecting the sensor wire to the transducer, please take care of a proper fixing, in order to avoid an electr. transition resistance on the clamp.

Please also note the general remarks in our INFORMATION SHEET THK.

Electrical Connection

The devices are constructed for the operation of protective low voltage (SELV). For the electrical connection, the technical data of the corresponding device are valid.

Specially with regard to passive sensors (e.g. PT100 etc.) in 2-wire conductor version, the wire resistance of the supply wire has to be considered. Probably, the same has to be compensated by the following electronics.

Due to the self-heating, the wire current affects the accuracy of the measurement. Thus, the same should not exceed 1 mA.

Sensing devices with transducer should in principle be operated in the middle of the measuring range to avoid deviations at the measuring end points. The ambient temperature of the transducer electronics should be kept constant.

The transducers must be operated at a constant supply voltage.

The adjustment of the measuring ranges is made by changing the bonding jumpers (see terminal connection diagram). The output value in the new measuring range is available after approx. 2 seconds.

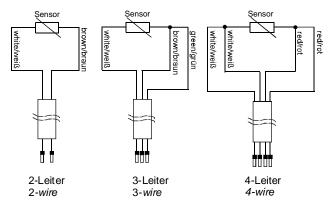
Location and Accuracy of Room Sensors

The accuracy of the temperature measurement is depending on a suitable representative mounting place corresponding to the room temperature. Otherwise, deviations in temperature measurement will occur. Furthermore, the temperature sensor should not be covered by furnitures etc.. Moreover, a mounting place next to doors (occurring draught) or windows (colder outside wall) should be avoided.

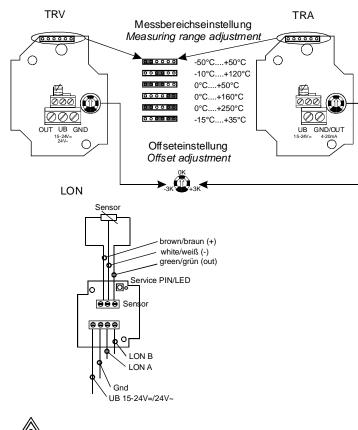
Seite 4 Page 4

Anschlussplan

Sensor



Terminal Connection Plan





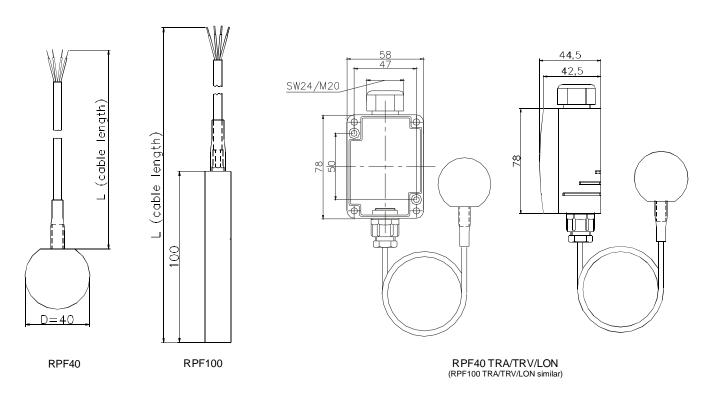
Bei elektronischen Sensoren wie z.B.: AD592, SMT160, LM235, DS1820 gilt: braun= plus (+), weiß= minus (-), grün=out



With electronic sensors such as AD592, SMT160, LM235, DS1820 the following applies: brown= plus (+), white= minus (-), green=out

Abmessungen (mm)





WRF04 CO2

Kombinierter Raumfühler CO2/Temperatur Combined room sensor CO2/Temperature



DE - Datenblatt

Technische Änderungen vorbehalten Stand 02.11.2009

EN - Datasheet

Subject to technical alteration Issue date 2009/11/02







WRF04 CO2 VV(V)-Z

WRF04 CO2 VV(V) LCD



Anwendung

Der Sensor dient zur Erfassung von Kohlendioxid (CO2), Temperatur und der relativen Feuchte (optional) im Wohnraum. Überall wo Personen sich in Räumen aufhalten, ist der CO2 Gehalt ein nachweisbarer Indikator für die Raumluftqualität. Je größer der CO2 Gehalt, desto schlechter die Luftqualität.

Verwendet wird zur CO2 Messung die "Non Dispersive InfraRed (NDIR) Technology" mit automatischer Selbstkalibrierung. Zur direkten Aufschaltung auf eine DDC oder ein Monitoring System stehen analoge 0...10V Ausgänge zur Verfügung. Zusätzlich kann das Gerät bei Bedarf mit einem passiven Temperatursensor, wie z.B. PT100, PT1000, NTC10k etc. geliefert werden.

Technische Details:

- Raumfühler zur Messung des CO2-Gehalts und der Temperatur
- Messbereich 0...2000ppm und 0...50°C
- Ausgänge 0...10V
- Betriebsspannung 15-24DC/24VAC
- Optional mit passivem Temperatursensor
- Optional mit LCD Display zur Anzeige des CO2 Gehalts, Temperatur und rel. Feuchte
- Optional mit 3 LEDs zur Anzeige des CO2 Gehalts
- Optional mit analogen Ausgang für die relative Feuchte

Typenübersicht

WRF04 CO2 VV

CO2: 0...10V / Temp: 0...10V WRF04 CO2 VV-Z CO2: 0...10V / Temp: 0...10V 3 LEDs zur Anzeige des CO2 Gehalts CO2: 0...10V / Temp: 0...10V WRF04 CO2 VV LCD Anzeige CO2 und Temp. über LCD CO2: 0...10V / Temp: 0...10V / Feuchte 0...10V CO2: 0...10V / Temp: 0...10V / Feuchte 0...10V WRF04 CO2 VVV WRF04 CO2 VVV-Z 3 LEDs zur Anzeige des CO2 Gehalts WRF04 CO2 VVV LCD CO2: 0...10V / Temp: 0...10V / Feuchte 0...10V Anzeige CO2, Temp. und Feuchte über LCD wie WRF04 CO2 VV, geeignet zur Montage LK CO2 VV am Lüftungskanal, inkl. Montageflansch und Anschlussleitung 1,5m LK CO2 VV LCD wie WRF04 CO2 VV LCD, geeignet zur Montage am Lüftungskanal, inkl. Montageflansch und Anschlussleitung 1,5m

Application

The sensor is designed for the detection of carbon dioxide (CO2), temperature and relative humidity (optionally) in living spaces. Wherever people are staying in rooms, the CO2 concentration is an evident indicator for the room quality.

For the CO2 measurement the "Non Dispersive InfraRed (NDIR) Technology" with automatic self-calibration is used. For a direct locking-on to a DDC or a monitoring system, analog 0...10V outputs are available. Additionally, the device can be supplied with a passive temperature sensor e.g. PT100, PT1000, NTC10k etc.

Technical Details:

- Room sensor for measuring the CO2 concentration and temperature in rooms
- Measuring range 0...2000ppm and 0...50°C
- Output 0...10V
- Power supply 15-24DC/24VAC
- Passive temperature sensor at option
- Optionally with LCD display to show CO2 concentration, temperature and rel. humidity
- Optionally with 3 LED to show the CO2 concentration
- Optionally with analog output for relative humidity

Types available

WRF04 CO2 VV

WRF04 CO2 VV-Z CO2: 0...10V / Temp: 0...10V 3 LEDs to show the CO2 concentration WRF04 CO2 VV LCD CO2: 0...10V / Temp: 0...10V CO2 and Temp. are shown in the LCD WRF04 CO2 VVV CO2: 0...10V / Temp: 0...10V / Feuchte 0...10V WRF04 CO2 VVV-Z CO2: 0...10V / Temp: 0...10V / Feuchte 0...10V 3 LEDs to show the CO2 concentration WRF04 CO2 VVV LCD CO2: 0...10V / Temp: 0...10V / Feuchte 0...10V CO2, Temp., rel. humity are shown in the LCD similar to WRF04 CO2 VV, for mounting on LK CO2 VV ventilation duct, with mounting flange and connection wire 1,5m LK CO2 VV LCD similar to WRF04 CO2 VV LCD, for mounting on ventilation duct, with mounting flange and connection wire 1,5m

CO2: 0...10V / Temp: 0...10V

Seite 2 Page 2

Normen und Standards

CE-Konformität: 2004/108/EG Elektromagnetische Verträglichkeit

Produktsicherheit: 2001/95/EG Produktsicherheit

FMV: EN 60730-1:2002 Produktsicherheit: EN 60730-1:2002

Technische Daten

Allgemein

Spannungsversorgung: 15-24VDC (±10%) oder 24VAC (±10%)

max. 3W / max.6VA Leistungsaufnahme:

Klemmen: Schraubklemme, max. 1,5mm²,

Draht oder Litze

Analog outputs: CO2, 0...10V, max.Last 10mA Temp., 0...10V, max. Last 10mA

0...2000ppm, NDIR (non dispersive infrared) CO2 Sensor:

Temp. Abhängigkeit: <0,2% vom Endwert pro °C Genauigkeit @21°C: typ. ±40ppm + 4% vom Messwert Temp.: Typisch ±1% vom Messbereich

Aufwärmzeit: < 2 Minuten Ansprechzeit: < 10 Minuten

Drift: < 2% vom Endwert über die Lebensdauer

(typ. Lebensdauer 15 Jahre)

Wiederholgenauigkeit: <1% vom Endwert

nicht notwendig - siehe ABCLogic™ IP20 nach EN60529 Kalibrierintervall:

Gehäuseschutzart:

Umgebungstemperatur: 0...+50°C, max. 85%rF nicht kondensierend

WRF04 CO2 VV

Material ASA. Farbe reinweiß Gehäuse:

Gewicht: ca. 90q

WRF04 CO2 VV-Z

LEDs: 3 LEDs zur Anzeige des CO2 Gehalts

0... 750ppm: Grüne LED leuchtet 751...1250ppm: Gelbe LED leuchtet 1251...2000ppm: Rote LED leuchtet

Gehäuse: Material ASA, Farbe reinweiß

Gewicht: ca. 90g

WRF04 CO2 VV LCD

Anzeige des CO2 Gehalts und der Temperatur LC-Display:

Gehäuse: Material ASA, Farbe reinweiß

ca. 90g Gewicht:

WRF04 CO2 VVV

Relative Feuchte, 0...10V, Last max. 10mA Analoger Ausgang: Genauigkeit rel. Feuchte: Typ. ±3% (im Bereich 20...80% rF)

Gehäuse: Material ASA, Farbe reinweiß

Gewicht:

WRF04 CO2 VVV-Z

Relative Feuchte, 0...10V, Last max. 10mA Analoger Ausgang: Genauigkeit rel. Feuchte: Typ. ±3% (im Bereich 20...80% rF)

3 LEDs zur Anzeige des CO2 Gehalts LEDs: 0... 750ppm: Grüne LED leuchtet

751...1250ppm: Gelbe LED leuchtet 1251...2000ppm: Rote LED leuchtet

Material ASA, Farbe reinweiß Gehäuse:

Gewicht:

WRF04 CO2 VVV LCD

Anzeige des CO2 Gehalts und der Temperatur LC-Display:

Gehäuse: Material ASA, Farbe reinweiß

Gewicht: ca. 90g

LK CO2 VV / LK CO2 VV LCD:

PC 120mm x 120mm x85mm mit Deckel Anschlusskopf:

glasklar

Fühlerrohr: Stahl, verzinkt, Länge 300mm, Ø30mm,

inkl. Montageflansch Anschlussleitung: PE, schwarz, Länge 1,5m

Gewicht: ca. 1,3kg **Norms and Standards**

CE-Conformity: 2004/108/EG Electromagnetic compatibility

Product safety: 2001/95/EG Product safety

EMC: EN 60730-1:2002 Product safety: EN 60730-1:2002

Technical Data

General

CO2 Sensor:

15-24VDC (±10%) or 24VAC (±10%) Power supply:

Power consumption: max. 3W / max.6VA

terminal screw, max. 1,5mm2, Clamps:

wire or braid

Analog outputs: CO2, 0...10V, load max. 10mA Temp., 0...10V, load max. 10mA

0...2000ppm, NDIR (non dispersive infrared)

Temp. Dependence: <0,2% of Full Scale per °C

Accuracy @21°C: typ. ±40ppm + 4% of reading Temp.: Typical ±1K of full scale

Warm Up Time: < 2 minutes < 10 minutes Response Time:

Stability: < 2% Full Scale over life of sensor

(typ. lifetime 15 years) <1% of Full Scale

Calibration interval: not required - see ABCLogic™ Housing protection: IP20 according to EN60529

Ambient temperature: 0...+50°C, max. 85%rH no condensate

WRF04 CO2 VV

Repeatability:

Material ASA, colour pure white Housing:

Weight: Approx. 90q

WRF04 CO2 VV-Z

3 LEDs to show the CO2 concentration LEDs:

0... 750ppm: Green LED is on 751...1250ppm: Yellow LED is on 1251...2000ppm: Red LED is on Material ASA, colour pure white

Housing:

Approx. 90g Weight:

WRF04 CO2 VV LCD

LC-Display: Shows the CO2 concentration and temperature

Housing: Material ASA, colour pure white

Weight: Approx. 90g

WRF04 CO2 VVV

Relative humidity, 0...10V, max. load 10mA Analog output:

Accuracy rel. humidity: Typ. ±3% (between 20...80% rH) Housing: Material ASA, colour pure white

Weight: Approx. 90g

WRF04 CO2 VVV-Z

Analog output: Accuracy rel. humidity:

LEDs:

Relative humidity, 0...10V, max. load 10mA Typ. ±3% (between 20...80% rH)

3 LEDs to show the CO2 concentration 0... 750ppm: Green LED is on 751...1250ppm: Yellow LED is on

1251...2000ppm: Red LED is on Material ASA, colour pure white Housing:

Approx. 90g Weight:

WRF04 CO2 VVV LCD

Anzeige des CO2 Gehalts und der Temperatur LC-Display:

Material ASA, colour pure white Housing:

Weight: Approx. 90g

LK CO2 VV / LK CO2 VV LCD:

PC 120mm x 120mm x 85mm, with transparent Connection head:

steel, galvanized, length 300mm, Ø30mm, Sensor tube:

with mounting flange Connection wire: PE, black, length 1,5m

approx. 1,3kg Weight:

Sicherheitshinweis /



Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.

Elektrischer Anschluss

Die Geräte sind für den Betrieb an Schutzkleinspannung (SELV) ausgelegt. Beim elektrischen Anschluss der Geräte gelten die techn. Daten der Geräte. Bei Fühlern mit Messumformer sollte dieser in der Regel in der Messbereichsmitte betrieben werden, da an den Messbereichsendpunkten erhöhte Abweichungen auftreten können. Die Umgebungstemperatur der Messumformerelektronik sollte konstant gehalten werden.

Die Messumformer müssen bei einer konstanten Betriebsspannung (±0,2V) betrieben werden. Strom-/Spannungssitzen beim Ein-/Ausschalten der Versorgungsspannung müssen bauseits vermieden werden.

Montagehinweise WRF04 CO2

Die Geräte werden in einem betriebsfertigen Zustand ausgeliefert.

Die Montage erfolgt mittels Dübel und Schrauben (Zubehör) auf der ebenen Wandfläche.

Zum Verdrahten muss das Geräteoberteil von der Grundplatte gelöst werden. Grundplatte und Oberteil sind mittels Rastnasen lösbar miteinander verbunden.

Die Montage muss an repräsentativen Stellen für die Raumtemperatur erfolgen, damit das Messergebnis nicht verfälscht wird. Sonneneinstrahlung und Luftzug sind zu vermeiden. Bei Montage auf einer Standard Unterputzdose ist das Ende des Installationsrohres abzudichten, damit kein Luftzug im Rohr entsteht, der das Messergebnis verfälscht.

Montagehinweise LK CO2

Die Geräte werden in einem betriebsfertigen Zustand ausgeliefert. Dabei ist das Gerät bereits ab Werk mit einer 1,5m langen Anschlussleitung ausgerüstet und braucht nicht geöffnet zu werden. Sollte ein Öffnen des Deckels notwendig sein, ist darauf zu achten, dass anschließend das Gehäuse wieder Luftdicht verschlossen wird.

Die Montage am Lüftungskanal erfolgt mittels der beiliegenden Flansch (Befestigungsschrauben nicht im Lieferumfang enthalten).

Wichtiger Hinweis:

Der interne Temperatursensor der Kanalausführung sollte nur in Ausnahmefällen verwendet werden. Aufgrund der besseren Ansprechgeschwindigkeit und besseren Genauigkeit sollte zur Temperaturerfassung ein entsprechender Raumfühler verwendet werden. Die Montage muss an repräsentativen Stellen für die Raumtemperatur und den CO2 Gehalt erfolgen, damit das Messergebnis nicht verfälscht werden.

Security Advice <u>[1]</u>



The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Electrical connection

The devices are constructed for the operation of protective low voltage (SELV). For the electrical connection, the technical data of the corresponding device are valid.

Sensing devices with transducer should in principle be operated in the middle of the measuring range to avoid deviations at the measuring end points. The ambient temperature of the transducer electronics should be kept constant.

The transducers must be operated at a constant supply voltage $(\pm 0,2V)$. When switching the supply voltage on/off, power surges must be avoided on site.

Mounting Advices WRF04 CO2

The devices are supplied in an operational status.

Installation is made by means of rawl plugs and screws (accessory) to the smooth wall surface.

For wiring, the snap-on lid must be separated from the base plate.

Installation must be made on representative places for the room temperature, to avoid a falsification of the measuring result. Solar radiation and draught should be avoided. If the device is mounted on standard flush box, the end of the installation tube in the flush box must be sealed, so to avoid any draught in the tube falsifying the measuring result.

Mounting Advices LK CO2

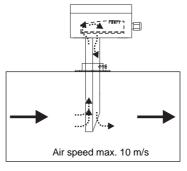
The devices are supplied in a ready to use condition and are already equipped with a 1,5 m connection cable. Thus, there is no need to open the device. If an opening of the cover becomes necessary,however, please make sure that the housing will be hermetically-sealed, again.

The installation in a ventilation duct is made by means of the mounting flange included (fixing screws are not included).

Important Notice:

The inside temperature sensor of the duct type should only be used in exceptional circumstances. Due to the improved response time and a better accuracy, the temperature detection should be made by a corresponding room sensor.

The mounting must be made on representative places for the room temperature and the CO2 concentration, so that the measuring result is not falsified.



Anwenderhinweise

Jegliche Berührung der empfindlichen Feuchtesensoren ist zu unterlassen und führt zum Erlöschen der Gewährleistung.

Beim Einsatz in aggressiven Gasen kann ein vorzeitiges Nachkalibrieren oder ein Feuchtesensortausch notwendigt werden. Eine solche Nachkalibrierung oder etwaiger Sensortausch fallen nicht unter die allgemeine Gewährleistung.

Application Notice

Refrain from touching the sensitive humidity sensor. Any touch of the same will result in an expiration of the warranty.

When using the sensor in aggressive gases, an early recalibration or a change of the humidity sensor can become necessary. Such a recalibration or a probable sensor change do not come under the general warranty.

Raumluftqualität

Die DIN EN 13779 definiert verschiedene Klassen für die Raumluftqualität, welche in der unteren Tabelle dargestellt sind.

		er dem Gehalt nluft in ppm	
Kategorie	Üblicher Bereich	Standardwert	Beschreibung
IDA1	<400 ppm	350 ppm	Hohe Raumluftqualität
IDA2	400 600 ppm	500 ppm	Mittlere Raumluftqualität
IDA3	600 1.000 ppm	800 ppm	Mäßige Raumluftqualität
IDA4	>1.000 ppm	1.200 ppm	Niedrige Raumluftqualität

ABCLogic[™] - Selbstkalibrierung

Einleitung

Im Grunde unterliegen alle Gassensoren einer Art Drift. Der Grad der Abweichung hängt zum Teil von der Verwendung von Qualitäts-Bauteilen und einer guten Bauform ab. Doch selbst bei guten Bauteilen und einer exzellenten Konstruktion können kleinere Drifts im Sensor auftreten, die schließlich zur Notwendigkeit einer Nachkalibrierung führen. Im allgemeinen erfordert die Nachkalibrierung eine Wartungskraft, die jeden Sensor im Gebäude aufsucht, um dann ein 5 bis 20-minütiges Nachkalibrierungsverfahren durchzuführen, bei dem ein Referenzgas zum Einsatz kommt. Der Kalibrierungsprozess kann zu erheblichen Kosten führen, wenn die Kalibrierung häufiger erforderlich wird. Wenn man sich für den falschen Sensor entscheidet, können die Kosten für die Sensorwartung jegliche Energieeinsparungen, die durch den Einsatz einer bedarfsgesteuerten CO2 Lüftung erwirtschaftet werden, aufheben.

Was verursacht den Sensor Drift?

Wie bereits erwähnt, haben Sensorbauform und Bauteile Einfluss auf Drifts. Bei den Thermokon Sensoren ist die natürliche Abweichung des Sensors mit wenigen ppm pro Monat sehr langsam, wobei die größte Abweichung in den ersten Betriebsmonaten auftritt. Dieser Drift kann sich nach oben oder unten auswirken. Die Selbstkalibrierungseigenschaft, die sogenannte ABCLogic™, dient zur Korrektur aller Sensorabweichungen einschließlich Alterung der Lichtquelle.

ABCLogic[™] - Eigenschaft der Selbstkalibrierung

Arbeitsweise

Die äußeren Niveaupegel von CO2 sind im allgemeinen mit 400 bis 500 ppm sehr niedrig. In Gebäuden sind Menschen die größte CO2 Quelle. Wenn ein Gebäude für 4 bis 8 Stunden unbewohnt ist, neigen die CO2 Niveaupegel dazu, auf die Außen-Hintergrundwerte abzufallen Dies ist vor allem dann der Fall, wenn der Betriebsplan eines Gebäudes eine Reinigungstätigkeit vorsieht, bei der vor Tagesbeginn Frischluft in das Gebäude gelassen wird.

ABCLogic™ was für "Automatic Background Calibration" steht, nutzt die Rechenleistung des Mikroprozessors auf der Sensorplatine, um sich an die niedrigste CO2 Konzentration, die alle 24 Stunden auftritt, zu erinnern. Der Sensor nimmt an, dass dieser Tiefpunkt der Wert des äußeren Niveaupegels ist. Der Sensor ist auch intelligent genug, um periodisch erhöhte Anzeigewerte herabzusetzen, die z.B. auftreten könnten, wenn ein Raum 24 Stunden über den Tag besetzt wäre. Wenn der Sensor die 14-Tage-Werte mit Konzentrationstiefwerten gesammelt hat, erarbeitet er eine statistische Analyse, um festzustellen, ob es kleine Veränderungen bei der Sensoranzeige über Hintergrundniveauwerte gibt, die Sensordrifts zuzuschreiben sind. Wenn die Analyse entscheidet, dass es eine Drift gibt, erfolgt ein kleiner Korrekturfaktor auf die Sensorkalibrierung, um diese Abweichung zu regulieren.

Die nachstehende Abbildung zeigt CO2 Konzentrationen, wie sie über 14 Tage jeden Morgen und Abend in einem Büroraum mit Spitzenkonzentrationen vorkommen. Die gepunktete Linie ist durch alle Tiefpunkte eines jeden Tages gezogen als Vergleich zu einem angenommen Hintergrundnivauwert von 400 ppm. Wenn eine statistisch relevante Veränderung der Daten eine Verschiebung ober- oder unterhalb des Hintergrundwertes anzeigt, erfolgt eine leichte Anpassung zu der Sensorkalibrierung, wie von der festen Niveaulinie angezeigt. Jeden Tag prüft der Sensor die letzten 14-Tage-Werte und entscheidet, ob eine Anpassung der Kalibrierung notwendig ist.

Indoor Air Quality

The DIN EN 13779 defines several classes for the indoor air quality, which are shown in the table below.

	CO2 content ov		
Category	Typical range	Standard value	Description
IDA1	<400 ppm	350 ppm	High Indoor Air Qualitiy
IDA2	400 600 ppm	500 ppm	Mean Indoor Air Qualitiy
IDA3	600 1.000 ppm	800 ppm	Moderate Indoor Air Qualitiy
IDA4	>1.000 ppm	1.200 ppm	Low Indoor Air Qualitiy

ABCLogic[™] - Self Calibration Feature

Introduction

Virtually all gas sensors are subject to some sort of drift. The degree of drift is partially dependent on the use of quality components and good design. But even with good components and excellent design a small amount of drift can still occur in the sensor that may ultimately result in the need for a sensor to be recalibrated. Generally, recalibration involves a maintenance person visiting each sensor in a building and performing a 5 minute to 20 minute recalibration routine using gas bottles and plastic tubing. The calibration process is simple but it can turn into a significant expense if recalibration is required frequently. If the wrong choice of sensors is made, the expense of sensor maintenance may wipe out any potential energy savings that could come from CO2 based demand controlled ventilation.

What Causes Sensor Drift?

As discussed before, sensor design and components have a lot to do with drift. In the Thermokon sensor the natural drift of the sensor is very gradual at a few ppm per month with the greatest drift occurring in the first few months of operation. This drift can be up or down. The self-calibration feature called ABCLogic™is designed to correct all sensor dirft including aging of the light source.

ABCLogic[™] - Self Calibration Feature

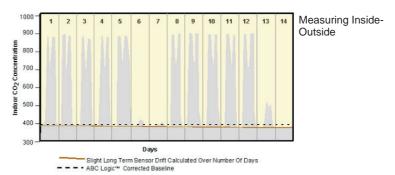
How It Works

Outside levels of CO2 are generally very low at around 400 to 500 ppm. Inside buildings people are the major source of CO2. When a building is unoccupied for 4 to 8 hours CO2 levels will tend to drop to outside background levels. This is especially the case if the building operational schedule includes a pre-occupancy purge of fresh air into the building prior to the start of the day.

ABCLogic™ which stands for "Automatic Background Calibration" utilizes the computing power in the sensor's on-board microprocessor to remember the lowest CO2 concentration that takes place every 24 hours. The sensor assumes this low point is at outside levels. The sensor is also smart enough to discount periodic elevated readings that might occur if for example a space was used 24 hours per day over a few days. Once the sensor has collected 14 days worth of low concentration points it performs a statistical analysis to see if there has been any small changes in the sensor reading over background levels that could be attributable to sensor drift. If the analysis concludes there is drift, a small correction factor is made to the sensor calibration to adjust for this change.

The figure below shows CO2 concentrations as they might occur over 14 days in an office space with peak concentrations occurring in the morning and afternoon of each day. The dotted line is drawn through all the low points for each day as compared to an assumed background of 400 ppm. If a statistically relevant change in the data shows a shift above or below background, a slight adjustment is made to sensor calibration as shown by the solid level line. Every day the sensor looks at the past 14 days worth of data and determines if a calibration adjustment is necessary.

Seite 5 Page 5



Wenn man CO2 zur Messung und Steuerung der Lüftung benutzt, ist es wichtig, nicht die absoluten ppm Pegel, sondern die Differentialkonzentration zwischen der Innen- und Außenkonzentration zu berücksichtigen. Ein weiterer zusätzlicher Nutzen von ABCLogic $^{\rm TM}$ ist, dass der Sensor nach Außenniveau kalibriert wird, ohne die Kosten und Probleme, einen Sensor in der Außenluft platzieren zu müssen. Der Sensor geht davon aus, dass der niedrigste Pegel 400 ppm ist.

When using CO2 to measure and control for ventilation it is most important to consider not the absolute ppm levels but the differential concentration between inside and outside concentrations. One of the additional benefits of ABCLogicTM is that the sensor is calibrated to outside levels without having the expense and trouble of placing a sensor in the outside air. The sensor assumes that the lowest level is 400 ppm. Any readings above this level are related to the differential.

Anwendung ABCLogic™

Bitte beachten Sie, dass ABCLogic™ für Anwendungen konstruiert wurde, bei denen Räume periodisch für 4 oder mehr Stunden pro Tag unbesetzt sind, so dass die Innenraumkonzentrationen auf typische Außenpegelniveaus fallen können.

Inbetriebnahme der Sensoren mit ABCLogic™

Wenn CO2 Sensoren mit ABCLogic[™] installiert wurden, dienen die ersten 14 Betriebstage den Sensoren zur Selbstkalibrierung auf die lokalen Hintergrundniveauwerte. Jeder Sensor kalibriert sich während der ersten 14 Betriebstage selbst auf seine Umgebung.

Applications for ABCLogic™

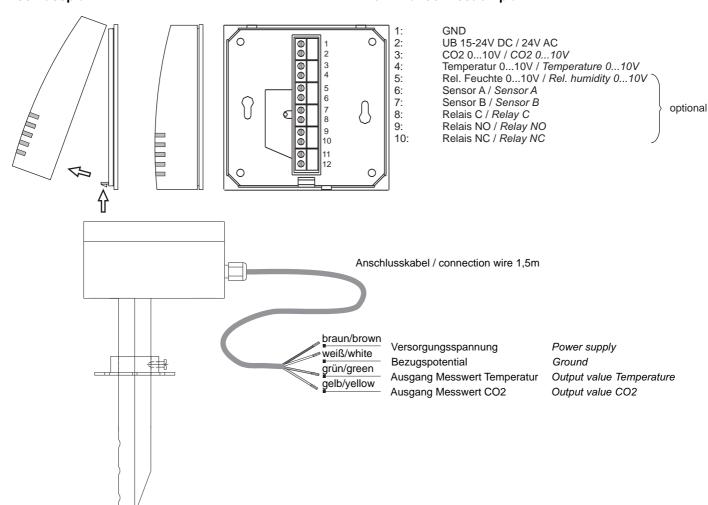
It is important to note that ABCLogic™ is designed for use in applications where spaces are periodically unoccupied for 4 hours per day or more so that indoor concentrations can drop down to typical outside levels.

Commissioning Sensors with ABCLogic™

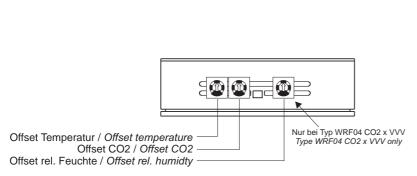
When first installed CO2 sensors with ABCLogicTM, the sensors will use the first 14 days of operation to calibrate themselves to local background levels. Each sensor will calibrate itself to its environment over the first 14 days of operation.

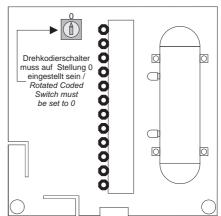
Anschlussplan





Seite 6 Page 6



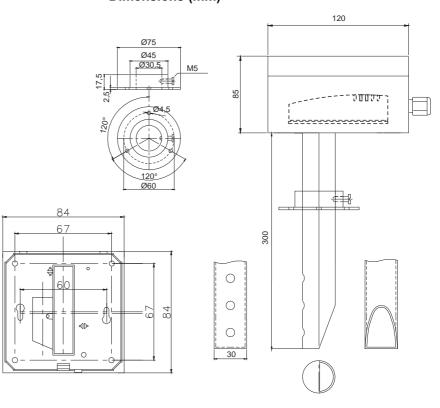


Abmessungen (mm)

94,5

84,5

Dimensions (mm)



Zubehör optional

(D+S) 1 Satz (je 2 Stück) Dübel und Schrauben

Optional Accessories

(D+S) 1 Set (each 2 pieces) rawl plugs and screws

G3G140-AW05-12

$EC\ centrifugal\ fan\ \ {\it with\ housing\ (small\ flange)}$

forward curved, single inlet



ebm-papst Mulfingen GmbH & Co. KG Bachmühle 2 74673 Mulfingen Phone: +49 7938 81-0

Fax: +49 7938 81-110 www.ebmpapst.com info1@de.ebmpapst.com

Nominal data

Туре	G3G140-AW0	5-12	
Motor	M3G055-CF		
Nominal voltag	je	[VAC]	230
Frequency		[Hz]	50/60
Type of data d	efinition		ml
Speed	[min ⁻¹]	2300	
Power input		[W]	67
Current draw		[A]	0,5
Max. ambient	temperature	[°C]	60
Air flow		[m ³ /h]	310
Back pressure		[Pa]	250
Sound pressur	e level	[dB(A)]	55,5

ml = max. load \cdot me = max. efficiency \cdot rfa = running at free air \cdot cs = customer specs \cdot cu = customer unit Subject to alterations



$EC\ centrifugal\ fan\ \ {\it with\ housing\ (small\ flange)}$

forward curved, single inlet

Technical features

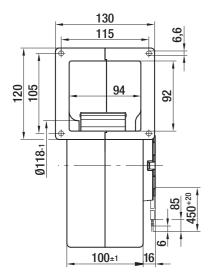
Leackage current	<= 3,5 mA
General description	Integrated electronics
Size	140 mm
Operation mode	Continuous operation (S1)
Direction of rotation	Clockwise, seen on rotor
Mounting position	Any
Insulation class	"B"
Cable exit	Variable
Bearing motor	Ball bearing
Mass	2.6 kg
Material of electronics housing	Rotor: Galvanized
Material of impeller	PP plastic
Motor protection	Locked-rotor protection
Type of protection	IP 44 - depending on position
Protection class	I and the second
Technical features	Input for set value for line 0-10 VDC / PWM (1.7 V = $50 \text{ m/}^3\text{h}$, $10\text{V} = 300 \text{ m/}^3\text{h}$), output 10 VDC max. 1.1 mA, tach output, locked rotor protection
Approval	GOST

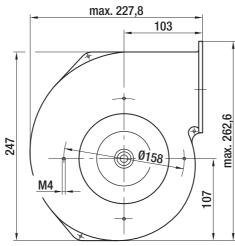


$EC\ centrifugal\ fan\ \ {\it with\ housing\ (small\ flange)}$

forward curved, single inlet

Product drawing

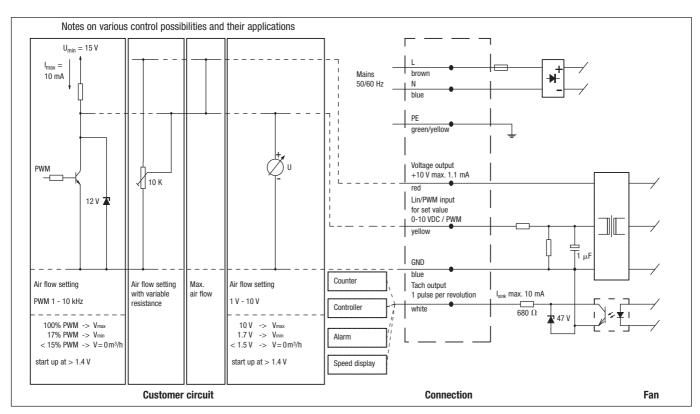


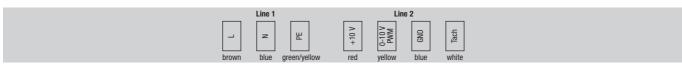


EC centrifugal fan with housing (small flange)

forward curved, single inlet

Connection screen





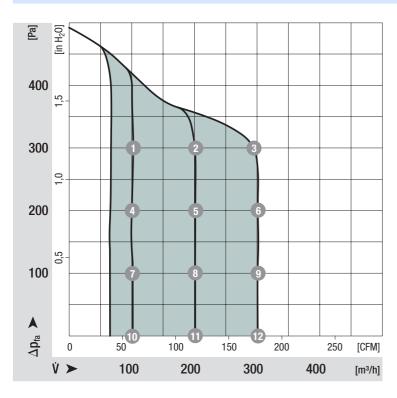
Line	Connection	Colour	Assignment / function
1	L	brown	Mains 50/60 Hz, phase
	N	blue	Mains 50/60 Hz, neutral
	PE	green/yel	Protective earth

Line	Connection	Colour	Assignment / function
2	+10 V	red	Voltage output +10 V max. 1.1 mA
	0-10 V / PWM	yellow	Input for set value (impedance 100 k Ω)
	GND	blue	GND
	Tach	white	Tach output: 1 pulse per revolution

$EC\ centrifugal\ fan\ \ {\it with\ housing\ (small\ flange)}$

forward curved, single inlet

Charts: Air flow



Measured values

	n	P ₁	1	η_{TL}
	[min ⁻¹]	[W]	[A]	[%]
1	2380	33	0.25	37
2	2495	51	0.45	50
3	2400	67	0.55	57
4	2030	22	0.20	38
5	2000	34		
6	2110	61	0.50	55
7	1325	12	0.10	36
8	1460	21	0.20	48
9	1755	43	0.35	48
10	480	3	0.05	
11	890	11	0.10	
12	1380	31	0.25	

forward curved, single inlet



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Nominal data

Туре	R3G140-AW0	5-12	
Motor	M3G055-CF		
Nominal voltag	j e	[VAC]	230
Frequency		[Hz]	50/60
Type of data d	efinition		ml
Speed		[min ⁻¹]	2300
Power input		[W]	67
Current draw		[A]	0,5
Max. ambient	temperature	[°C]	60
Air flow		[m ³ /h]	310
Back pressure		[Pa]	250
Sound pressur	e level	[dB(A)]	55,5

ml = max. load \cdot me = max. efficiency \cdot rfa = running at free air \cdot cs = customer specs \cdot cu = customer unit Subject to alterations



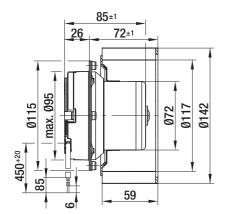
forward curved, single inlet

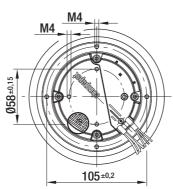
Technical features

General description	Integrated electronics
Size	140 mm
Operation mode	Continuous operation (S1)
Direction of rotation	Clockwise, seen on rotor
Mounting position	Any
Insulation class	"B"
Cable exit	Variable
Bearing motor	Ball bearing
Mass	1.3 kg
Material of electronics housing	Rotor: Galvanized
Material of impeller	PP plastic
Motor protection	Locked-rotor protection
Type of protection	IP 44 - depending on position
Protection class	I
Technical features	Input for set value for line 0-10 VDC / PWM (1.7 V = $50 \text{ m/}^3\text{h}$, $10\text{V} = 300 \text{ m/}^3\text{h}$), output 10 VDC max. 1.1 mA , tach output, locked rotor protection
Approval	GOST

forward curved, single inlet

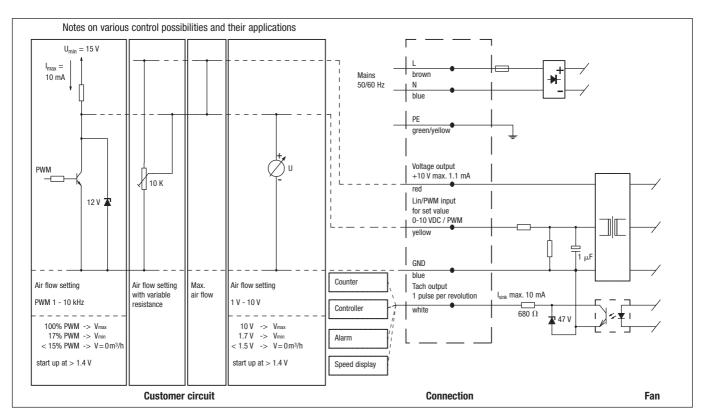
Product drawing





forward curved, single inlet

Connection screen



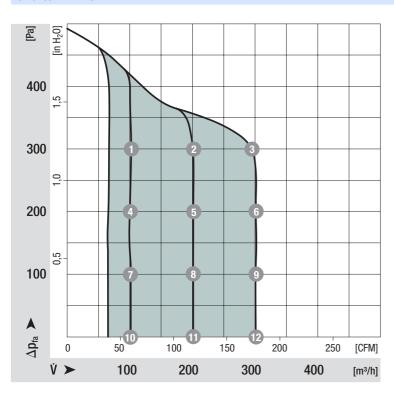


Line	Connection	Colour	Assignment / function
1	L	brown	Mains 50/60 Hz, phase
	N	blue	Mains 50/60 Hz, neutral
	PE	green/yel	Protective earth

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2	+10 V	red	Voltage output +10 V max. 1.1 mA
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	GND	blue	GND
	Tach	white	Tach output: 1 pulse per revolution

forward curved, single inlet

Charts: Air flow



Measured values

	n	P ₁	1	η_{TL}
	[min ⁻¹]	[W]	[A]	[%]
1	2380	33	0.25	37
2	2495	51	0.45	50
3	2400	67	0.55	57
4	2030	22	0.20	38
5	2000	34		
6	2110	61	0.50	55
7	1325	12	0.10	36
8	1460	21	0.20	48
9	1755	43	0.35	48
10	480	3	0.05	
11	890	11	0.10	
12	1380	31	0.25	





Thies Clima

Startseite / Wind / Windrichtungssensor compact

The world of weather data

Produkte

Service

News

Infos Kontakt

Unternehmen

Impressum

AGB

Site Map

Suche

English 💥

Windrichtungssensor compact

Messwertgeber zur Messung der horizontalen Windrichtung, mit digitalem Ausgangssignal (<u>Gray-Code</u>). Die Windfahne besteht aus Kunststoff, das Gehäuse aus Aluminium, eloxiert und Kunststoff. Zur Montage hat das Gerät einen Gewindezapfen Pg 21 mit 2 Muttern.



Bestell-Nr.

4.3128.00.000 mit Heizung max. 20 W; 24 V AC/DC

4.3128.10.000 ohne Heizung

Messbereich 0 ... 360° Genauigkeit ± 5°

Auflösung 90°, 45°, 22,5° Elektrischer Ausgang 2, 3, 4 bit <u>Gray-Code</u>

Betriebsspannung 10 - 27 V DC Stromaufnahme 20 mA Umgebungs Temperatur -30 - +70 °C

Kabel 5 m, LiYCY 8 x 0,25 mm²

Abmessung 50 x 220 mm Gewicht 0,6 kg

Windrichtungssensor compact

Messwertgeber zur Messung der horizontalen Windrichtung, mit digitalem Ausgangssignal (<u>Gray-Code</u>). Geeignet für Dataloggerbetrieb. Die Windfahne besteht aus Kunststoff, das Gehäuse aus Aluminium, eloxiert und Kunststoff. Zur Montage hat das Gerät einen Gewindezapfen Pg 21 mit 2 Muttern.

Bestell-Nr.

4.3129.00.000 Messbereich

Genauigkeit ± 5° Auflösung 11,25°

Elektrischer Ausgang seriell synchron, 5 bit Gray-Code

0 ... 360°

Betriebsspannung 5 - 14 V DC

Stromaufnahme Standby < 15 µA (5 V) aktiv ca. 500µA (5 V)

Heizung max. 20 W; 24 V AC/DC

Umgebungs Temperatur -40 - +70 °C

Kabel 12 m, LiYCY 6 x 0,25 mm²

Abmessung 50 x 220 mm Gewicht 1,1 kg

Windrichtungssensor compact

Messwertgeber zur Messung der horizontalen Windrichtung, mit analogen Ausgangssignalen. Die Windfahne besteht aus Kunststoff, das Gehäuse aus Aluminium, eloxiert und Kunststoff. Zur Montage hat das Gerät einen Gewindezapfen Pg 21 mit 2 Muttern.

Bestell-Nr.

4.3129.00.xxx Elektrischer Ausgang
.140 0 - 20 mA
.141 4 - 20 mA
Bürde (bei Betriebsspsannung)
max. 500 Ohm; (>13 V DC)
max. 500 Ohm; (>13 V DC)

.161 0 - 10 V min. 1 k Ohm .167 0 - 2 V min. 1 k Ohm





Thies Clima

Home / Wind / Wind Direction Sensor compact

The world of weather data

Products

Service News

Infos Contact

Company

Imprint

Sales terms

Site map

Site search

Deutsch =

Wind Direction Sensor compact

Measuring value transmitter for the measurement of the horizontal wind direction, with digital output signal (<u>Gray code</u>). The wind vane consists of plastic, the housing is made of anodized aluminium and plastic. Instrument with threaded pin Pg 21 with 2 nuts for mounting.



Order-No.

4.3128.00.000 with heating max. 20 W; 24 V AC/DC

4.3128.10.000 without heating

Measuring range $0 \dots 360^{\circ}$ Accuracy $\pm 5^{\circ}$ Resolution $90^{\circ}, 45^{\circ}, 22,5^{\circ}$

Electr. output 2, 3, 4 bit <u>Gray-Code</u>
Operating voltage 10 - 27 V DC

Current consumption 20 mA
Ambient temperature -30 - +70 °C

Cable 5 m, LiYCY 8 x 0,25 mm²

Dimensions 50 x 220 mm Weight 0,6 kg

Wind Direction Sensor compact

Measuring value transmitter for the measurement of the horizontal wind direction, with digital output signal (<u>Gray code</u>). Suited for datalogger operation. The wind vane consists of plastic, the housing is made of anodized aluminium and plastic Instrument with threaded pin Pg 21 with 2 nuts for mounting.

Order-No.

4.3129.00.000 Measuring range 0 ... 360°

Ambient temperature

Accuracy $\pm 5^{\circ}$ Resolution 11,25°

Electr. output serial synchron, 5 bit <u>Gray-Code</u>

Operating voltage 5 - 14 V DC

Current consumption Standby < 15 μ A (5 V) active approx. 500 μ A (5

V)

Heating max. 20 W; 24 V AC/DC

Cable 12 m, LiYCY 6 x 0,25 mm²

Dimensions 50 x 220 mm

Weight 1,1 kg

Wind Direction Sensor compact

Measuring value transmitter for the measurement of the horizontal wind direction, with analogue output signals. The wind vane consists of plastic, the housing is made of anodized aluminium and plastic Instrument with threaded pin Pg 21 with 2 nuts for mounting.

-40 - +70 °C

Order-No.

4.3129.00.xxx Electr. output load (at operating voltage)
.140 0-20 mA max. 500 Ohm; (>13 V DC)
.141 4-20 mA max. 500 Ohm; (>13 V DC)

.161 0-10 V min. 1 k Ohm .167 0-2 V min. 1 k Ohm Windsensor compact Page 1 of 2





Thies Clima

Startseite / Wind / Windsensor compact

The world of weather data

Produkte

Service News

Infos

Kontakt

Unternehmen

Impressum

AGB Site Map

Suche

English

Windsensor compact

Messwertgeber zur Messung der horizontalen Windgeschwindigkeit mit digitalem Ausgangssignal (open collector). Der Schalenstern besteht aus Kunststoff, das Gehäuse aus Aluminium, eloxiert und Kunststoff. Zur Montage hat das Gerät einen Gewindezapfen Pg 21 mit 2 Muttern.

Bestell-Nr.

4.3518.00.000 mit Heizung open collector sink 4.3520.00.000 mit Heizung open collector source 4.3520.10.000 ohne Heizung open collector source

> 0,5 ... 50 m/s Messbereich

Genauigkeit ±3 % v. Messwert oder ±0,5

m/s

Auflösung < 0.1 m/sElektrischer Ausgang 2 ... 573 Hz Betriebsspannung 12 - 24 V DC Stromaufnahme 20 mA

Heizung max. 20 W; 24 V AC/DC

Umgebungs -30 - +70 °C Temperatur

Kabel 5m, LiYCY 5 x 0,25 mm² Abmessung Ø 135 x 165 mm

Gewicht 0,4 kg

Windsensor compact

Messwertgeber zur Messung der horizontalen Windgeschwindigkeit mit digitalem Ausgangssignal (aktives Signal). Geeignet für Datalogger. Der Schalenstern besteht aus Kunststoff, das Gehäuse aus Aluminium, eloxiert und Kunststoff. Zur Montage hat das Gerät einen Gewindezapfen Pg 21 mit 2 Muttern.

Bestell-Nr.

4.3519.00.000 Messbereich 0,5 ... 50 m/s

> ±3 % v. Messwert oder ±0,5 Genauigkeit

m/s

Auflösung < 0.1 m/sElektrischer Ausgang 2 ... 630Hz Betriebsspannung 3,3 - 42 V DC Stromaufnahme < 1 mA

max. 20 W; 24 V AC/DC Heizung

Umgebungs Temperatur -30 - +70 °C

12m, LiYCY 6x0,25 mm2

Abmessung Ø 135 x 165 mm

Gewicht 0,75 kg

Windsensor compact

Messwertgeber zur Messung der horizontalen Windgeschwindigkeit mit analogen Ausgangssignalen. Der Schalenstern besteht aus Kunststoff, das Gehäuse aus Aluminium, eloxiert und Kunststoff. Zur Montage hat das Gerät einen Gewindezapfen Pg 21 mit 2 Muttern.

Bestell-Nr.

4.3519.00.xxx Elektrischer Ausgang Bürde (bei Betriebsspg.) .140 0 - 20 mA max. 500 Ohm; (>13 V DC)

.141 4 - 20 mA max. 500 Ohm: (>13 V DC)



Produkte

Service

News

Infos

Kontakt

Unternehmen Impressum

AGB

Site Map

Suche

English 💥

.161 0 - 10 V

.167 0 - 2 V

.173 0 - 5 V

Messbereich

Stromaufnahme

Heizung

Kabel

Umgebungs

Abmessung

Gewicht

Temperatur

Genauigkeit

±3 % v. Messwert oder ±0,5

m/s

Auflösung < 0,1 m/s

9 - 30 V DC oder 24V AC/DC Betriebsspannung

min. 1 k Ohm

min. 1 k Ohm

min. 1 k Ohm

0,5 ... 50 m/s

für 0 - 10 V Ausg.13 - 30 V DC

ca. 10 mA, unbelastet max. 20 W; 24 V AC/DC

-30 - +70 °C

12m , LiYCY 6x0,25 mm²

Ø 135 x 165 mm

0,75 kg





Thies Clima

Home / Wind / Wind Sensor compact

The world of weather data

Products

Service

News

Infos

Contact

Company

Imprint Sales terms

Site map

Site search

Deutsch =

Wind Sensor compact

velocity with digital output signal (oper collector). The cup star consists of plastic, the housing is made of anodized aluminium and plastic. For mounting the instrument is equipped with a threaded pin Pg 21 and 2 nuts.

Order-No.

4.3518.00.000 with heating open collector sink 4.3520.00.000 with heating open collector source 4.3520.10.000 w/o heating open collector source

> Measuring range 0,5 ... 50 m/s

Accuracy \pm 3 % of meas. value or \pm 0,5 m/s

Resolution < 0.1 m/sElectr. output 2 ... 573 Hz Operating voltage 12 - 24 V DC

Current consumption

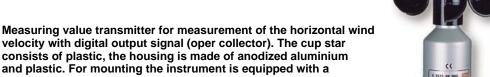
max. 20 W; 24 V AC/DC Heating

Ambient -30 - +70 °C temperature

Cable 5m, LiYCY 5 x 0,25 mm²

Ø 135 x 165 mm Dimension

Weight 0,4 kg





Wind Sensor compact

Measuring value transmitter for the measurement of the horizontal wind velocity with digital output signal (active signal). Suited for datalogger. The cup star consists of plastic, the housing is made of anodized aluminium and plastic. For mounting the instrument is equipped with a threaded pin Pg 21 and 2 nuts.

Order-No.

4.3519.00.000 Measuring range 0,5 ... 50 m/s

> ±3% of meas. value or ±0,5 Accuracy

m/s Resolution < 0,1 m/sElectr. output 2 ... 630Hz Operating voltage 3,3 - 42 V DC Current consumption < 1 mA

max. 20 W; 24 V AC/DC Heating

-30 - +70 °C Ambient temperature

Cable 12m, LiYCY 6x0,25 mm2

Dimension Ø 135 x 165 mm

Weight $0.75 \, \text{kg}$

Windsensor compact

Measuring value transmitter for the measurement of the horizontal wind velocity with digital output signal. The cup star consists of plastic, the housing is made of anodized aluminium and plastic. For mounting the instrument is equipped with a threaded pin Pg 21 and 2 nuts.

Order-No.

4.3519.00.xxx Electr. output

Load (with operating voltage)



Products

Service

News

Infos

Contact

Company

Imprint Sales terms

Site map

Site search

Deutsch =

.140 0-20 mA max. 500 Ω ; (>13 V DC) .141 4-20 mA max. 500 Ω ; (>13 V DC)

 $\begin{array}{lll} .161 \ 0\text{-}10 \ V & \text{min. 1 k}\Omega \\ .167 \ 0\text{-}2 \ V & \text{min. 1 k}\Omega \\ .173 \ 0\text{-}5V & \text{min. 1 k}\Omega \\ & \text{Measuring range} & 0,5 \dots 50 \ \text{m/s} \\ \end{array}$

Accuracy $\pm 3 \%$ of meas. value or ± 0.5

m/s

Resolution < 0,1 m/s

Operating voltage 9-30 V DC or 24 V AC/DC

for 0-10 V output 13-30 V DC

Current consumption approx. 10 mA, unloaded Heating max. 20 W; 24 V AC/DC

Ambient temperature -30 - +70 °C

Cable 12m , LiYCY 6x0,25 mm²

Dimension Ø 135 x 165 mm

Weight 0,75 kg





Thies Clima

Home / Relative Air Humidity / Hygro-thermo transmitter compact

The world of weather data

Products

Service News

Infos

Contact

Company

Imprint Sales terms

Site map

Site search

Deutsch =

Hygro-thermo transmitter compact

Instrument designed for measurement of temperature and air humidity. The data are output as electrical analogue signals. The transmitters consist of a capacitive humidity element and a Pt 100 resistance thermometer. For outside mounting we recommend the use of the weather- and thermal radiation shield. Order-No..1.1025.55.xxx.

Order-No.

1.1005.54.xxx Humidity Temperature .000 0 ... 1 V Pt 100 (± 0,15 K) .241 4 ... 20 mA 4 ... 20 mA 0 ... 10 V .161 0 ... 10 V 0 ... 100% rel. h - 30 ... + 70 °C Accuracy humidity ± 2 % rel. h Temp. Meas. elem. PT 100 acc. to IEC 751

1/3 class B Accuracy

9 - 30 V DC (.000) 12 - 30 V DC Operating voltage

(.241) 24 V DC (.161)

Protection IP 30 for sensor IP 65 for electronics

5 m long

Dimension 20 x 115 mm Weight 0,45 kg

Teflon Filter with Gauze

ZE 20 w/o fig.

1.1005.54.901 dust protection filter

Cable

Sinter filter

ZE 21 w/o fig.

1.1005.54.902 Dust and wind protection filter

Weather and Thermal Radiation Shield, compact

Protective case for the Temperature or Hygro Thermo-Transmitter compact for outside installation. This case essentially eliminates the influence of weather and radiation errors which might affect the measurement result.

Order-No.

1.1025.55.000 without ventilator

.100 with ventilator 12 V DC; 2,5 W

> Material synthetic lamellas white Mounting stainless steel holder Cable 5 m. for model .100 Dimension Ø 120 x 270/290 mm

Weight 0,75 kg





Products		
Service		
News		
Infos		
Contact		
Company		
Imprint		
Sales terms		
Site map		
Site search		

Deutsch =

Global Radiation Page 1 of 3





Thies Clima

Home / Radiation / Global Radiation

The world of weather data

Products

Service News

Infos

Contact

Company

Imprint

Sales terms Site map

Site search



Pyranometer CMP 11

<u>WMO</u>- recommended measured value transmitter to determine <u>global radiation</u>. It is also used as a reference instrument due to its measurement precision. Easy to adjust horizontally owing to its adjustable feet and a level.

The instrument is "secondary standard" according to <u>WMO</u> and ISO 9060. Delivery includes calibration certificate.

Order Code

7.1415.01.001 Measuring range 0 - 2000 W/m²

Sensitivity 7 - 14 μ V/W/m² Spectral range 0,31 - 2,8 μ m

Non-linearity $\pm 0.5 \% (0 - 1000 \text{ W/m}^2)$

Internal resistance 10 - 100 ohm
Time constant 1/e 4s; 99% 24s
Ambient temp. 100 Thermocouples
Sensor type - 40 - + 80°C
Cable 10 m long
Dimensions Ø 150 x 92 mm

Weight 0,85 kg



Pyranometer CMP 6

Measured value transmitter to determine <u>global radiation</u>. It is also used as Albedometer. Easy to adjust horizontally owing to its adjustable feet and a level. The instrument is "first class" according to <u>WMO</u> and ISO 9060. Delivery includes calibration certificate.

Order Code

7.1415.02.002 Measuring range 0 - 2000 W/m²

Sensitivity 5 -16 µV/W/m² Spectral range 0,31 - 2,8 µm Non-linearity 1 % (0 - 1000 W/m²) Internal resistance 20 - 200 Ohm 1/e 4s; 99% 55s Time constant Sensor type 64 Thermocouples Ambient temp. - 40 - + 80°C Cable 10 m long Dimensions Ø 150 x 92 mm Weight 0,85 kg



Pyranometer CMP 3

Measuring value transmitter for the determination of the <u>global radiation</u>. The instrument can be used also as Albedometer.

The instrument is "second class" according to \underline{WMO} and ISO 9060. Delivery includes calibration certificate.

Order Code

7.1415.03.003 Measuring range 0 - 2000 W/m²

Sensitivity $5 - 20 \mu V/W/m^2$ Spectral range $0.31 - 2.8 \mu m$ Non-linearity 2.5 % (0 - 1000)



Global Radiation Page 2 of 3



Products

Service

News

Infos

Contact

Company Imprint

Sales terms

Site map

Site search

Deutsch =

VV/111**~**)

Internal resistance 20 - 200 Ohm Time constant 18s bei 95%

Sensor type 64 Thermocouples Ambient temp. - 40 - + 80°C

Cable 10 m long
Dimensions Ø 110 x 68 mm

Weight 0,35 kg

Shadow Ring CM 121 Typ B

Serves for shading the <u>Pyranometer</u> from direct <u>solar radiation</u>. By that, an exact measurement of the diffuse sky radiation is possible. Suitable sensors:

Pyranometer CM 11 or

Pyranometer CM 6B (without ventr.???)

Remark: Pyranometer not included in delivery

Order Code

7.1415.01.121 Material Aluminium

Height (max.) 800 mm
Ring outer Ø Ø 620 mm
Ring width 55 mm
Ring width / Ring radius ratio
View angle 10,6 °
Weight, incl. CM

6 kg



Silicon Pyranometer SP-Lite

Electrical measuring instrument to measure the global radiation. The sensor element consists of a <u>silicon photodiode</u>; it delivers a voltage signal in direct proportion to the radiation.

Delivery includes calibration certificate.

Order Code

7.1415.08.000 Measuring range 0 - 2000 W/m²

Measuring element Silicon diode Spectral range 0,4 - 1,1 µm Sensitivity $100 \mu V/W/m^2$ Cos-error < 10 % Temperature error ± 0,15 % / °C Temperature range - 30 - + 70 °C Response time < 1 sec Internal resistance 50 Ohm Cable 5 m long Dimensions Ø 54 x 34 mm Weight 0,15 kg



Silicon Pyranometer GSM 3.3

Electrical measuring instrument to measure the <u>global radiation</u>. The measurement is coscorrected.

0 10 1/

Delivery includes calibration certificate.

Order Code

7.1415.09.xxx Measuring range 0 - 1300 W/m²

.040 Electrical output 0 - 20 mA .041 4 - 20 mA .051 0 - 5 V



Global Radiation Page 3 of 3



Products

Service

News

Infos

Contact

Company Imprint

Sales terms

Site map

Site search

Deutsch =

U - 1U V ι συ. 0,4 - 1,1 µm Spectral range Cos - correction error f2 < 3% Linearity < 1% < 10% Abs. error Diffuser **PTFE** Dome **PMMA** - 30 - + 60°C Temperatur range Operating voltage 12 - 24 V DC for output 10 V 14 - 24 V AC Cable 5 m long Dimensions Ø 80 x 95 mm Weight 0,3 kg



Pyranometer GSM 10.7

Electrical measuring instrument to measure the global radiation. The measurement is coscorrected.

Delivery includes calibration certificate.

Order Code

7.1415.05.xxx Measuring range 0 - 1300 W/m² .040 Electrical output 0 - 20 mA 4 - 20 mA .041 .051 0 - 5 V .061 0 - 10 V Spectral range 0,38 - 2,8 µm Cos - correction error f2 < 3% Linearity < 1% Abs. error < 10% Diffuser PTFE Dome optical glass Temperature range - 30 - + 60°C Operating voltage 12 - 24 V DC for output 10 V 14 - 24 V AC Cable 5 m long **Dimensions** Ø 80 x 95 mm Weight 0,3 kg







Thies Clima

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Products

Precipitation Monitor





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The instrument serves for detecting start and end of precipitation. It can be used as status indicator or as signal transmitter for the controlling of security devices against precipitation such as windows, venetian blinds, awnings.

The precipitation is acquired opto-electronically via a measuring surface of approx. 25 cm². A relays contact signalises the precipitation status (precipitation yes/no).

An integrated heating avoids possible snow-covering resp. freezing of the instrument during winter

Delivery is effected completely with mast holder which can be used also for wall mounting.

Order-No. 5.4103.10.000 with screwed cable gland .700 with plug connector

Technical Data

Measuring value Precipitation yes/no

Switching on undelayed

Switch-on condition 1...15 events selectable in 50 s Switch-off delay 25...375 s selectable in 25s-increments

25 cm² Sensor surface ≥ 0.2 mm

Drop size Output Single-pole double throw switch

Contact load

- with 5.4103.10.000 max. 230 V AC/DC; 4 A

- with 5.4103.10.700 max. 60 V AC/DC; 4 A Operating voltage 24 V AC/DC ± 15 % Operating current Approx. 70 mA Heating power Ambient temperature max. 1 A - 30 ... + 55 °C

Protection IP 65

130 x 140 x 40 mm Dimensions

Weight

EN 61321-1 mit EN 61000-4-3 EMČ

SR-MDS

Funk-Decken-Multisensor 360° Wireless Ceiling Multi Sensor 360°



DE - Datenblatt

Technische Änderungen vorbehalten Stand 17.11.2008

EN - Data Sheet

Subject to technical alteration Issue date 2008/11/17



Anwendung

Der batterielose Funk-Decken-Multisensor dient zur Bewegungserfassung und Helligkeitsmessung in Wohn- oder Büroräumen.

Übertragung mittels Funk-Telegrammen gemäß EnOcean-Standard an den Empfänger. Mit internem solarbetriebenen Energiespeicher für einen wartungsfreien Betrieb.

Das Gerät besitzt folgende Funktionen:

- Bewegungserfassung 360°
- Integrierter Helligkeitssensor 0-512Lux
- Überwachung der Ladespannung des Energiespeichers

Typenübersicht

SR-MDS Funk-Decken-Multisensor 360°

Normen und Standards

CE-Konformität: 2004/108/EG Elektromagnetische Verträglichkeit

R&TTE 1999/5/EC Radio and

Telecommunications Terminal Equipment Directive

Produktsicherheit: 2001/95/EG Produktsicherheit

EMV: ETSI EN 301 489-1: 2001-09

ETSI EN 301 489-3: 2001-11 ETSI EN 61000-6-2: 2002-08 ETSI EN 300 220-3: 2000-09

Produktsicherheit: EN 60730-1:2002

Die allgemeine Zulassung für den Funkbetrieb gilt für alle EU-Länder und für

die Schweiz.

Application

The battery- and wireless ceiling multi sensor is designed for movement detection in room or office spaces. In addition, the sensor detects the ambient brightness in rooms.

Radio telegrams according to EnOcean standard. With integrated solar energy storage for maintenace-free operation.

Functions of the MDS:

- Occupancy detection 360°
- Integrated light sensor 0-512Lux
- Monitoring of charging voltage of the energy storage

Types Available

SR-MDS Wireless Ceiling Multi Sensor 360°

Norms and Standards

CE-Conformity: 2004/108/EG Electromagnetic compatibility

R&TTE 1999/5/EC Radio and

Telecommunications Terminal Equipment Directive

Product safetyt: 2001/95/EG Product safety

Standards: ETSI EN 301 489-1: 2001-09

ETSI EN 301 489-3: 2001-11 ETSI EN 61000-6-2: 2002-08 ETSI EN 300 220-3: 2000-09

Product safety: EN 60730-1:2002

The general registration for the radio operation is valid for all EU-countries

as well as for Switzerland.

Technische Daten

Technologie: EnOcean, STM Sendefrequenz: 868,3 MHz

Reichweite: ca. 30m in Gebäude, ca. 300m Freifeld

Bewegungserfassung: PIR "passive infrared"

Helligkeitserfassung: 0...512Lux

Messwerterfassung: alle 100 Sekunden

Sendeintervall: sofort bei Bewegungserkennung

...alle 100 Sekunden

bei Änderungen der Helligkeit >10Lux

oder bei Ausschalten des Bewegungsmelders

...alle 1000 Sekunden

bei Änderungen der Helligkeit <10Lux oder falls keine Bewegung detektiert wird.

Energiegenerator: Solarzelle, interner goldcap, wartungsfrei

Gehäuse: PC V0, Farbe perlweiß ähnlich RAL1013

Schutzart IP50 gemäß EN60529

Umgebungstemperatur: 10...50°C

Transport: -10...65°C / max. 70%rF, nicht kond..

Gewicht: 120g

Technical Data

Technology: EnOcean, STM Transmitting frequency: 868,3 MHz

Transmitting range: approx. 30m in buildings, approx. 300m

upon free propagation

Movement detection: PIR "passive infrared"

Brightness detection: 0...512Lux

Measuring value detection: every 100 seconds

Sending interval: directly with movement detection

...every 100 seconds

if brightness changes >10Lux, or with switching off the movement

detector

...every 1000 seconds if brightness changes <10Lux, or if no movement is detected

Energy generator: Solar cell, internal goldcap,

maintenance-free

Enclosure: PC V0, colour pearl white

similar to RAL1013

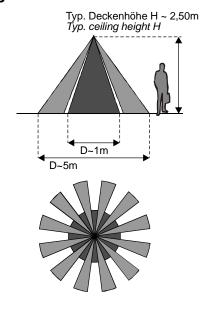
Protection: IP50 according to EN60529

Ambient temperature: 10...55°C

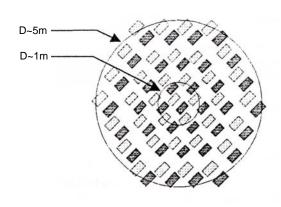
Transport: -10...65°C/ max. 70%rH, non-condensed

Weight: 120g

Erfassungsbereich



Detection Range





Sicherheitshinweis

Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.



Security Advice

The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Auswahl des Montageorts für Solar Energiespeicher

Bei der Auswahl des Montageortes in Bezug auf korrekte und ausreichende Umgebungshelligkeit sind folgende Vorgaben einzuhalten.

Durch die Verwendung der energieoptimierten EnOcean Funktechnik in den "EasySens" Funksensoren, die sich mittels einer Solarzelle selbst mit elektrischer Energie versorgen, können die Geräte ohne Batterien arbeiten. Durch den Wegfall austauschbarer Batterien sind die Geräte quasi wartungsfrei und umweltschonend.

Gegebenenfalls muss nach längerer Lagerung der Funksensoren in Dunkelheit, z.B. während der Inbetriebnahme, der solarbetriebene Energiespeicher nachgeladen werden. In der Regel geschieht dies automatisch während den ersten Betriebsstunden im Tageslicht. Sollte die Anfangsladung in den ersten Betriebsstunden nicht ausreichend sein, erreicht der Fühler jedoch spätestens nach 3 bis 4 Tagen seine volle Betriebsbereitschaft. Spätestens nach dieser Zeit sendet der Fühler auch problemlos im Dunkelbetrieb (nachts).

Bei der Auswahl des Montageortes sollten folgende Punkte beachtet werden:

- Die Mindestbeleuchtungsstärke von 50-100lx sollte für mindestens 3-4 Stunden täglich am Montageort vorhanden sein - unabhängig davon, ob es sich um Kunst- oder Tageslicht handelt. Zum Vergleich: Die Arbeitsstättenverordnung fordert für Büroarbeitsplätze eine Mindestbeleuchtungsstärke von 500lx.
- Nicht über den Tagesverlauf ausreichend ausgeleuchtete Raumnischen sollten gemieden werden.

Was tun, wenn die Umgebungshelligkeit nicht ausreicht?

Je nach Anwendung (dunkle Räume etc. Beleuchtungsstärke <30Lux) kann das Gerät auch mit Batterien betrieben werden. Der Multisensor ist mit entsprechenden Batteriehaltern vorbereitet.

Zu verwendende Batterien: 2x Alkaline Batterie 1,5V / AAA, Betriebszeit bei Batteriebetrieb ca. 5 - 8 Jahre, abhängig von der Alterung und Selbstentladung der verwendeten Batterie. Um den Sensor von Solarbetrieb auf Batteriebetrieb umzustellen, die Batterien in den Halter einlegen.

Sendehäufigkeit

Die Sensoren senden ereignis- oder zeitgesteuert Funktelegramme an den Empfänger.

Messprinzip und Telegramm-Erzeugung

A: "ereignisgesteuert"

Durch Tastendruck auf die Lerntaste des Gerätes oder bei Bewegungserkennung wird der interne Mikroprozessor aufgeweckt, die Messwerte ermittelt und ein Telegramm an den Empfänger generiert.

B: "zeitgesteuert"

Im Zeitintervall von ca. 1,6 Minuten (T_wake up) wird der interne Mikroprozessor aufgeweckt und die Messwerte ermittelt. Sollte sich der Zustand eines Einganges seit der letzten Abfrage geändert haben (Helligkeitsänderung > 2% (>10Lux)), wird sofort ein Telegramm erzeugt. Ist der Helligkeitswert unverändert gegenüber dem vorherigen Telegramm, so wird spätestens nach Ablauf der festen Sendezeit von ca. 16 Minuten (T_send) automatisch ein Telegramm erzeugt.

Telegramm-Erzeugung **Information** Helligkeitswert zeitaesteuert

Nachdem Versenden eines Telegramms, egal ob durch Zustandsänderung

oder durch Ablauf von T_send erzeugt, werden die Timer für T_wake up und T intervall neu gestartet.

Hinweis: Ein Telegramm beinhaltet immer alle Informationen (Bewegung, Helligkeit, Ladespannung des Energiespeichers...)

Selecting the Mounting Place for Solar **Energy Storage**

To meet special requirements concerning a correct and sufficient ambient brightness, certain basic conditions must be observed, when selecting the mounting place.

By means of the energy-optimized EnOcean radio technology used in our "EasySens" wireless sensors, supplying themselves with electric energy by a solar cell, the devices can work without batteries. Thanks to the cessation of changeable batteries the sensors are almost maintenance-free and environmentally sound.

If necessary, the solar-powered energy storage must be recharged after a longer storage of the radio sensors in darkness, e.g. during installation. In principle, however, this is made automatically during the first operating hours in daylight. If the initial charging should not be sufficient in the first operating hours, the sensor is reaching its full operating state after 3 to 4 days at the latest. The sensor is sending properly in darkness (in the night) after this period of time at the very latest.

When selecting the mounting place for the radio sensors, the following should be considered:

- The minimum illumination of 50-100lx should be guaranteed at the mounting place for at least 3 to 4 hours everyday regardless whether there is artificial light or daylight. The health and safety regulations at work require a minimum illumination of 500lx for office workplaces.
- A recess that is not illuminated sufficiently in the course of a day should be avoided.

What to do if the ambient brightness is not sufficient?

Depending on the application (dark rooms etc. brightness <30Lux) it is also possible to operate the device by a battery. Thus, the multi sensor is equipped with a corresponding battery holder.

Battery to be used: 2x Alkaline battery 1,5V/AAA, operating time approx. 5 to 8 years, depending on the intentional component aging and the selfdischarge of the battery used. In order to change the sensor from solar to battery operation, put the battery into the battery holder.

Transmitting Frequency

The sensors send event or time controlled telegrams to the receiver.

Measuring Principle and Production of Telegram

A: event controlled

By actuating the learn button of the device or by movement detection, the internal microprocessor is woken up, the measuring values are detected and a telegram to the receiver is generated.

B: time controlled

The internal microprocessor is woken up within a time interval of approx. 1,6 minutes (T_wake up) and the measuring value is detected. If the status of an input has changed since the last inquiry (brightness change > 2% (>10Lux)), a telegram is produced immediately. If the input value brightness remain unchanged compared with the previous telegrams, a telegram is automatically produced at the latest after expiration of the fixed sending time of approx. 16 minutes (T_send).

Telegram-Production Information Brightness time controlled

After a telegram is sent, regardless whether produced by status changes or after expiration of T-send, the times T_wake up and T_intervall are restarted.

Remark: A telegram always includes all information (movement, brightness charging voltage of energy storage...)

Beschreibung Funk-Telegramm

ORG	7 dez. Immer (EnOcean Gerätetyp "4BS")		ORG	7 dec. Always (EnOcean module type "4BS"		
Data_byte3	Ladespannung 05,12V, linear n=0255		Data_byte3	Charging voltage 05,12V, linear n=0255		
Data_byte2	Helligkeitswert 0512Lux, linear n=0255		Data_byte2	Brightness 0512Lux, linear n=0255		
Data_byte1	0		Data_byte1	0		
Data_byte0	Bit D1 Bewegu (0=Bew Keine B	te (0=Taster gedrückt) ing egung, 1=keine Bewegung) ewegung: Byte0 = 15 dez. ing: Byte0 = 13 dez.	Data_byte0	Bit D3 Bit D1	Learn Button (0=Button pressed) Movement (0=movement, 1=no movement) No movement: Byte0 = 15 dec. Movement: Byte0 = 13 dec.	
ID_Byte3 ID_Byte2 ID_Byte1 ID_Byte0	Geräte ID (Byte3) Geräte ID (Byte2) Geräte ID (Byte1) Geräte ID (Byte0)		ID_Byte3 ID_Byte2 ID_Byte1 ID_Byte0	device id device id	lentifier (Byte3) lentifier (Byte2) lentifier (Byte1) lentifier (Byte0)	

Montagehinweise

Die Montageplatte entgegen dem Uhrzeigersinn drehen und vom Multisensor abheben.

Die Montageplatte über dem zu erfassenden Bereich befestigen (Schraubbefestigung). Multisensor aufsetzen und im Uhrzeigersinn bis zum Finrasten drehen.

Der Sensor wird in einem betriebsfertigen Zustand ausgeliefert. Gegebenenfalls muss nach längerer Lagerung der Funksensoren in Dunkelheit, der interne solarbetriebene Energiespeicher nachgeladen werden. In der Regel geschieht dies automatisch während der ersten Betriebsstunden im Tageslicht. Siehe hierzu Hinweise "Solar Energiespeicher".

Montagehöhe

Die Montagehöhe nimmt unmittelbar Einfluß auf die Reichweite des Bewegungsmelders. Die optimale Montagehöhe ist 2,70m. Alle davon abweichenden Maße haben eine Veränderung der Reichweite zur Folge.

Feste Montage

Der Bewegungsmelder ist auf einem festen Untergrund zu montieren, da jede Bewegung des Melders zu Fehlauslösungen führt.

Abstand zu geschalteten Leuchten

Um ein ungewolltes Einschalten der Leuchte durch den Bewegungsmelder zu vermeiden, sollten die Leuchte nicht im Erfassungsbereich des Bewegungsmelders montiert werden. Ebenfalls ist die Montage des Bewegungsmelders oberhalb einer Leuchte zu vermeiden. Die Wärmestrahlung der Leuchte kann die Funktion des Bewegungsmelders beeinflussen und ggf. zu einer Fehlauslösung des Melders führen.

Montage seitlich zur Gehrichtung

Für eine optimale Bewegungserfassung muss der Melder seitlich vom Erfassungsbereich montiert werden, damit die Zonen möglichst senkrecht geschnitten werden. Montageorte, bei denen sich die zu erfassenden Objekte direkt auf den Bewegungsmelder zu bewegen, haben eine starke Reduzierung der Reichweite zur Folge.

Abstand zu Störquellen

Um Fehlauslösungen zu vermeiden, sollten Störquellen wie z.B. Heizkörper, Lampen, Luftauslässe von Klimaanlagen usw. außerhalb des Erfassungsbereiches liegen. Zudem sollte direkte Sonneneinstrahlung vermieden werden.

Bitte beachten Sie auch die allgemeinen Hinweise in unserem INFOBLATT $\mathsf{THK}.$

Mounting Advices

Description Radio Telegram

Rotate the mounting plate anti-clockwise and lift it off from the multi sensor. Mount the mounting plate above the range that shall be detected (mounting by screws). Put the multi sensor on the mounting plate and rotate the same clockwise until it locks.

The sensor is supplied in an operational status. Probably, the internal solar energy storage must be recharged after a longer storage of the radio sensors in darkness. In principle, the recharging process is done automatically during the first operating hours in daylight. For this purpose, please refer to the remarks "solar energy storage".

Mounting Height

The mounting height has a direct influence on the coverage range of the occupancy sensor. The optimum mounting height is 2,70m. All deviating measures will result in a change of the coverage range.

Fixed Installation

The occupancy sensor has to be mounted on a solid ground, as every movement of the sensor leads to a faulty release.

Distance to Switched Lamps

In order to avoid an unintended switch-on of the lamp released by the occupancy sensor, the lamps should not be mounted in the detection range of the sensor. Moreover, the sensor should not be installed above a lamp. The heat radiation of the lamp can affect the function of the occupancy sensor and might probably cause a faulty release.

Installation to the Side of Walk Direction

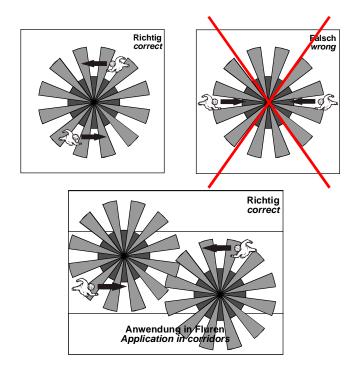
For an optimum occupancy detection, the sensor has to be mounted to the side of the detection range, so that the zones are cutted as rectangular as possible. Installation places, where the detected objects move straightly to the occupancy sensor, result in a considerable reduced coverage range.

Distance to Sources of Interferences

In order to avoid any faulty releases, sources of interferences such as heat radiators, lamps, air exits of air-conditioning systems etc. should be installed outside the detection range. In addition, direct sun raditation should be avoided.

Please note the general remarks in our "INFOBLATT THK"

Seite 5 Page 5

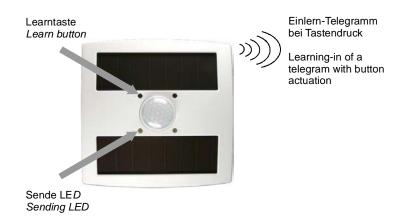


Inbetriebnahme

Damit die Messwerte der Sensoren am Empfänger korrekt ausgewertet werden, ist es notwendig, die Geräte in den Empfänger einzulernen. Dies geschieht automatisch mittels der "Lerntaste" am Sensor oder manuell durch Eingabe der 32bit Sensor-ID und einer speziellen "Einlernprozedur" zwischen Sender und Empfänger. Details werden in der jeweiligen Softwaredokumentation des Empfängers beschrieben.

Installation

In order to assure a correct evaluation of the measuring values by the receiver, it is necessary to have the devices learned in by the receiver. This is done automatically by means of a "learn button" at the sensor or manually by input of the 32bit sensor ID and a special "learning procedure" between sender and receiver. The respective details are described in the corresponding software documentation of the receiver.



Informationen zu Funk

Reichweitenplanung

Da es sich bei den Funksignalen um elektromagnetische Wellen handelt, wird das Signal auf dem Weg vom Sender zum Empfänger gedämpft. D.h. sowohl die elektrische als auch die magnetische Feldstärke nimmt ab, und zwar umgekehrt proportional zum Quadrat des Abstandes von Sender und Empfänger (E,H~1/r²)

Neben dieser natürlichen Reichweiteneinschränkung kommen noch weitere Störfaktoren hinzu: Metallische Teile, z.B. Armierungen in Wänden, Metallfolien von Wärmedämmungen oder metallbedampftes Wärmeschutzglas reflektieren elektromagnetische Wellen. Daher bildet sich dahinter ein sogenannter Funkschatten.

Zwar können Funkwellen Wände durchdringen, doch steigt dabei die Dämpfung noch mehr als bei Ausbreitung im Freifeld.

Durchdringung von Funksignalen:

MaterialDurchdringungHolz, Gips, Glas unbeschichtet90...100%Backstein, Pressspanplatten65...95%Armierter Beton10...90%Metall, Aluminiumkaschierung0...10%

Für die Praxis bedeutet dies, dass die verwendeten Baustoffe im Gebäude eine wichtige Rolle bei der Beurteilung der Funkreichweite spielen. Einige Richtwerte, damit man etwa das Umfeld bewerten kann:

Funkstreckenweite/-durchdringung:

Sichtverbindungen:

Typ. 30m Reichweite in Gängen, bis zu 100m in Hallen

Rigipswände/Holz:

Typ. 30m Reichweite durch max. 5 Wände

Ziegelwände/Gasbeton:

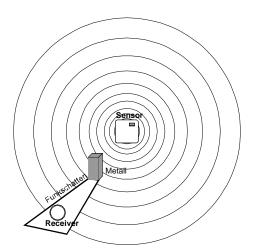
Typ. 20m Reichweite durch max. 3 Wände

Stahlbetonwände/-decken:

Typ. 10m Reichweite durch max. 1 Decke

Versorgungsblöcke und Aufzugsschächte sollten als Abschottung gesehen werden

Zudem spielt der Winkel eine Rolle, mit dem das gesendete Signal auf die Wand trifft. Je nach Winkel verändert sich die effektive Wandstärke und somit die Dämpfung des Signals. Nach Möglichkeit sollten die Signale senkrecht durch das Mauerwerk laufen. Mauernischen sind zu vermeiden.



Andere Störquellen

Geräte, die ebenfalls mit hochfrequenten Signalen arbeiten, z.B. Computer, Audio-/Videoanlagen, elektronische Trafos und Vorschaltgeräte etc. gelten als weitere Störquellen. Der Mindestabstand zu diesen Geräten sollte 0,5m betragen.

Information on Wireless Sensors

Transmission Range

As the radio signals are electromagnetic waves, the signal is damped on its way from the sender to the receiver. That is to say, the electrical as well as the magnetic field strength is removed inversely proportional to the square of the distance between sender and receiver $(E,H^{-1}/r^2)$.

Beside these natural transmission range limits, further interferences have to be considered: Metallic parts, e.g. reinforcements in walls, metallized foils of thermal insulations or metallized heat-absorbing glass, are reflecting electromagnetic waves. Thus, a so-called radio shadow is built up behind these parts.

It is true that radio waves can penetrate walls, but thereby the damping attenuation is even more increased than by a propagation in the free field.

Penetration of radio signals:

MaterialPenetrationWood, gypsum,glass uncoated90...100%Brick, pressboard65...95%Reinforced concrete10...90%Metall, alumium pasting0...10%

For the practice, this means, that the building material used in a building is of paramount importance for the evaluation of the transmitting range. For an evaluation of the environment, some guide values are listed:

Radio path range/-penetration:

Visual contacts:

Typ. 30m range in passages, corridors, up to 100m in halls

Rigypsum walls/wood:

Typ. 30m range through max. 5 walls

Brick wall/Gas concrete:

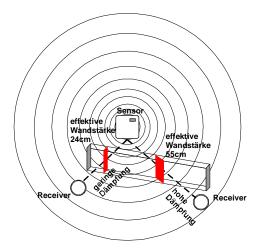
Typ. 20m range through max. 3 walls

Reinforced concrete/-ceilings:

Typ. 10m range through max. 1 ceiling

Supply blocks and lift shafts should be seen as a compartmentalisation

In addition, the angle with which the signal sent arrives at the wall is of great importance. Depending on the angle, the effective wall strength and thus the damping attenuation of the signal changes. If possible, the signals should run vertically through the walling. Walling recesses should be avoided.



Other Interference Sources

Devices, that also operate with high-frequency signals, e.g. computer, auido-/video systems, electronical tansfomers and ballasts etc. are also considered as an interference source.

The minimum distance to such devices should amount to 0,5m.

Finden der Geräteplatzierung mit Feldstärke-Messgerät EPM100

Das EPM 100 ist ein mobiles Feldstärke-Messgerät, das die Feldstärke (RSSI) von empfangenen EnOcean Telegrammen und von Störquellen im Bereich 868,3 MHz anzeigt.

Es dient dem Elektroinstallateur während der Planungsphase zur Bestimmung der Montageorte für Sender und Empfänger.

Weiterhin kann es zur Überprüfung von gestörten Verbindungen bereits installierter Geräte benutzt werden.

Vorgehensweise bei der Ermittlung der Montageorte für Funksensor/Empfänger:

Person 1 bedient den Funksensor und erzeugt durch Tastendruck Funktelegramme.

Person 2 überprüft durch die Anzeige am Messgerät die empfangene Feldstärke und ermittelt so den Montageort.

Hochfrequenzemmissionen von Funksensoren

Seit dem Aufkommen schnurloser Telefone und dem Einsatz von Funksystemen in Wohngebäuden werden auch die Einflußfaktoren der Funkwellen auf die Gesundheit der im Gebäude lebenden und arbeitenden Menschen stark diskutiert. Oft herrscht sowohl bei den Befürwortern als auch bei den Kritikern eine große Verunsicherung aufgrund fehlender Messergebnisse und Langzeitstudien.

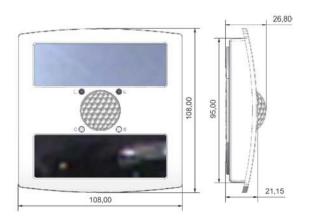
Ein Messgutachten des Instituts für sozial-ökologische Forschung und Bildung (ECOLOG) hat nun bestätigt, daß die Hochfrequenzemissionen von Funkschaltern und Sensoren mit EnOcean Technologie deutlich niedriger liegen als vergleichbare konventionelle Schalter.

Dazu muß man wissen, daß auch konventionelle Schalter aufgrund des Kontaktfunkens elektromagnetische Felder aussenden. Die abgestrahlte Leistungsflußdichte (W/m²) liegt, über den Gesamtfrequenzbereich betrachtet, 100 mal höher als bei Funkschaltern. Zudem wird aufgrund der reduzierten Verkabelung bei Funkschaltern eine potentielle Exposition durch über die Leitung abgestrahlten niederfrequenten Magnetfelder vermindert. Vergleicht man die Funkemissionen der Funkschalter mit anderen Hochfrequenzquellen im Gebäude, wie z.B. DECT-Telefone und Basistationen, so liegen diese Systeme um einen Faktor 1500 über denen der Funkschalter.

Zubehör optional

(D+S) 1 Satz (je 2 Stück) Dübel und Schrauben

Abmessungen (mm)



Find the Device Positioning by means of the Field Strength Measuring Instrument EPM100

EPM 100 is a mobile tool for measuring and indicating the received field strength (RSSI) of the EnOcean telegrams and disturbing radio activity at 868,3 MHz. It supports electrical installers during the planning phase and enables them to verify whether the installation of EnOcean transmitters and receivers is possible at the positions planned.

It can be used for the examination of interfered connections of devices, already installed in the building.

Proceeding for determination of mounting place for wireless sensor/receiver:

Person 1 operates the wireless sensor and produces a radio telegram by key actuation

By means of the displayed values on the measuring instrument, person 2 examines the field strength received and determines the optimum installation place, thus.

High-Frequency Emission of Wireless Sensors

Since the development of cordless telephones and the use of wireless systems in residential buildings, the influence of radio waves on people's health living and working in the building have been discussed intensively. Due to missing measuring results and long-term studies, very often great feelings of uncertainly have been existing with the supporters as well as with the critics of wireless systems.

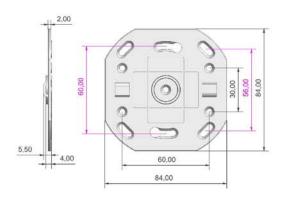
A measuring experts certificate of the institute for social ecological research and education (ECOLOG) has now confirmed, that the high-fequency emissions of wireless keys and sensors based on EnOcean technology are considerably lower than comparable conventional keys.

Thus, it is good to know, that conventional keys do also send electromagnetic fields, due to the contact spark. The emitted power flux density (W/m²) is 100 times higher than with wireless sensors, considered over the total frequency range. In addition, a potential exposition by low-frequency magnet fields, emitted via the wires, are reduced due to wireless keys. If the radio emission is compared to other high-frequency sources in a building, such as DECT-telephones and basis stations, these systems are 1500 times higher-graded than wireless keys.

Optional Accessories

(D+S) 1 Set (each 2 pieces) rawl plugs and screws

Dimensions (mm)



LI04/LI65

Helligkeitsfühler Light sensors



DE - Datenblatt

Technische Änderungen vorbehalten Stand 27.10.2008

EN - Data Sheet

Subject to technical alteration Issue date 2008/10/27





Anwendung

Fühler zur Helligkeitsmessung in Wohn- und Büroräumen (Modell LI04, speziell für Wandmontage) oder im Außenbereich (Modell LI65). Ausgelegt zur Aufschaltung an Regler- und Anzeigesysteme. Die Fühler besitzen einen integrierten Farbfilter (Grünfilter), der an die Empfindlichkeit des menschlichen Auges angepasst ist.

Typenübersicht

LI04	A V LON	aktiv, 420mA aktiv, 010V aktiv, FTT10
LI65	A V LON	aktiv, 420mA aktiv, 010V aktiv, FTT10

Normen und Standards

CE-Konformität: 2004/108/EG Elektromagnetische Verträglichkeit

2001/95/EG Produktsicherheit Produktsicherheit:

EN 607301:2002 Produktsicherheit: EN 607301:2002

Technische Daten

Allgemein:

BPW21 Messelement:

Genauigkeit²⁾: Typ. ±5% v. Messbereich

Gehäuse: LI04: ABS, Farbe weiß ähnlich RAL9010

LI65: Polyamid, Farbe weiß

Umgebungstemp.: -20 ... +70°C

-20 ... +70°C / max 85%rF, nicht kond. Lagertemperatur:

LI04: IP20 gemäß EN60529 Schutzart:

LI65: IP65 gemäß EN60529

Application

Sensor for light measurement in rooms and offices (model LI04, specially for wallmounting) or in outdoor areas (model LI65). Designed for locking-on control anddisplay systems. The sensors have an integrated colour filter (green filter) which isadapted to the sensitivity of human eyes.

Types Available

LI04	A V LON	active, 420mA active, 010V active, FTT10
LI65	A V LON	active, 420mA active, 010V active, FTT10

Norms and Standards

CE-Conformity: 2004/108/EG Electromagnetic compatibility

Product safety: 2001/95/EG Product safety

EN 607301:2002 FMC: Product safety: EN 607301:2002

Technical Data

General:

Measuring element: BPW21 Accuracy²⁾: Typ. ±5°

Typ. ±5% of measuring range

Housing: LI04: ABS, colour white similar to RAL9010

LI65: Polyamide, colour white

Ambient temp.: -20 ... +70°C

-20 ... +70°C / max. 85%rF, no condensate Storage temp.:

LI04: IP20 according to EN60529 Protection:

LI65: IP65 according to EN60529

Page 2

Typ A:

Betriebsspannung: 15-24V= (±10%) Stromaufnahme: max. 20mA Messbreich1): 1: bis 2kLux 2: bis 20kLux

3: bis 100kLux

4...20mA, max. Bürde 500 Ausgang:

2polig (Zweileiter), Klemmleiste max. 1,5mm² Klemmen: Kabeleinführung: Li65: Einfach, M20 für Leiter mit max. D=8mm

Li04: 80g; Li65: 100g Gewicht:

Typ V:

Betriebsspannung: 15-24V= (±10%) oder 24V~ (±10%)

Typ. 0,15W / 0,5VA Stromaufnahme: Messbreich1): 1: bis 2kLux 2: bis 20kLux 3: bis 100kLux

0...10V, min. Belastung 5k Ausgang:

3polig (Dreileiter), Klemmleiste max. 1,5mm² Klemmen: Kabeleinführung: Li65: Einfach, M20 für Leiter mit max. D=8mm

Gewicht: Li04: 80g; Li65: 100g

Typ LON:

Betriebsspannung: 15-24V= (±10%) oder 24V~ (±10%)

Typ. 0,5W / 2VA Stromaufnahme: Messhreich1). 1: bis 2kLux 2: bis 20kLux 3: bis 100kLux

4polig (Vierleiter), Klemmleiste max. 1,5mm² Klemmen: Kabeleinführung: Li65: Einfach, M20 für Leiter mit max. D=8mm, Doppelt, M20 für 2 Leiter mit max. D=7mm

Gewicht: Li04: 120g; Li65: 120g Type A:

Operating voltage: 15-24V= (±10%) Power consumption: max. 20mA Measuring range¹⁾: 1: max. 2kLux 2: max. 20kLux

3: max. 100kLux

4...20mA, max. load 500 Output:

2pole (two-wire), terminal strip max. 1,5mm² Clamps: Cable entry: Li65: Single entry, M20 for wire conductor D=8mm

Weight: Li04: 80g; Li65: 100g

Type V:

Operating voltage: 15-24V= (±10%) oder 24V~ (±10%)

Power consumption: Typ. 0,15W / 0,5VA Measuring range1): 1: max. 2kLux 2: max. 20kLux 3: max. 100kLux

Output: 0...10V, min. load 5k 3pole (three-wire), terminal strip max. 1,5mm² Clamps: Cable entry: Li65: Single entry, M20 for wire conductor D=8mm

Weight: Li04: 80g; Li65: 100g

Type LON:

Operating voltage: 15-24V= (±10%) oder 24V~ (±10%)

Power consumption: Typ. 0,5W / 2VA Measuring range¹⁾: 1: max. 2kLux 2: max. 20kLux

3: max. 60kLux

4pole (four-wire), terminal strip max. 1,5mm² Clamp:

Cable entry: Li65: Single entry, M20 for wire conductor

with max. D=8mm.

Double entry, M20 for 2-wire conductor

with max. D=7mm

Weight: Li04: 120g; Li65: 120g

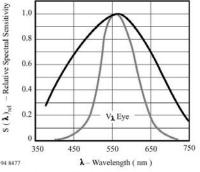


Figure 5. Relative Spectral Sensitivity vs. Wavelength



Gefahrenhinweis

Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.



Warning Advice

The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

¹⁾ Empfindlichkeit des Sensors. Einstellbar über DIP-Schalter am Messumformer.

²⁾ Genauigkeit Messumformer. Die Werkskalibrierung erfolgt bei Ll04 im Bereich 2kLux und bei Ll65 im Bereich 20kLux. Bei Betriebsspannung 24V= und 21°C (+/-5K) Umgebungstemperatur. Zu beachten ist, dass der Messumformer in der Regel in der Messbereichsmitte betrieben werden sollte, da an den Messbereichsendpunkten erhöhte Abweichungen auftreten können. Zudem sollte die Umgebungstemperatur der Messumformerelektronik konstant gehalten werden.

Densitivity of sensor without prism. Adjustable by means of DIP-switch on the transducer

²⁾ Accuracy of transducer without prism. Manufacturer's calibration is made in the 2kLux range. Operating voltage 24V= and 21°C (+/- 5K) ambient temperature. Please take care that the transducer should generally be operated in the measuring range centre, as increased deviations could occur on the measuring range end points. In addition the ambient temperature of the transducer electroncis should be kept constant.

Seite 3 Page 3

Elektrischer Anschluss

Die Geräte sind für den Betrieb an Schutzkleinspannung (SELV) ausgelegt. Beim elektrischen Anschluss der Geräte gelten die techn. Daten der Geräte.

Speziell bei passiven Fühler (z.B. PT100 etc.) in Zweileiter-Ausführung ist der Leitungswiderstand der Zuleitung zu berücksichtigen. Gegebenenfalls muss dieser in der Folgeelektronik korrigiert werden.

Infolge der Eigenerwärmung beeinflusst der Messstrom die Genauigkeit der Messung. Daher sollte dieser nicht größer 1mA liegen.

Bei Fühlern mit Messumformer sollte dieser in der Regel in der Messbereichsmitte betrieben werden, da an den Messbereichsendpunkten erhöhte Abweichungen auftreten können. Die Umgebungstemperatur der Messumformerelektronik sollte konstant gehalten werden.

Montagehinweise

Der Fühler wird mittels Schrauben befestigt. Bei LI04 ist auch die Montage auf einer Standard ISO Schalterdose möglich. Befestigungsmaterial nicht im Lieferumfang enthalten.

Bitte beachten Sie auch die allgemeinen Hinweise in unserem INFOBLATT THK.

Electrical connection

The devices are constructed for the operation of protective low voltage (SELV). For the electrical connection, the technical data of the corresponding device are valid.

Specially with regard to passive sensors (e.g. PT100 etc.) in 2-wire conductor versions, the wire resistance of the supply wire has to be considered. Probably, the same has to be compensated by the following electronics.

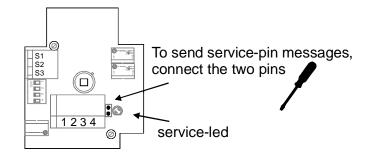
Due to the self-heating, the wire current affects the accuracy of the measurement. Thus, the same should not exceed 1mA.

Sensing devices with transducer should in principle be operated in the middle of the measuring range to avoid deviations at the measuring end points. The ambient temperature of the transducer electronics should be kept constant.

Mounting Advices

The sensor is fixed by means of screws. With LI04, an installation on standard ISO boxes is possible. Tightening material is not included in delivery range.

Please also note the general remarks in our INFORMATION SHEET THK



Zubehör optional

(D+S) 1 Satz (je 2Stück) Dübel und Schrauben

(DE) Designrahmen optional in den transparenten Farben grün, blau, orange

Optional Accessories

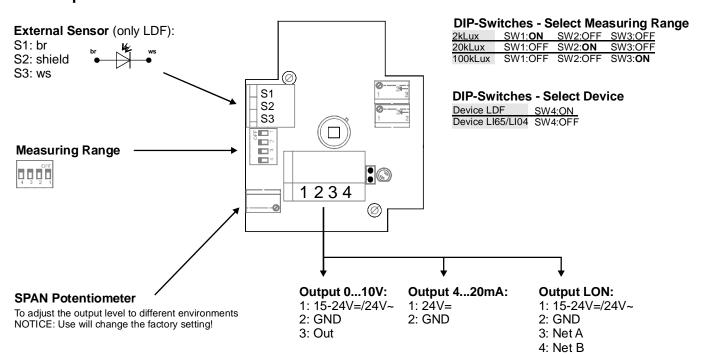
(D+S) 1 set (each 2 pcs.) raw plugs and screws

(DE) Design frames optional in the transparent colours green,

blue, orange

Anschlussplan

Terminal Connection Plan



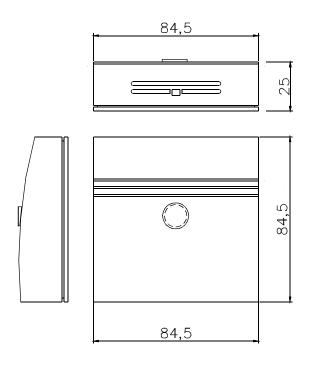
Seite 4 Page 4

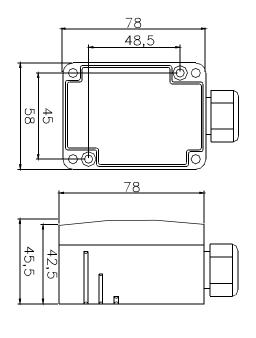
Abmessungen (mm)

Dimensions (mm)

Li04 A/V/LON

Li65 A/V/LON





SR-KCS

Funk-Schalter für Zugangskarten Wireless Key Card Activeated Switch



DE - Datenblatt

Technische Änderungen vorbehalten Stand 11.09.2008

EN - Data Sheet

Subject to technical alteration Issue date 2008/09/11





EasySens
Drahtlos - Batterielos
Wireless - Battery-less

Anwendung

Der SR-KCS ist ein batterieloser Funktransmitter für Raumzugangskarten. Die Energieerzeugung erfolgt über einen wartungsfreien Energiegenerator. Einsatzgebiete sind z.B. Hotelzimmer, Besprechungsräume oder Büros, wo sichergestellt sein muss, dass die Beleuchtung oder Klimatisierung nur bei Raumbelegung eingeschaltet ist und automatisch bei Verlassen des Raumes ausgeschaltet ist.

Application

The SR-KCS is a wireless, self-powered transmitter which is designed to accept room or security card keys. Energy harvesting is made via a maintenance-free energy generator. The SRC-KCS is suitable for many different applications, including hotel rooms, boarding rooms and offices, where it must be ensured that lights are on when occupied and turned off when the occupant leaves.

Typenübersicht

SR-KCS rws Funk-Schalter für Zugangsdaten

Types Available

SR-KCS rws Wireless key card activated switch

Normen und Standards

CE-Konformität: 89/336/EWG Elektromagnetische Verträglichkeit

R&TTE 1999/5/EC Radio and Telecommunications

Terminal Equipment Directive

Standards: ETSI EN 301 489-1: 2001-09

ETSI EN 301 489-3: 2001-11 ETSI EN 61000-6-2: 2002-08 ETSI EN 300 220-3: 2000-09

Die allgemeine Zulassung für den Funkbetrieb gilt für alle EU-Länder und für die Schweiz.

FCC ID: SZV-PTM200

Dieses Gerät ist in Übereinstimmung mit Part 15/FCC Rules.

Der Betrieb unterliegt den folgenden Bestimmungen:

(1) das Gerät darf keine schwerwiegenden Störungen verursachen und (2) das Gerät muss sicher gegen Störungen sein, speziell gegen Störungen, die ein Fehlverhalten des Gerätes verursachen.

Achtung: Änderungen oder Modifikationen des Gerätes, welche nicht ausdrücklich von Thermokon genehmigt sind, führen zur Aufhebung der FCC Betriebs-Zulassung

Norms and Standards

CE-Conformity: 89/336/EWG Electromagnetic compatibility

R&TTE 1999/5/EC Radio and Telecommunications

Terminal Equipment Directive

Standards: ETSI EN 301 489-1: 2001-09

ETSI EN 301 489-3: 2001-11 ETSI EN 61000-6-2: 2002-08 ETSI EN 300 220-3: 2000-09

The general registration for the radio operation is valid for all EUcountries as well as for Switzerland.

FCC ID: SZV-PTM200

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications made to this equipment not expressly approved by Thermokon may void the FCC authorization to operate this equipment.

Technische Daten

Technologie: EnOcean, PTM200

Sendefrequenz: 868,3 MHz

Reichweite: ca. 30m in Gebäude, ca. 300m Freifeld

Energieerzeugung: Wartungsfreier, elektrodynamischer

Energiegenerator

Schaltspiele: >50000 Betätigungen gemäß

EN60669/VDE0632

Gehäuse: Material PC, Farbe reinweiß
Abmessungen: LxBxH: 114mm x 70mm x 35mm

Umgebungstemperatur: -25...65°C

Transport: -25...65°C / max. 95%rF, nicht kond...

Gewicht: ca. 130g



Sicherheitshinweis

Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.

Beschreibung Funk-Telegramm

siehe "produktblatt_easyfit_enocean_details.pdf"

Montagehinweis

Die Geräte werden in einem betriebsfertigen Zustand ausgeliefert.

- Grundplatte mittels Klebeband oder Schrauben auf die ebene Wandfläche montieren. Markierung TOP auf der Grundplatte muss nach oben zeigen.
- Die Zugangskarteneinheit mittels den Schrauben auf die Grundplatte montieren. Befestigungschrauben nur handfest anziehen.

Inbetriebnahme

Damit die Schalterinformationen am Empfänger korrekt ausgewertet werden, ist es notwendig, den SR-KCS in den Empfänger einzulernen. Dies geschieht automatisch durch Betätigung des SR-KCS und einer speziellen "Einlernprozedur" zwischen Sender und Empfänger. Details werden in der jeweiligen Softwaredokumentation des Empfängers beschrieben.

Technical Data

Technology: EnOcean, PTM200

Transmitting frequency: 868,3 MHz

Transmitting range: approx. 30m in buildings, approx. 300m

upon free propagation

Energy harvesting source: Maintenance-free, electrodynamic energy

generator

Switching cycles: >50000 operations according to

EN60669/VDE0632

Enclosure: Material PC, colour pure white Dimension: WxHxD: 70mm x 114mm x 35mm

Ambient temperature: -25...+65°C

Transport: -25...+65°C/ max. 95%rH, non-condensed

Weight: approx. 130g



Security Advice

The installation and assembly of electrical equipment may only be performed by a skilled electrician.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Description Radio Telegram

see "produktblatt_easyfit_enocean_details.pdf"

Mounting Advice

The devices are supplied in operational status.

- Mount base plate to the smooth wall surface by means of doublesided tape or screws. The marking "Top" on the base plate must be face up.
- The key card wall plate is screwed to the base plate. Care needs to be taken with the tension (torque) on the key card assembly screws. The screws should be tighten lightly only; too much tension can damage the switch.

Installation

To make sure that the switch information is interpreted correctly at the receiver, it is necessary to learn-in the SR-KCS into the receiver. This is done automatically by actuation of the SR-KCS and a special "learning-in procedure" between transmitter and receiver. Details to be found in the corresponding software documentation of the receiver.

Informationen zu Funk

Reichweitenplanung

Da es sich bei den Funksignalen um elektromagnetische Wellen handelt, wird das Signal auf dem Weg vom Sender zum Empfänger gedämpft. D.h. sowohl die elektrische als auch die magnetische Feldstärke nimmt ab, und zwar umgekehrt proportional zum Quadrat des Abstandes von Sender und Empfänger (E,H~1/r²)

Neben dieser natürlichen Reichweiteneinschränkung kommen noch weitere Störfaktoren hinzu: Metallische Teile, z.B. Armierungen in Wänden, Metallfolien von Wärmedämmungen oder metallbedampftes Wärmeschutzglas reflektieren elektromagnetische Wellen. Daher bildet sich dahinter ein sogenannter Funkschatten.

Zwar können Funkwellen Wände durchdringen, doch steigt dabei die Dämpfung noch mehr als bei Ausbreitung im Freifeld.

Durchdringung von Funksignalen:

MaterialDurchdringungHolz, Gips, Glas unbeschichtet90...100%Backstein, Pressspanplatten65...95%Armierter Beton10...90%Metall, Aluminiumkaschierung0...10%

Für die Praxis bedeutet dies, dass die verwendeten Baustoffe im Gebäude eine wichtige Rolle bei der Beurteilung der Funkreichweite spielen. Einige Richtwerte, damit man etwa das Umfeld bewerten kann:

Funkstreckenweite/-durchdringung:

Sichtverbindungen:

Typ. 30m Reichweite in Gängen, bis zu 100m in Hallen

Rigipswände/Holz:

Typ. 30m Reichweite durch max. 5 Wände

Ziegelwände/Gasbeton:

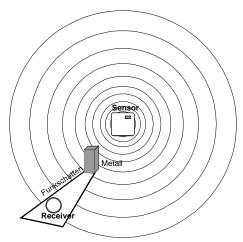
Typ. 20m Reichweite durch max. 3 Wände

Stahlbetonwände/-decken:

Typ. 10m Reichweite durch max. 1 Decke

Versorgungsblöcke und Aufzugsschächte sollten als Abschottung gesehen werden

Zudem spielt der Winkel eine Rolle, mit dem das gesendete Signal auf die Wand trifft. Je nach Winkel verändert sich die effektive Wandstärke und somit die Dämpfung des Signals. Nach Möglichkeit sollten die Signale senkrecht durch das Mauerwerk laufen. Mauernischen sind zu vermeiden.



Andere Störguellen

Geräte, die ebenfalls mit hochfrequenten Signalen arbeiten, z.B. Computer, Audio-/Videoanlagen, elektronische Trafos und Vorschaltgeräte etc. gelten als weitere Störquellen. Der Mindestabstand zu diesen Geräten sollte 0,5m betragen.

Information on Wireless Sensors

Transmission Range

As the radio signals are electromagnetic waves, the signal is damped on its way from the sender to the receiver. That is to say, the electrical as well as the magnetic field strength is removed inversely proportional to the square of the distance between sender and receiver $(E,H\sim1/r^2)$.

Beside these natural transmission range limits, further interferences have to be considered: Metallic parts, e.g. reinforcements in walls, metallized foils of thermal insulations or metallized heat-absorbing glass, are reflecting electromagnetic waves. Thus, a so-called radio shadow is built up behind these parts.

It is true that radio waves can penetrate walls, but thereby the damping attenuation is even more increased than by a propagation in the free field.

Penetration of radio signals:

MaterialPenetrationWood, gypsum,glass uncoated90...100%Brick, pressboard65...95%Reinforced concrete10...90%Metall, alumium pasting0...10%

For the practice, this means, that the building material used in a building is of paramount importance for the evaluation of the transmitting range. For an evaluation of the environment, some guide values are listed:

Radio path range/-penetration:

Visual contacts:

Typ. 30m range in passages, corridors, up to 100m in halls

Rigypsum walls/wood:

Typ. 30m range through max. 5 walls

Brick wall/Gas concrete:

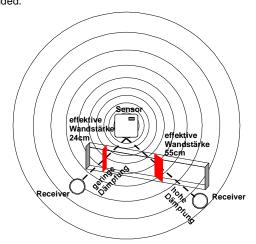
Typ. 20m range through max. 3 walls

Reinforced concrete/-ceilings:

Typ. 10m range through max. 1 ceiling

Supply blocks and lift shafts should be seen as a compartmentalisation

In addition, the angle with which the signal sent arrives at the wall is of great importance. Depending on the angle, the effective wall strength and thus the damping attenuation of the signal changes. If possible, the signals should run vertically through the walling. Walling recesses should be avoided.



Other Interference Sources

Devices, that also operate with high-frequency signals, e.g. computer, auido-/video systems, electronical tansfomers and ballasts etc. are also considered as an interference source.

The minimum distance to such devices should amount to 0,5m.

Finden der Geräteplatzierung mit Feldstärke-Messgerät EPM100

Das EPM 100 ist ein mobiles Feldstärke-Messgerät, das die Feldstärke (RSSI) von empfangenen EnOcean Telegrammen und von Störquellen im Bereich 868,3 MHz anzeigt.

Es dient dem Elektroinstallateur während der Planungsphase zur Bestimmung der Montageorte für Sender und Empfänger.

Weiterhin kann es zur Überprüfung von gestörten Verbindungen bereits installierter Geräte benutzt werden.

Vorgehensweise bei der Ermittlung der Montageorte für Funksensor/Empfänger:

Person 1 bedient den Funksensor und erzeugt durch Tastendruck Funktelegramme.

Person 2 überprüft durch die Anzeige am Messgerät die empfangene Feldstärke und ermittelt so den Montageort.

Hochfrequenzemmissionen von Funksensoren

Seit dem Aufkommen schnurloser Telefone und dem Einsatz von Funksystemen in Wohngebäuden werden auch die Einflußfaktoren der Funkwellen auf die Gesundheit der im Gebäude lebenden und arbeitenden Menschen stark diskutiert. Oft herrscht sowohl bei den Befürwortern als auch bei den Kritikern eine große Verunsicherung aufgrund fehlender Messergebnisse und Langzeitstudien.

Ein Messgutachten des Instituts für sozial-ökologische Forschung und Bildung (ECOLOG) hat nun bestätigt, daß die Hochfrequenzemissionen von Funkschaltern und Sensoren mit EnOcean Technologie deutlich niedriger liegen als vergleichbare konventionelle Schalter.

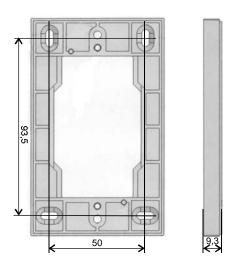
Dazu muß man wissen, daß auch konventionelle Schalter aufgrund des Kontaktfunkens elektromagnetische Felder aussenden. Die abgestrahlte Leistungsflußdichte (W/m²) liegt, über den Gesamtfrequenzbereich betrachtet, 100 mal höher als bei Funkschaltern. Zudem wird aufgrund der reduzierten Verkabelung bei Funkschaltern eine potentielle Exposition durch über die Leitung abgestrahlten niederfrequenten Magnetfelder vermindert. Vergleicht man die Funkemissionen der Funkschalter mit anderen Hochfrequenzquellen im Gebäude, wie z.B. DECT-Telefone und -Basistationen, so liegen diese Systeme um einen Faktor 1500 über denen der Funkschalter.

Zubehör optional

(KF-04) Klebefolie zur Befestigung des Fühlers

(D+S) 1 Satz (je 2 Stück) Dübel und Schrauben

Abmessungen (mm)



Find the Device Positioning by means of the Field Strength Measuring Instrument EPM100

EPM 100 is a mobile tool for measuring and indicating the received field strength (RSSI) of the EnOcean telegrams and disturbing radio activity at 868,3 MHz. It supports electrical installers during the planning phase and enables them to verify whether the installation of EnOcean transmitters and receivers is possible at the positions planned.

It can be used for the examination of interfered connections of devices, already installed in the building.

Proceeding for determination of mounting place for wireless sensor/receiver:

Person 1 operates the wireless sensor and produces a radio telegram by key actuation

By means of the displayed values on the measuring instrument, person 2 examines the field strength received and determines the optimum installation place, thus.

High-Frequency Emission of Wireless Sensors

Since the development of cordless telephones and the use of wireless systems in residential buildings, the influence of radio waves on people's health living and working in the building have been discussed intensively. Due to missing measuring results and long-term studies, very often great feelings of uncertainly have been existing with the supporters as well as with the critics of wireless systems.

A measuring experts certificate of the institute for social ecological research and education (ECOLOG) has now confirmed, that the high-fequency emissions of wireless keys and sensors based on EnOcean technology are considerably lower than comparable conventional keys.

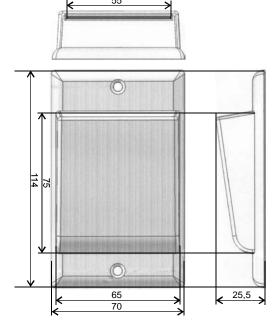
Thus, it is good to know, that conventional keys do also send electromagnetic fields, due to the contact spark. The emitted power flux density (W/m²) is 100 times higher than with wireless sensors, considered over the total frequency range. In addition, a potential exposition by low-frequency magnet fields, emitted via the wires, are reduced due to wireless keys. If the radio emission is compared to other high-frequency sources in a building, such as DECT-telephones and basis stations, these systems are 1500 times higher-graded than wireless keys.

Optional Accessories

(KF-04) Adhesive foil for fixing of sensor

(D+S) 1 Set (each 2 pieces) rawl plugs and screws

Dimensions (mm)



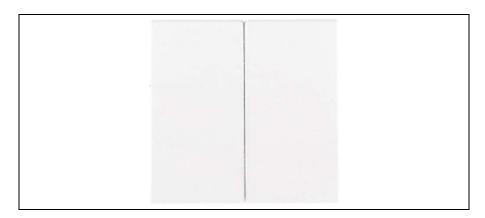


CP69xx | "Economy"-Einbau-Control-Panel mit DVI/USB-Extended-Anschluss

СР69хх	"Economy"-Einbau-Control-Panel	Maßzeichnungen	244							
Ausstattung	TFT-Display in sechs Größen									
	– 5,7-Zoll-Display 640 x 480									
	– 6,5-Zoll-Display 640 x 480									
	– 12-Zoll-Display 800 x 600									
	– 15-Zoll-Display 1024 x 768									
	– 19-Zoll-Display 1280 x 1024									
	– 24-Zoll-Display 1920 x 1200									
	Aluminiumfront mit Stahlblechhaube, Frontseite IP 65, Rückseite IP 20									
	Frontfolie in fünf Varianten									
	– nur Display									
	 Funktionstasten und 10 SPS-Sondertasten mit LED 									
	 numerische Tastatur und 10 SPS-Sondertasten mit LED 									
	 alphanumerische PC-Tastatur im US-Layout und 10 SPS-Sondertasten mit LED 									
	 alphanumerische PC-Tastatur im US-Layout und 16 seitliche SPS-Sondertasten mit LED 									
	integrierte DVI/USB-Extension-Technologie									
	 DVI-E und USB-E ermöglichen das Absetzen des Panels bis zu 50 m vom PC. 									
	DVI-E-Eingang kompatibel zum Standard-DVI-Ausgang eines PCs									
	USB-Eingang zum direkten Anschluss an den Standard-USB-Ausgang eines PCs bei Entfernun	gen bis zu 5 m								
	alle Anschlüsse unten auf der Rückseite									
	24-V-Stromversorgung									
	Betriebstemperaturbereich 055 °C									
	ausklappbare Klemmhebel zur schnellen Installation ohne lose Teile									
Optionen	Touchscreen-Stift mit Wandhalter									
	Tastererweiterungen mit elektromechanischen Schaltern und Tastern									
	Anschlusskit bis 50 m Länge									
	Wandeinbaurahmen für Gebäudeinstallation									
Weitere Informationen	www.beckhoff.de/CP69xx									



Bedienungsanleitung EnOcean Funk-Wandsender



1. Sicherheitshinweise

Einbau und Montage elektrischer Geräte dürfen nur durch Elektrofachkräfte erfolgen.

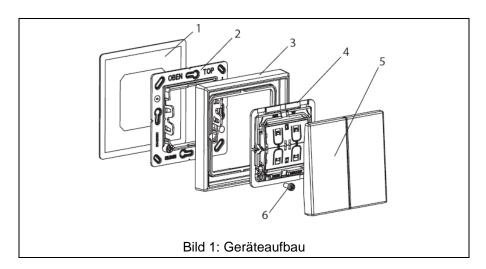


Bei Nichtbeachten der Anleitung können Schäden am Gerät, Brand oder andere Gefahren entstehen.

Die Funk-Übertragung erfolgt auf einem nicht exklusiv verfügbaren Übertragungsweg und ist daher nicht geeignet für Anwendungen aus dem Bereich der Sicherheitstechnik, wie z. B. Not-Aus, Not-Ruf.

Diese Anleitung ist Bestandteil des Produktes und muss beim Endkunden verbleiben.

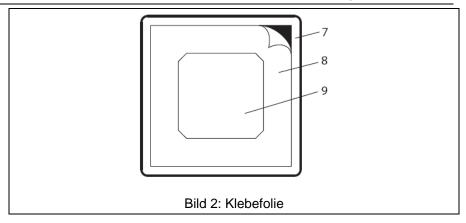
2. Geräteaufbau



- (1) Klebefolie
- (2) Halteplatte
- (3) Rahmen
- (4) EnOcean-Modul
- (5) Wippe
- (6) Sicherungsschraube



Art.-Nr.: ENO..590.., ENO..990.., ENO..595.., ENO..995..



- (7) Schutzfolie für Rahmen
- (8) Schutzfolie für Halteplatte
- (9) Schutzfolie für EnOcean-Modul

3. Funktion

EnOcean

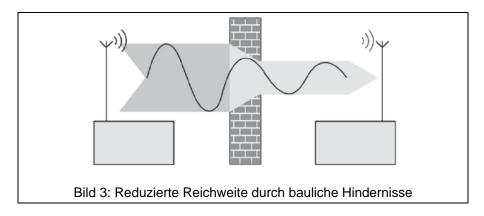
3.1. Systeminformation

Die Sendeleistung, die Empfangscharakteristik und die Antenne dürfen aus gesetzlichen Gründen nicht verändert werden.

Das Gerät darf in allen EU- und EFTA-Staaten betrieben werden. Die Konformitätserklärung steht auf unserer Internet-Seite.

Die Reichweite eines Funksystems aus Sender und Empfänger hängt von verschiedenen Gegebenheiten ab.

Durch die Wahl des bestmöglichen Montageortes unter Berücksichtigung der baulichen Gegebenheiten, kann die Reichweite des Systems optimiert werden. (Bild 3)



Beispiele für die Durchdringung von verschiedenen Materialien:

Material	Durchdringung
Holz, Gips, Gipskartonplatte	ca. 90 %
Ziegelstein, Presspanplatte	ca. 70 %
Armierter Beton	ca. 30 %
Metall, Metallgitter	ca. 10 %
Regen, Schnee	ca. 1 – 40 %





3.2. Bestimmungsgemäßer Gebrauch

- Funksender zur Übertragung von Schalt-, Dimm- oder Jalousiebefehlen an Funkempfänger des EnOcean Funk-Systems.
- Montage auf Gerätedose nach DIN 49073 oder auf glatten, ebenen Flächen durch Schrauben oder Kleben.

3.3. Produkteigenschaften

- Batterieloses Gerät ohne externe Spannungsversorgung.
- Sendeenergie wird aus mechanischer Energie bei Betätigung erzeugt.
- Die Anzahl der Funkkanäle ist abhängig von der verwendeten Wippe.

4. Bedienung

Die Bedienung ist abhängig von der eingelernten EnOcean-Funkkomponente.

Information für Elektrofachkräfte

5. Montage

Abstand zu großflächigen Metallteilen halten, z. B. metallischen Türrahmen.

Die Montage erfolgt durch Schrauben oder Kleben direkt auf ebenem Untergrund.

5.1. Schrauben

- Halteplatte lagerichtig auf eine Gerätedose oder direkt auf die Wand montieren, dabei muss die Kennzeichnung "TOP/OBEN" oben liegen.
- Rahmen (3) auf die Halteplatte (2) stecken.
- EnOcean-Modul (4) lagerichtig auf die Halteplatte (2) aufrasten.
- EnOcean-Modul (4) mit beiliegender Schraube (6) sichern (optional).
- Wippe (5) aufrasten.

5.2. Kleben

Die Oberfläche ist sauber, fettfrei und tragfähig.

- Schutzfolie von der Rückseite der Klebefolie lösen.
- Klebefolie (1) ausrichten und aufkleben.
- Klebefolie mit geeignetem Werkzeug andrücken.
- Schutzfolie (8) entfernen.
- Halteplatte (2) lagerichtig aufkleben, dabei muss die Kennzeichnung "TOP/OBEN" oben liegen.
 - Rahmen und EnOcean-Modul müssen nicht verklebt werden. Schutzfolien (7) und (9) bei Bedarf belassen.





- Schutzfolie (7) entfernen (optional).
- Rahmen (3) auf die Halteplatte (2) stecken und andrücken.
- Schutzfolie (9) entfernen (optional).
- EnOcean-Modul (4) lagerichtig auf die Halteplatte (2) aufrasten.
- EnOcean-Modul (4) mit beiliegender Schraube (6) sichern (optional).
- Wippe (5) aufrasten.

6. Inbetriebnahme

Die Funktion Schalten, Tasten, Dimmen oder Jalousie ist abhängig von der eingelernten EnOcean-Funkkomponente.

7. Sender in Funkempfänger einlernen

Damit ein Empfänger ein Funk-Telegramm des Senders versteht, muss der Empfänger dieses Funk-Telegramm "lernen". Ein Kanal des Senders kann in beliebig viele Empfänger eingelernt werden. Der Einlernvorgang führt ausschließlich im Empfänger zu einer Zuordnung. (siehe Anleitung EnOcean-Funkkomponente)

8. Anhang

8.1. Technische Daten

Trägerfrequenz: 863,3 MHz (ASK)

Sendereichweite

im Freifeld: bis 300 m in Gebäuden: ca. 30 m

Lagertemperatur: -40 ... 85 °C

Umgebungstemperatur: -25 ... +65 °C

Luftfeuchtigkeit: 0 ... 95 % (keine Betauung)





9. Gewährleistung

Wir leisten Gewähr im Rahmen der gesetzlichen Bestimmungen.

Bitte schicken Sie das Gerät portofrei mit einer Fehlerbeschreibung an unsere zentrale Kundendienststelle:

ALBRECHT JUNG GMBH & CO. KG

Service-Center Kupferstr. 17-19 D-44532 Lünen

Service-Line: 0 23 55 . 80 65 51 Telefax: 0 23 55 . 80 61 89 E-Mail: mail.vki@jung.de

Technik (allgemein)

Service-Line: 0 23 55 . 80 65 55 Telefax: 0 23 55 . 80 62 55 E-Mail: mail.vkm@jung.de

Technik (KNX)

Service-Line: 0 23 55 . 80 65 56 Telefax: 0 23 55 . 80 62 55 E-Mail: mail.vkm@jung.de

Das CE-Zeichen ist ein Freiverkehrszeichen, das sich ausschließlich an die Behörden wendet und keine Zusicherung von Eigenschaften beinhaltet.





RICHTER SYSTEMKANAL

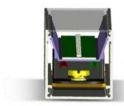


Der Richter Systemkanal ist ein innovativer, neuartiger Lichtkanal mit LED Technik.

Er zeichnet sich dadurch aus, dass der Systemkanal millimetergenau auf die gegebenen Maße eingepasst werden kann und die Ausleuchtung ohne Schatten oder dunkle Stellen durchläuft. Die komplette Technik ist im lediglich 50x55mm großen Kanal integriert- Schaltnetzteil, Reflektor, LEDs und Kabel sind im Kanal untergebracht.

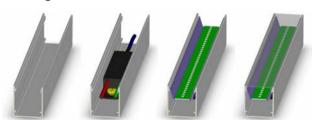
Der Richter Systemkanal kann abgehängt, auf Abstandshalter montiert, oder auch einbetoniert oder eingeputzt werden.

<u>Aufbau</u>:



Diffusor LED Profil einklickbar Integriertes Netzteil Aluminium Kanal

Montageschritte:



Entscheidender Vorteil ist, dass der 6050mm lange Grundkanal gekürzt, oder über Passstifte beliebig verlängert werden kann. Dieser wird dann fest eingebaut.

Im zweiten Bauabschnitt werden vom Elektriker einfach die speziell für den Kanal entwickelten Schaltnetzteile mit dem Reflektor eingeklickt, der gleichzeitig als Träger für die LEDs dient und deren Wärme an den Grundkanal abgibt.

Diese Baugruppe macht unsere light engine aus. Diese ist 1205mm lang und kann beliebig getrennt werden.

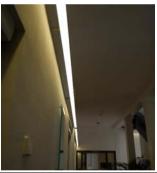
Die Rasterung der Platine liegt bei 30mm.

Dann wird einfach der Diffusor eingeklickt, der das Licht der LEDs in eine gleichmäßige Fläche verteilt. Zusätzliche Innovationen sind das Schaltnetzteil, welches durch handelsübliche Dimmer gedimmt werden kann, sowie die verschiedenen Ausleuchtungsoptionen, die der Kunde festlegen kann:

- -weiß 6500°Kelvin
- -warmweiß 3700°Kelvin
- -vom Kunden frei einstellbare Farbtemperatur von 2700°K bis 8000°K.

Das besondere ist hier, dass der Farbwiedergabeindex (Ra) bei dieser Variante konstant zwischen $91\ \text{und}\ 92$.

- -rot als Effekt
- -blau als Effekt
- -grün als Effekt









Ausschreibungstexte:

Pos. 1:

Richter System Lichtkanal; Aluminium-Strangpressprofil; eloxiert; 50x55mm (bxh); Länge 6050mm; lineare Verbindungsmöglichkeit mittels Kupplungsstifte; Aufnahme für Richter LED-System light engine; Diffusor PMMA weiß mit Snap-In Technik;

Pos. 2:

Richter LED-System light engine; Länge 1205mm; für Richter System Lichtkanal; Schnellmontage durch Klicksystem; teilbar alle 30mm; Lichtfarbe Kaltweiss (6500K);dimmbar; OnBoard-Schaltnetzteil; Steckerfertig; LED-Leistung ca. 29W; Eingangsspannung 230V/50Hz; inkl. Kabel 1200mm;

Alt. zu Pos. 2:

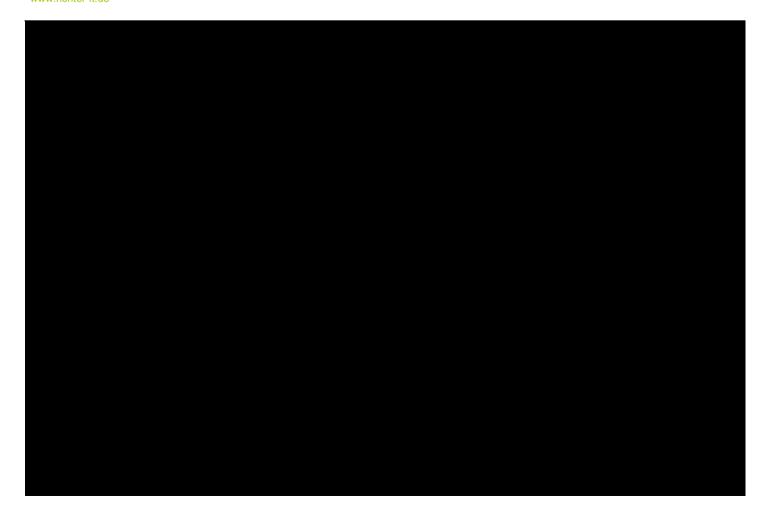
Richter LED-System light engine; Länge 1205mm; für Richter System Lichtkanal; Schnellmontage durch Klicksystem; teilbar alle 30mm; Lichtfarbe warmweiss (3700K);dimmbar; OnBoard-Schaltnetzteil; Steckerfertig; LED-Leistung ca. 29W; Eingangsspannung 230V/50Hz; inkl. Kabel 1200mm;



Richter lighting technologies GmbH Geschäftsführer Bernd Richter Böbinger Str. 34 73540 Heubach

Tel. +49(0)7173-71440-0 Fax:+49(0)7173-71440-12

info@richter-It.de www.richter-It.de

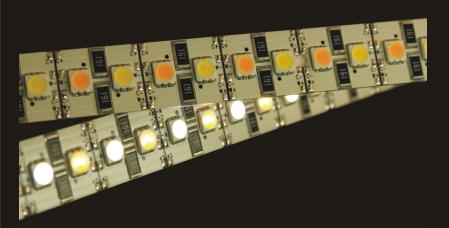


Slim-Line (12V)

FEATURES

RICHTER lighting technologies

- LED Bar 600mm with 3Chip LEDs
- Cuttable every 2 LED
- Adjustable colour temperature from 2700K to 8000K
- Includes self-adhesive heat tape
- Perfect heat dissipation by glue on metal (always necessary!)



SLIMLINE

The new 3-chip-led bar with adjustable colour temperature and Ra 95

SPECIFICATION

OI LOII IOATION	
SUPPLY VOLTAGE	12V/DC
LENGTH	600mm
WIDTH	16mm
LED BEAM ANGLE	120°
COLOUR TEMPERATURE	2700K-8000K
LUMINOUS FLUX	609 LUMEN
COLOUR RENDERING INDEX	95
POWER	11,9 Watt
STRIP MATERIAL	Aluminium
OPERATING TEMPERATURE	-30°C~+70°C
STORAGE TEMPERATURE	-40°C~+85°C
WEIGHT	38 g
ORDERCODE	IT600/162700-8000





IP68 version

High power LED Lighting









Mounting Mode-2



X-BAR-HIP68 series

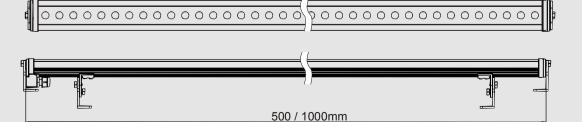
DEDING	THEODMATION	П

OKDEKTI	IQ TIALOKIANI TOIA							
Order code	Model	Color Range	LED Qaulity	Operating Voltage	Power Consumption	IP rating	Length	Housing
88-001-0850-00	X-BAR-HIP68-DC-500-RGB	RGB	18	24VDC	25W	IP 68	500mm	Aluminum extrusion in special anodize process
88-001-0850-01	X-BAR-HIP68-DC-500-WW	Warm white	18	24VDC	25W	IP 68	500mm	Aluminum extrusion in special anodize process
88-001-0850-01	X-BAR-HIP68-DC-500-CW	Cool white	18	24VDC	25W	IP 68	500mm	Aluminum extrusion in special anodize process
88-001-0860-00	X-BAR-HIP68-DC-1000-RGB	RGB	36	24VDC	50W	IP 68	1000mm	Aluminum extrusion in special anodize process
88-001-0860-01	X-BAR-HIP68-DC-1000-WW	Warm white	36	24VDC	50W	IP 68	1000mm	Aluminum extrusion in special anodize process
88-001-0860-02	X-BAR-HIP68-DC-1000-CW	Cool white	36	24VDC	50W	IP 68	1000mm	Aluminum extrusion in special anodize process

SPECIFICATION

SPECIFICATION							
COLOR RANGE	16.7 million (24bit) / 3200K / 6000K						
SOURCE LIFE	50,000 hours under normal operating conditions						
LED TYPE	1W LUXEON LED						
LIGHT SOURCE	18 / 36x 1W highpower LUXEON LEDsper meter						
CURRENT CONSUMPTION	350mA constant current						
BEAM ANGLE	10 x 35deg (oval lens)						
EMISSION WAVE LENGTH	Red Green Blue Warm white Cool white IF=350mA						
	Min. Typ. Max. Min. Typ. Max. Min. Typ. Max. Min. Typ. Max. 3200K° 6000K° Unit						
FORWARD VOLTAGE	Red Green Blue Warm/cool white IF=350n	nΑ					
	Min. Typ. Max. Unit 2.31 2.95 3.51 2.79 3.42 3.99 2.79 3.42 3.99 2.79 3.42 3.99 V						
CONTROL DRIVER	X-Power-HP-Pro						
CONNECTION	Single/Double-deck Terminal Connector with 15 metre cable						
LISTING	CE certified						
OPERATING TEMPERATURE	0°C ~ +40°C						
STORAGE TEMPERATURE	-20° C ∼ +70° C						
DIMENSION	500/1000(L) x 62(W)x96(H)mm						
WEIGHT	1.1Kgs / 2.3Kgs						

PHYSICAL DIMENSIONS







X-BAR-HIP68-DC-1000-RGB

► PHOTOMETRIC DATA

Light source specifications

Optics: polycarbonate lens + tempered glass
Light source: 36 high power led (12 red, 12 green, 12 blue)

Beam angle: 11 x 38 deg

Light distribution: symmetric direct illumination

Illuminance

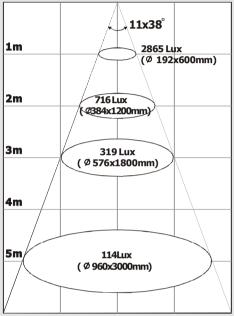
DISTANCE	1m		2	2m	3m		5m	
COLOR	Lux	Size (mm)	Lux	Size (mm)	Lux	Size (mm)	Lux	Size (mm)
RED	1185.6	190x600	296.4	380x1200	131.8	570x1800	47.4	950x3000
GREEN	1591	191x603	397.8	382x1206	176.8	573x1809	63.6	955x3015
BLUE	194	200x647	48.6	400x1294	21.6	600×1941	7.8	1000x3235
WHITE	2865	192x600	716	384x1200	319	576x1800	114	960x3000

^{*} light pattern indicates the size at 50% of peak intensity

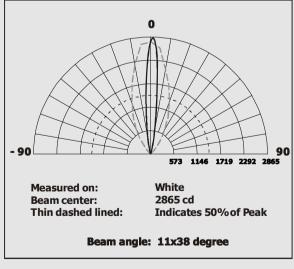
Light output

COLOR	Total (lumens)	Power(watts)	Efficacy(Im/W)
RED	211.3	19.5	10.8
GREEN	296.5	19.5	15.2
BLUE	38.64	19.9	1.9
WHITE	525.7	43.7	12

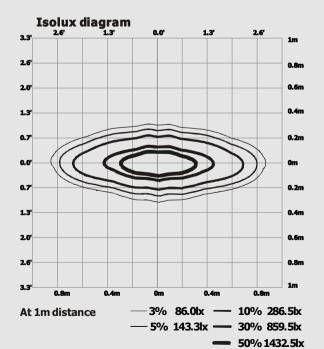
Full intensity in white color



Light distribution



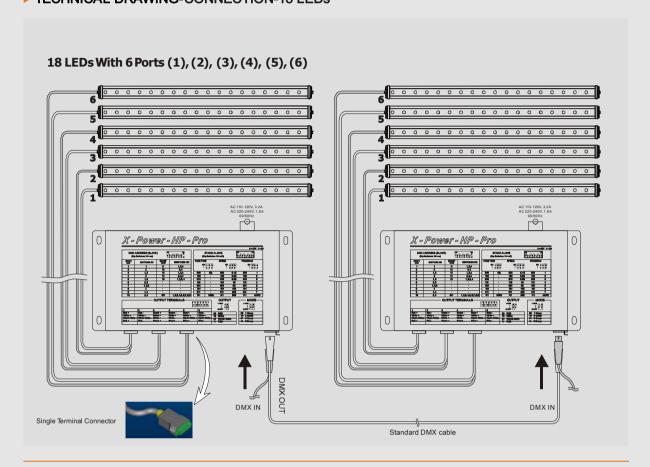
IES file is also avai lable



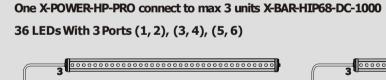


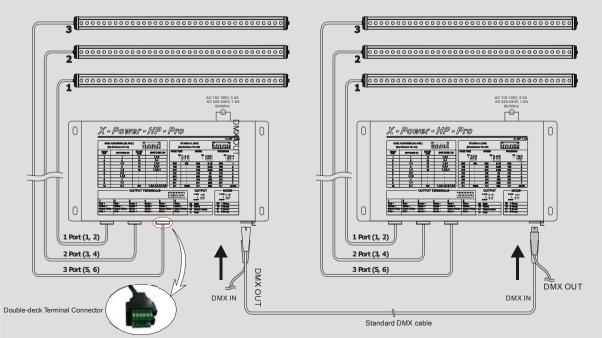
X-BAR-HIP68 DC version

► TECHNICAL DRAWING-CONNECTION-18 LEDs



► TECHNICAL DRAWING-CONNECTION-36 LEDs





MONTAGEHINWEIS

INSTALLATION NOTE

RE-LIGHT

Pendelleuchte Pendant light



STENG LICHT AG | Hedelfinger Strasse 103 | D- 70327 Stuttgart Phone +49- 711- 23 88 00 | Fax +49- 711- 23 88 088 mail@steng.de | www.steng.de

Installation der Leuchte | Installation of the fixture

Vor Montage der Leuchte Strom abschalten. Die Leuchte darf nur durch qualifiziertes Fachpersonal (Elektriker) angeschlossen werden. Die Leuchte darf nur in trockenen Innenräumen eingesetzt werden.

To avoid the possibility of electric shock, turn off power-supply before installing or serving and read all instructions before installing the fixture. It is recommended that the fixture is installed only by a qualified electrician. The fixture is suitable only for normal dry rooms.

Leuchtmittel / Lamps







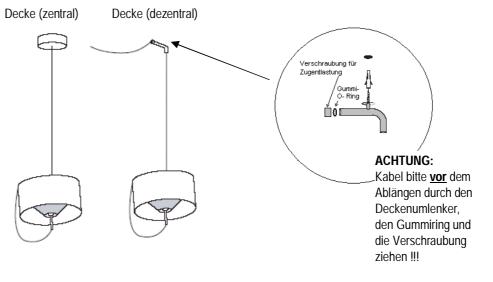




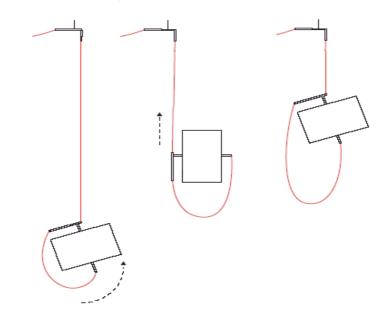




Mögliche Befestigungen/ Montagearten



Höhenverstellung



RE-LIGHT Hochvolt Pendelleuchten

High-Voltage Pendant Lights

Dank seines neu konstruierten doppeltem Stoffschirms mit integriertem Reflektor strahlt die Leuchte in eine Richtung Ihrer Wahl und, wenn gewünscht, zweifarbig: In Reflektorrichtung weiß, nach hinten zum Beispiel in rot, und taucht somit den Raum in angenehmes Glühlampenlicht ganz ohne zu blenden. Der Schirm kann einfach in die Strahlrichtung gedreht werden. Die schlaue Aufhängung ermöglicht - durch Ziehen am Kabel schnell und einfach die Höhe stufenlos zu verstellen. Die Stoffkabel sind in fünf Farben lieferbar (letzter Buchstabe). RE-LIGHT: Von der Decke, an der Wand und mit Stehfuß auf dem Boden. (Siehe Seite 116). Die Metallteile sind verchromt. Schirme in zwei Varianten: weiß/weiß oder weiß/rot.

Thanks to a new kind of fabric shade with integrated reflector, light only shines in one desired direction, and where required, in two colors: white in the direction of the reflector, and red towards the rear. This casts a pleasant luminance throughout the room, without glare. The clever way the cable is threaded means the pendant light can be quickly and easily adjusted to any height. RE-LIGHT is available as a ceiling, wall or free-standing light. The metal parts are chrome-plated. Shades are available in two versions: white/white or white/red. Additional color filters available in three colors.

RE-LIGHT Farbfilter / Color filter

ZRL FRO (Rot / Red)

ZRL FBL (Blau / Blue)



Der Farbfilter wird einfach von hinten in den Schirm eingelegt und mit Klammern gehalten.

Design: e27 Berlin

RE-LIGHT Pendel

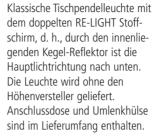
Fassung.

PRL -

Pendelleuchte zur zentralen oder dezentralen Deckenmontage. Umlenkhülse und Anschlussdose werden mitgeliefert. Inkl. fünf Meter Stoffzuleitungskabel, wahlweise in fünf verschiedenen Farben (letzte Artikel-Nr.). Mit integriertem Schalter an der

RE-LIGHT CLASSIC

PRM -

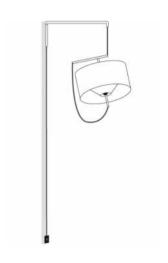


RE-LIGHT Wand



Ausführung wie Pendelleuchte. iedoch mit einfach mit zwei Schrauben zu montierendem Wandausleger 400 mm. In der Fassung ist ein Schalter integriert. Fünf Meter Stoffkabel mit Schucostecker, wahlweise in fünf verschiedenen Farben (letzte Artikel-Nr.).





RE-LIGHT pendant

This pendant light can be positioned practically anywhere on the ceiling. An L-shaped cable guide and a plug come as standard. Five meters of fabriccovered cable are also included choose from five different colors (last digit of product code indicates color).

In addition, RE-LIGHT comprises an E27 / Medium base socket with integrated switch.

RE-LIGHT CLASSIC

A classic pendant light with the RE-LIGHT shade. Due to the inner conical reflector, most of the light is beamed downwards. The lamp is supplied without height-adjusting mechanism. Connecting socket and cableguide sleeve are included.

RE-LIGHT wall mounted

Similar to the pendant light, but with an easy to install 400 mm/15" wall bracket. Five meters of fabriccovered cable are also included choose from five different colors (last digit of product code indicates color). An E27 / medium base socket with integrated switch, suitable for bulbs up to 100 watts, also comes as standard.

Schirmfarben / Shade colors





Durchmesser / Dimensions ø 390 mm /15.4"

Kabelfarben / Cable colors

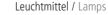




























RE-LIGHT RE-FLECT Hochvolt- Stehleuchten

High- voltage free-standing lamps



RE-LIGHT

QRL -

Klassische Stehleuchte mit einsteckbarem Schirm und direkt oder indirekt gerichteter Abstrahlung. Durch Drehen des Schirms kann das Licht in die gewünschte Strahlrichtung gebracht werden. Das im Stabprofil einklippbare Stoffkabel ist fünf Meter lang und in fünf verschiedenen Farben erhältlich. (letzte Art. Nr.) Der Schalter befindet sich direkt an der Lampenfassung.



QRF 1 5 -

Stabiler Standfuß mit aufgestecktem, orientierbaren RE-FLECT Strahler zur Anwendung diverser Leuchtmittel mit E27-Sockelung. Das im Stabprofil einklippbare Stoffkabel ist fünf Meter lang und in fünf verschiedenen Farben erhältlich. (letzte Art. Nr.) Der Schalter befindet sich direkt an der Lampenfassung.





RE-LIGHT Schirmfarben / Shade colors



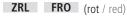


weiß / weiß white / white A free-standing light with a moveable shade that allows light to be pointed in various direc-

Includes five meters/15´ of fabric-covered cable (five colors available), and an E27/medium base socket (last digit of product code indicates color). The RE-FLECT free-standing spotlight features a stable base, and an upright that also houses the cable.

Includes five meters/15' of fabrik-covered cable (five colors available), and an E27/medium base socket (last digit of product code indicates color).

RE-LIGHT Farbfilter / color filter



ZRL FBL (blau / blue)



Kabelfarben / Cable colors



Leuchtmittel / Lamps











390 mm / 15.4" 240 mm / 9.4' . 61 710 mm / 265 mm / 10.4"



Design: e27 Berlin Peter Steng



ORILED 2/1W LED WD 350MA IP65

60812570

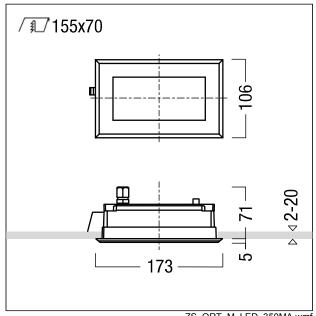
LED-Wandeinbauleuchte

LED-Wandeinbauleuchte; für bodennahe Montage; Bestückung: PowerLED-Platine (2x1W 350mA), LEDs tageslicht weiß (6000K); spezielle Linsenoptik mit Freiformreflektor für gerichtetes Licht auf dem Boden; Gehäuse: Aluminiumdruckguss; Farbe: titan, Mikrostrukturlack; Abdeckrahmen überlappend aus Edelstahl mit Camlockverschlüssen (keine sichtbaren Schrauben); schlagfestes Schutzglas (6 Joules) mit Siebdruck; Schutzart: IP65, Schutzklasse: III; Anschlussleistung: ca. 2,4W; mit ca. 0,35 m Zuleitung; Ausführung IP65 mit PG-Verschraubung; inklusive integriertem Hohlwand-Montageset; Montage in Beton oder Mauerwerk mit Betoneingießgehäuse (separat zu bestellen); Wandausschnitt:155x70 mm, Einbautiefe: 71 mm; Außen-Abmessungen: 173 x 76 x 106 mm; Gewicht: 0,74 kg;

Hinweis: Betriebsgerät bitte separat bestellen!

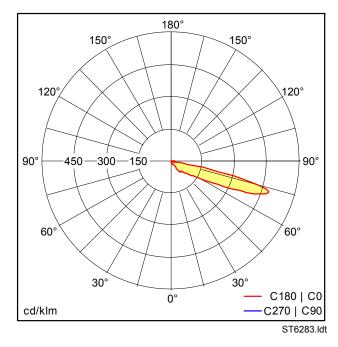


ZS_ORT_F_LED_350MA_PSV.jpg



ZS_ORT_M_LED_350MA.wmf

Lichtverteilung STD - Standard



TECHNISCHES DATENBLATT

24169174 MINIPLANO





Begehbare Bodeneinbauleuchte

Einbautiefe 135 mm IP Klasse: IP 67

-MATERIAL EIGENSCHAFTEN

Gehäuse Aluminium-Druckguss (kupferfrei) EN AB-44100 mit hohem Komoslonsschutz.

Gieltschleifen als Vorbehandlung zur Lacklerung.

Abdeckring Edelstahl AISI 316L mit 2,5-3% Molybdängehalt mit hohem Komoslonsschutz.

Edelstahlschrauben mit 2,5-3% Molybdängehalt, dass den Komoslonsschutz erhöht.

Vorbehandelte Sillkondichtungen

Dreiphasen Doppelte Pulverbeschichtung mit hoher Resistenz:

Oberflächenbehandlung mit BONDERITE

Das Bonderite Konversionsverfahren ist ein führendes nanokeramisches Beschichtungsverfahren zur Oberflächenbehandlung. Dadurch wird die Lackhhaffung und der Korrosionsschutz deutlich verbessert,

2) PRE POLYMERISATION

Vorbereitungsprozess zur Polymerisation mittels eines zinkahaltingen Epoxidpulvers zur Erhöhung der Lackhaftung mit erhöhter Beständigkeit gegen Oxidation;

3) POLYMERIBATION

Die finale Pulverlacklerung mittels Polyesterpulvers, das sich durch eine hohe Resistenz gegen UV-Strahlung und raue Witterungsbedingungen auszeichnet, "Verbesserter Schutz bei Einsatz in Meeresumgebung".

Mechanische Belastbarkeit des Glases IK 09

Maximale Tragfähigkeit 1000 Ko

-LICHTTECHNIK

tellmattlertes glas gehärtetes Kalk-Natron-Glas, Stärke 8mm mit einem hohen Transmissionsgrad +12%.

Schwenkbar ±15% installertes Leuchtmittel .

Betriebswirkungsgrad --

-GERINGE OBERFLÄCHENTEMPERATUR

Durch die hohe Lichtdurchlässigkeit des Glases wird ein optimaler Lichtwirkungsgrad und eine geringere Wärmeentwicklung in der Leuchte etzleit.

Oberflächentemperatur des Glases 37°C (bei 25° Umgebungstemperatur) Durch die spezielle Anordnung der Bautelle wird eine verbesserte Wärmeverteilung erzielt und die Wärmeentwicklung im Gehäuse wird dadurch eingeschränkt.

-EINBAUGEHÄUSE

Einglefigehäuse Polypropylen, vorbereitet für Kabeleingang durch alle 4 Wände, ermöglicht außerdem:

- 1) einfache Verkabeiung:
- 2) Verkabelung für Leitungsverbinder;
- 3) Einfache Handhabung bei der Wartung.

-VERKABELUNG

Einspelsung Typ HO7RN-F geschützt durch Kabelverschraubung PG 13.5 6+12 mm) und abgedichtet mit B-Komponenten Epoxidharz, innenverkabelung geschützt durch Sillkonschutzhülle.

Leitungsverbinder M20 (Ø 5+14 mm) beigestellt als Einzelkabelverbindung.

Der Verbinder befindet sich innerhalb des Eingleßgehäuses.

Einfacher Leuchtmittelwechsel ohne die komplette Leuchte zu entfernen.

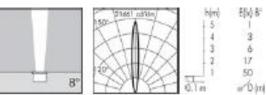
Isolation: SCHUTZKLASSE I. Verfügbare Farben: Edelstahl.

Gewicht: 1.59 Kg

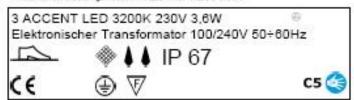
Glübdrahffest: -

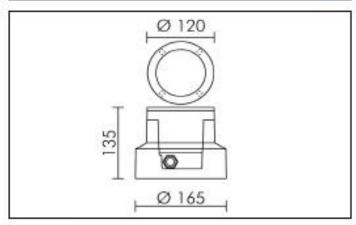
LED Platineneinheiten nach CEI EN 60826-1 Emissionsklasse 2





* Photometrische Daten gemessen mit LED KALT WEISS 6650K







LEITUNGSVERBINDER INBEGRIFFEN

LETZE VERTAGUNG 11/03/2010

Zentrale Lemgo Zumtobel Light GmbH Grevenmarscholz, 74-78 D-32657 Lemgo

Tet: Fax Website +49 (0)5281/212-0 +49 (0)5281/212-7777 http://www.zumtobel.de





FEW 1/54W T16 M625 LDB

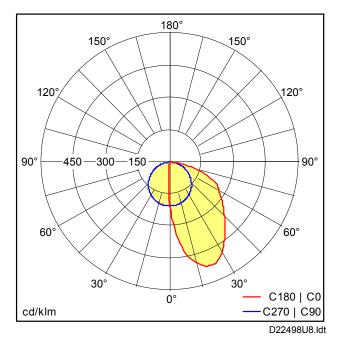
42918609

Einbauleuchten m. asymmetrischer Optik

Einbauleuchten m. asymmetrischer Optik 1/54W; für T16, mit Taster oder DIMLITE dimmbares elektronisches Vorschaltgerät, sehr schmales Einbaugehäuse aus Stahlblech weiß thermolackiert, 3-polige Steckverbindungsklemme; Minimal erforderliche Deckenstärke 34 mm (Siehe Montageanleitung für weitere Informationen); asymmetrisch strahlender matt eloxierter Reflektor mit ausgeprägter Wallwasher - Lichtverteilung. Lampenabdeckung beim Leuchtmittelwechsel werkzeuglos demontierbar. Leuchte halogenfrei verdrahtet. Abmessungen: Modul: 625; 1248 x 114 x 85 mm; Gewicht: 3,1 kg.



Lichtverteilung STD - Standard



Gesamtlichtstrom: 4450 lm
Farbwiedergabestufe: 1B
Betriebsgerät: EVG dim2save Tridonic PCA ES

Betriebsgerät: EVG dim2save Tridonic PCA ES
 Anschlussleistung: 59,7 W Lambda = 0,99

• Steuerung: LDB dimmbar bis 10%

• CELMA EEI: A1

• Lampen: 1 x T16 / 54W

SOLAR CELLS



Sunways Solar Cells

The monocrystalline Sunways Solar Cell is now provided with three energy feeder units (busbars) instead of two. This reduces the losses during the power generation in the solar module. This new contact design, in combination with the constant increase in the efficiency of the Sunways Solar Cells, results in extremely powerful and surface-effective solar modules.

Product description

Category: monocrystalline, 3 busbars

Dimensions: pseudo-square

156 +/-0.5 mm x 156 +/-0.5 mm

diagonal 200 +/-2.5 mm

Cell depth: 200 $^{+/-40}$ μm Temperature coefficients: Power -0.48 %/K,

Open circuit voltage -2.3 mV/K, Short circuit current 1.1 mA/K

Quality

- 100% camera-based, visual final check for an even appearance of the solar cells in the module
- 100% electric measurement with measuring equipment, calibrated according to ISO 9001:2000

Electrical key data

Current class acc. to I(V _{FIX})	Efficiency rate [%]	Power at V _{FIX} [W]	I (V _{FIX} = 510 mV) [A]	Fill factor [%]	V _{oc} [mV]	I _{sc} [A]
AH508200	17,5	4,18	8,20	77,3	616	8,82
AH508100	17,3	4,13	8,10	77,2	615	8,74
AH508000	17,1	4,08	8,00	77,1	615	8,59
AH507900	16,9	4,03	7,90	76,9	615	8,56
AH507800	16,6	3,98	7,80	76,7	614	8,49
AH507700	16,4	3,93	7,70	76,2	612	8,48

All figures are averages, all figures +/- 3 %. Cell class measurement at V_{FIX} = 510 mV.

Information and Sales

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Solar Cells

Recommendations for subsequent processing

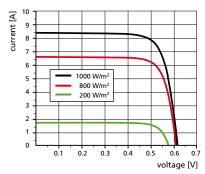
Monocrystalline Sunways Solar Cell can be processed using tin-coated copper bands (2 - 2.5 mm x 0.18 mm), which are coated with 10 -15 μ m Sn (62%), Pb (36%) and Ag (2%). We recommend the use of no clean flux. The solar cells should be pre-heated to 80°C - 150°C and soldered at a temperature of 250 - 350 °C. Contact is provided by two continuous busbars on the front of the solar cell measuring 1.54+/-0.15 mm and on the rear side with a width of 2.5+/-0.5 mm.

Production and packaging

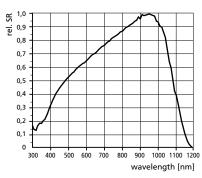
Each Sunways Solar Cell is subjected to mechanical and optical quality control before the individual cells are divided into narrowly defined current classes, and classified according to I ($V_{FIX} = 500 \text{ mV}$). The solar cells are sealed in foil packaging of 100 cells each. The foam packaging can hold up to 2 x 4 packaging units (= 800 solar cells) and offers optimal protection during transportation.

Electrical parameters

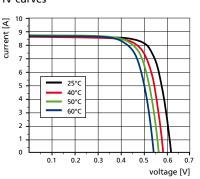




spectral response



IV curves



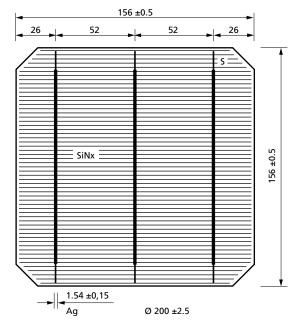
IV behaviour at various degrees of irradiation intensity.

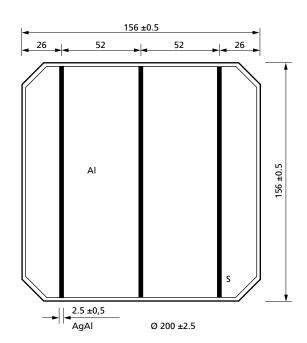
Spectral sensivity curve

IV behaviour for various temperatures.

Calibration by Fraunhofer ISE Freiburg. All data were derived under standard test conditions. Standard test conditions (STC): Light spectrum AM = 1.5. Irradiation intensity E = 1000 W/m². Cell temperature $T_C = 25$ °C.

Metallization drawing





SOLAR CELLS



Sunways Solar Cells

Aesthetics and function

Coloured design cells from Sunways combine power generation and aesthetics. The cells are available in emerald, gold, bronze and silver and therefore enable unique, customised PV system designs. The application options for building-integrated photovoltaics appear limitless. In the coloured design cells architecture and photovoltaics merge to form a multi-functional solution.

Fresh design

Sunways design cells will turn your façade into a colourful building component. The bronze and silver colours offer impressive colour homogeneity. Due to their slight colour gradient, design cells in gold and emerald create a fresh appearance. The three-busbar technology optimises the current pick-up and contributes to optimum current yield of your system.

Product description

Category: Multicrystalline, 3-busbar Format: $156 \, ^{+/-0.5} \, \text{mm} \times 156 \, ^{+/-0.5} \, \text{mm}$ Cell thickness: $200 \, ^{+/-40} \, \mu \text{m}$

Cell thickness: 200 $^{+/-40}$ µm Temperature coefficients: Output -0.43 %/K,

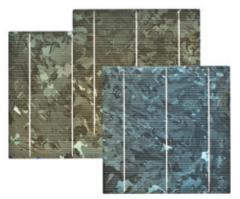
Open-circuit voltage -0,36 %/K Short-circuit current 0,06 %/K



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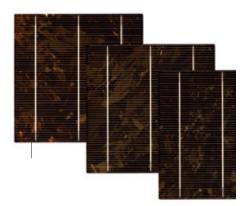
Solar Cells – Emerald

Current class as per	Efficiency	Output at V _{FIX}	I (V _{FIX} = 500 mV)	Fill factor	V _{oc}	I _{sc}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 6305	12,9	3,15	6,30	76,8	605	6,90
CH 50 6505	13,4	3,25	6,50	77,2	606	6,95
CH 50 6605	13,6	3,30	6,60	77,6	607	7,02
CH 50 6705	13,8	3,35	6,70	77,6	608	7,11
CH 50 6805	14,0	3,40	6,80	77,6	609	7,20
CH 50 6905	14,2	3,45	6,90	77,7	609	7,30
CH 50 7005	14,4	3,50	7,00	77,7	611	7,38
CH 50 7105	14,6	3,55	7,10	77,7	613	7,47



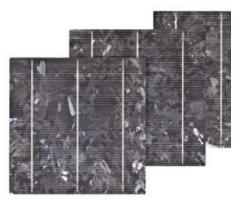
Solar Cells – Gold

Current class as per	Efficiency	Output at V _{FIX}	I (V _{FIX} = 500 mV)	Fill factor	V _{oc}	I _{sc}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 5904	12,1	2,95	5,90	72,8	605	6,60
CH 50 6104	12,5	3,05	6,10	75,5	605	6,67
CH 50 6204	12,7	3,10	6,20	76,1	607	6,72
CH 50 6304	12,9	3,15	6,30	77,0	606	6,75
CH 50 6404	13,1	3,20	6,40	77,4	607	6,82
CH 50 6504	13,4	3,25	6,50	77,5	608	6,91
CH 50 6604	13,6	3,30	6,60	77,6	608	7,00
CH 50 6704	13,8	3,35	6,70	77,6	610	7,09



Solar Cells - Bronze

Current class as per	Efficiency	Output at V _{FIX}	I (V _{FIX} = 500 mV)	Fill factor	V_{OC}	I _{SC}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 5803	11,9	2,90	5,80	74,6	599	6,65
CH 50 6103	12,5	3,05	6,10	77,1	602	6,59
CH 50 6203	12,7	3,10	6,20	77,5	603	6,65
CH 50 6303	12,9	3,15	6,30	77,6	603	6,74
CH 50 6403	13,1	3,20	6,40	77,7	605	6,81
CH 50 6503	13,4	3,25	6,50	77,7	605	6,91
CH 50 6603	13,6	3,30	6,60	77,7	607	7,00
CH 50 6703	13,8	3,35	6,70	78,0	609	7,04



Solar Cells – Silver

Current class as per	Efficiency	Output at V _{FIX} 1)	I (V _{FIX} = 500 mV)	Fill factor	V _{oc}	I _{sc}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 4801	9,9	2,40	4,80	74,7	594	5,66
CH 50 5101	10,5	2,55	5,10	76,0	595	5,72
CH 50 5201	10,7	2,60	5,20	76,5	596	5,77
CH 50 5301	10,9	2,65	5,30	76,9	597	5,81
CH 50 5401	11,1	2,70	5,40	77,2	598	5,86
CH 50 5501	11,3	2,75	5,50	77,3	600	5,92
CH 50 5601	11,5	2,80	5,60	77,4	602	6,00
CH 50 5701	11,7	2,85	5,70	77,4	604	6,08

¹⁾ An embedding gain is expected for this colour

Solar Cells

Notes for ordering and delivery

Coloured design cells are custom-made for each order or project. In this case, any order includes all current classes. The minimum order quantity is 10,000 units. Design cells in other formats and materials, for example 4 or 5 inch and monocrystalline silicon, are available on request.

Recommendations for further processing

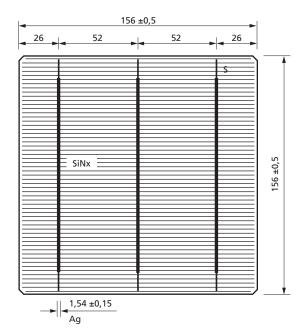
The multicrystalline Sunways Solar Cell can be processed further with tin-plated copper strips (2 - 2.5 mm x 0.18 mm). These are coated with $10 - 15 \mu m$ Sn (62%), Pb (36%) and Ag (2%). We recommend the use of no clean flux. The solar cells should be preheated to $80 - 150^{\circ}$ C and soldered at a temperature of $250 - 350^{\circ}$ C.

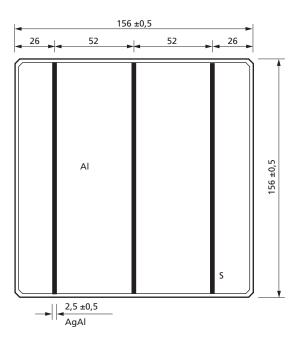
Contact is made via the three continuous busbars on the front of the solar cells with 1.54 */-0.15 mm and with 2.5 */-0.5 mm on the back.

Production and Packing

Each Sunways Solar Cell runs through a mechanical and visual quality check. Then the individual solar cells are classified in closely defined current classes. The classification is carried out according to I ($V_{FIX} = 500 \text{ mV}$). The solar cells are sealed in foil packages of 100 pieces. The foam packing material can hold 2 x 4 packing units (= 800 solar cells) and offers optimum protection for transport.

Metallization drawing





Information and Sales

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SOLAR CELLS



Sunways Solar Cells

Aesthetics and function

Coloured design cells from Sunways combine power generation and aesthetics. The cells are available in emerald, gold, bronze and silver and therefore enable unique, customised PV system designs. The application options for building-integrated photovoltaics appear limitless. In the coloured design cells architecture and photovoltaics merge to form a multi-functional solution.

Fresh design

Sunways design cells will turn your façade into a colourful building component. The bronze and silver colours offer impressive colour homogeneity. Due to their slight colour gradient, design cells in gold and emerald create a fresh appearance. The three-busbar technology optimises the current pick-up and contributes to optimum current yield of your system.

Product description

Category: Multicrystalline, 3-busbar Format: $156 \, ^{+/-0.5} \, \text{mm} \times 156 \, ^{+/-0.5} \, \text{mm}$ Cell thickness: $200 \, ^{+/-40} \, \mu \text{m}$

Cell thickness: 200 $^{+/-40}$ µm Temperature coefficients: Output -0.43 %/K,

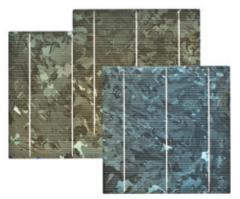
Open-circuit voltage -0,36 %/K Short-circuit current 0,06 %/K



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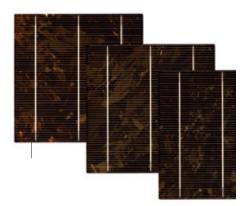
Solar Cells – Emerald

Current class as per	Efficiency	Output at V _{FIX}	I (V _{FIX} = 500 mV)	Fill factor	V _{oc}	I _{sc}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 6305	12,9	3,15	6,30	76,8	605	6,90
CH 50 6505	13,4	3,25	6,50	77,2	606	6,95
CH 50 6605	13,6	3,30	6,60	77,6	607	7,02
CH 50 6705	13,8	3,35	6,70	77,6	608	7,11
CH 50 6805	14,0	3,40	6,80	77,6	609	7,20
CH 50 6905	14,2	3,45	6,90	77,7	609	7,30
CH 50 7005	14,4	3,50	7,00	77,7	611	7,38
CH 50 7105	14,6	3,55	7,10	77,7	613	7,47



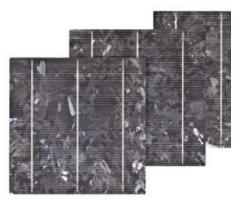
Solar Cells – Gold

Current class as per	Efficiency	Output at V _{FIX}	I (V _{FIX} = 500 mV)	Fill factor	V _{oc}	I _{sc}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 5904	12,1	2,95	5,90	72,8	605	6,60
CH 50 6104	12,5	3,05	6,10	75,5	605	6,67
CH 50 6204	12,7	3,10	6,20	76,1	607	6,72
CH 50 6304	12,9	3,15	6,30	77,0	606	6,75
CH 50 6404	13,1	3,20	6,40	77,4	607	6,82
CH 50 6504	13,4	3,25	6,50	77,5	608	6,91
CH 50 6604	13,6	3,30	6,60	77,6	608	7,00
CH 50 6704	13,8	3,35	6,70	77,6	610	7,09



Solar Cells - Bronze

Current class as per	Efficiency	Output at V _{FIX}	I (V _{FIX} = 500 mV)	Fill factor	V_{OC}	I _{SC}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 5803	11,9	2,90	5,80	74,6	599	6,65
CH 50 6103	12,5	3,05	6,10	77,1	602	6,59
CH 50 6203	12,7	3,10	6,20	77,5	603	6,65
CH 50 6303	12,9	3,15	6,30	77,6	603	6,74
CH 50 6403	13,1	3,20	6,40	77,7	605	6,81
CH 50 6503	13,4	3,25	6,50	77,7	605	6,91
CH 50 6603	13,6	3,30	6,60	77,7	607	7,00
CH 50 6703	13,8	3,35	6,70	78,0	609	7,04



Solar Cells – Silver

Current class as per	Efficiency	Output at V _{FIX} 1)	I (V _{FIX} = 500 mV)	Fill factor	V _{oc}	I _{sc}
I (V _{FIX})	[%]	[Wp]	[A]	[%]	[mV]	[A]
CH 50 4801	9,9	2,40	4,80	74,7	594	5,66
CH 50 5101	10,5	2,55	5,10	76,0	595	5,72
CH 50 5201	10,7	2,60	5,20	76,5	596	5,77
CH 50 5301	10,9	2,65	5,30	76,9	597	5,81
CH 50 5401	11,1	2,70	5,40	77,2	598	5,86
CH 50 5501	11,3	2,75	5,50	77,3	600	5,92
CH 50 5601	11,5	2,80	5,60	77,4	602	6,00
CH 50 5701	11,7	2,85	5,70	77,4	604	6,08

¹⁾ An embedding gain is expected for this colour

Solar Cells

Notes for ordering and delivery

Coloured design cells are custom-made for each order or project. In this case, any order includes all current classes. The minimum order quantity is 10,000 units. Design cells in other formats and materials, for example 4 or 5 inch and monocrystalline silicon, are available on request.

Recommendations for further processing

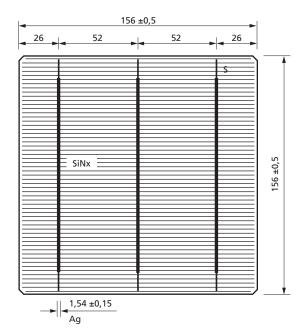
The multicrystalline Sunways Solar Cell can be processed further with tin-plated copper strips (2 - 2.5 mm x 0.18 mm). These are coated with $10 - 15 \mu m$ Sn (62%), Pb (36%) and Ag (2%). We recommend the use of no clean flux. The solar cells should be preheated to $80 - 150^{\circ}$ C and soldered at a temperature of $250 - 350^{\circ}$ C.

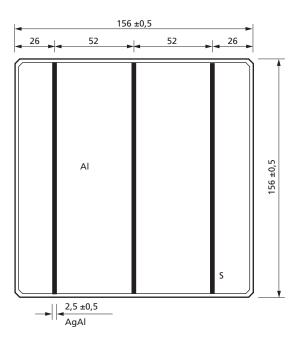
Contact is made via the three continuous busbars on the front of the solar cells with 1.54 */-0.15 mm and with 2.5 */-0.5 mm on the back.

Production and Packing

Each Sunways Solar Cell runs through a mechanical and visual quality check. Then the individual solar cells are classified in closely defined current classes. The classification is carried out according to I ($V_{FIX} = 500 \text{ mV}$). The solar cells are sealed in foil packages of 100 pieces. The foam packing material can hold 2 x 4 packing units (= 800 solar cells) and offers optimum protection for transport.

Metallization drawing





Information and Sales

Sunways AG \cdot Photovoltaic Technology \cdot Macairestraße 3-5 D-78467 Konstanz \cdot Telephone +49 (0)7531 996 77-0 Fax +49 (0)7531 996 77-444 \cdot E-Mail info@sunways.de www.sunways.de



RADOX® SOLAR CABLE SINGLE-CORE





Conductor stranded tin-plated copper, fine wired acc. to IEC 60228, class 5

Insulation RADOX® black

Coating RADOX®, see schedule for colors

General characteristics

Cable made of electron-beam cross-linked insulation and coating; high resistance against heat, cold, oil, abrasion, ozone, UV and weather; with improved reaction in case of fire, low smoke, halogen free, flame retardant; flexible, easy to strip, very low space requirement, extremely mechanically robust, very long lifetime.

Application

Specifically designed for connecting photovoltaic system components inside and outside of buildings and equipment with high mechanical requirements and extreme weather conditions. For permanent installations.

Cross section mm ²	Conductor design n x mm	Conductor diameter rated mm	Cable diameter rated mm	Colour	Weight rated kg/100m	ltem no.
2.5 *	50 x 0.26	2.01 ± 0.05	5.2 ± 0.15	black	4.6	12529714
4.0 *	56 x 0.31	2.54 ± 0.05	5.8 ± 0.15	red	6.6	12545801
4.0 *	56 x 0.31	2.54 ± 0.05	5.8 ± 0.15	blue	6.6	12537896
4.0 *	56 x 0.31	2.54 ± 0.05	5.8 ± 0.15	black	6.6	12545802
6.0 *	81 x 0.31	3.30 ± 0.10	6.9 ± 0.20	black	9.2	12552756
6.0 *	81 x 0.31	3.30 ± 0.10	6.9 ± 0.20	red	9.2	12568182
6.0 *	81 x 0.31	3.30 ± 0.10	6.9 ± 0.20	blue	9.2	12568183
10.0	78 x 0.40	4.30 ± 0.10	8.1 ± 0.15	black	14.4	12537897
16.0	119 x 0.40	5.30 ± 0.10	9.5 ± 0.20	black	21.0	12567377

Selection from range; different sizes and colors on request

^{*}Approvals: TÜV Rheinland design tested, certificate R 02210086

Technical Data	
Voltage Rating	1000V DC or 600/1000V AC
Alternating test voltage	4000V AC (50Hz, 1 min.)
Temperature range	-40°C up to +120°C
Temperature range (TÜV)	-40°C up to +110°C
Max. conductor temperature at short circuit	+280°C (max. 5s)
Min. bending radius	cable diameter < 8mm: 4xD; cable diameter > 8mm: 6xD

Cables have passed the following fire tests:

Vertical flame spread of a single cable IEC 60332-1, EN 50265-2-1 Content of halogen hydracid Omg/g IEC 670754-1, EN50267-2-1 Corrosivity of combustion gases IEC 60754-2, EN 50267-2-3 Smoke density IEC 61034-2, EN 50268-2

SOLAR INVERTER



Sunways Solar Inverter AT 5000, AT 4500, AT 3600 and AT 2700

Thanks to HERIC® topology with innovative FP switching, the new AT Solar Inverters from Sunways achieve a constant yield at changing irradiation levels and temperatures.

And that even across technological limits.

Flexible system planning – thin-film and silicon technology Thanks to its expanded input voltage range from 150 to 680 V, solar inverters of the AT series offer the greatest possible flexibility for planning solar systems. Due to their innovative technology (without a transformer), AT Solar Inverters achieve a constant, consistently high efficiency even with fluctuating DC voltages and different power levels. Negative voltages, which are particularly undesirable with thin-film modules, are eliminated by the HERIC® topology with FP switching.

All-in-one - standard equipment

- · Integrated DC load break cut-out
- · Lighted graphic display and keypad
- · Extensive internal 128 MB data logger
- · Inverter networking via CAN bus
- · Ethernet interface for integration in networks
- · Interface for direct modem connection
- · Active email alerting in case of system faults
- Voltageless alarm relay for the connection of external alarm devices
- · SO pulse output for controlling the Sunways display
- Integrated web server for display and configuration via a web browser



Information and Sales

Sunways AG \cdot Photovoltaic Technology \cdot Macairestraße 3-5 D-78467 Konstanz \cdot Telephone +49 (0)7531 996 77-0 Fax +49 (0)7531 996 77-444 \cdot E-Mail info@sunways.de www.sunways.de

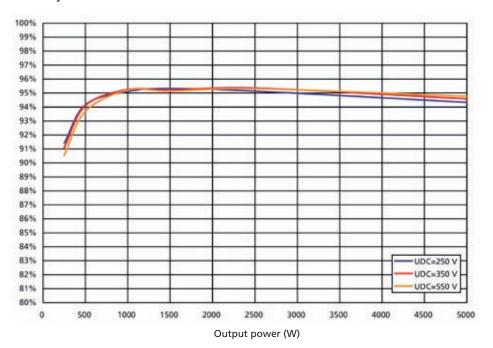


Technical Data of Sunways Solar Inverter AT

	AT 5000	AT 4500	AT 3600	AT 2700
DC Input				
Rated DC power	5200 W	4700 W	3750 W	2800 W
Maximum DC current	22.0 A	22.0 A	15.5 A	15.5 A
Nominal DC voltage	350 V			
MPP voltage range	236 V 600 V	214 V 600 V	242 V 600 V	181 V 600 V
Maximum voltage DC	680 V			
Number of inputs per MPP tracker	2 x Tyco Solarlok			
Number of MPP trackers	1			
AC output				
Rated AC output power	5000 W	4500 W	3600 W	2700 W
Maximum AC power	5000 W	4500 W	3600 W	2700 W
Nominal AC current	21.7 A	19.6 A	15.7 A	11.7 A
Maximum AC current	23.0 A	21.0 A	17.0 A	12.5 A
Nominal frequency	50 Hz			
Frequency tolerance range	47.5 Hz 50.2 Hz	(according to DIN VDE	0126-1-1)	
Grid voltage	230 V			
AC voltage range	-20% +15% (ac	cording to DIN VDE 01	26-1-1)	
Distortion factor at Pn	< 4%	-		
Reactive power factor (cos phi)	ca. 1			
Grid voltage monitoring	according to DIN \	/DE 0126-1-1		
Earth fault protection	_	DIN VDE 0126-1-1)		
Insulation, frequency and DC current monitoring	•	ng to DIN VDE 0126-1-	1	
Required phases, number of grid connections	3 (L1, L2, L3, N, PE)	-		
Number of feed-in phases (230 V single-phase)	1			
Performance				
Stand-by consumption	6.5 W			
Night-time consumption	< 0.06 W			
Maximum efficiency	95.5%	95.5%	95.5%	95.5%
European efficiency	95.0%	95.0%	94.9%	94.7%
MPP efficiency (static)	99.99%	99.99%	99.99%	99.99%
Switching concept	HERIC® / FP topolo	gy, transformerless		
Other				
DC switch	internal, mechanic	al		
Grid-connection fuse layout	25 A	25 A	25 A	16 A
Data interfaces	Ethernet, CAN, RS	485, voltageless alarm	relay, SO pulse output,	modem
Sensor interfaces	irradiation, tempe	rature		
Display	LCD, backlit, 128 x	64 pixels		
Plant supervision	active alarm via e-	mail, integrated web-s	erver, Sunways Commu	nictor, Sunways Porta
IP degree of protection according to IEC 60529	IP 54		•	,
Max. relative humidity	95%			
Cooling	free convection			
Ambient temperature	-25°C 40°C (at fu	ıll load)		
Overload behaviour	working point adj	•		
Dimensions (height x width x depth)	59 x 35 x 21 cm			
Weight	29 kg			
Type of installation	wall installation			
Noise development	< 35 dB (A)			
	5 years (10 / 15 / 20	1 / 25 years)		
Standard warranty (option)				

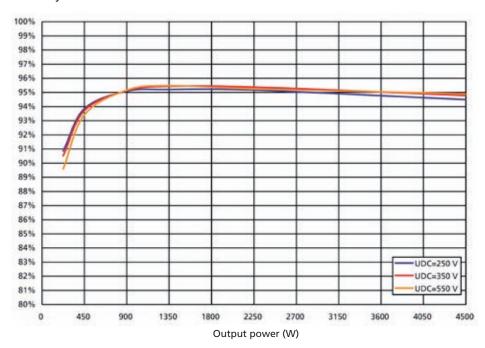
Subject to technical changes, as at 01/2010

Efficiency curve AT 5000



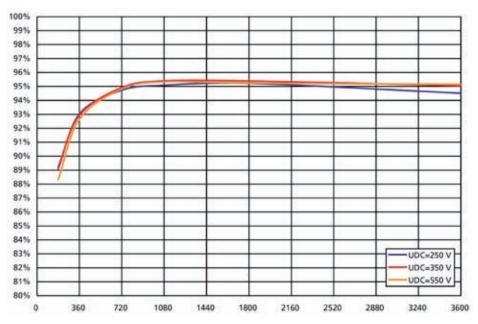
Output power	(%)	5.0	10.0	20.0	30.0	50.0	100.0	Max	Euro
Efficiency	250 V	91.4	94.2	95.1	95.3	95.1	94.3	95.4	94.8
	350 V	91.1	94.1	95.3	95.2	95.4	94.6	95.5	95.0
	550 V	90.5	93.7	95.2	95.1	95.3	9/1 8	95.5	9/1 9

Efficiency curve AT 4500



Output power	(%)	5.0	10.0	20.0	30.0	50.0	100.0	Max	Euro
Efficiency	250 V	90.9	93.9	95.1	95.2	95.2	94.5	95.4	94.8
	350 V	90.5	93.7	95.1	95.4	95.4	94.8	95.5	95.0
	550 V	89.6	93.4	95.2	95.5	95.3	94.9	95.5	94.9

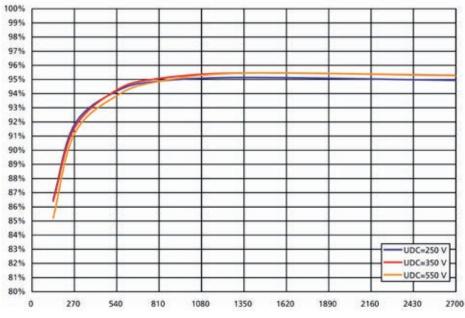
Efficiency curve AT 3600



Output power (W)

Output power	(%)	5.0	10.0	20.0	30.0	50.0	100.0	Max	Euro
Efficiency	250 V	89.1	93.0	94.7	95.1	95.2	94.5	95.3	94.7
	350 V	89.2	92.9	94.9	95.4	95.4	95.1	95.5	94.9
	550 V	88.3	92.6	94.8	95.3	95.2	95.1	95.5	94.8

Efficiency curve AT 2700



Output power (W)

Output power	(%)	5.0	10.0	20.0	30.0	50.0	100.0	Max	Euro
Efficiency	250 V	86.5	91.8	94.2	94.9	95.1	94.9	95.3	94.5
	350 V	86.4	91.6	94.3	95.1	95.5	95.3	95.5	94.7
	550 V	85.2	91.2	93.9	94.9	95.5	95.3	95.5	94.6



Bureau Veritas E&E Product Services GmbH

Businesspark A96 86842 Türkheim Germany + 49 (0) 8245 96810-0 info-tur@de.bureauveritas.com

Certificate of compliance

Applicant:

Sunways AG

Photovoltaic Technology Macairestraße 3 – 5 78467 Konstanz

Germany

Product:

Automatic disconnection device between a generator

and the public low-voltage grid

Model:

AT2700, AT3600, AT4500, AT5000

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with DIN V VDE V 0126-1-1:2006-02 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with insulating function which the distribution network provider can access at any time.

Applied rules and standards:

DIN V VDE V 0126-1-1 (VDE V 0126-1-1):2006-02 and "Generator at the public low-voltage grid, 4th edition 2001, guideline for connection and parallel operation of generators in the public low-voltage grid" with VDN additions (2005) from the German Electricity Association (VDEW) and Association of network operator (VDN).

The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate of valid safety specifications for the specified use in accordance with regulations.

Report number:

06KFS180-VDE0126

Certificate nummer:

U08-155

Date of issue:

2008-09-19

Valid until:

2010-08-29

1. 1.

Andreas Aufmuth



CE Declaration of Conformity

We herewith declare that the following products are in accordance with the provisions of the EMC directive 2004/108/EC and the EC low voltage directive 2006/95/EC as well as the other below-mentioned norms.

Norm	Description of the norm	NT 2500, NT 2600, NT 3700, NT 4000, NT 4200, NT 5000, NT 6000, NT 8000, NT 10000	AT 2700, AT 3600, AT 4500, AT 5000	PT 30k PT 33k
EN 50178:1997 IEC 62103:2003	Electronic equipment for use in power installations	х	х	х
EN 61000-3-2:2008	Limits for harmonic current emissions < 16 A per phase	х	х	
EN 61000-3-3:2006	Limitation of voltage fluctuations and flicker < 16 A per phase	х	х	
EN 61000-3-11:2000	Electromagnetic compatibility (EMC) by equipment > 16 A and < 75 A per phase	х	х	х
EN 61000-3-12:2005	Limits for harmonic currents produced by equipment > 16 A and < 75 A per phase	х	х	х
EN 61000-6-2 :2006	Generic standards – Immunity for industrial environments	х	х	х
EN 61000-6-3:2005	Generic standards – Emission standard for residential, commercial and light-industrial environments	х	х	
EN 61000-6-4:2007	Generic standards – Emission standard for industrial environments	х	х	х
IEC 62109-1:2003	Electrical safety of static inverters and charge controllers for use in photovoltaic (PV) power systems	Х	х	х

Konstanz, 01.01.2009

Place Date Thomas Hauser
PDM Solar Inverter







Kunde: Baumgartner GmbH **Projekt: Solar Decathlon 2010** Siegfried Baumgartner [2.1]

Modulaufbau: VSG

Tvp 1

4 mm ESG Weißglas / PVB / Zellen / PVB / 5 mm ESG

Typ 2 und Typ 3

6 mm TVG Weißglas / PVB / Zellen / PVB / 6 mm TVG

Zellen:

Polykristallin gold T1&T3 3.15 Wp Seitenlänge: 156 mm Monokristallin T2 4,03 Wp Seitenlänge: 156 mm Seitenlänge: 156 mm

Polykr. gold/ bronze T1&T3 3.15 Wp

Ausführung:

Überkopftaugliche Module Typ 2 und Typ 3

- Farbzelle Typ 1 und Typ 3

- Unterschiedliche Farbzellen in einem String Typ 1 und Typ 3

	Zellabstände:	Randabstände	Position Anschlussdosen	Gesamttransparenz
Typ1	7 mm (Breite) 5 mm (Höhe)	62 mm (Breite) 39 mm (Höhe)	Seitlich - lange Seite	16%
Typ2	5 mm (Breite) 10 mm (Höhe)	39 mm (Breite) 102 mm (Höhe)	Seitlich - kurze Seite	23%
Тур3	5 mm (Breite) 10 mm (Höhe)	39 mm (Breite) 108 mm (Höhe)	Seitlich - Kurze und lange Seite	35%

Berechnung Module:

	Breite	Höhe	Fläche	Zellen/Str.	Stränge	Leistung	Listenpreis	Stk.	Gesamtpreis	Gesamtleistung	Fläche	Gewicht/Mod.	Gewicht
Typ1	3.050 mm	1.200 mm	3,7 m ²	18 Stk.	7 Stk.	377,1 Wp	2.230,99 €/Stk.	14	31.233,90 €	5.278,8 Wp	51,2 m ²	79,2 kg	1.108,1 kg
Typ2	1.200 mm	2.518 mm	3,0 m ²	7 Stk.	14 Stk.	375,2 Wp	1.928,93 €/Stk.	12	23.147,10 €	4.502,3 Wp	36,3 m ²	95,6 kg	1.146,7 kg
Тур3	1.200 mm	870 mm	1,0 m ²	7 Stk.	4 Stk.	83,8 Wp	558,08 €/Stk.	14	7.813,18 €	1.173,1 Wp	14,6 m ²	34,7 kg	486,0 kg
							Summe:	40	62.194,18 €	10.954,1 Wp	102,1 m ²		2.740,9 kg

Typ 1: VSG mit Poly gold + Poly bronze

Typ 2: VSG mit Mono

Typ 3: VSG Sondermodul mit Poly gold/bronze

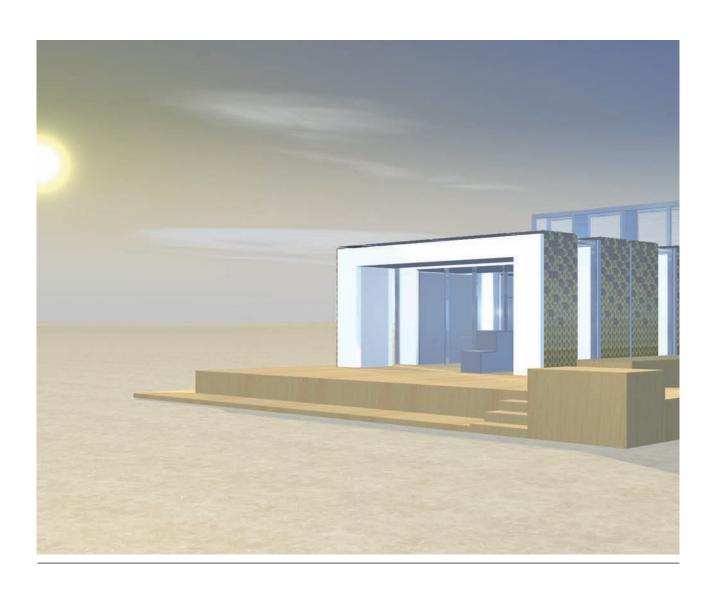
Allgemeine Bedingungen:

- → Preisstellung netto ab Werk Amstetten, ohne Montage, ohne Transportkosten.
- → Lieferzeit ca. 7 Wochen.
- → Ertex Solar darf Bilder der Anlage für Marketingzwecke verwenden.
- → Dieses Angebot ist für 3 Monate gültig.

Technische Information

- → Keine statische Berechnung durchgeführt, nur Vorbemessung zur Preisermittlung.
- → Statische Berechnung hat nach lokalen Normen und Richtlinien zu erfolgen.
- → Montagedetails müssen vor Bestellung abgeklärt werden.
- → Anschlussdetails müssen vor Bestellung abgeklärt werden.

Appendix 2 Structural Calculations

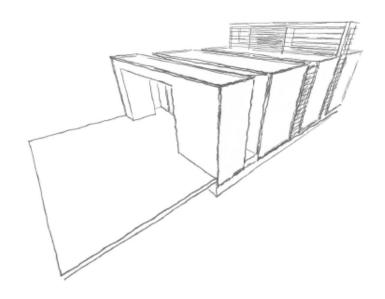






Structural Analysis

Solar Decathlon Europe



1. Statik - Structure Module

Students of the Master Degree in Civil Engineering:

Stephanie Blank

Drazen Dolibasic

Jörg Henning

Jan Hudecek

Lisa Peter

Claudio Porcaro

and

2. Statik - Details

Prof. Dr.-Ing. Heiner Hartmann

(Timberconstruktion, Statik and Stability)





Structural Design

1. Basics:

The construction was designed on the base of the national Building Codes of Germany, on the base of partial safety factors and gy an ultimate limit state design.

If there were more loads by the SDE-Building-Code, the Loads of the SDE-Code were based for design. In all other situations with more loads of the national Code, the national Code of Germany ist based.

In this description, the design bases were listed,

However, a part of this description is also in the project manual of September 2009

In this way, the compliance of the national building codes and , as far as the SD-Building-Code, was countersigned.

The module will be proved as a single, self-supporting load-bearing structure, not being connected to the neighbouring modules. The load of the glass-joints will be distributed in equal parts to the neighbouring modules.

The bracing in the longitudinal axis or in the frame respectively will be ensured by two frames, restrained in every corner. The modules will be built from veneer plywood "Kerto-S".

In the lateral axis or perpendicular to the frame respectively, the structure is braced by the shear walls at the fronts. Those shear walls are manufactured as post-and-beam structures from coniferous wood with OSB-Platten paneling. By symmetrical arrangement of the walls, twisting for the whole system is not to be expected.

The roof loads (superstructure, snow) are transmitted to auxiliary girders, here cross girders, made of coniferous wood. These pass the loads on to the pricipal girders, here frames from Kerto-S. On the bottom of the modules, cross girders are used to accept the loads from dead weight (superstructure, floor covering, etc.) and the imposed load. Those loads are likewise transmitted to the frame.

To obtain a clear load transmission into the soil, the loads are concentrated to four steel footings per frame. Since the modules will be errected on different locations because of the competition, the dimensions of the foundation should be adapted the the respective soil characteristics.



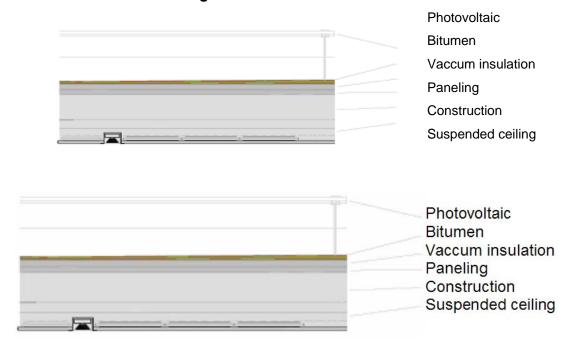


2. Loading Assumption

2.1 Charge of modules (timber structure)

The basis for the structural design is the German Industrial Standard DIN 1055. The modules will be built as timber structures. In the following, the loading assumption will be determined according to the German Industrial Standard DIN 1055, Part 1-5.

2.1.1 Structure and loading



Graph 1: Superstructure of ceiling

2.1.2 Dead loads

a) Permanent load

Turret:

-	Photovoltaic		g _k	$= 0.50 \text{ kN/m}^2$
-	Bitumen		$g_k = 3 \times 0.06$	$= 0.18 \text{ kN/m}^2$
-	Vaccum insulation (6	6.0 cm)	g _k	$= 0.10 \text{ kN/m}^2$
-	Paneling (2.0 cm OS	SB)	$g_k = 2.0x0.06$	$= 0.12 \text{ kN/m}^2$
-	Construction		g _k	$= 0.06 \text{ kN/m}^2$
-	Suspended ceiling		<u>g_k</u>	$= 0.50 \text{ kN/m}^2$
		Total:	g_{k}	$= 1.46 \text{ kN/m}^2$
		Line load:	$g_k = 1.5 \times 2.4$	2= 1.80 kN/m





b) Floor covering:

Floor (4,0 cm)	g_{k}	$= 0.22 \text{ kN/m}^2$
Vapour-proof barrier (single-layer)	g_{k}	$= 0.05 \text{ kN/m}^2$
Vaccum insulation (6.0 cm)	g_{k}	$= 0.10 \text{ kN/m}^2$
Construction	g k	$= 0.10 \text{ kN/m}^2$
Water tank h = 10 cm (incl. lines)	<u>g_k</u>	$= 1.00 \text{ kN/m}^2$
Total:	g_k	$= 1.47 \text{ kN/m}^2$

Line load: $g_k = 1.47 \times 2.4/2 = 1.76 \text{ kN/m}$

2.1.3 Live Loads

The roof area is not accessible; maintenance is only to be conducted when the area is free of snow and after clearing the roof from snow respectively.

a) Category A3 = domestic room, but without sufficient lateral distribution of the loads (wooden beams).

	Residential Areas	German Code DIN 1055	$p = 2.0 \text{ kN/m}^2$
b)	Roof for private Acess	German Code DIN 1055	$p = 1.0 \text{ kN/m}^2$
c)	Area of the Decks	German Code DIN 1055	$p = 5.0 \text{ kN/m}^2$

2.1.4 Snow Loads

a) Roof German Code DIN 1055 Category: $2 s_k = 0,60 \text{ kN/m}^2$ $s = 1,0 \text{ kN/m}^2$

2.1.5 Wind Loads

SDE-Building German Code DIN 1055

Category (Windzone) 1 Midland Flat roof q = 0,5 kN/m²

Simplified value sity processors q = 0.5 kN/m²

Simplified velocity pressure: $q = 0.5 \text{ kN/m}^2$

The wind pressure for the exterior walls acts constantly upon the entire height of the wall. Wind pressure: $wk = 0.8 \times 0.5 \text{ kN/m2} = 0.40 \text{kN/m}^2$

Line load: $wk = 0.4 \times 2.4/2 = 0.48 \text{ kN/m}$

Wind suction: $wk = -0.50 \times 0.5 \text{ kN/m2} = -0.25 \text{kN/m2}$

Line load: $wk = -0.25 \times 2.4/2 = -0.3 \text{ kN/m}$

The height/width ratio of the structure amounts to h/d = 3.6 / 6.8 = 0.5.





Roof:

Geometry (roof): d = 6,80m

b = 2,40m, e/10 = 0,24m, e/2 = 1,20mCoefficient for external pressure on flat roofs:

> Area F: Cpe,10 = -1,8 Area G: Cpe,10 = -1,2 Area H: Cpe,10 = -0,7 Area I: Cpe,10 = -0,6

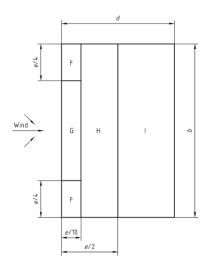
or Area I: $c_{pe,10} = +0,2$

Surface loads:

Area F: $w_k = -1.8 \times 0.5 \text{ kN/m}_2 = -0.90 \text{ kN/m}_2$ Area G: $w_k = -1.2 \times 0.5 \text{ kN/m}_2 = -0.60 \text{ kN/m}_2$ Area H: $w_k = -0.7 \times 0.5 \text{ kN/m}_2 = -0.35 \text{ kN/m}_2$ Area I: $w_k = -0.6 \times 0.5 \text{ kN/m}_2 = -0.30 \text{ kN/m}_2$ or Area I: $w_k = 0.2 \times 0.5 \text{ kN/m}_2 = +0.10 \text{ kN/m}_2$

Line loads:

Area F: w_k = -0,90 kN/m₂ x 2,40/2 = - 1,08 kN/m Area G: w_k = -0,60 kN/m₂ x 2,40/2 = - 0,72 kN/m Area H: w_k = -0,35 kN/m₂ x 2,40/2 = - 0,42 kN/m Area I: w_k = -0,30 kN/m₂ x 2,40/2 = - 0,36 kN/m or Area I: w_k = +0,10 kN/m₂ x 2,40/2 = +0,12 kN/m



Glass-joints

The glass elements have a width of 80cm and will be fixed laterally to the timber modules in the roof areas. The glass joints act as superimposed loads to the timber modules. Identical surface loads will be used. The load of the floor construction is transmitted to the ground through distinct supports.

The line loads result from a respective width of 0.80m/2 for the every wooden frame.

2.1.6 Horizontal forces

Based on SD-Building-Code, al force of 1,6 kN/m in the hight of 1,20 m was the base for design the handrails and the colums for the handrails





3. Safety factors

3.1 Safety factors of material

The German Code DIN 1052:2008 an all other national codes are based on the partial safety factors for Strength of material und by a design of an ultimate limit state design.

material	Code	factor
- concrete	DIN 1045	1,5
- Steel	DIN 68 800	1,1
- Timber	DIN 1052:2008	1,3

3.2 Safety factors of Loads and actions

According zu DIN 1055: 100 an EC 1, the national codes based on the following safety factors:

- Dead loads	γg	= 1,35
- Imposed load	γg	= 1,50
- Wind- and Snow loads	γ _{s,w}	= 1,50

3.3 Load combination

Die Load combinations are according zu DIN 1055 – 100 and EC-1 and based on the probabilistic factors of combinations.

$$E_{d} = E\left\{ \sum_{j \geq 1} \gamma_{G,j} \cdot G_{k,j} \oplus 1,35 \cdot \sum_{i \geq 1} Q_{k,i} \right\}$$





4. Description of materials

4.1 Allocation of material

Column: veneer plywood, Kerto®-S
Cross-frame member: veneer plywood, Kerto®-S
Exterior wall: veneer plywood, Kerto®-Q

(Properties of Kerto® see next chapter)

Cross girders (floor): Finnjoist = FJI (veneer plywood in flange and OSB

Properties of FJI: Low dead weight, high dimensional stability, no rupture

and twisting, reduction of thermal bridges due to thin web.

Cross girders (roof): KVH (structured solid timber)

Properties of KVH: Technically dehumidified and calibrated, dimensionally

stable

Floor slab: OSB
Top slab: OSB
Panelling: OSB

Slats: veneer plywood steel footings

5. Fundation

First, the construction and also die foundations-plates were planed according National Code DIN 1053 with a pressure strains of 250 kN/m² = 2,5 kg/cm²

In the next Step, the foundation-plates werde dimensioned according to SD- Building-Code for a pressure strains of 0,5 kg/cm² = 50 kN/m²

Stuttgart, 24.03.2010

Prof. Dr. Heiner Hartmann

Civil Engenieer, HFT-Stuttgart

Table of contents

2	Justi	fication	2
3	Desc	ription of materials	3
	3.1	Allocation of material	3
	3.2	Properties of Kerto®-S	4
4	Load	ling Assumption	7
	4.1	Loading of modules (timber structure)	7
	4.1.1	Preliminary consideration	7
	4.1.2	Structure and loading	7
	4.1.3	Loading	7
	4.2	Loading of glass-joints	.11
	4.2.1	Preliminary consideration	.11
	4.2.2	Loading	.11
	4.2.3	Total loading	.12
5	Calc	ulations and structural design	.13
	5.1	Structural design of the timber frame	.13
	5.2	EDP-prinouts	.14
	5.3	Concept and structural design of the connection	.23
	5.4	Determination of the preload force required	.24
	5.5	Analysis in the section between cross-frame member and column (top)	.25
	5.6	Analysis of pressing under the steel profile	.25
	5.7	Analysis in the section between cross-frame member and column (bottom)	.26
	5.8	Pre-dimensioning of prestressing steel	.27
	5.9	Analysis of buckling for the column (equivalent bar method)	.28
	5.10	Analysis of enlargement in the cross section at the bottom cross-frame member	.29
	5.11	Pre-dimensioning of cross girders	.30
	5.11	1 Deformation for the top cross-frame member	.30
6	Fire	resistance justification	.31

2 Justification

Advantages of selected structure:

- Simple and clear load bearing
- Practicable fabrication and connections, e.g. cross girders to cross-frame member
- The cross-frame members do not have to be pierced and a sufficient height is available because of the glass joints → use the height since it is favourable concerning
- Bearing structure is not too complex → is not visible when not wanted
- Important saving in weight compared to other material (steel, concrete, ...) → saving in transportation- and material costs
- Due to the rigid structure, the deformation at midspan is lower because of redistribution of corner moments
- Inner walls are solid (due to transportation and stability) but exterior walls can be composed

02/02/2010

3 Description of materials

3.1 Allocation of material

The complete report based on the structurally evaluation with the veneer plywood from Finnforest "kerto Q and kerto S". In our dealings of the material floating for tenders have we performed at the postion veneer plywood this product or a equivalent product. Our construction will be built this the veneer plywood from Steico "ultralam X and R". This product has be the some or better properties. The product kerto Q replaced by ultralam X and kerto S replaced by ultralam R.

Column: veneer plywood, Kerto[®]-S
Cross-frame member: <u>veneer plywood, Kerto</u>[®]-S
Exterior wall: veneer plywood, Kerto[®]-Q

(Properties of Kerto® see next chapter)

Cross girders (floor): Finnjoist = FJI (veneer plywood in flange and OSB in web)

Properties of FJI:

Low dead weight, high dimensional stability, no rupture and

twisting, reduction of thermal bridges due to thin web.

Cross girders (roof): KVH (structured solid timber)

Properties of KVH:

Technically dehumidified and calibrated, dimensionally stable

Floor slab: OSB
Top slab: OSB
Panelling: OSB

Slats: veneer plywood

Bearing: steel footings

Sub-structure: timber beams with OSB-panels for bracing

3.2 Properties of Kerto®-S

Kerto[®]-S has been chosen as material, since it shows the best properties for the required dimensions and the existing system. The mechanical strength is significantly higher than for conventional timber material.

Data supplied by the manufacturer (source: www.kerto.de):

"Kerto®-S can be used as beams and columns in most diverse structures. In conventional constructions, it provides the ideal solution for beam reinforcement. The material shows completely new constructional possibilities for complex structures like wide span structures or high-stressed or special buildings. One notable feature of Kerto®-S is that the grains run longitudinally through all the layers."

In accordance with the permit, Kerto[®]-S can be manufactured in the following dimensions:

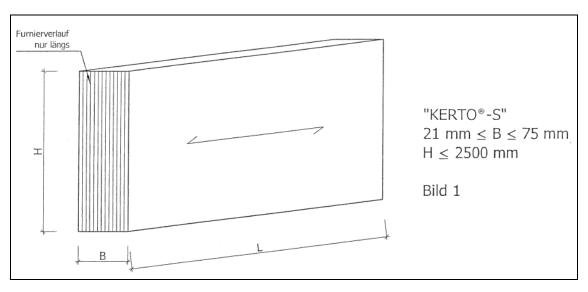


Figure 1: Available cross-sectional dimensions of Kerto®-S (Extract from permit)

For reasons of stability of the frame girder, the maximum width is defined as B=75 mm. The dimensions for the columns are defined as follows:

• H/B/L = 60 cm / 7.5 cm / 250 cm

The height of the cross-frame member will be determined in the preliminary structural measurement, which has been accomplished by the use of RSTAB (software).

Für die erforderlichen Abminderungen bei der Bemessung von Verbindungsmitteln in den Schmalflächen von "KERTO®"-Fumierschichtholz gelten die Bestimmungen des Abschnitts 3.1.5 sinngemäß.

<u>Tabelle 3:</u> Charakteristische Festigkeits- und Steifigkeitskennwerte in MN/m² und charakteristische Rohdichtekennwerte in kg/m³ für "KERTO®"-Furnierschichtholz

Art der Beanspruchung (siehe auch Anlage 6) Nenndicke in mm		Furnierschichtholz	Furnierschichtholz		
		"KERTO [®] -S"	"KERT	"KERTO®-Q"	
		21 ≤ B ≤ 75	21 ≤ B ≤ 24	27 ≤ B ≤ 69	
		Festigkeitskennwerte			
Plattenbeanspruchun	g				
Biegung II zur Faser ¹	f _{m,0,k}	50	32	36	
Biegung ⊥ zur Faser	f _{m,90,k}	•	9,0 2	9,0	
Druck	f _{c,90,k}	2,0	2,0		
Schub	f _{v,k}	2,3	1,5		
Scheibenbeanspruch	ung		1		
Biegung ¹	f _{m,k}	48	32	36	
Zug II zur Faser	f _{t,0,k}	38	20	27	
Zug ⊥ zur Faser	f _{t,90,k}	0,8	6,0		
Druck II zur Faser	f _{c,0,k}	38	20	27	
Druck ⊥ zur Faser	f _{c,90,k}	6,0	9,0		
Schub	f _{v,k}	4,4	4,	4,8	
Ausklinkung	k _n	6,0	1	16	
		Steifigkeitskennwerte			
Elastizitätsmodul	E _{0,mean}	13800	10000	10500	
Elastizitätsmodul	E _{0,05}	11600	8500		
Elastizitätsmodul	E _{90,mean}	300	1000 ²	2500	
Schubmodul	G _{mean}	500	50	500	
Rohdichtekennwerte i	n kg/m³				
Rohdichte	Pk	480	480		

H ist die für die jeweilige Biegebeanspruchung maßgebende Höhe des Gesamtquerschnitts nach Anlagen 3, 4 und 5 in mm.

14

Deutsches Institut für Bautechnik

31140.04

Figure 2: Extract from permit

5

 $^{^2}$ Für B = 21 mm und den Furnieraufbau I-III-I darf $f_{m,90,k}$ = 16 N/mm 2 bzw. $E_{90,mean}$ = 2500 N/mm 2 angenommen werden.

Die charakteristischen Werte für Biegung, Zug und Druck unter dem Winkel α (Winkel zwischen der Faser richtung der Deckschicht und der Beanspruchungsrichtung) sind im gleichen Verhältnis wie bei den zuläss gen Spannungen in Tabelle 1, Fußnote 3, abzumindern.

Design values of the material's characteristics were evaluated and used for the computer calculation to determine the level of material use:

Partial safety factor for material: $\gamma_M = 1.3$

- Load duration (KLED): medium; service class 1 (heated and indoors) $\rightarrow k_{mod} = 0.8$
- Design values of strength coefficients in the plane of the panel:

•
$$f_{m,d} = k_{mod} x f_{m,k} / \gamma_m = 0.8 x 4.8 / 1.3 = 2.95 \text{ kN/cm}^2$$

•
$$f_{t,0,d} = k_{mod} x f_{t,0,k} / \gamma_m = 0.8 x 3.8 / 1.3 = 2.34 kN/cm^2$$

•
$$f_{c,0,d} = k_{mod} x f_{c,0,k} / \gamma_m = 0.8 x 3.8 / 1.3 = 2.34 kN/cm^2$$

•
$$f_{c,90,d} = k_{mod} x f_{c,90,k} / \gamma_m = 0.8 x 0.6 / 1.3 = 0.34 kN/cm^2$$

•
$$f_{v,d} = k_{mod} x f_{v,k} / \gamma_m = 0.8 \times 0.44 / 1.3 = 0.27 \text{ kN/cm}^2$$

- $E_{0,mean} = 1380 \text{ kN/cm}^2$
- $G_{mean} = 50 \text{ kN/cm}^2$

4 Loading Assumption

4.1 Loading of modules (timber structure)

4.1.1 Preliminary consideration

The modules with the dimension of l/b/h = 6.78m/2.40m/3.59m are designed as entirely restrained frames with cross girders.

The dimensions of the cross-frame member amount to b/h = 8/300cm, the cross girders have dimensions of b/h = 10/12cm. The load-bearing structure of the bottom resembles generally the basic structure of the cross girders in the ceiling.

The basis for the structural design is the German Industrial Standard DIN 1055.

4.1.2 Structure and loading

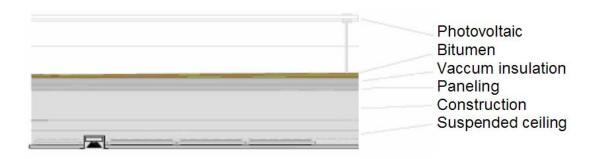


Figure 3: Superstructure of ceiling

4.1.3 Loading

a) Permanent load

Turret:

-	Photovoltaic	g_{k}	$= 0,50 \text{ kN/m}^2$
-	Bitumen	$g_k = 3 \times 0,06$	$= 0.18 \text{ kN/m}^2$
-	Vacuum insulation (6.0 cm)	g _k	$= 0,10 \text{ kN/m}^2$
-	Panelling (2.0 cm OSB)	$g_k = 2,0x0,06$	$= 0,12 \text{ kN/m}^2$
-	Construction	g _k	$= 0.06 \text{ kN/m}^2$
-	Suspended ceiling	<u>q</u> k	$= 0.50 \text{ kN/m}^2$

Total: $g_k = 1,46 \text{ kN/m}^2$

Line load: $g_k = 1.5 \times 2.4/2 = 1.80 \text{ kN/m}$

02/02/2010

Floor construction:

Floor (4,0 cm)	g_k	$= 0.22 \text{ kN/m}^2$
Vapour-proof barrier (single-layer)	g_{k}	$= 0.05 \text{ kN/m}^2$
Vacuum insulation (6,0 cm)	g_{k}	$= 0,10 \text{ kN/m}^2$
Construction	g_k	$= 0,10 \text{ kN/m}^2$
Water tank h = 10 cm (incl. lines)	<u>g_k</u>	$= 1,00 \text{ kN/m}^2$
Total:	q_k	$= 1,47 \text{ kN/m}^2$

Line load: $g_k = 1,47 \times 2,4/2 = 1,76 \text{ kN/m}$

b) Variable load

Live load:

Roof:

The roof area is not accessible; maintenance is only to be conducted when the area is free of snow and after clearing the roof from snow respectively.

Floor:

Category A3 = domestic room, but without sufficient lateral distribution of the loads (wooden beams).

 $q_k = 2,00kN/m^2$

Line load: $q_k = 2,00 \times 2,40/2 = 2,40 \text{kN/m}$

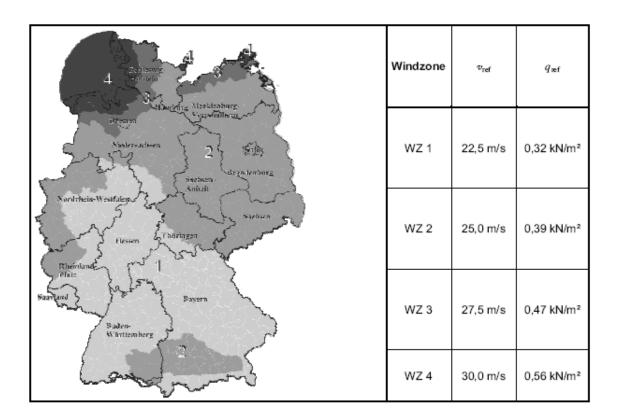
Snow load:

Category: 2 $s_k = 0.60 \text{ kN/m}^2$

Line load: $s_k = 0.60 \times 2.40/2 = 0.72 \text{ kN/m}$

Wind load (Stuttgart):

- Category (Windzone) 1
- Midland
- Flat roof



Simplified velocity pressure: $q = 0.50 \text{ kN/m}^2$

• Sidewall area:

The wind pressure for the exterior walls acts constantly upon the entire height of the wall.

Wind pressure: $w_k = 0.8 \times 0.5 \text{ kN/m}^2 = 0.40 \text{kN/m}^2$ Line load: $w_k = 0.4 \times 2.4/2 = 0.48 \text{ kN/m}$

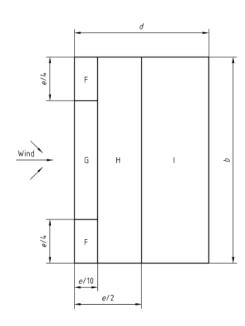
Wind suction: $w_k = -0.50 \times 0.5 \text{ kN/m}^2 = -0.25 \text{kN/m}^2$

Line load: $w_k = -0.25 \times 2.4/2 = -0.3 \text{ kN/m}$

The height/width ratio of the structure amounts to h/d = 3.6 / 6.8 = 0.5.

02/02/2010

Roof:



Geometry (roof):

d = 6,80m b = 2,40m e/10 = 0,24me/2 = 1,20m

Coefficient for external pressure on flat roofs:

Area F: $c_{pe.10} = -1.8$

Area G: $c_{pe,10} = -1,2$

Area H: $c_{pe,10} = -0.7$

Area I: $c_{pe,10} = -0.6$

or Area I: $c_{pe.10} = +0.2$

Surface loads:

Area F: $W_k = -1.8 \times 0.5 \text{ kN/m}^2 = -0.90 \text{ kN/m}^2$

Area G: $w_k = -1.2 \times 0.5 \text{ kN/m}^2 = -0.60 \text{ kN/m}^2$

Area H: $w_k = -0.7 \times 0.5 \text{ kN/m}^2 = -0.35 \text{ kN/m}^2$

Area I: $w_k = -0.6 \times 0.5 \text{ kN/m}^2 = -0.30 \text{ kN/m}^2$

or Area I: $w_k = 0.2 \times 0.5 \text{ kN/m}^2 = +0.10 \text{ kN/m}^2$

Line loads:

Area F: $w_k = -0.90 \text{ kN/m}^2 \text{ x } 2.40/2 = -1.08 \text{ kN/m}$

Area G: $w_k = -0.60 \text{ kN/m}^2 \text{ x } 2.40/2 = -0.72 \text{ kN/m}$

Area H: $w_k = -0.35 \text{ kN/m}^2 \text{ x } 2.40/2 = -0.42 \text{ kN/m}$

Area I: $w_k = -0.30 \text{ kN/m}^2 \text{ x } 2.40/2 = -0.36 \text{ kN/m}$

or Area I: $w_k = +0.10 \text{ kN/m}^2 \text{ x } 2,40/2 = +0.12 \text{ kN/m}$

4.2 Loading of glass-joints

4.2.1 Preliminary consideration

The glass elements have a width of 80cm and will be fixed laterally to the timber modules in the roof areas. The glass joints act as superimposed loads to the timber modules. Identical surface loads will be used. The load of the floor construction is transmitted to the ground through distinct supports.

The line loads result from a respective width of 0.80m/2 for the every wooden frame.

4.2.2 Loading

a) Permanent load:

Dead weight: $g_k = 25 \times 5 \times 0,006 \times 0,80/2 = 0,30 \text{ kN/m}$

b) Variable load:

Snow load:

Line load: $s_k = 0.6 \times 0.8/2 = 0.24 \text{ kN/m}$

Wind loading:

Line load on roof:

Area F: $w_k = -0.90 \text{ kN/m}^2 \times 0.80/2 = -0.36 \text{ kN/m}$ Area G: $w_k = -0.60 \text{ kN/m}^2 \times 0.80/2 = -0.24 \text{ kN/m}$ Area H: $w_k = -0.35 \text{ kN/m}^2 \times 0.80/2 = -0.14 \text{ kN/m}$ Area I: $w_k = -0.30 \text{ kN/m}^2 \times 0.80/2 = -0.12 \text{ kN/m}$ Area I: $w_k = +0.10 \text{ kN/m}^2 \times 0.80/2 = +0.04 \text{ kN/m}$

Line load on walls:

or

The wind pressure for the exterior walls acts constantly upon the entire height of the wall.

Wind pressure: $w_k = 0.4 \times 0.8/2 = 0.16 \text{ kN/m}$ Wind suction: $w_k = -0.25 \times 0.8/2 = -0.10 \text{ kN/m}$

4.2.3 Total loading

By superposition, the loads of the timber modules and the glass joints amount to the total loading of the frames.

a) Permanent load:

Dead weight: $g_k = 1,80 \text{ kN/m} + 0,30 \text{ kN/m} = 2,10 \text{ kN/m}$

b) Variable load:

Snow load:

Line load: $s_k = 0.72 \text{ kN/m} + 0.24 \text{ kN/m} = 0.96 \text{ kN/m}$

Wind loading:

Line load on roof:

	Area F:	$\sum w_k = -1,08 \text{ kN/m} - 0,36 \text{ kN/m} = -1,44 \text{ kN/m}$
	Area G:	$\sum w_k = -0.72 \text{ kN/m} - 0.24 \text{ kN/m} = -0.96 \text{ kN/m}$
	Area H:	$\sum w_k = -0.42 \text{ kN/m} - 0.14 \text{ kN/m} = -0.56 \text{ kN/m}$
	Area I:	$\sum w_k = -0.36 \text{ kN/m} - 0.12 \text{ kN/m} = -0.48 \text{ kN/m}$
or	Area I:	$\sum w_k = +0.12 \text{ kN/m} +0.04 \text{ kN/m} = +0.16 \text{ kN/m}$

Line load on walls:

Wind pressure: $w_k = 0.48 \text{ kN/m} + 0.16 \text{ kN/m} = 0.64 \text{ kN/m}$ Wind suction: $w_k = -0.30 \text{ kN/m} - 0.10 \text{ kN/m} = -0.40 \text{ kN/m}$

c) Design values

• All unfavourable variable influences are considered:

$$E_{d} = E\left\{ \sum_{j \geq 1} \gamma_{G,j} \cdot G_{k,j} \oplus 1,35 \cdot \sum_{i \geq 1} Q_{k,i} \right\}$$

5 Calculations and structural design

5.1 Structural design of the timber frame

The load-bearing capacity for the cross-frame member will not be proven in detail, since the level of material use is very low (see Figure 13). Every other necessary proof which has to be provided is constituted in the following.

The calculations are based on the following dimensions.

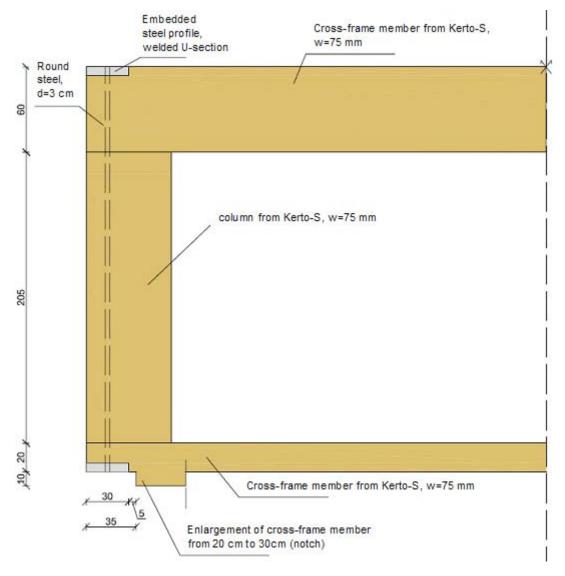


Figure 4: Front view of frame

The static system for computer calculations consists of a frame which is clamped on all around. The values of strength of Kerto[®]-S have been entered into the EDP-program to show the level of material use.

5.2 EDP-prinouts

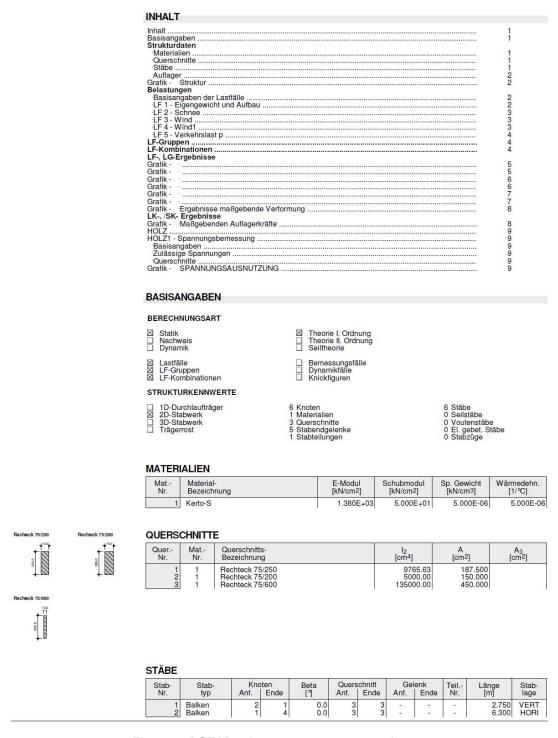


Figure 5: RSTAB-printout, page 1 – system input

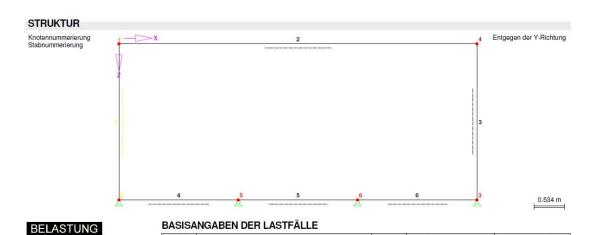


2,3,5,6 Gelenkig

Gelenkig

LF-Nr.

LF-Bezeichnung



0.0

0.0

0.0 Ja

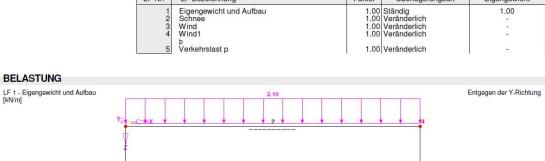
0.0 Ja

Faktor

Ja

Ja

Überlagerungsart



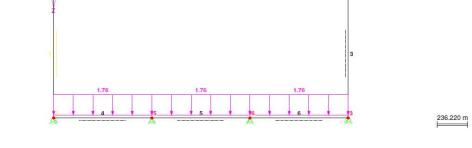


Figure 6: RSTAB-printout, page 2 – system input and load pattern

Stab-lage

VERT HORI HORI HORI

Nein

Eigengewicht

1.00

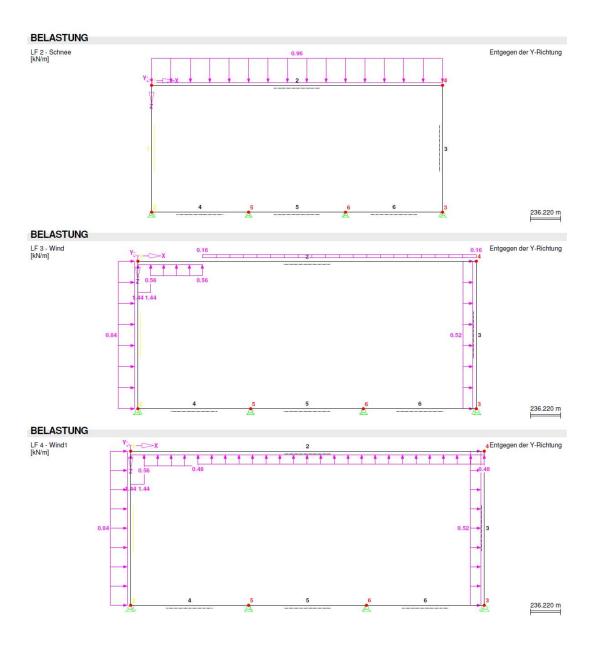


Figure 7: RSTAB-printout, page 3 – load pattern

02/02/2010

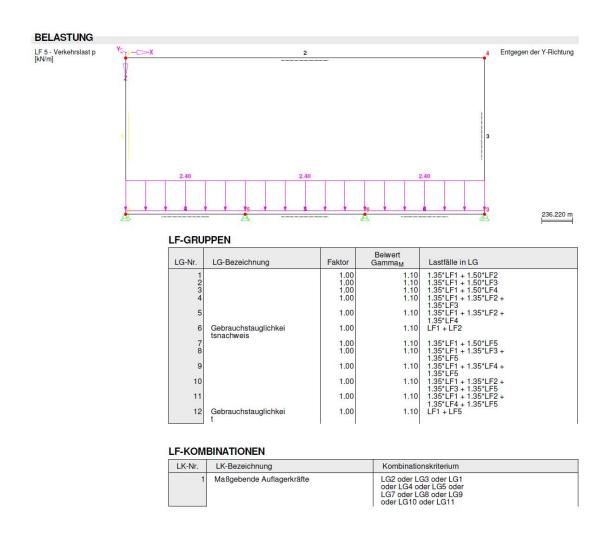
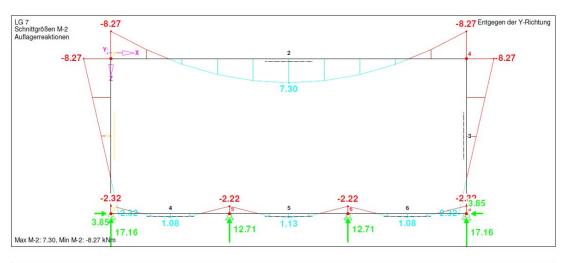


Figure 8: RSTAB-printout, page 4 – load pattern and load groups



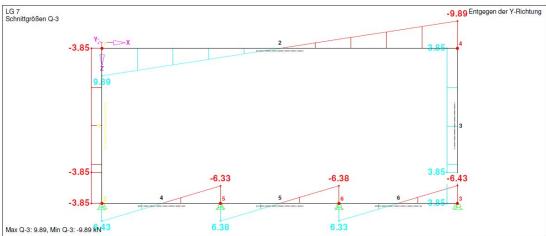
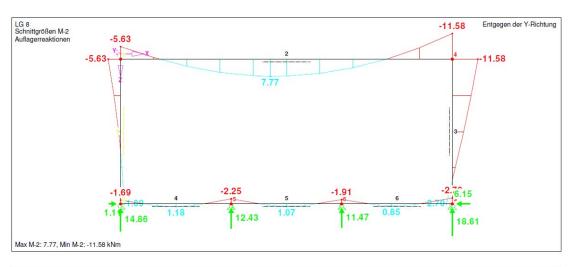


Figure 9: RSTAB-printout, page 5 – critical internal forces for load group 7



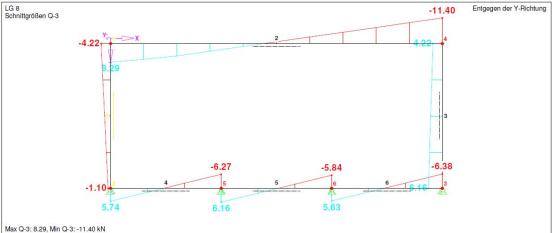
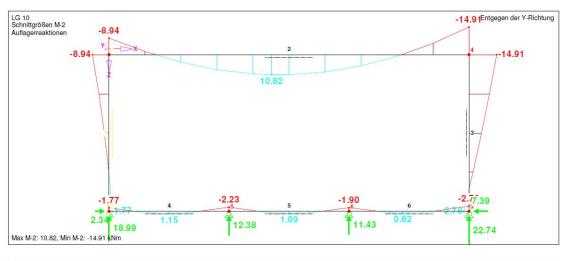


Figure 10: RSTAB-printout, page 6 – critical internal forces for load group 8



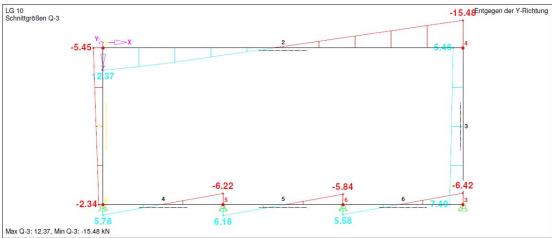


Figure 11: RSTAB-printout, page 7 – critical internal forces for load group 10



Figure 12: RSTAB-printout, page 8 – critical deformation and bearing reaction

BASISANGABEN

ZU BEMESSENDE STÄBE Alle

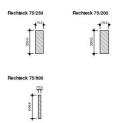
Alle

ZU BEMESSENDE LASTFÄLLE
LF1 - Eigengewicht und Aufbau
LG1 - 1.35°LF1 + 1.50°LF2
LF2 - Schnee
LG2 - 1.35°LF1 + 1.50°LF3
LF3 - Wind
LG3 - 1.35°LF1 + 1.50°LF4
LF4 - Wind1
LG4 - 1.35°LF1 + 1.35°LF2 + 1.35°LF3
LF5 - Verkehrslast p
LG5 - 1.35°LF1 + 1.35°LF2 + 1.35°LF4
LG6 - Gebrauchstauglichkeitsnachweis
LG7 - 1.35°LF1 + 1.50°LF5
LG9 - 1.35°LF1 + 1.50°LF5
LG9 - 1.35°LF1 + 1.55°LF5
LG9 - 1.35°LF1 + 1.35°LF4 + 1.35°LF5
LG9 - 1.35°LF1 + 1.35°LF4 + 1.35°LF5
LG10 - 1.35°LF1 + 1.35°LF2 + 1.35°LF3 + 1.35°LF5
LG11 - 1.35°LF1 + 1.35°LF2 + 1.35°LF3 + 1.35°LF5
LG12 - Gebrauchstauglichkeit (Nutzlast)

ANGABEN ZUM STABILITÄTSNACHWEIS Nach Omega-Verfahren Maximal möglicher Schlankheitsgrad Lambda: Ausknicken aus der Ebene möglich:

ZULÄSSIGE SPANNUNGEN

Mat	Material-	Zulässige Spannungen [kN/cm^2]					
Nr.	Bezeichnung	Sigma-Bie	Sigma-Zug	Sigma-Druck	Tau-Schub	Tau-Torsion	
1	Kerto-S	2.95	2.34	2.34	0.27	0.00	



QUERSCHNITTE

Quer Nr.	Mat Nr.	Querschnittsbezeichnung Querschnittsdrehung	I-T [cm^4] A [cm^2]	I-2 [cm^4] Alpha pl. y	I-3 [cm^4] Alpha pl. z
1	1	Rechteck 75/250	2851.62 187.50	9765.63 1.00	
2	1	Rechteck 75/200	2149.13 150.00	5000.00 1.00	703.13 1.00
3	1	Rechteck 75/600	7773.06 450.00	135000.03 1.00	

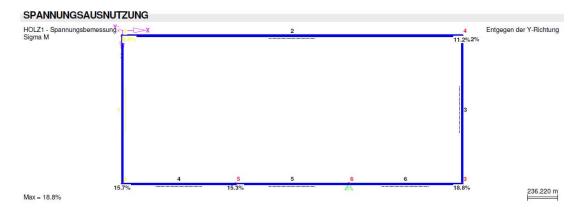


Figure 13: RSTAB-printout, page 9 – level of material use

5.3 Concept and structural design of the connection between crossframe member and column

To connect the column (bottom and top end) to the cross-frame member a connection by means of a prestressed, full length steel bar is considered. Thereby, the lifting tractive forces resulting from the corner moments will be overpressurised. A rigid connection is formed. From computer calculations, the leading internal forces regarding the corner moments and therefore for the connection at the top of the cross-frame member for load group 10 amount to:

$$M_{Ed} = -14,91 \text{ kNm}$$

 $N_{Ed} = -16,32 \text{ kN}$

It is assumed that by prestressing the steel bar, the connection is rigid and substantially nondeformable. Therefore the stress distribution is linear.

The following stresses result for the structural design of the connection:

$$\sigma_1 = -(16,32 / 60 \cdot 7,5) - (14,91 \cdot 100 / (60^2 \cdot 7,5/6)) = -0,37 \text{ kN/cm}^2$$

 $\sigma_2 = -(16,32 / 60 \cdot 7,5) + (14,91 \cdot 100 / (60^2 \cdot 7,5/6)) = +0,30 \text{ kN/cm}^2$

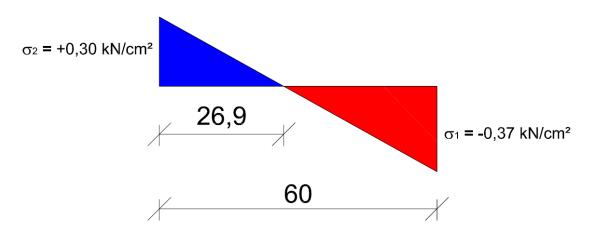


Figure 14: Stress distribution for determining the preload force required from LG 10

0,30 kN/cm² have to be overpressurised by the prestressing. To introduce the prestressing forces as efficiently as possible, the prestressing steel bar will be integrated in the tensile stressed part of the cross-section.

A welded U-section made of steel will be embedded in the cross-frame member to initiate the load to the whole tensile area.

The length of the U-section should be at least as long as the tensile stressed cross-section area.

According to the intercept theorems, the length can be calculated:

$$\frac{0,30}{0,30 + |-0,37|} = \frac{x}{60} \rightarrow x = 26,9 \text{ cm}$$

The length of the steel profile has been determined to 30 cm. The prestressing steel bar will be built into the middle of the profile.

For determination of the height of the embedded steel section, a standard length of load distribution of 2,5 x t is assumed.

req.
$$t = (30 / 2) / 2,5 = 6 cm$$

5.4 Determination of the preload force required

The tensile force resulting from the critical corner moment (LG 10) has to be completely overpressurised. Hence the preload force has to create a compressive stress of σ = 0,30 kN/cm² in the section between cross-frame member and column (see stress distribution in Figure 14). In consideration of the eccentricity of the prestressing force (see below), it is calculated to:

$$\sigma = N / A + N x e / W$$
 0,30 kN/cm² = N_{prestress} / (60 cm x 7,5 cm) + N_{prestress} x 15 cm x 6 / (60² x 7,5 cm) N_{prestress} = 0,30 / (1 / (60 x 7,5) + 15 x 6 / (60² x 7,5)) = 54,0 kN

The preload force spreads in the cross-frame member at an angle of 45°. At a height of the cross-frame member of 60 cm, the whole cut surface is stressed. The eccentrically introduced preload force gives a lever arm on the center of gravity of:

$$e = 60 \text{ cm} / 2 - 30 \text{ cm} / 2 = 15 \text{ cm}$$

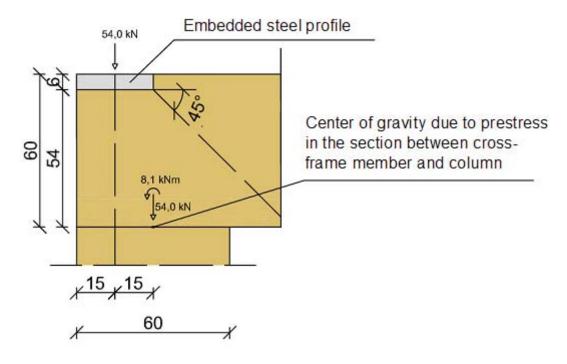


Figure 15: sketch of connection and applied forces due to prestressing

The outcome of this is the distribution of stresses due to prestressing in the section between cross-frame member and column:

02/02/2010

$$\sigma_1 = \frac{-54,0}{60,0 \cdot 7,5} + \frac{54,0 \cdot 15,0}{7,5 \cdot 60,0^2} \cdot 6 = +0,06kN / cm^2$$

$$\sigma_2 = \frac{-54,0}{60,0 \cdot 7,5} + \frac{-54,0 \cdot 15,0}{7,5 \cdot 60,0^2} \cdot 6 = -0,30kN / cm^2$$

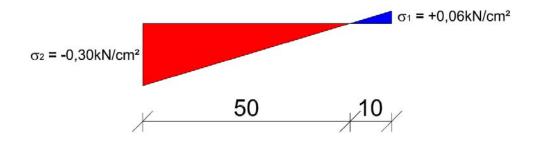


Figure 16: Stress distribution due to prestressing in the section between cross-frame member and column

5.5 Analysis in the section between cross-frame member and column (top)

The preload force always overpressurises the tensile stress due to the corner moment. A gaping fissure cannot occur.

The maximum compressive stresses in this section would result from load case "prestress + min. external loading". These values would never exceed the value due to prestress alone $(\sigma_2 = 0.30 \text{ kN/cm}^2)$. Therefore, those values don't have to be proven $(f_{c,90,d} = 0.34 \text{ kN/cm}^2)$. Considering the load groups, it can be seen that no positive corner moment will arise, e.g. due to wind load.

According to a stress distribution describing the transmission of corner moments, the stress in the compression zone is determined as follows:

$$\sigma_{c,90,d}$$
 = - 0,37 kN/cm²

From the stress distribution due to prestress, the tensile stress in this area amounts to: $\sigma_1 = +0.06 \text{ kN/cm}^2$

Structural analysis:
$$\frac{\sigma_{c,90,d}}{k_{c,90,d} \cdot f_{c,90,d}} = \frac{-0.37 + 0.06}{1.25 \cdot 0.34} = 0.73 \le 1.0$$

The factor $k_{c,90}$ has a positive impact and therefore is conservatively set to $k_{c,90} = 1,25$. Tensile stresses to be anchored in this area can thus be excluded.

5.6 Analysis of pressing under the steel profile

Under the steel profile, compressive forces due to prestressing arise. Additional forces in the prestressing steel occur due to external loading. These forces have to be anchored and generate additional pressing.

Conservatively, the compressive force due to prestressing and the tensile force due to full load have been added up. From the total amount, the resulting compressive force for the pressing has been determined.

Compression rectangular to the direction of grains (cross-frame member):

$$A_{ef} = b (I + 3.0 cm) = 7.5 (30 + 3.0) = 247.5 cm^{2}$$

$$N = N_{prestress} + N_{tension} = 54.0 + 0.30 \times 26.9 \times 7.5 / 2 = 84.3 \text{ kN}$$

$$\sigma_{\text{c,90,d}} = N_{\text{prestress}}$$
 / $A_{\text{ef}} = 84.3$ / $247.5 = 0.34 \text{ kN/cm}^2$

Conservatively: $k_{c,90} = 1,25$

 $f_{c,90,d} = 0.34 \text{ kN/cm}^2$

Analysis:
$$\frac{\sigma_{c,90,d}}{k_{c,90,d} \cdot f_{c,90,d}} = \frac{0,34}{1,25 \cdot 0,34} = 0,8 \le 1,0 \ \to \text{proven!}$$

5.7 Analysis in the section between cross-frame member and column (bottom)

At the bottom cross-frame member, an opening moment arises (load group 8).

Internal forces:

$$M_{Ed} = 2,70 \text{ kNm}$$

$$N_{Ed} = -12,23 \text{ kN}$$

The lower connection point looks like follows:

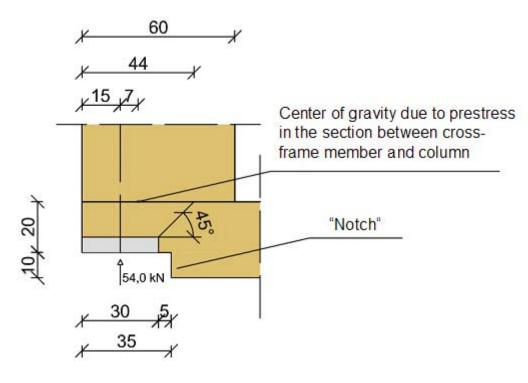


Figure 17: Section bottom cross-frame member - column

Stresses decisive for the structural design of the connection:

$$\sigma_1 = -(12,23 / 60 \cdot 7,5) + (2,7 \cdot 100 / (60^2 \cdot 7,5/6)) = +0,04 \text{ kN/cm}^2$$

$$\sigma_2 = -(12,23 / 60 \cdot 7,5) - (2,7 \cdot 100 / (60^2 \cdot 7,5/6)) = -0,09 \text{ kN/cm}^2$$

With the assumption of a propagation angle of 45°, the load surface can be calculated in the section due to prestress:

$$30 \text{ cm} + 20 \text{cm} - 6 \text{ cm} = 44 \text{ cm}$$

The eccentricity can be determined to:

$$e = 44 \text{ cm} / 2 - 15 \text{ cm} = 7.0 \text{ cm}$$

Respective stress distribution:

$$\sigma_1 = \frac{-54.0}{44.0 \cdot 7.5} + \frac{54.0 \cdot 7.0}{7.5 \cdot 44.0^2} \cdot 6 = -0.007 kN / cm^2$$

$$\sigma_2 = \frac{-54.0}{44.0 \cdot 7.5} + \frac{-54.0 \cdot 7.0}{7.5 \cdot 44.0^2} \cdot 6 = -0.32 kN / cm^2$$

Analysis of transversal compressive stress at the outer edge:

The courses of stress due to the corner moment and the prestressing result in a compressive stress at each exterior side. These stresses are superposed to comply with the limit value for transversal compressive stress.

 $k_{c.90}$ has been set to 1,25.

Analysis:
$$\frac{\sigma_{c,90,d}}{k_{c,90,d} \cdot f_{c,90,d}} = \frac{0,09 + 0,32}{1,25 \cdot 0,34} = 0,96 \le 1,0$$

5.8 Pre-dimensioning of prestressing steel

The normal force to be absorbed by the prestressing steel can be calculated from preload force and maximum external loading from load group 10 (assumption: the total tensile stress is converted into normal force):

- $N_{\text{steel}} = 54.0 \text{ kN} + 26.9 \text{ cm x } 7.5 \text{ cm x } 0.30 \text{ kN/cm}^2 = 115 \text{ kN}$
- To keep the steel section as small as possible, high strength steel S355 is used. The required diameter results to:

$$\operatorname{req} \operatorname{d} = \sqrt{\frac{4 \cdot N_{\mathit{Spannstahl}}}{\pi \cdot f_{\mathit{y,d}}}} = \sqrt{\frac{4 \cdot 115}{\pi \cdot 32,7}} = 2,12 \operatorname{cm}$$

selected: d = 2.4 cm

The prestressing steel has to be guided centrically through the column and has to be fixed by appropriate constructional measures.

02/02/2010

5.9 Analysis of buckling for the column (equivalent bar method)

To prevent buckling at the inner side of the column, buckling will be analysed in a simplified calculation. Therefore, an equivalent bar of the width of one third of the column width (w = 60 cm / 3 = 20 cm) will be analysed.

A compression strut will be examined whose loading results from the integration of the superposed stress courses from preload and external loading (see Figure 14 and 16). Since the bending moment is already factored in, the analysis of a "centrically loaded compression strut" is adequate.

Furthermore, "Eulerfall II" is assumed ($I_{eff} = I$), where the length I equals the system-line of the static system (conservative assumption). An appropriately fixed cross girder should be attached to the inner side of the columns to guarantee this "Eulerfall".

Resulting course of stress:

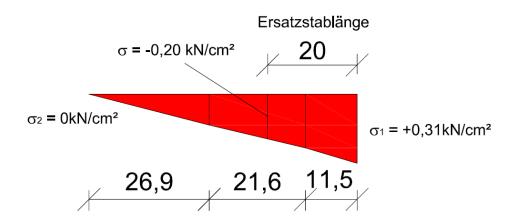


Figure 18: Stress distribution for determination of normal forces of the compression strut The normal force to be applied (conservatively, the kink in the stress distribution can be neglected):

- $N = 20 \text{ cm x } 7.5 \text{ cm x } (0.31 \text{ kN/cm}^2 + 0.20 \text{ kN/cm}^2) / 2 = 38.25 \text{ kN}$
- $\sigma_{c.0.d} = (-0.31 0.20) / 2 = -0.51 \text{ kN/cm}^2$

Determination of buckling coefficient k_c :

- $E_{0.05} = 5 / 6 \times 1380 = 1150 \text{ kN/cm}^2$
- $I_{eff} = 60 \text{ cm} / 2 + 240 \text{ cm} + 20 \text{ cm} / 2 = 280 \text{ cm} \text{ (conservatively)}$
- b = 20 cm; h = 7,5 cm (dimensions of equivalent compression strut)
- $A = 20 \text{ cm x } 7.5 \text{ cm} = 150 \text{ cm}^2 \text{ (area of compression strut)}$
- $I_z = 20 \text{ cm x } (7.5 \text{ cm})^3 / 12 = 703.13 \text{ cm}^4 \text{ (weak axis)}$

•
$$i_z = \sqrt{\frac{I_z}{A}} = \sqrt{\frac{703,13}{150}} = 2,17 \text{ cm}$$

• $\lambda = I_{eff} / i_z = 280 \text{ cm} / 2,17 \text{ cm} = 129,3$

•
$$\lambda_{rel,c} = \frac{\lambda}{\pi} \cdot \sqrt{\frac{f_{c,0,k}}{E_{0,05}}} = \frac{129,3}{\pi} \cdot \sqrt{\frac{3,8}{1150}} = 2,37$$

• $\beta_c = 0.1$ (laminated timber)

•
$$k = 0.5 (1 + \beta_c (\lambda_{rel,c} - 0.3) + (\lambda_{rel,c})^2) = 0.5 (1 + 0.1 (2.37 - 0.3) + 2.37^2) = 3.40$$

•
$$k_c = \frac{1}{k + \sqrt{k^2 - (\lambda_{rel,c})^2}} = \frac{1}{3,40 + \sqrt{3,40^2 - (2,37)^2}} = 0,17 \le 1,0$$

Analysis:
$$\frac{\sigma_{c,0,d}}{k_c \cdot f_{c,0,d}} = \frac{0.255}{0.17 \cdot 2.34} = 0.64 \le 1.0$$

Buckling will not occur. The arrangement of cross girders in the area of the equivalent compression strut must be noticed.

Because of low loads, further stability checks are not necessary.

5.10 Analysis of enlargement in the cross section at the bottom cross-frame member (notch)

The bottom cross-frame member has to be enlarged from 20cm to 30cm to create enough space for the plumbing required. The analysis for notches will be provided to prevent rupture of the cross-frame member's cross section. The notch is assumed to be rectangular.

The critical shear force results from load group 7:

• $V_d = 6,43 \text{ kN}$

Determination of coefficient k_v:

- $\varepsilon = 90^{\circ}$
- $\alpha = h_e / h = 20 \text{ cm} / 30 \text{ cm} = 0.67$

•
$$k_{\varepsilon} = 1 + \frac{1,1}{\tan \varepsilon \cdot \sqrt{h \cdot \tan \varepsilon}} = 1 + \frac{1,1}{\tan 90^{\circ} \cdot \sqrt{30 \cdot \tan 90^{\circ}}} = 1,0 \ (\rightarrow \tan 90^{\circ} \rightarrow \infty)$$

•
$$k_{90} = \frac{k_n}{\sqrt{h \cdot (\sqrt{\alpha \cdot (1-\alpha)} + 0.8 \cdot c/h \cdot \sqrt{1/\alpha - \alpha^2})}}$$

$$= \frac{6.5}{\sqrt{30 \cdot (\sqrt{0.67 \cdot (1-0.67)} + 0.8 \cdot 20/30 \cdot \sqrt{1/0.67 - 0.67^2})}} = 1.17$$

• $k_v = 1.0 \le 1.17$

Analysis:
$$\frac{1.5 \cdot \frac{V_d}{b \cdot h_e}}{k_v \cdot f_{v,d}} = \frac{1.5 \cdot \frac{6.43}{7.5 \cdot 20}}{1.0 \cdot 0.27} = 0.24 \le 1.0$$

No reinforcement for the notch is required.

The analysis of shear forces is not needed, since the level of use is very low (see RSTAB-printout "level of use").

5.11 Pre-dimensioning of cross girders

The cross girders have a width of 8 cm. The height required will be calculated in the following.

Employed action:

- $s_k = 0.60 \text{ kN/m}^2 \times 0.8 \text{ m} = 0.48 \text{ kN/m}$
- $g_k = 1,47 \text{ kN/m}^2 \times 0.8 \text{ m} = 1,18 \text{ kN/m}$
- $q_d = 1,35 \times 1,18 + 1,5 \times 0,48 = 2,3 \text{ kN/m}$
- $M_d = 2.3 \times 2.4^2 / 8 = 1.7 \text{ kNm}$

Resistance:

• $f_{m,d} = 0.8 \times 2.4 / 1.3 = 1.48 \text{ kN/cm}^2$ (for coniferous wood C24)

Height required:

req h
$$\geq \sqrt{\frac{M \cdot 6}{b \cdot f_{m,d}}} = \sqrt{\frac{1,7 \cdot 100 \cdot 6}{8 \cdot 1,48}} = 9,3cm$$

Selected: h = 10,0 cm

Deformation:

$$w = 5/384 \times (1,18 + 0,48) \times 2,4^4 \times 12/(11000000 \times 0,08 \times 0,1^3) = 0,0098 \text{ m} \approx 1,0 \text{ cm} = 1/240 \ge 1/300$$

Selected value is not sufficient. New value:

h = 12,0 cm

5.11.1 Deformation for the top cross-frame member

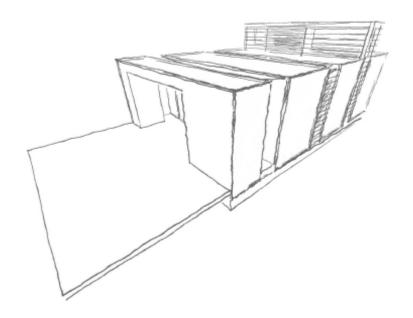
The analysis of serviceability given by the RSTAB-calculation (load group 6, without magnification) indicates a deformation in the centre of the cross-frame member of w=1,55cm. Permissible value: w = 6300/300 = 21mm >> existing w = 1,55 mm

6 Fire resistance justification

Since the building is exclusively used for domestic purposes, the German Industrial Standards ranges the building in fire resistance class FO which means that no further calculations are required and no additional arrangements have to be made.







Details

Statik / Tragwerksplanung Stand 31.01.2010

Bearbeiter:

Prof. Dr.-Ing. H. Hartmann





Inhaltsverzeichnis Detailnachweise Modul

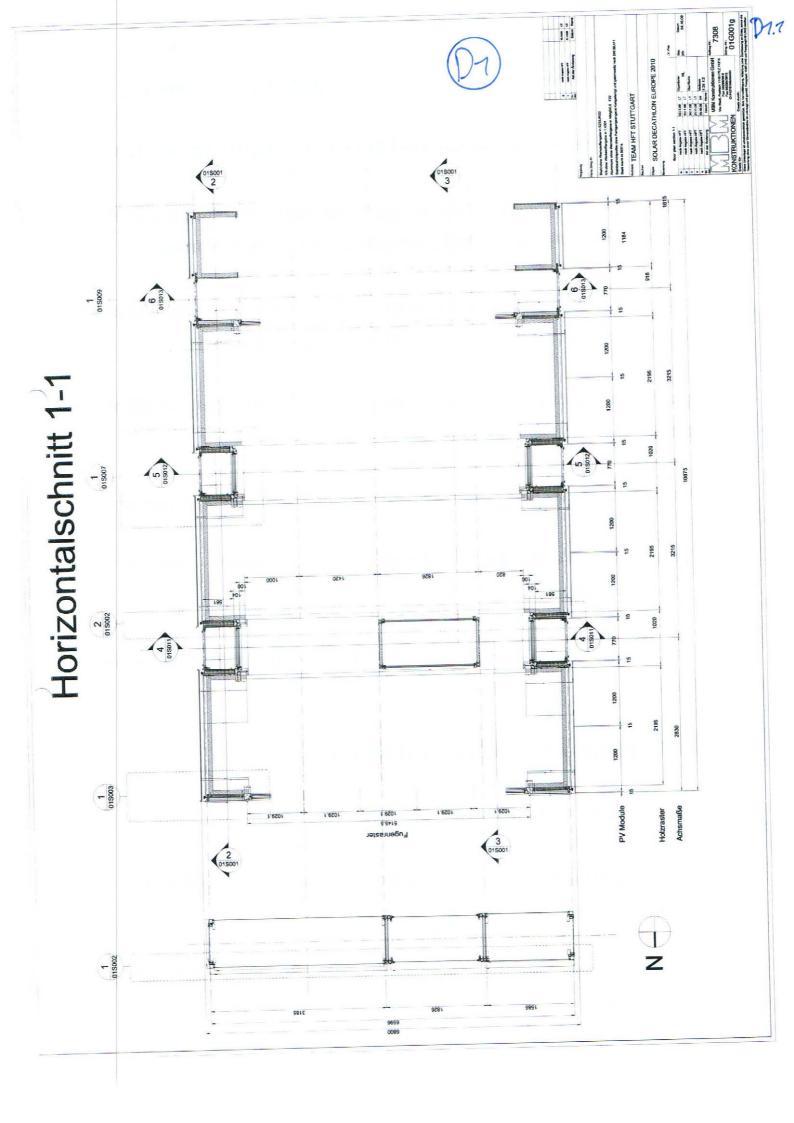
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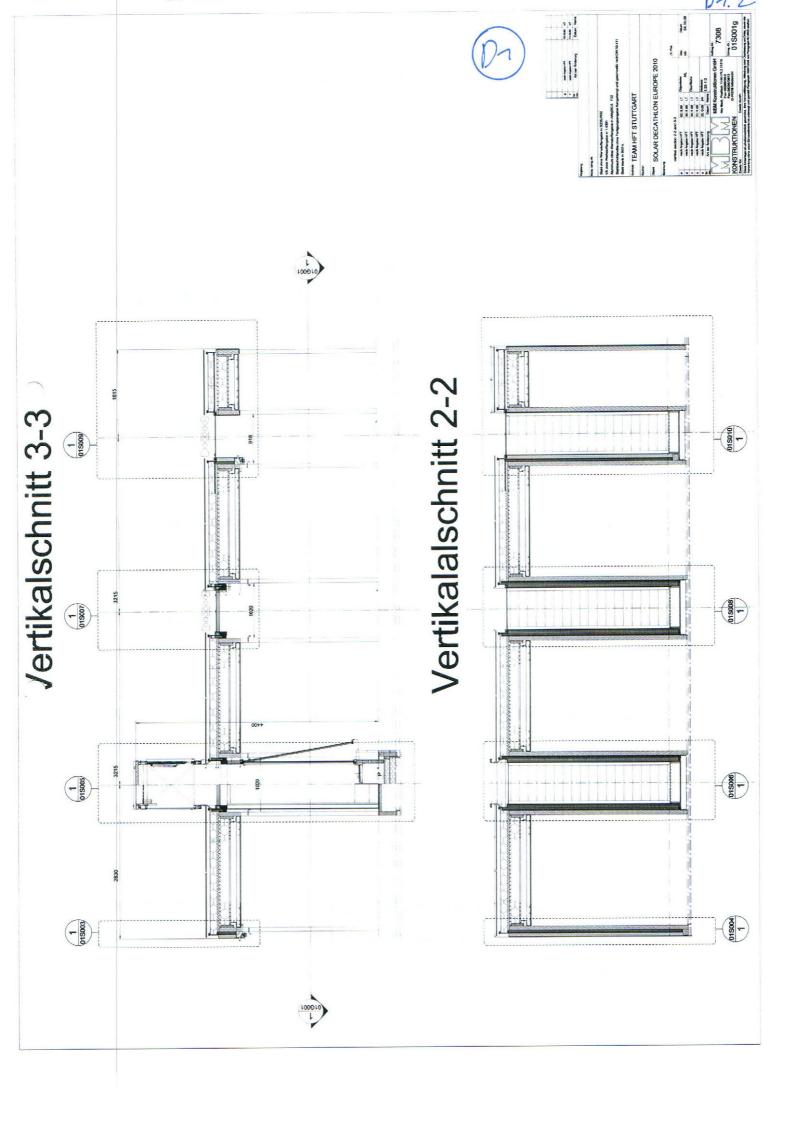
Pos.	Inhalt	content	Seite/page
D1	Übersicht Horizontalschnitt / Vertika	lschnitt (scheme)	D1.1 ff
D2	Biegesteife Eckverbindung	(rigid corner joint)	D2.1 ff
D3	Fußpunkte Modul	(base point)	D3.1 ff
D4	Rahmenverbindungen	(frame connectors)	D4.1 ff
D5	Anschluss Rahmen – Nebenträger I	Dach (connection frame-root)	D5.1 ff
D6	Lüftungsöffnung im Rahmen	(ventilation hole in frame)	D6.1
D7	Aussparungen im unteren Rahmen	(hole in foot-frame)	D7.1 ff
D8	Querträger aus Stahl im Boden	(cross beam steal)	D8.1 ff
D9	Anschlüsse für Fugen-Boden und B	ohlenträger	
	(connections base - gap and cross-	beam)	D9.1 ff
D10	Anschlüsse PV-Fassade	(connections PV-front)	D10.1ff
D11	Anschlüsse PV-Dach	(connections PV-root)	D11.1 ff
D12	Verankerung Türelemente an Fuge	(connections door at the front)	D12.1
D13	Verankerung Tower oben und unter	(connections Tower Top and base) D13.1 ff

Inhaltsverzeichnis Detailnachweise Terrasse (Deck)

(Table of contens of statik detail of modul)

T1	Übersicht Terrassenkonstruktion	(scheme deck)	T1.1
	Übersicht Positionen Terassenkons	truktion (scheme positions)	T1.2
	Grundlagen – Skizzen	(scheme base scetch)	T1.3 ff
	Lastannahmen	(design loads)	T1.5
	Zusammenstellung Lagerlasten	(table of reactions)	T1.6
T2 / B1-B5	Bohlenbelag in verschiedenen Situa	ationen (planking)	T2.1 ff
T3 / U1-U5	Unterkonstruktion in verschiedenen	Situationen (substructure)	T3.1 ff
T4 -1	Träger entlang Längsseite Ost	(beam east-side)	T4.1 ff
T4 – 2	Träger entlang Längsseite West	(beam west-side)	T4.6 ff
T4 – 3	Träger entlang Querseite Nord	(beam north side)	T4.10 ff
T4 – 4	Träger entlang Querseite Süd	(beam south-side)	T4.15 ff
T5	Rampenträger und Ausbildung	(ramp and construction)	T5.1 ff
T6	Ausbildung Wassertankmöbel	(construction water furniture)	T6.1 ff
T7	Mastanschluss Wetterstation	(weather station mast)	T7.1 ff





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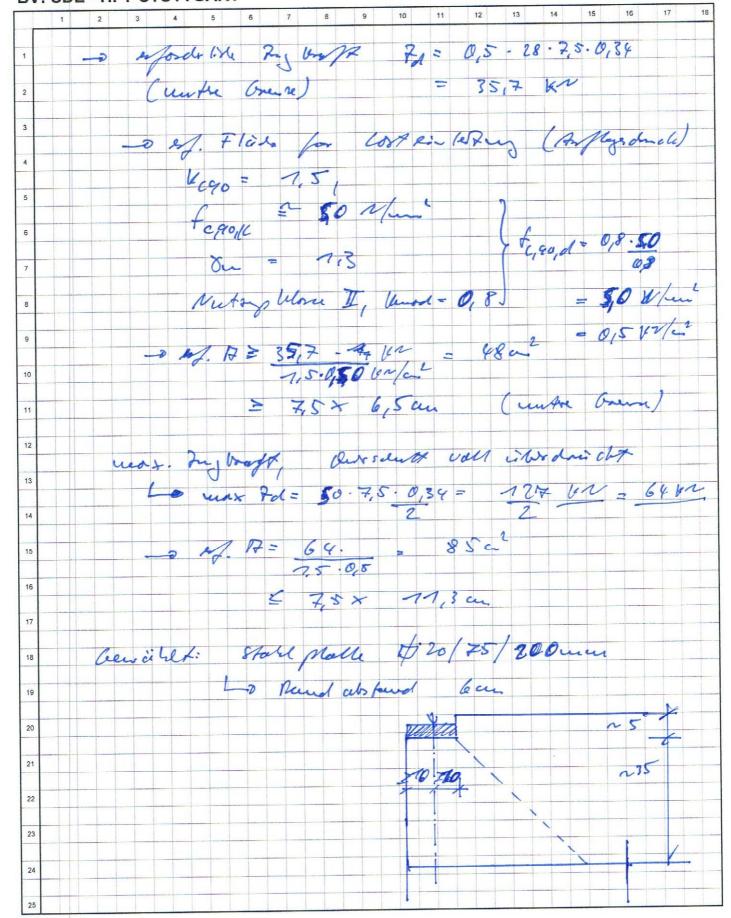
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Tel: 08805/266; Fax.: 08805/955489

BV: SDE - HFT-STUTTGART Seite:



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Tel: 08805/266; Fax.: 08805/955489

BV: SDE - HFT-STUTTGART Benons y de e-gelei-te Ceentre Marge aus max 201 = 69 len 3 6-EW1 - Slauge M20, Re = 2,45ct -> 5 = 2 = 64 W = 26,7 U2 5 6 -0 M 76-8.8 , Nex = 97,3 cm > waz Rd= 64 m od M20-5.6, red = 77,9 4 > 4 10 Ceen in de steenge M20-5,6, Mu = 60,7 por 2 man 201 och 1416-8.8, 121= 83,0 len > = 6462 12 Welleldinge; Brooks und Tal. #23 fune = 3,5 1/mit 14 - Tes & mix Tet = Ft, 90,d - 83 V2

1. 1. 1. 1. lad - 1,6. 2. lad

- 2 ef. lad = 83 (-2 - 47 cm

7.6. 27 - 0,35 V2/cm² - 47 cm Concilt: \$ 16 (ach 20) / lad = 50 au

- o fure = 3,5 Men.

Tel 83 = 0,94 C7

ture 7,6.0.50.0735

25

Ingenieurbüro Dr Hartmann Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

Tel: 08805/266; Fax.: 08805/955489

BV: SDE - HFT-STUTTGART Need with the Passery in Schutz Perisde Ralem - Ringel und 8 Hel 2 3 e = d/6 = 50 - 8,3 cm -> max Grorp = 2.64 = 0,57 m/m²

7,5.30 0,34 @ A 0,36 0,23 8 0,36 kr/m 21 23

25

02.5

Tabelle F.22 — Verhältnisse der mittleren Steifigkeitswerte von Flächen aus Nadelholzlamellen

	1	2	3	4	5
1	Lamellena	E_{y}/E_{x}	G_{XZ}/E_{X}	G_{xy}/G_{xz}	G_{yz}/G_{xz}
2	genagelt	0	0,06	0,10	0,05
	vorgespannt				
3	sägerau	0,015	0,06	0,30	0,08
4	gehobelt	0,02	0,06	0,50	0,09
5	geklebt	0,03	0,06	1,0	0,10

Tabelle F.23 — Rechenwerte für charakteristische Festigkeitskennwerte in N/mm² für Klebefugen bei Verstärkungen^a

	1	2	3					
			Wirksame Einkleblänge ℓ_{ad} des Stahlstabes					
1			≤ 250 mm	250 mm < ℓ _{ad} ≤ 500 mm	$500 \text{ mm} < \ell_{ad} \le 10 000 \text{ mm}$			
2	∫ _{k1,k}	Klebefuge zwischen Stahlstab und Bohrlochwandung	4,0	$5,25 - 0,005 \times \ell_{ad}$	3,5 − 0,0015 × ℓ _{ad}			
3	<i>f</i> _{k2,k}	Klebefuge zwischen Trägeroberfläche und Verstärkungsplatte		0,75				
4	<i>f</i> _{k3,k}	Klebefuge zwischen Trägeroberfläche und Verstärkungsplatte bei gleichmäßiger Einleitung der Schubspannung		1,50				

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Seite: ... 2.6 **BV: SDE - HFT-STUTTGART** 15 I_ Peter7: 2 odr 420 5355. M20 - 5-6
M20 - 8-8
10 5 6 8 screw nut M20, for camber ver strip = 40 x 280 x 255 mm, \$235 crossbeam 60 x 160 mm, KVH 11 12 13 En Whole long 2 50 cm 14 15 16 18 19 20 Deluny des Ceni - State (\$ 16, 7=69 62 21 22 -0 se = hard = 84 lor = 0,05 cm = 8,5 mm 23 Hispanier un 1/4 Um doch. ale Schoarle 8 24

Steifigkeitskennwerte in MN/m² und 02.7und Festigkeits-Charakteristische Tabelle 4: charakteristische Rohdichtekennwerte in kg/m³ für "KERTO" -Furnierschichtholz

Art der Beanspruchung (siehe auch Anlage 5)		Furnierschichtholz "KERTO*-S"			Furnierschichtholz "KERTO ⁶ -Q" 27 mm ≤ B ≤ 69 mm ¹			
- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		H²≤300 _mm_	H ² = 900 mm	H² =1800 mm	H ² ≤ 300. mm	H ² = 900 mm	H ² ~2500 mm	
Biegung hoch und flachkant	this.	50	42,5 3	35°	36 5	31,22	26,43	
Zug Il zur Faser	- f _{1.0,k}	3	38 25°		2	7 5	18 4	
Żug — — — — — — — — — — — — — — — — — — —	f _{1,90,6}		8,0			5,0 "		
Druck Il zur Faser	feat	3	38 26 '		27 ⁵ 1B		18*	
Druck Sur Foser	1,304		5,0 7,0°		12,0			
Schub hochkant	4,0,1	6,0		6,0				
Schub flachkant	f. as j		4,0		1,5			
Elastizitātsmodul B iegung	Engressi		13 000		10 000			
Elastizitalsmodul Zug	Eleman		13 000		10 000			
Elastizitälsmodul Druck	Econeen		13 000		10 000			
Schubmodul	Great		600		600			
Querdruck flachkant	Est (2,0 3,5 °		2,0 3,5 °			
Rohdichte	Pi.		480			480		

¹ Für den Dickenbereich 21 mm ≤ 8 ≤ 24 mm sind folgende Abminderungen vorzunehmen:

Abminderung um 10 %, ZUÉ DIE

zul a₂/ zul a₀ Abminderung um 25 %,

E_B / E_B / E_{DI} Abminderung um 25 %.

Deutsches Institut für Hautechnik

Für die jeweilige Biegebeanspruchung maßgebende Höhe H des Gesamtquerschnitts nach Anlage 6 in mm

Zwischenwerte dürfen linear interpoliert werden.

Der Wert gilt für H > 900 mm.

Die charakteristischen Werte für Biegung, Zug und Druck unter dem Winkel a (Winkel zwischen der Faser richtung der Deckschicht und der Beanspruchungsrichtung) sind im gleichen Verhältnis wie bei den zulässigen Spannungen in Tabelle 1 mit den Fußnoten 7, 10 und 11 abzumindern.

Bei Anwendung dieser Werte ergeben sich größere Eindrückungen, die erforderlichenfalls konstruktiven berücksichtigen sind. Sie dürfen bei Anschlüssen mit verschiedenen Verbindungsmitteln nicht angewen werden

Stahlteil S20

M 7:5

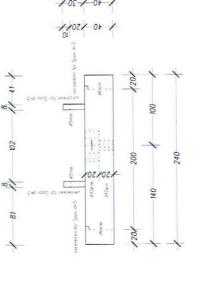
Material: S235

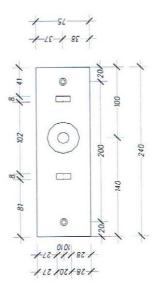
Stahlteil kennzeichnen!

Oberfläche: verzinkt

herstellen: 16Stk







gewinde MT6 verZürken Innengew säubern

521 Stahlteil

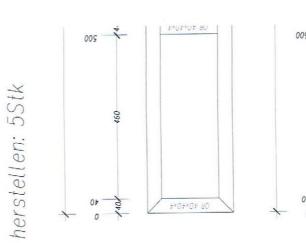
Stahlteil

M 7:5

Material: S235

Oberfläche: verzinkt

herstellen: 16Stk





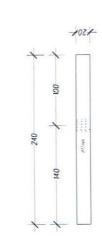


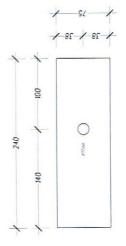
Stahlteil kennzeichnen!

Material: S235

M 1:10

Oberfläche:

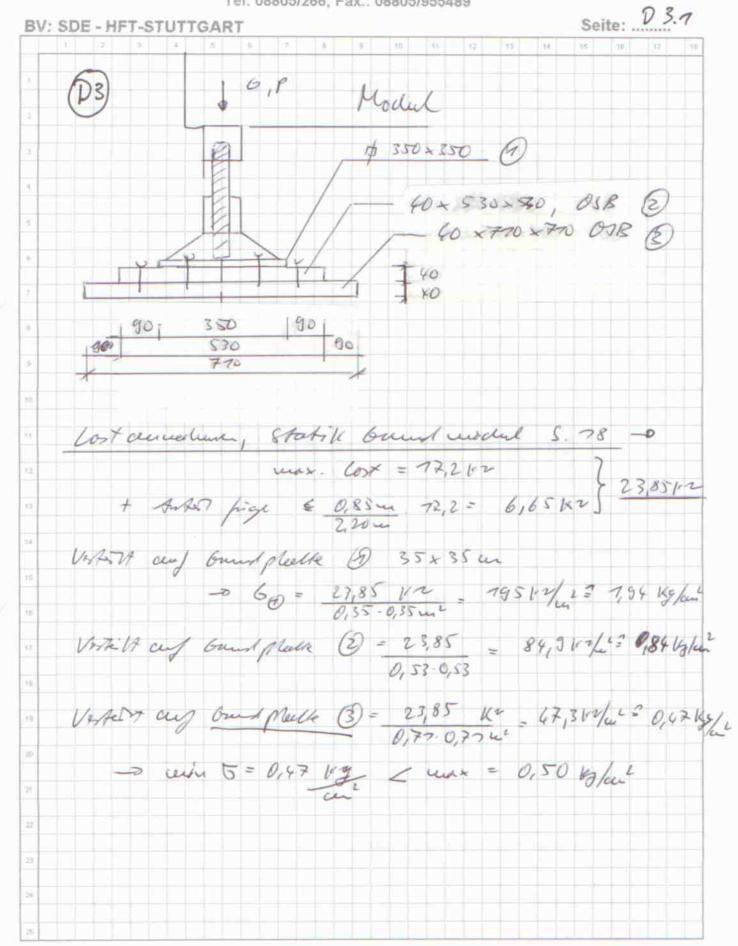


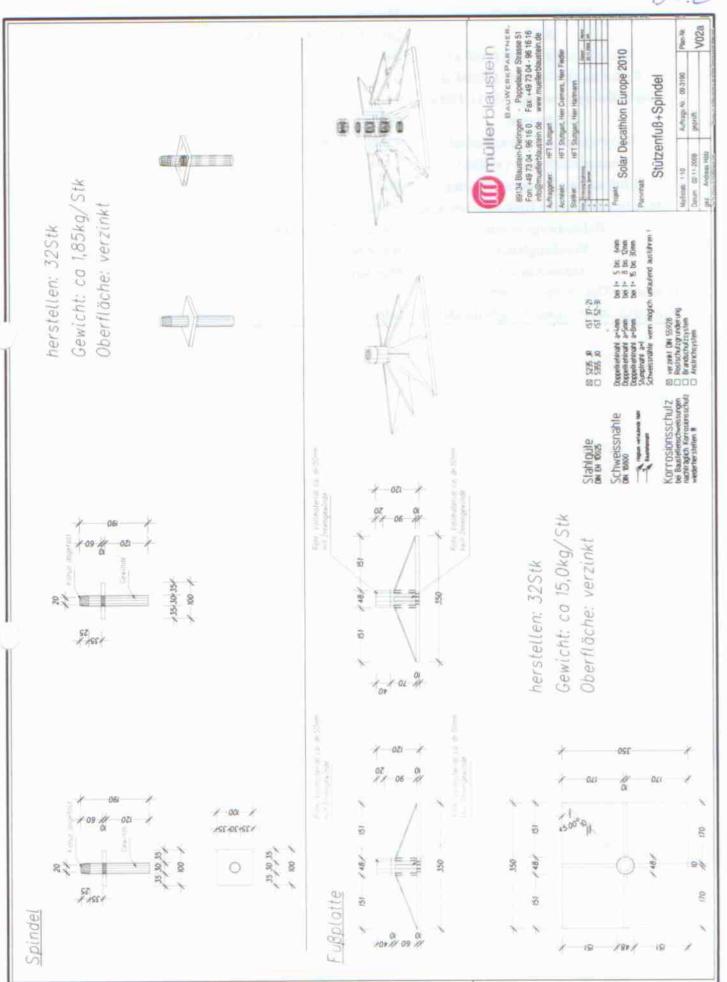


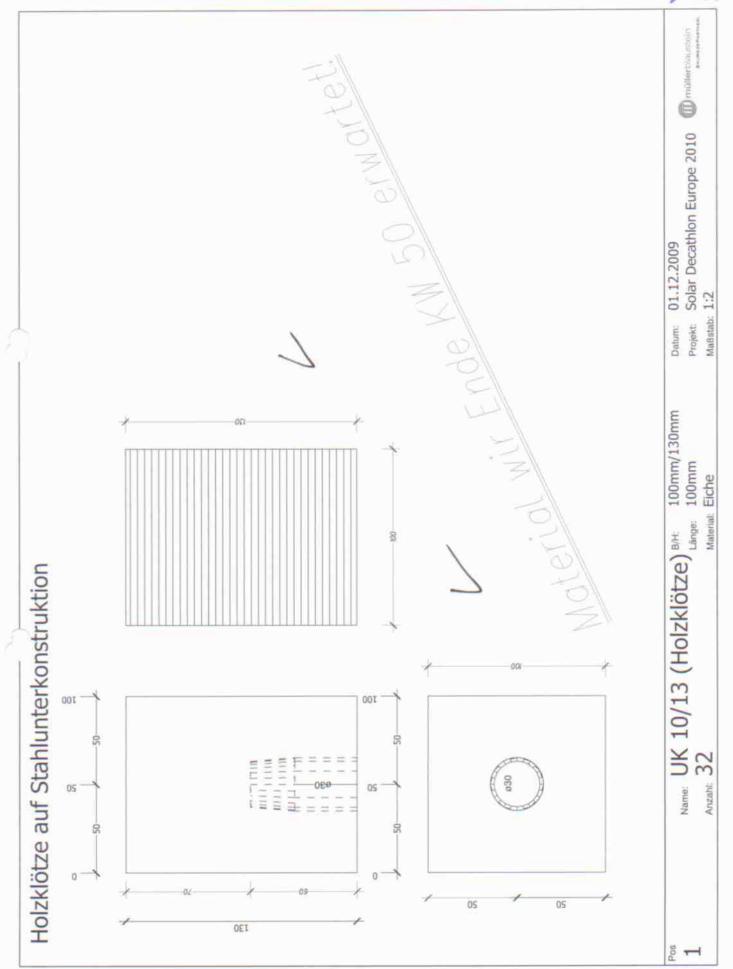
Ingenieurbüro Dr Hartmann

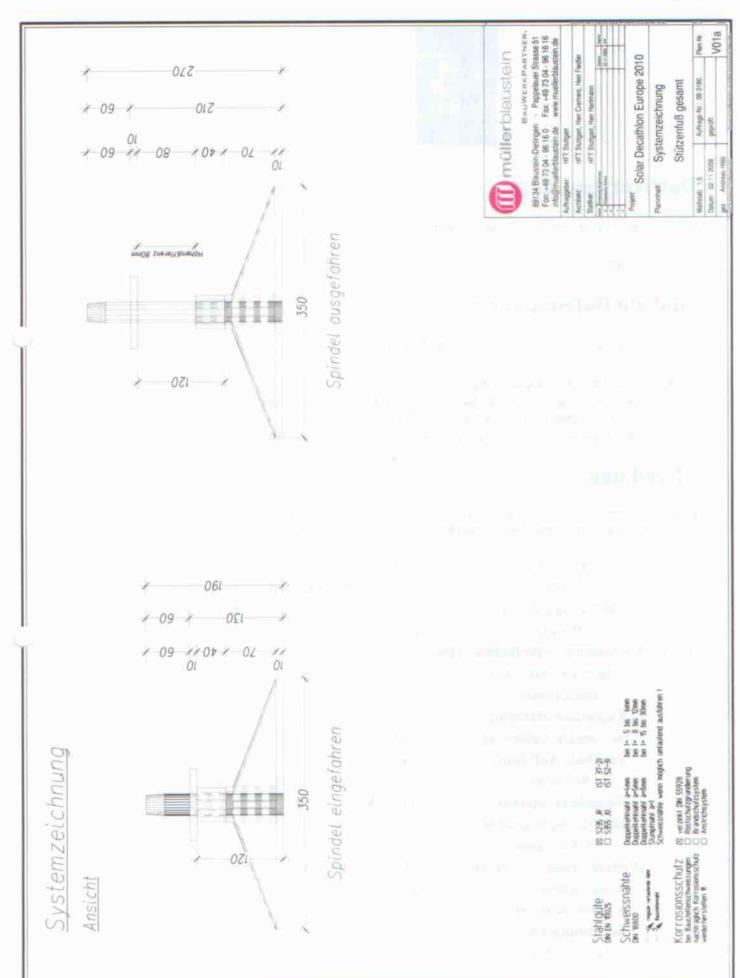
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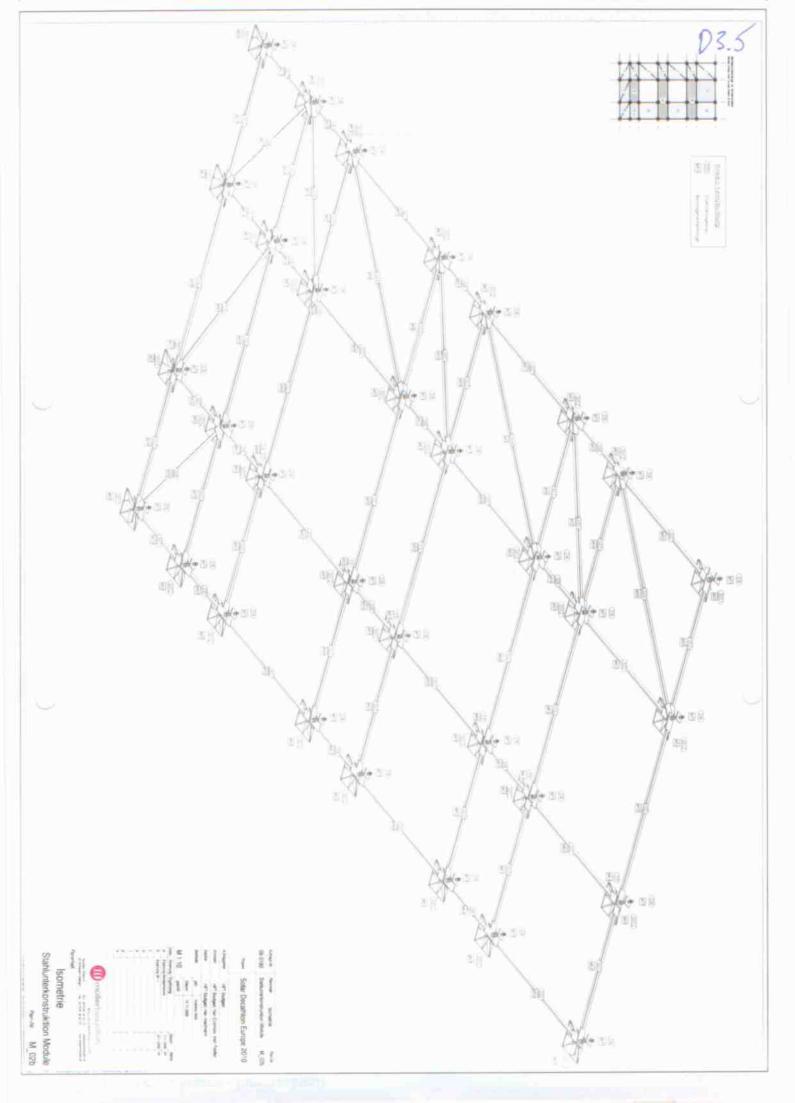
Tel: 08805/266; Fax.: 08805/955489











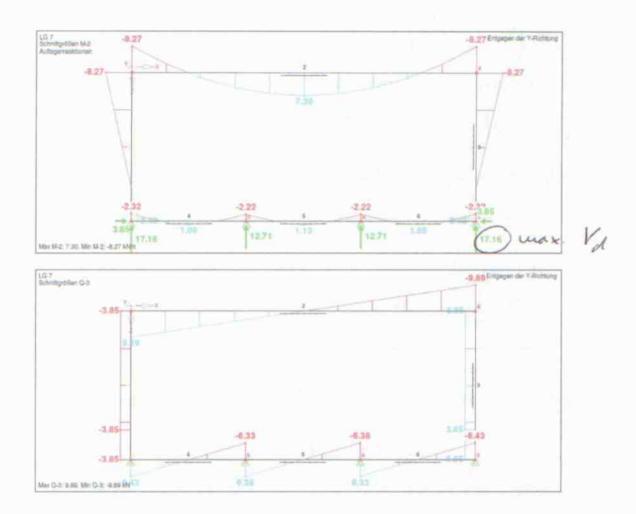


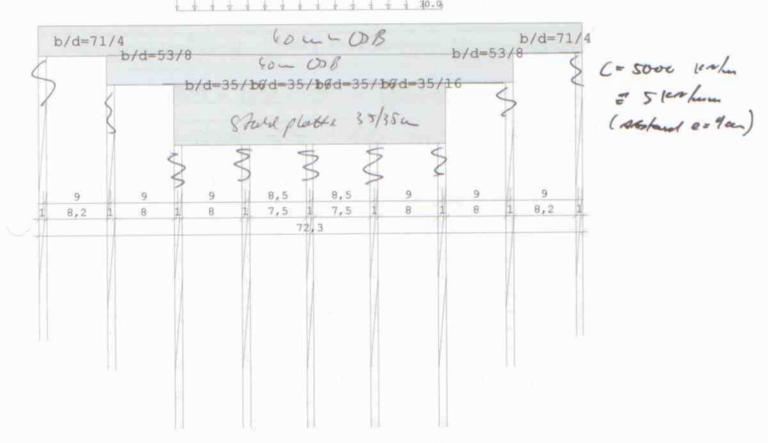
Figure 9: RSTAB-printout, page 5 - critical internal forces for load group 7

Durchlaufträger DLT 04/2008/B WinXP

PROJEKT: SDE

POS: Fundamentplatte

1:5 g=38,5 kol- } 68,5.0,35m = 24 km Maßstab



Holzträger über 8 Felder NH S 7

E-Modul E = 800 kN/cm2

SYSTEM	Länge		Querschni	ttswerte		
Feld 1 2 3 4 5 6 7	L (m) 0.09 0.09 0.09 0.09 0.09 0.09 0.09	konstant konstant konstant konstant konstant konstant konstant	b (cm) 71.0 53.0 35.0 35.0 35.0 35.0 35.0	d (cm) 4.0 8.0 16.0 16.0 16.0 16.0 4.0	Iy (cm4) 378.7 2261.3 11946.7 11946.7 11946.7 2261.3 378.7	

Feld 2 muß ggf. zusätzlich als Scheibe nachgewiesen werden.

Feld 3 muß ggf. zusätzlich als Scheibe nachgewiesen werden.

Feld 4 muß ggf. zusätzlich als Scheibe nachgewiesen werden.

Feld 5 muß ggf. zusätzlich als Scheibe nachgewiesen werden.

PROJEKT: SDE

POS: Fundamentplatte

Feld 6 muß ggf. zusätzlich als Scheibe nachgewiesen werden.

Feld 7 muß ggf. zusätzlich als Scheibe nachgewiesen werden.

Stütze Nr.	1	5000.0	kN/m	1 1 1
Stütze Nr.	2	5000.0	kN/m	1/35×35/ >
Stütze Nr.	3	5000.0	kN/m	1/ 5/1/27
Stütze Nr.	4	5000.0	kN/m	
Stütze Nr.	5	5000.0	kN/m	1/1//20
Stütze Nr.	6	5000.0	kN/m	() 4/ / 1
Stütze Nr.	7	5000.0	kN/m	3 3 5 (1)
tütze Nr.	8	5000.0	kN/m	3 3 (2
Stütze Nr.	9	5000.0	kN/m	9 0,5 kg/cm 3 50 bs

BELASTUNG (kN,m)	Lasttyp	3=Ein	ichlast ü zelmoment ieckslast	bei a	a , 4=Tra	apezlast	von a -	a+b
Typ EG Gr	VK	g_1/r	p_1/r F	aktor	Abstand	Lb/Lc	ausPOS	Phi
4	0.18	30.00	38.50 38.50	1.00	0.00	0.35		

Rechenteil Version 2006.1

0.09 0.09 0.09	Mf 0.21 0.66	M li 0.00 0.21	M re 0.21	Q li 2.34	Q re 2.34
0.09					2.34
	0.66	0.21			
0.00		0.21	0.66	4.96	4.96
0.00	1.08	0.66	1.08	7.73	1.56
0.07	1.22	1.08	1.20	4.40	-1.43
0.02	1.22	1.20	1.08	1.43	-4.40
0.00	1.08	1.08	0.66	-1.56	-7.73
0.00	0.66	0.66	0.21	-4.96	-4.96
0.00	0.21	0.21	0.00	-2.34	-2.34
	0.02 0.00 0.00	0.02 1.22 0.00 1.08 0.00 0.66	0.02 1.22 1.20 0.00 1.08 1.08 0.00 0.66 0.66	0.02 1.22 1.20 1.08 0.00 1.08 1.08 0.66 0.00 0.66 0.66 0.21	0.02 1.22 1.20 1.08 1.43 0.00 1.08 1.08 0.66 -1.56 0.00 0.66 0.66 0.21 -4.96

Stütze	M li	M re	0.11	+ 0 re	= max V	min V	200
1	0.00	0.00	0.00	2.34	2.34	1.03	
2	0.09	0.09	1.03	2.17	2.62	1.15	
3	0.29	0.29	2.17	3.38	2.76	1.21	
4	0.47	0.47	0.69	1.92	2.83	1.24	
5	0.53	0.53	-0.62	0.62	2.85	1.25	
6	0.47	0.47	-1.92	-0.69	2.83	1.24	
7	0.29	0.29	-3.38	-2.17	2.76	1.21	
8	0.09	0.09	-2.17	-1.03	2.62	1.15	
9	0.00	0.00	-2.34	0.00	2.34	1.03	

PROJEKT: SDE

POS: Fundamentplatte

Auflagerkräfte

(kN)

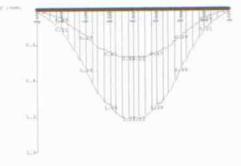
Stütze	aus g	max p	min p	Vollast	max	min	
1	1.03	1.32	0.00	2.34	2.34	1.03	
2	1.15	1.47	0.00	2.62	2.62	1.15	
3	1.21	1.55	0.00	2.76	2.76	1.21	
4	1.24	1.59	0.00	2.83	2.83	1.24	
5	1.25	1.60	0.00	2.85	2.85	1.25	
6	1.24	1.59	0.00	2.83	2.83	1.24	
7	1.21	1.55	0.00	2.76	2.76	1.21	
8	1.15	1.47	0.00	2.62	2.62	1.15	
9	1.03	1.32	0.00	2.34	2.34	1.03	
Summe:	10.50	13.47	0.00	23.97	23.97	10.50	

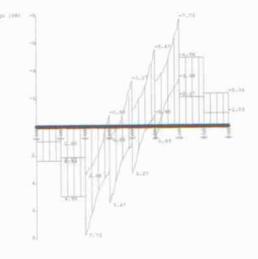
Durchbiegungen maximale

minimale

							-
Feld Nr.	× (m)	f (cm)	Komb	x (m)	f (cm)		
1	0.09	0.052	3	0.00	0.021	0	
2	0.09	0.055	3	0.00	0.023	0	
3	0.09	0.057	3	0.00	0.024	0	
4	0.08	0.057	3	0.00	0.025	0	
5	0.00	0.057	3	0.08	0.025	0	
6	0.00	0.057	3	0.09	0.024	0	
7	0.00	0.055	3	0.09	0.023	0	
8	0.00	0.052	3	0.09	0.021	0	

1:20 Maßstab





Durchlaufträger DLT 04/2008/B WinXP

PROJEKT: SDE

POS: Fundamentplatte

Bemessung: NH S 7 E = 800 kN/cm2 G = 50 kN/cm2 $zul\sigma B = 7.0 \quad zul\tau = 0.9 \text{ N/mm2}$ LF H

Normalspannungen

ld Ir.	x (m)	My (kNm)	σο (N	συ 1/mm2)	kb	η	
1	0.00	0.00	0.00	0.00	1.00	0.00	
_	0.09	0.21	-1.11		1.00	0.16	
2	0.00	0.21			1.00	0.05	
-	0.09	0.66	-1.16		1.00	0.17	
3	0.00	0.66	-0.44		1.00 / /	0.06	
	0.09	1.08			1.00 = 3	0.10	
4	0.00	1.08			1.00 7	TR 0.10	
	0.07	1.22	-0.81	0.81	1.00	0.12	
	0.09	1.20	-0.80	0.80	1.00	0.11	
5	0.00	1.20	-0.80	0.80	1.00	0.11	
	0.02	1.22	-0.81	0.81	1.00	0.12	
	0.09	1.08	-0.72	0.72	1.00	0.10	
6	0.00	1.08	-0.72	0.72	1.00	0.10	
	0.09	0.66	-0.44	0.44	1.00	0.06	
7	0.00	0.66	-1.16	1.16	1.00	0.17	
	0.09	0.21	-0.37	0.37	1.00	0.05	
8	0.00	0.21	-1.11	1.11	1.00	0.16	
	0.09	0.00	0.00	0.00	1.00	0.00	

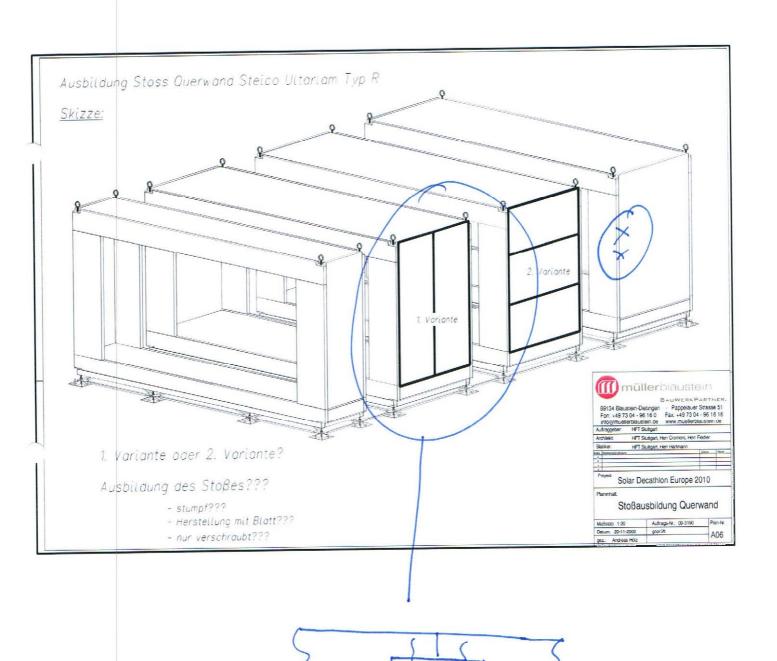
Bei Querschnittssprüngen sind zusätzliche Nachweise erforderlich.

Schubspannungen

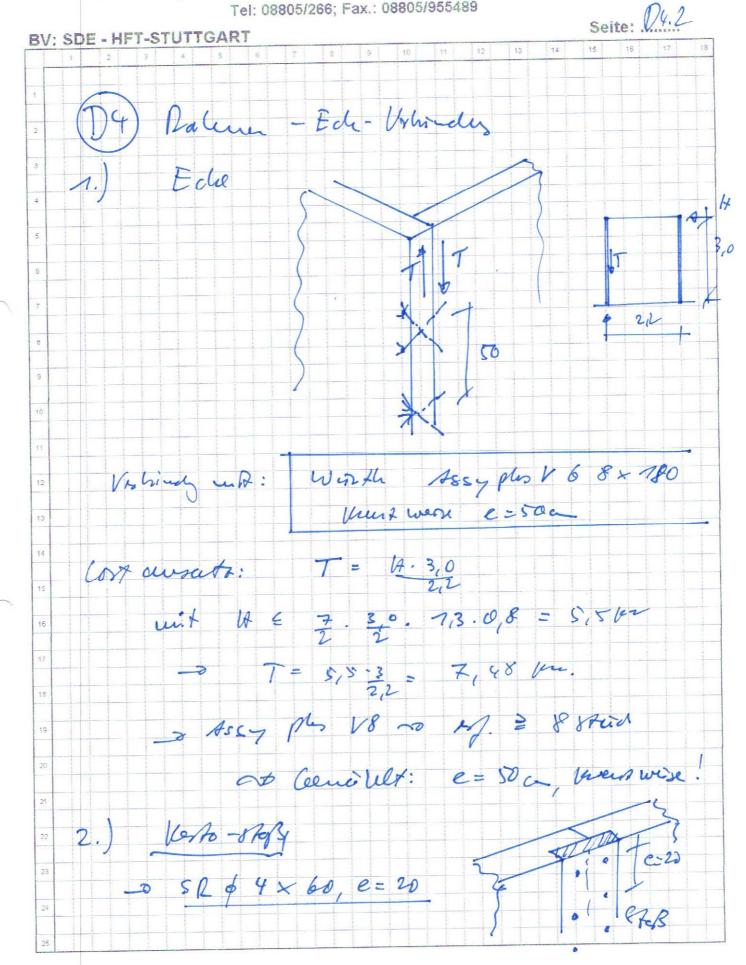
	ütze Ir.	e x (m)	Qz (kN)	τQ (N/mm2)	η
1	re	0.023	2.34	0.12	0.14
- 2	1i	0.025	2.34	0.12	0.14
	re	0.045	4.96	0.18	0.20
- 3	3 li	0.045	4.96	0.18	0.20
	re	0.085	3.28	0.09	0.10
2		0.085	7.39	0.20	0.22
- 1	1 1 i	-0.185	-3.27	0.09	0.10
(5 li	0.085	3.27	0.09	0.10
	re	0.085	-7.39	0.20	0.22
*	7 li	0.085	-3.28	0.09	0.10
	re	0.045	-4.96	0.18	0.20
		0.045	-4.96	0.18	0.20
	re	0.025	-2.34	0.12	0.14
(li	0.023	-2.34	0.12	0.14
-					icha Nachweise erforderlich

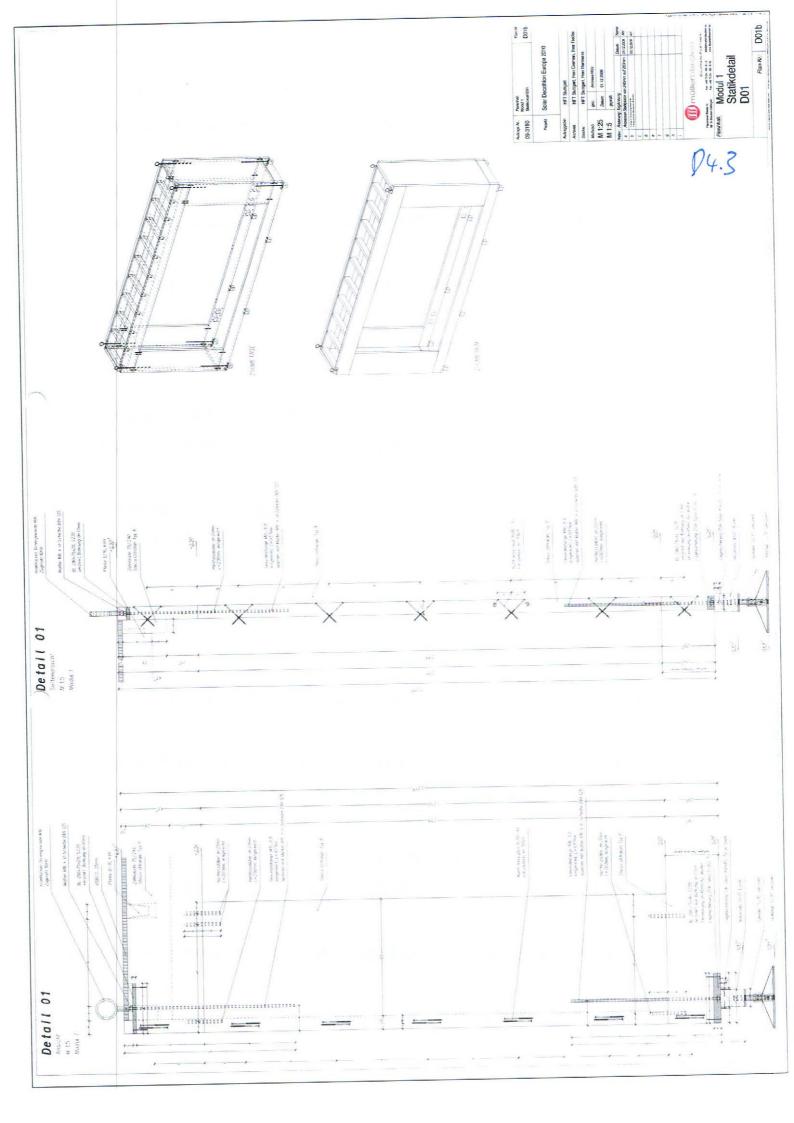
Bei Querschnittssprüngen sind zusätzliche Nachweise erforderlich.

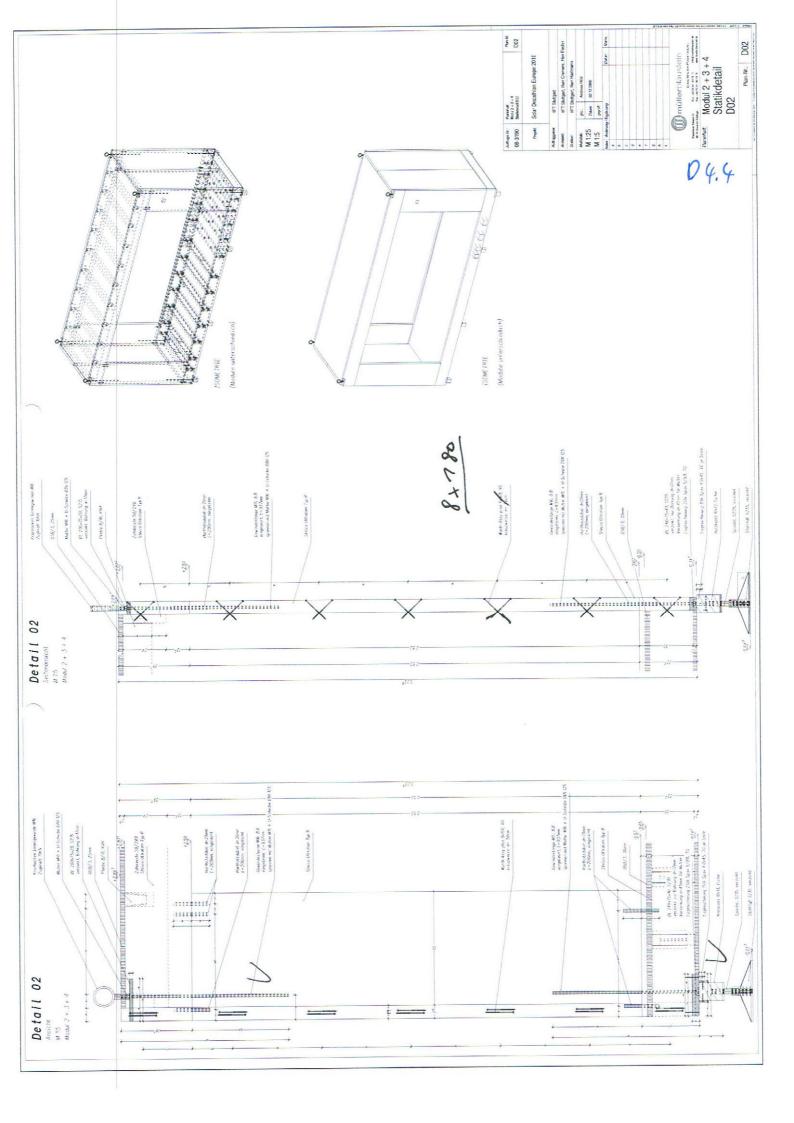
D4) Rahmer verbindege

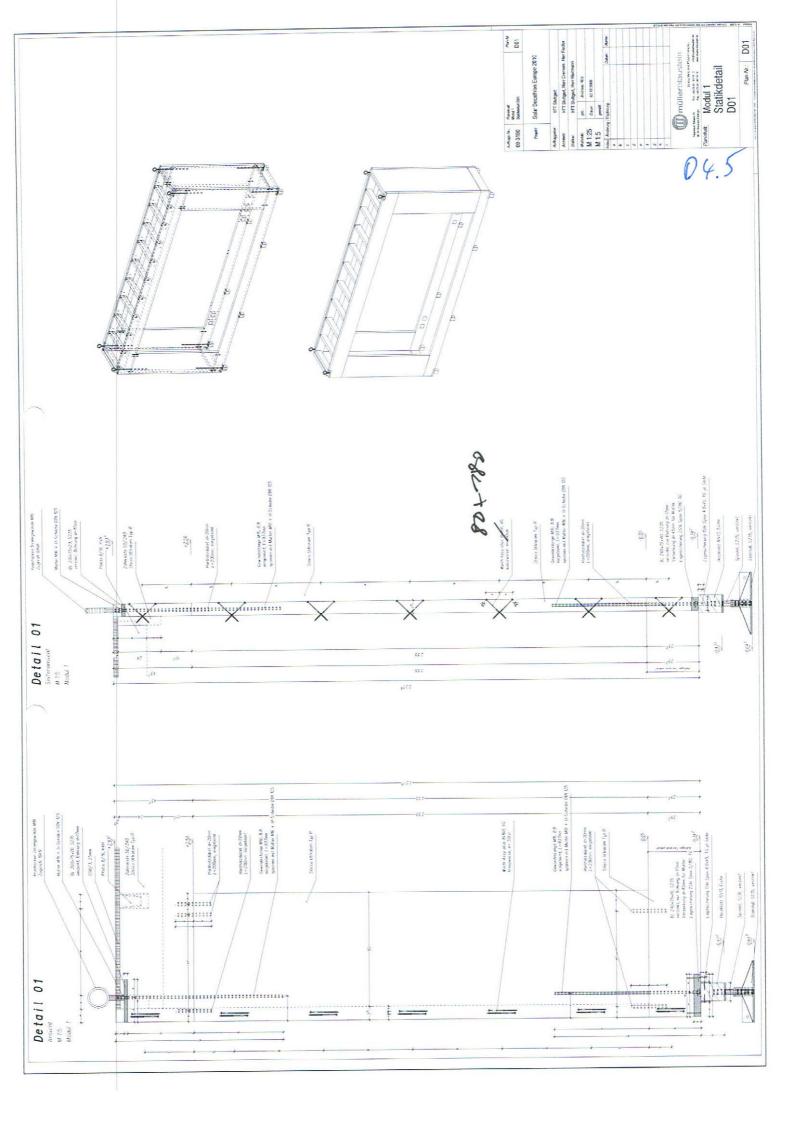


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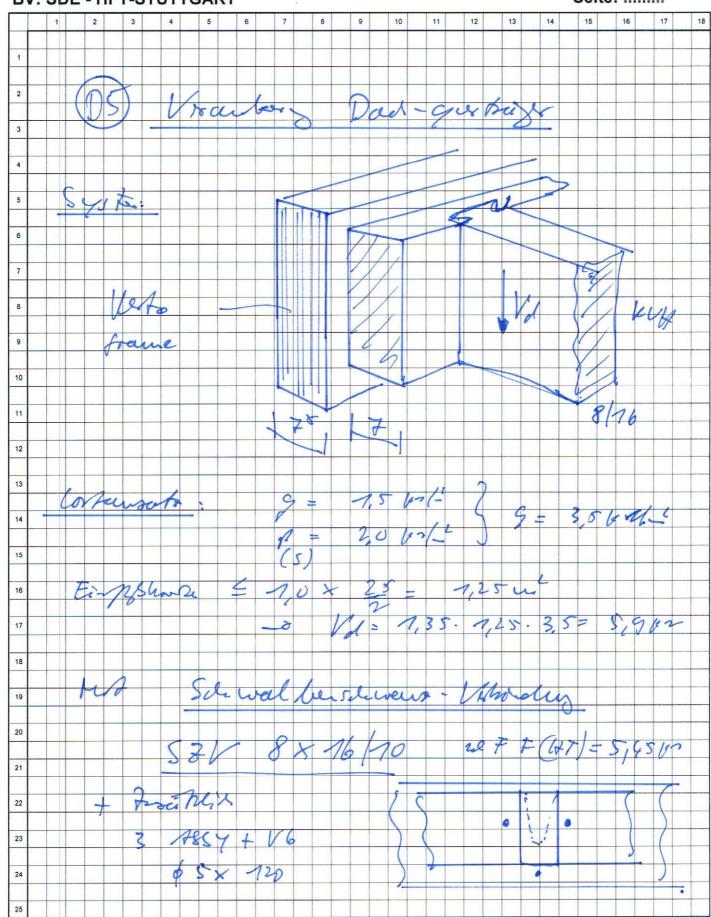


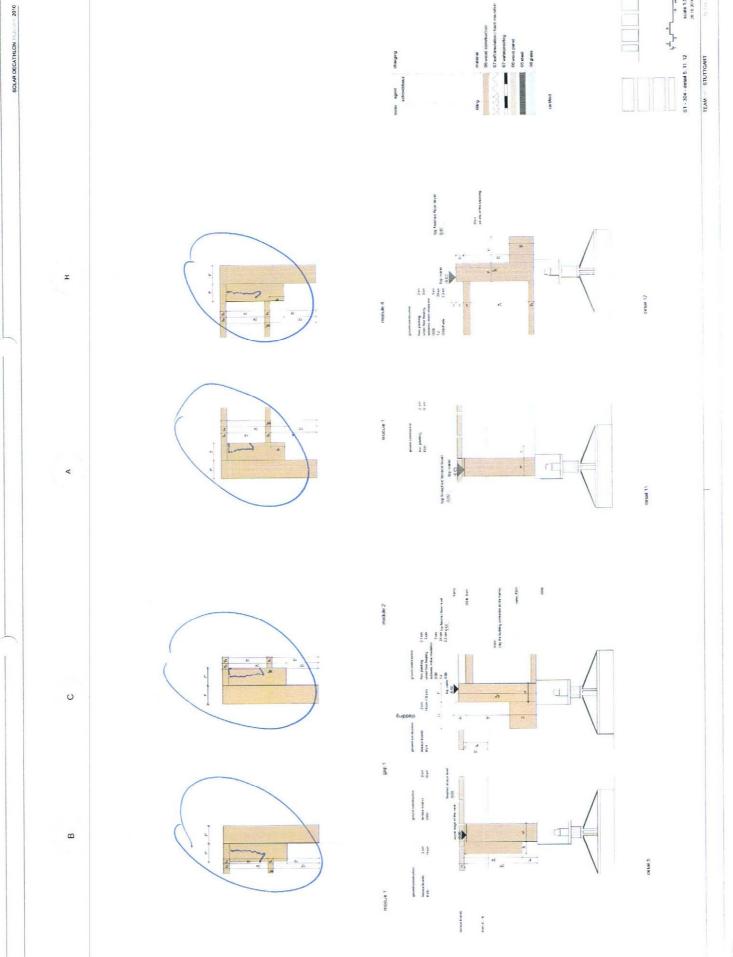


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and the last hand to be to be

Anlage 3

Tabelle 3 Bemessungstabelle für verschiedene Schwalbenschwanz-Zapfenverbindungen

Zapfen- b(HT) Verbindung mm SZV 8x16/10° KVH 80 SZV 8x20/10° KVH 80	б(нт) п(нт)		- NCDCINI	_	1000		_				1	Table III	MACINACIS	MACHINES		.600
lung 16/10° KVH 18/10° KVH 20/10° KVH		a	(LN)q	h(TN)	he	5	p2	-	Z	K/2	۵	A(Z)	Hauptträger	Hauptträger Nebenträger	Belastung	Nachweis
0° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° °	_	_							_				zul F(HT)	zul F (NT)	Zul F	
KVH KVH KVH	um u	mm u	mm	mm	mm	E	mm	mm mm	mm			mm²	ĸ	ĸ	Z	
K K K		-								_	-		6			
X X	160		8	160	115	9,99	_			_	***************************************	5270	5,45	3,16	3,16	K
KVH		0 81		180		9'99	32	28	25	40	15	5270	7,25	3,16	3,16	Ż
	200		80	200	115	9,99	_		25	10	15	5270	9,05	3,16	3,16	Z
SZV 10×16/10° KVH 100	160			160	128	86.6	-	28	25	-0	15	8021	5.18	4.81	4.81	Ę
Z Z	-		100	180		86.6	42	28	25	9		8812	4,86	5,29	4,86	노
Ş		_		200		86.6	_	28	25	10		9461	4,53	5,68	4,53	도
Ş				220		86.6		28	25	10		9461	6,33	5,68	5,68	F
SZV 10x24/10° KVH 100	0 240	06 0		240		86,6		28	25	10	120	9461	8,13	2,68	2,68	Ä
											_			1000		!
SZV 12x16/15° KVH 120				160	130	107	20	78	25	15	-	9242	4,92	5,55	4,92	노
-				180	140	107	43	28	25	15	-	9582	5,59	5,75	5,59	노
KVH		-		200	168	107	22	28	25	9	15	12748	5,41	7,65	5,41	노
KVH	-	0 57	120	220	188	107	49	28	25	10		13655	60'5	8,19	5,09	노
	0 240		_	240	207	107	14	28	25	10	15	14421	4,76	8,65	4,76	노
		_				ļ	i	9	č	,	,	0007		,	02.3	5
SZV 14x16/15° KVH 140	-	_	_	160	133	171	0	27	67	2	0	000	2,73	2,'	ה ה'ר	Ξ
		_		180	152	127	62	28	25	15		12884	5,33	7,73	5,33	노
KVH	-			200	171	127	48	28	25	15	15	13713	4,79	8,23	4,79	노
X	0 220	0 48	3 140	220	189	127	34	28	25	15		14312	4,33	8,59	4,33	노
Y X	_	_		240	189	127	8	28	25	12	15	14312	6,13	8,59	6,13	노



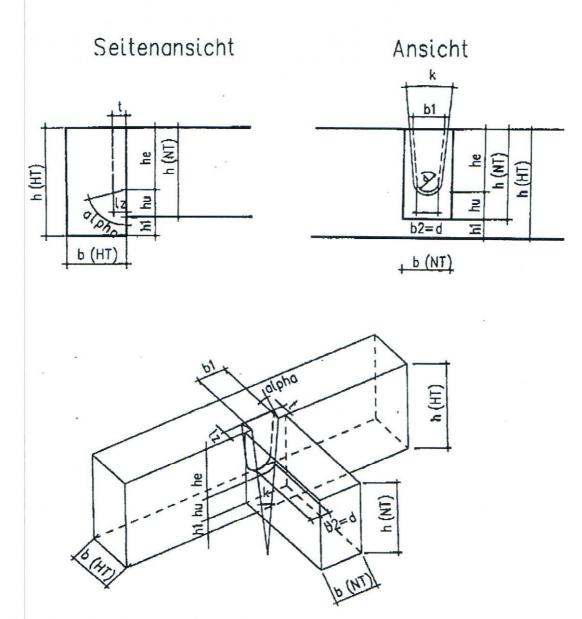


Bild 1: Schwalbenschwanzzapfenverbindung (Parameter der Verbindungsgeometrie) [1]



05.5

2.3 Untersuchungen an der TU München mit maschinell gefertigten Schwalbenschwanz-Zapfenverbindungen [9], [10]

Im Rahmen von 18 Kurzzeitversuchen wurde das Tragverhalten von Haupt- und Nebenträgerverbindungen mit Schwalbenschwanzzapfen untersucht. Die Verbindungen waren unterschiedlich hinsichtlich der Zapfenhöhe (140 oder 70 mm), der Zapfenform (Konuswinkel), der Einbettung des Zapfens (mit oder ohne 2 mm Fuge unter der Zapfenunterkante) sowie der Lagerungsart des Hauptträgers (gabelgelagert oder frei drehbar). Die Geometrie und die Versagenslasten sind in Tabelle 1 (Anlage 1) für Verbindungen mit gabelgelagerten Hauptträgern angegeben. Die in München durchgeführten Versuche sind mit TU-M bezeichnet.

Die Verbindungen mit Zapfenhöhe 70 mm versagten immer im Nebenträger durch Aufreißen des Nebenträgers (Bild 5).

Bei den Zapfen der Höhe 140 mm versagte der Hauptträger infolge Querzug.

In [10] wird vorgeschlagen, die zulässige Belastung der Schwalbenschwanz-Zapfenverbindung in Anlehnung an DIN 1052-1 wie unten ausgeklinkte Träger zu bemessen. Wobei diese zulässige Belastung mit einem Wert von 3,5 multipliziert werden müsste.

$$zul Q = \left(\frac{2}{3} \cdot b \cdot h_1 \cdot k_A \cdot zul \tau_Q\right) \cdot 3,5$$

$$0.3 \le k_A = 1 - 2.8 \frac{a}{h_{NT}}$$

$$a = h_{NT} - h_1$$

$$b = \frac{b_1 + b_2}{2}$$



2.4 Untersuchungen an der Versuchsanstalt für Stahl, Holz und Steine der Universität Karlsruhe mit schwalbenschwanzähnlicher Zapfenverbindung [11]

An der Versuchsanstalt für Stahl, Holz und Steine wurden orientierende Tragfähigkeitsversuche von Haupt- Nebenträgerverbindungen mit Schwalbenschwanzzapfen sowie mit SFS-Holzschrauben durchgeführt. Bei der Versuchsreihe 1 (3 Versuche) wurden passgenau hergestellte Zapfenverbindungen geprüft. Die Nebenträger der Versuchsreihe 2 wurden an den Zapfenflanken jeweils 1,2 mm abgearbeitet um den Einfluss von Fertigungstoleranzen und Holzfeuchteänderungen mit einzubeziehen.

Die Geometrie und die Versagenslasten sind in Tabelle 1 (Anlage 1) angegeben. Die in Karlsruhe durchgeführten Versuche sind mit VA-KA bezeichnet.

2.5 Untersuchungen im Labor für Holztechnik (LHT) der Fachhochschule Hildesheim mit CNC-gefertigten Schwalbenschwanz-Zapfenverbindungen [1]

Im Labor für Holztechnik (LHT) der Fachhochschule Hildesheim wurden 77 Tragfähigkeitsversuche mit Schwalbenschwanz-Zapfenverbindungen durchgeführt. Dabei wurde die Holzart, die Holzfeuchte bei der Herstellung und Prüfung, der Haupt- und Nebenträgerquerschnitt, die Zapfenhöhe und -breite variiert. Der Konuswinkel k war mit Ausnahme von Versuchsreihe I (0°) immer 10°. Die Zapfenlänge war 26 mm und Lochtiefe 28 mm. Die Geometrie und die Mittelwerte der Versuchsergebnisse der einzelnen Reihen sind ebenfalls in Tabelle 1 (Anlage 1) angegeben.

In dieser Arbeit wurden auch Bemessungsgleichungen für den Nachweis des Nebenträgers auf Grundlage von E DIN 1052 (5/2000) vorgeschlagen. Diese Gleichungen für den Nachweis von Ausklinkungen wurden mit Hilfe der Bruchmechanik hergeleitet.

Nach E DIN 1052:2000-05 sind für Ausklinkungen am Endauflager von Trägern mit Rechteckquerschnitt folgende Bedingung einzuhalten:

$$\frac{1.5 \cdot \frac{V_d}{b \cdot h_e}}{\frac{k_v \cdot f_{v,d}}{k_v = \min \{1 \atop k_{90} \cdot k_s}} \le 1$$
mit



wobei
$$k_{90} = \frac{\kappa_n}{\sqrt{h} \cdot \left(\left(\sqrt{\alpha (1 - \alpha)} + 0.8 \cdot \frac{v}{h} \cdot \sqrt{\frac{1}{\alpha} - \alpha^2} \right) \right)}$$
und
$$k_s = 1 + \frac{1.1}{\tan s \cdot \sqrt{h \cdot \tan s}}$$

$$\alpha = \frac{h_e}{h}$$

Hierin bedeuten:

h Nebenträgerhöhe in mm
 ν Abstand zwischen Kraftwirkungslinie der Auflagerkraft und Ausklinkungsecke in mm
 ε Steigungswinkel des Anschnitts
 k_n = 5 für Vollholz und Balkenschichtholz
 k_n = 6.5 für Brettschichtholz und Furnierschichtholz

Diese Gleichungen dürfen nur angewendet werden, wenn $\alpha \ge 0.5$ und v/h ≤ 0.4 ist. Für Träger mit Ausklinkungen auf der unbelasteten Seite ist $k_v = 1$.

Die Beispielrechnungen in [1] zeigen, dass die Bemessungswerte mit diesem Formelwerk um ca. den Faktor k_v zu gering gegenüber den Versuchswerten abgeschätzt wurden.

Für die Bemessung des Hauptträgers wurde ein Bemessungsdiagramm (siehe <u>Bild 7</u>) vorgeschlagen. In diesem Diagramm ist der Bemessungswert der Tragfähigkeit R_d in Abhängigkeit vom Absatzmaß $(h_u + h_1)$ dargestellt.

Für den Gebrauchstauglichkeitsnachweis wurde ein Verschiebungsmodul für Bauteile aus BS-Holz mit $k_s = 6000 \text{ N/mm}$ für Bauteile aus Konstruktionsvollholz mit $k_s = 3500 \text{ N/mm}$ für die Bemessung vorgeschlagen.



In Tabelle 3 (<u>Anlage 3</u>) sind für verschiedene Schwalbenschwanz- Zapfenverbindungen entsprechend Anlage <u>4</u>, <u>5</u>, <u>6</u>, <u>7</u> die zulässigen Belastungen nach dem Bemessungsvorschlag angegeben.

6. Zusammenfassung

An drei verschiedenen Prüflabors wurden 101 Traglastversuche mit Schwalbenschwanz-Zapfenverbindungen mit unterschiedlichen Parametern durchgeführt. Auf Grundlage dieser Versuchsergebnisse wurde ein einfaches Bemessungsverfahren vorgeschlagen.

Nachweis des Nebenträgers

$$zul F_{NT} = \frac{2}{3} \cdot A_Z \cdot zul \tau_Q$$

mit

$$A_{z} = \frac{b_{1} + b_{2}}{2} \cdot \left(h_{e} - \frac{b_{2}}{2}\right) + \pi \cdot \frac{b_{2}^{2}}{8}$$

A_z Zapfenfläche

 $zul_{T_{O}}$ zulässige Schubspannung nach DIN 1052-1 Tabelle 5

h_e Zapfenhöheh_{NT} Nebenträgerhöhe

b₁ Zapfenbreite oben

Zapfenbreite beim Ausrundungsbereich (Durchmesser der Ausrundung)

Dabei sollte die Bedingung

$$\frac{h_e}{h_{NT}} \ge 0.5$$

eingehalten werden.

Nachweis des Hauptträgers

$$zulF_{HT} = 0.09 \cdot a$$

$$a = h_{HT} - h_e + \frac{b_2}{2}$$

a Lage des erwarteten Risses

h_{нт} Hauptträgerhöhe h_e Zapfenhöhe

Zapfenbreite beim Ausrundungsbereich (Durchmesser der Ausrundung)

in kN

HIGH TECH ABBUND



Es wird eine Mindestbreite des Hauptträgers bei einseitiger Anordnung von

 $\min b = t + 50$

in mm

Zapfenlochtiefe

in mm

vorgeschlagen. Bei zweiseitiger Anordnung der Zapfenlöcher im Hauptträger ist dieser Wert zu verdoppeln.

Die Zapfenlänge sollte 25 mm $\leq l_z \leq$ 30 mm betragen. Die Zapfenlochtiefe darf nicht mehr als 3 mm größer als die Zapfenlänge sein.

Die Zapfenlöcher sind im ausreichenden Abstand voneinander anzuordnen. Die Querschnittschwächung ist bei der Bemessung des Hauptträgers zu berücksichtigen.

Die zulässige Belastung der Schwalbenschwanz-Zapfenverbindung ergibt sich dann zu

$$zul F = min \left\{ \begin{array}{l} zulF_{NT} \\ zulF_{HT} \end{array} \right.$$

Als Verschiebungsmodul kann ein Wert von

C=O,7-zul F

angesetzt werden.

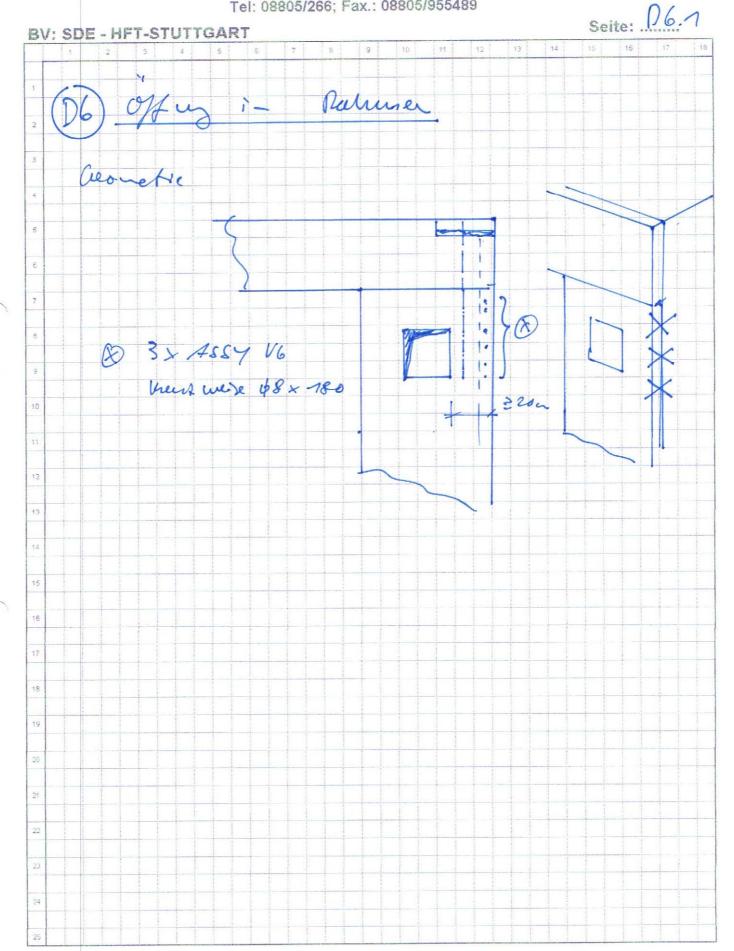
Um größere Verschiebungen zu vermeiden, muss eine ausreichende Passgenauigkeit (Toleranz \pm 0,2 mm) vorausgesetzt werden.

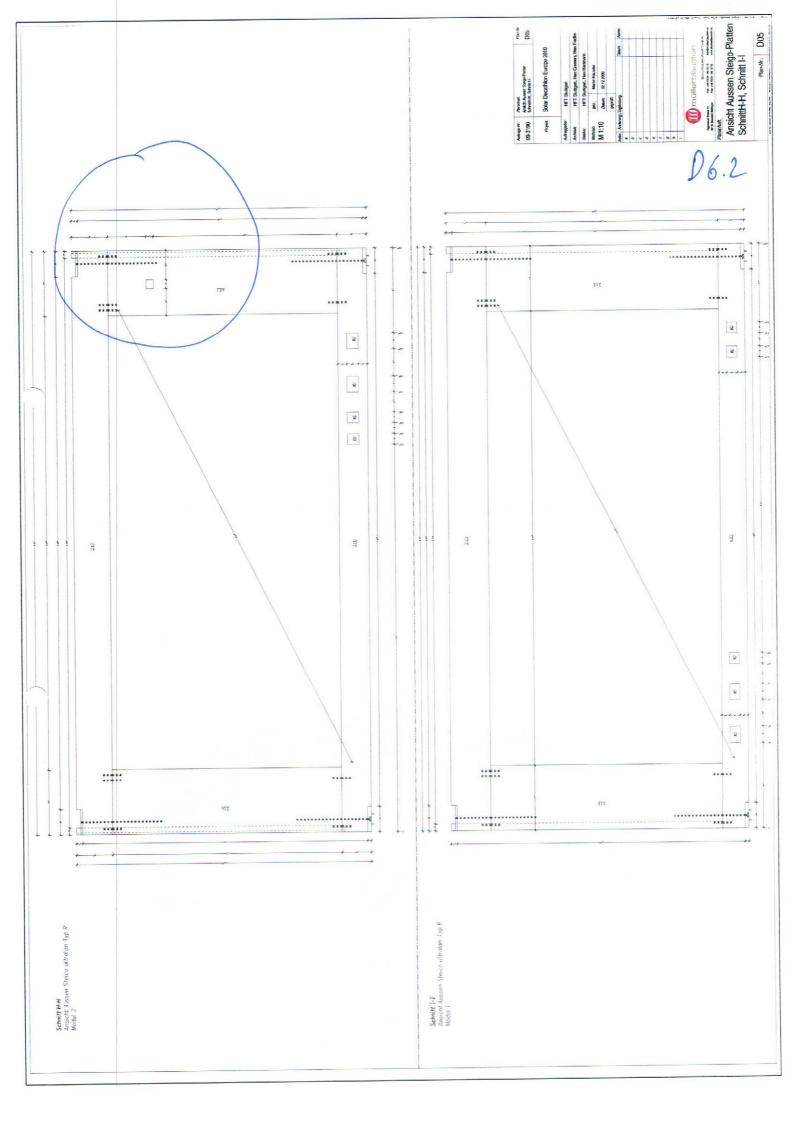
Diese Verbindungsart sollte nur in der Nutzungsklasse 1 (Innenräume) eingesetzt werden. Bei der Herstellung der Verbindung dürfen die Hölzer eine *maximale* Holzfeuchte von 15 % haben. Die Holzfeuchte ist zu überprüfen.

Es sollte in jedem Fall nachgewiesen werden, dass die Konstruktion diese Verschiebung aufnehmen kann, und dass die Gebrauchstauglichkeit dadurch nicht beeinträchtigt wird.

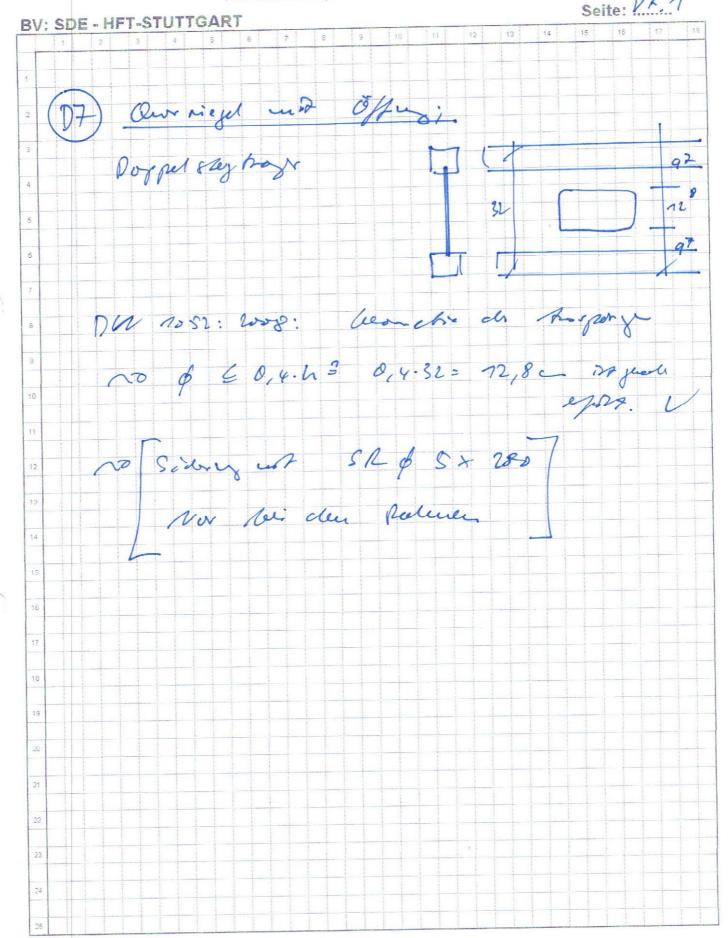


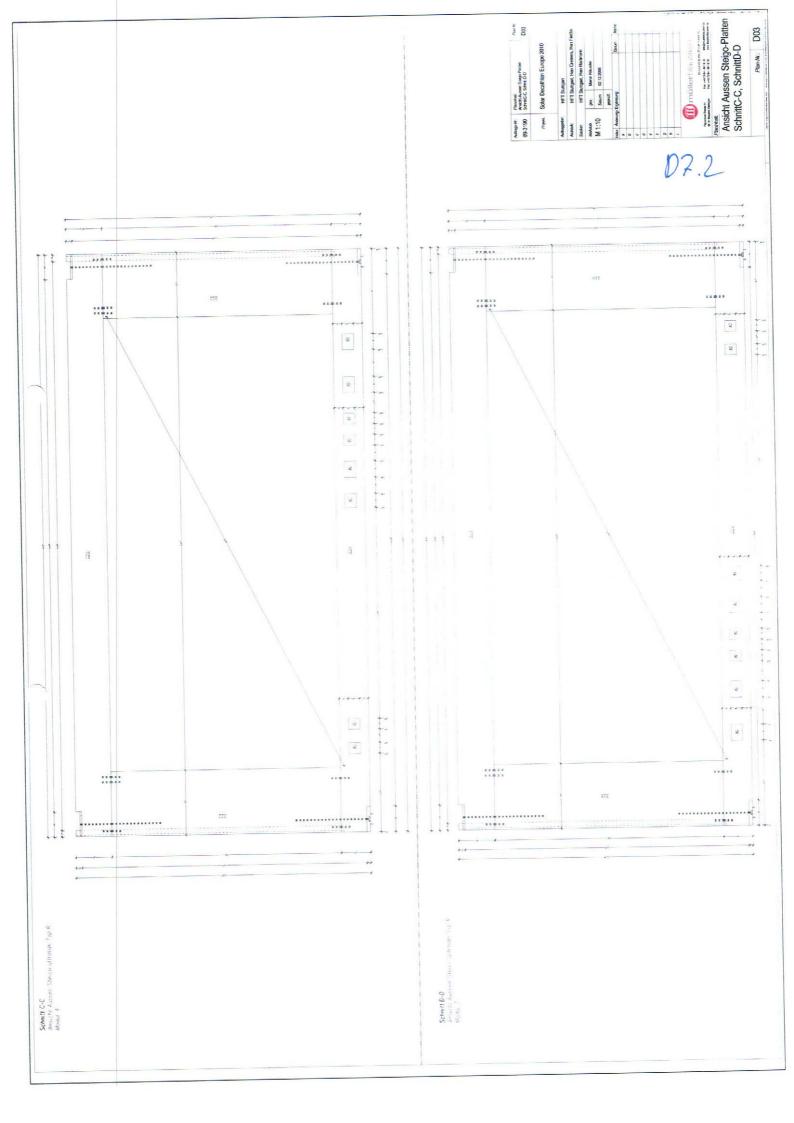
Ingenieurbüro Dr Hartmann Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,





Ingenieurbüro Dr Hartmann Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

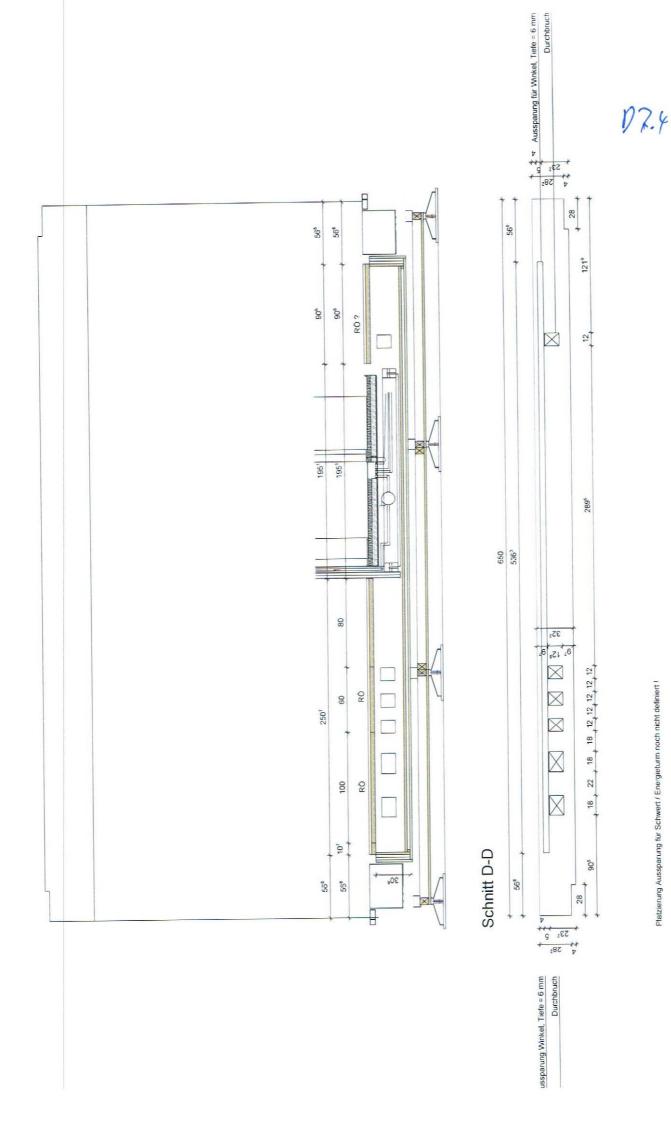




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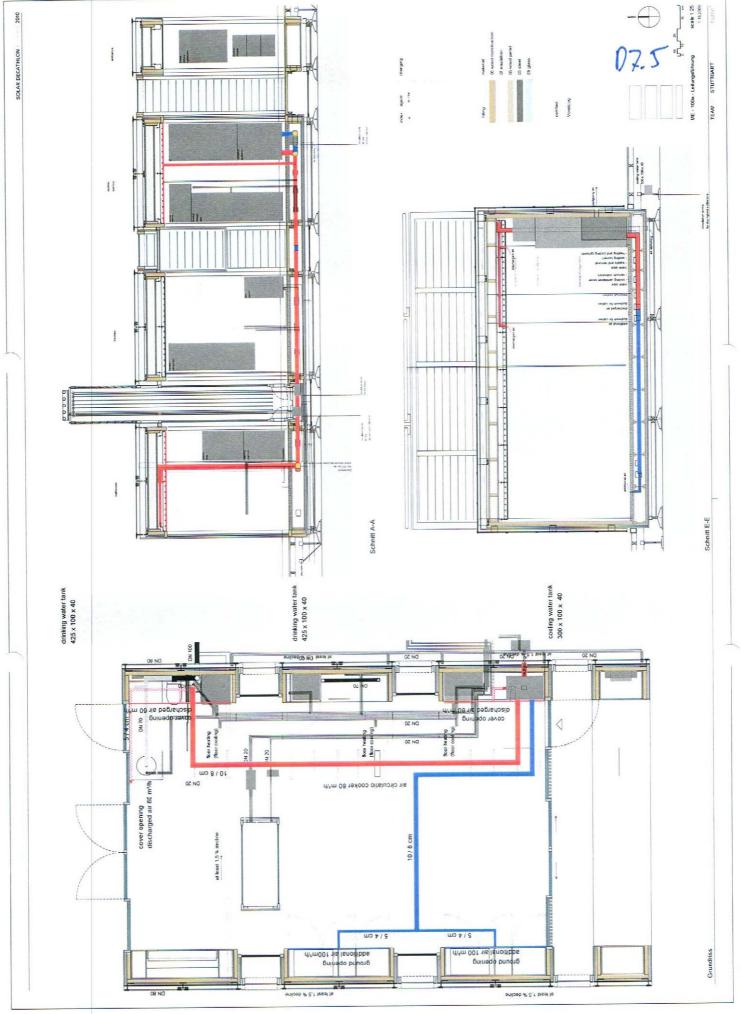
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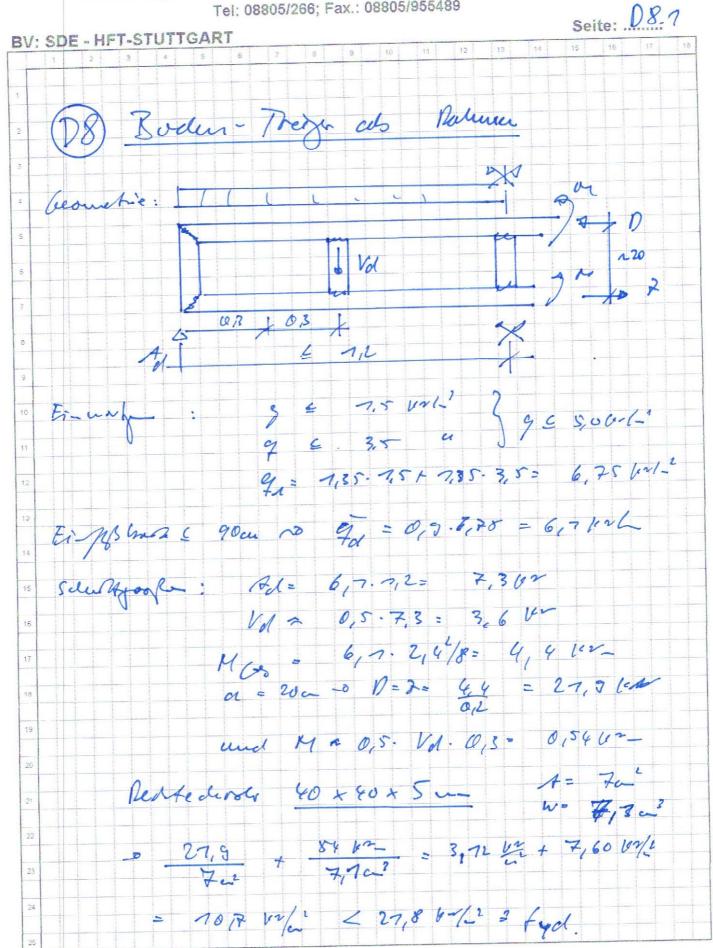
Platzierung Aussparung für Schwert / Energieturm noch nicht definiert !

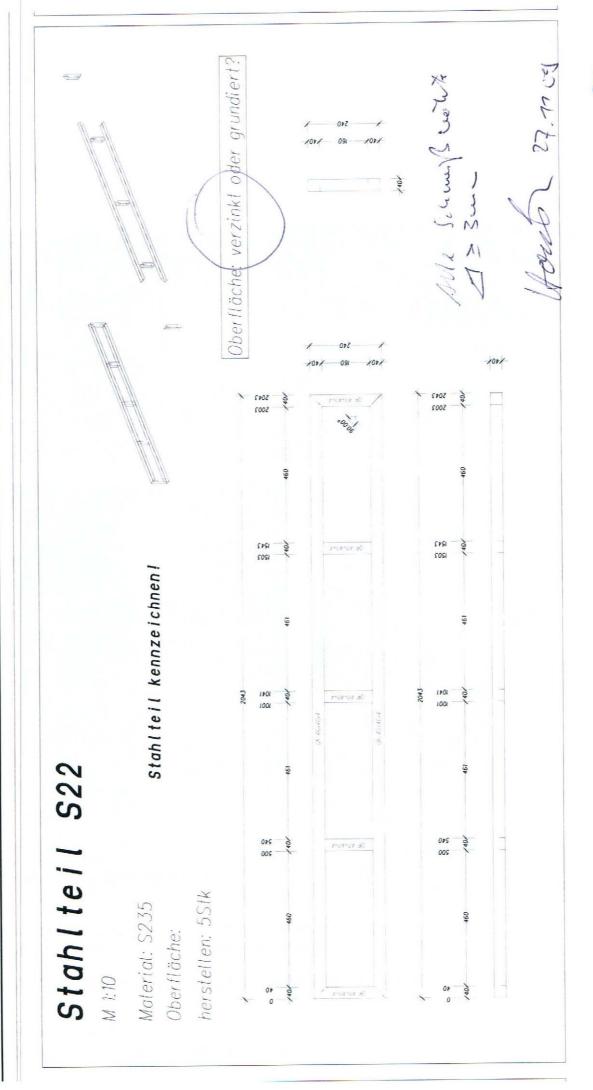
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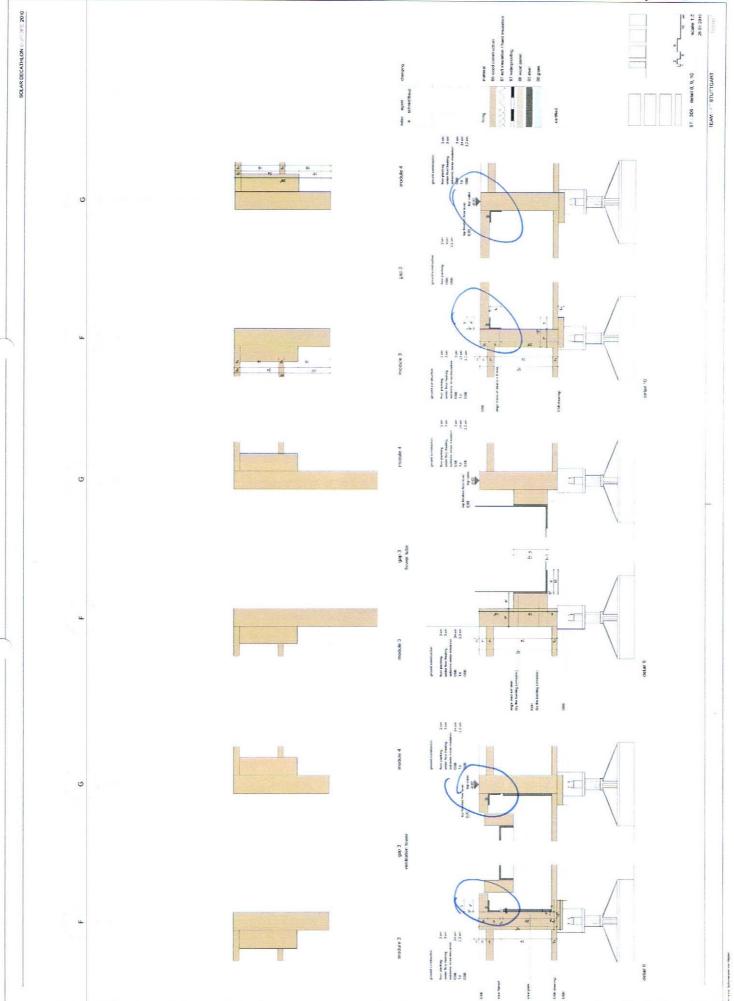


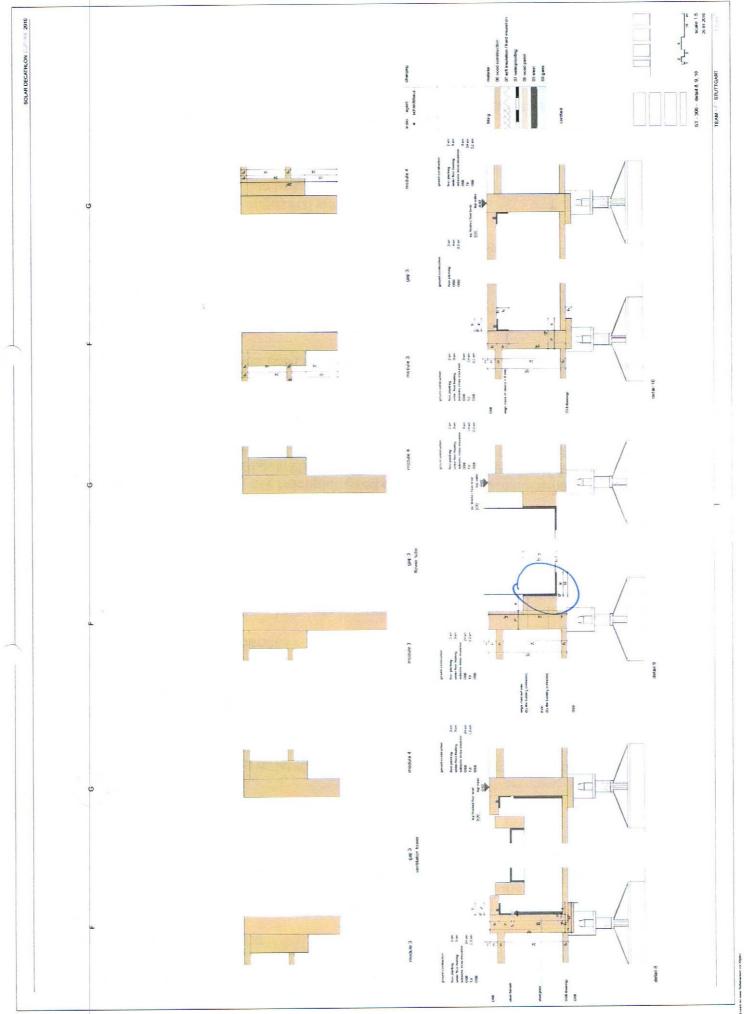
Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

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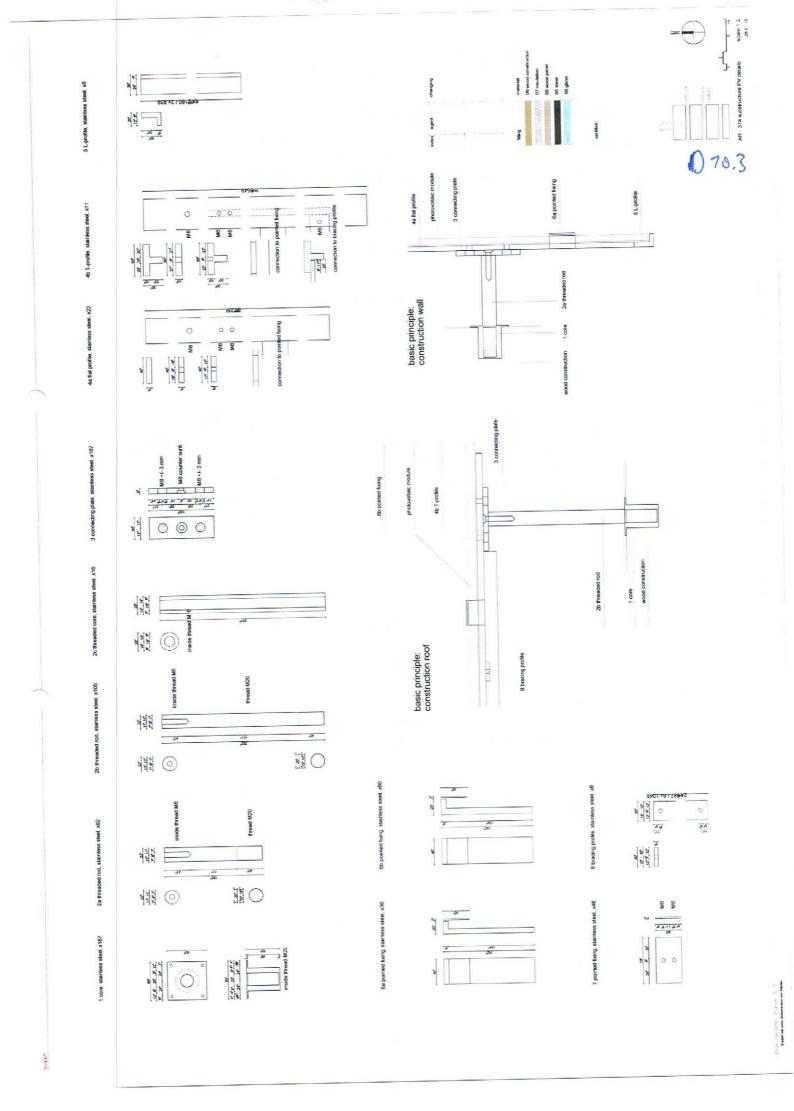




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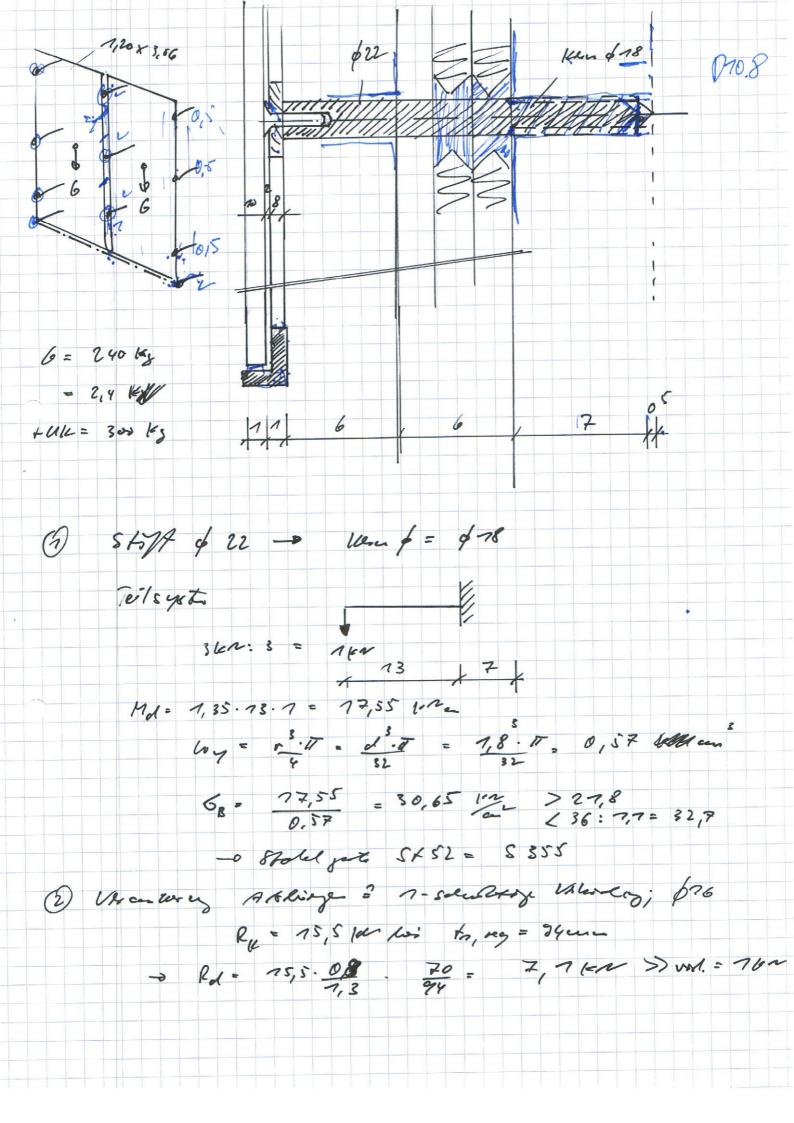
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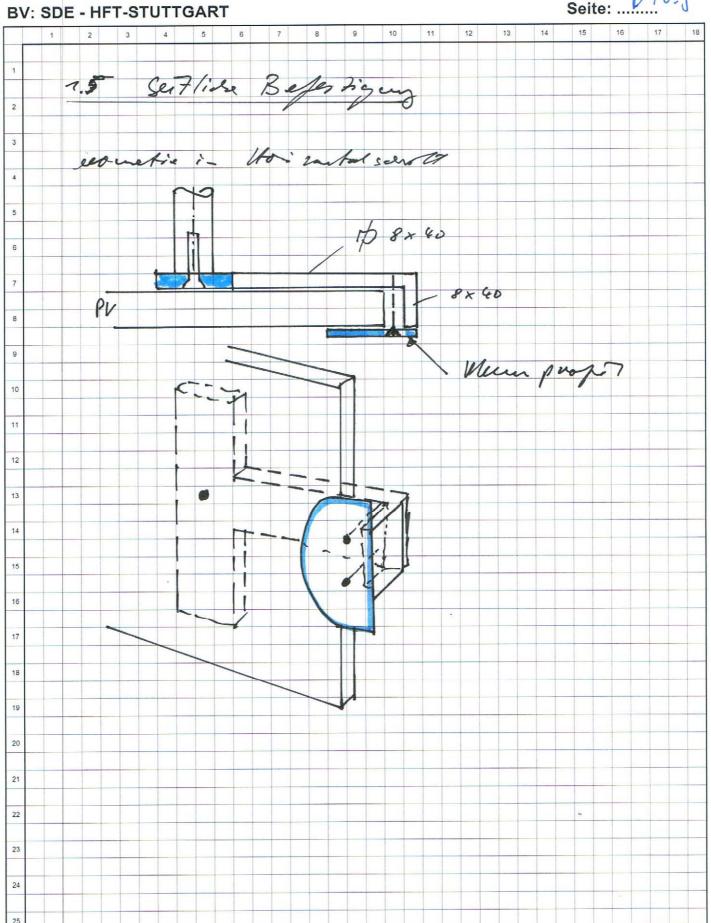
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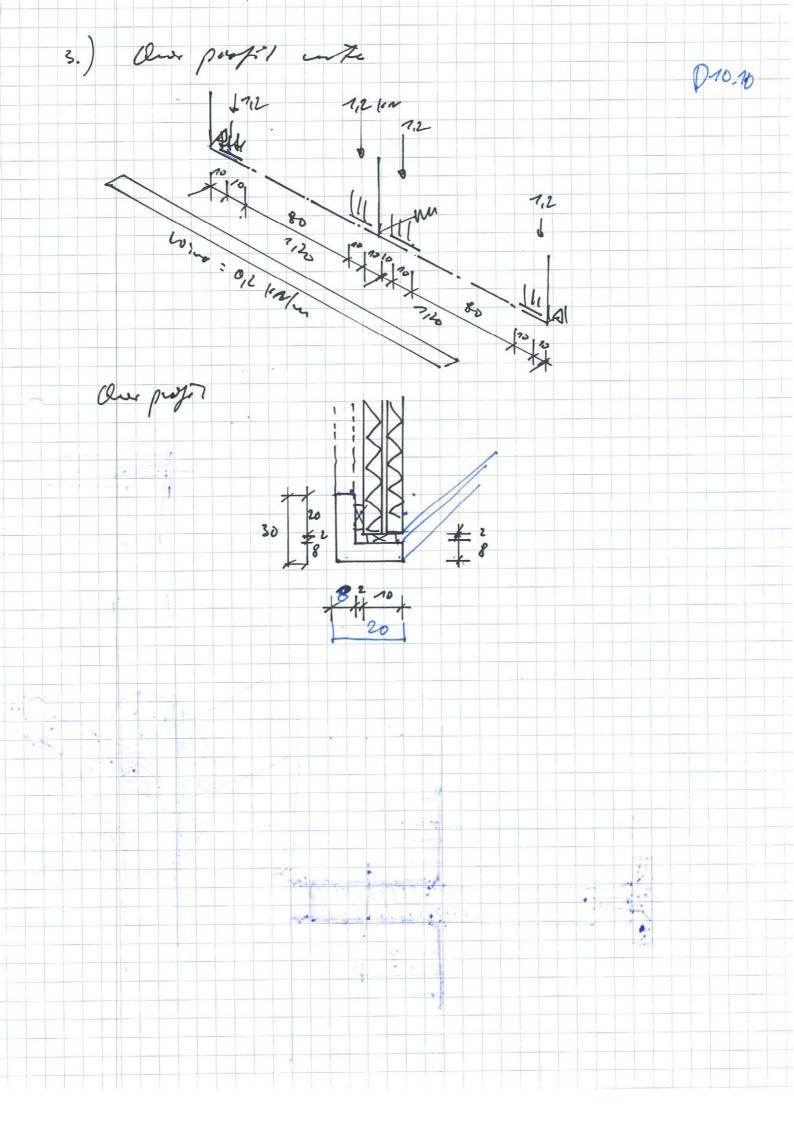
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Durchlaufträger DLT 04/2008/B WinXP

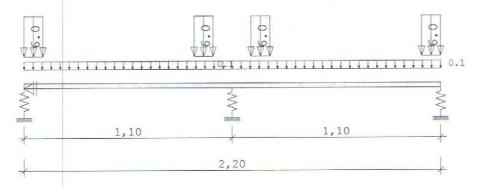
Bl. 1

PROJEKT: SDE

POS: PV-Profil-unten

070.77

Maßstab 1:20



Stahlträger über 2 Felder S 235

E-Modul E = 21000 kN/cm2

SYSTEM	Länge		Querso	hnittswer	te		
Feld	L (m)	1	QNr.	I (cm4)	Wo (cm3)	Wu (c	m3) L25x20x6,0(
2	1.100	konstant konstant	1	1.3	0.8		L25x20x6,0(

Elastische Lager

-				
Stütze	Nr.	1	5000.0	kN/m
Stütze	Nr.	2	5000.0	kN/m
Stütze	Nr.	3	5000.0	kN/m

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a (kN,m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

Feld	Тур	EG Gr	g_1/r	q_l/r Faktor	Abstand	Länge	ausPOS	Phi
1	4	A	6.000	0.000 1.000	0.000	0.100		
	4	A	6.000	0.000 1.000	0.900	0.100		
	1	A	0.000	0.100 1.000				
2	4	A	6.000 6.000	0.000 1.000	0.100	0.100		
	4	A	6.000	0.000 1.000	1.000	0.100		
	1	A	0.000	0.100 1.000				

Durchlaufträger DLT 04/2008/B WinXP Bl. 2

PROJEKT: SDE POS: PV-Profil-unten

D-10-72

Eir	nwi	ckungen:
Mr	K1	Rezeichnung

Nr Kl Bezeichnung $\psi 0$ $\psi 1$ $\psi 2$ γ

A 1 Wohnräume 0.70 0.50 0.30 1.50

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

									-
Feldmo	omente Maxi	mum					(kNm	, kN)
Feld 1 2	x0 = 0.250 x0 = 0.850		.03	M li 0.00 -0.09	M re -0.09 0.00	V li 0.62 0.69	V re -0.69 -0.62	ko	mb 2 3
Stützı	momente Max	kimum					(kNm	, kN)
Stütz 1 2 3	e M li 0.00 -0.10 0.00	0 -0	.10	V li 0.00 -0.69 -0.62	V re 0.62 0.69 0.00	max F 0.62 1.38 0.62	min F 0.57 1.25 0.57	ko	omk 2 4
Aufla	gerkräfte							(kN	()
Stütz 1 2 3 Summe	0.58 1.25 0.58	3 0 5 0 8 0	.05 .14 .05	min q -0.01 0.00 -0.01 -0.01	Vollast 0.62 1.38 0.62 2.62	max 0.62 1.38 0.62 2.63	min 0.57 1.25 0.57 2.39		
Aufla	gerkräfte							(kN	1)
EG g A	Stütze 1 max 0.6 0.0	min 0.6 0.0	Stütze max 1.2 0.1	2 min 1.2 0.0					
Sum	0.6	0.6	1.4	1.2	0.6	0.6			

Durchlaufträger DLT 04/2008/B WinXP Bl. 3

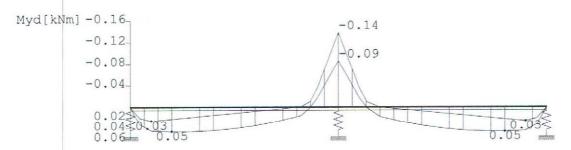
PROJEKT: SDE POS: PV-Profil-unten

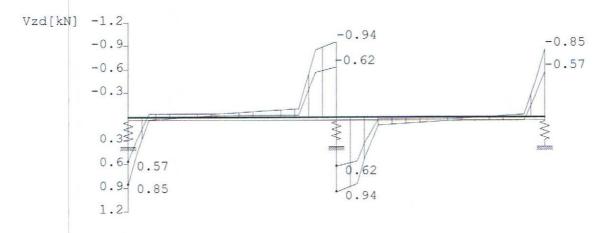
0-10.73

Ergebnisse für γ -fache Lasten Teilsicherheitsbeiwert γ G über Trägerlänge konstant

Feldmo	mente M	(kNm ,	kN)					
Feld 1 2	x0 = 0. x0 = 0.	07FF 30 1FE	Mfd 0.05 0.05	Mdli 0.00 -0.13	Mdre -0.13 0.00	V li 0.85 0.93	V re -0.93 -0.85	komb A 2 A 3
Stützm	nomente	Maxim	um				(kNm ,	kN)
Stütze	e M	Idli	Mdre	Vdli	Vdre	max F	min F	komb
1	0	.00	0.00	0.00	0.85	0.85	0.57	A 2
2	-0	.14	-0.14	-0.94	0.94	1.89	1.25	A 4
3	0	.00	0.00	-0.85	0.00	0.85	0.57	A 3

Maßstab 1:20





Durchlaufträger DLT 04/2008/B WinXP Bl. 4

PROJEKT: SDE POS: PV-Profil-unten

040.74

Bemessung: S 235 fy, d = fy, k / 1.1 = 218.2 N/mm2

Feld Nr.	X (m)	My,d (kNm)	Vz,d (kN)	σ ₀	σu N/ı	τ nm2	σV)	η	ko	mb
1	0.000	0.0	0.9	0	0	8	***	0.06	А	2
	0.270	0.0	0.0	-57	32	0	***	0.26	A	2
	1.100	-0.1	-0.9	170	-97	9	***	0.78	A	4
2	0.000	-0.1	0.9	170	-97	9	***	0.78	A	4
	0.830	0.0	0.0	-57	32	0	***	0.26	A	3
	1.100	0.0	-0.9	0	0	8	***	0.06	A	3

*** Nachweis SigmaV nicht erforderlich (Element 747)

L-Profile sind mit schenkelparallelen Achsen gerechnet. Die Spannungen sind ggf. analog DIN 18800 (751) um 30% zu erhöhen.

Der Druckgurt ist kontinuierlich gehalten. NACHWEIS Biegedrillknicken ist nicht erforderlich.

Zulässige Durchbiegungen: im Feld zul f = L / 300

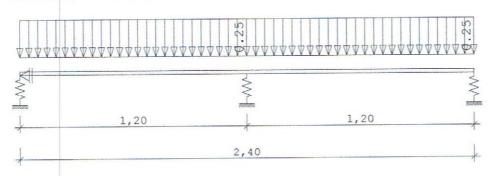
komb	η	zulf (cm)	f (cm)	ftot (cm)	fg (cm)	x (m)	Feld Nr.
2	0.43	0.367		0.16		0.550	1
3	0.43	0.367	0.156	0.16	0.11	0.550	2

Durchlaufträger DLT 04/2008/B WinXP Bl. 1

PROJEKT: SDE POS: PV-Profil-unten-wind

010.75

Maßstab 1:20



Stahlträger über 2 Felder S 235

E-Modul E = 21000 kN/cm2

SYSTEM	Länge		Querso	hnittswer	te		
Feld 1	L (m) 1.200 1.200	konstant konstant	QNr. 1	I (cm4) 0.8 0.8	Wo (cm3) 0.6 0.6	1.2	m3) L20x30x6,0(L20x30x6,0(

Elastische Lager

Stütze	Nr.	1	5000.0	kN/m
Stütze	Nr.	2	10.0	kN/m
Stütze	Nr.	3	5000.0	kN/m

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a (kN,m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

Feld	Тур	EG Gr	g_1/r	q_l/r Faktor	Abstand Länge	ausPOS	Phi
1	1	A	0.000	0.250 1.000			
2	1	A	0.000	0.250 1.000			

Einwirkungen: Nr Kl Bezeichn

Nr	Kl	Bezeichnung	ψ0	Ψ1	ψ2	γ
A	1	Wohnräume	0.70	0.50	0.30	1.50

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Durchlaufträger DLT 04/2008/B WinXP Bl. 2

PROJEKT: SDE POS: PV-Profil-unten-wind

0-10-16

Ergebnisse	für	1-fache	Lasten
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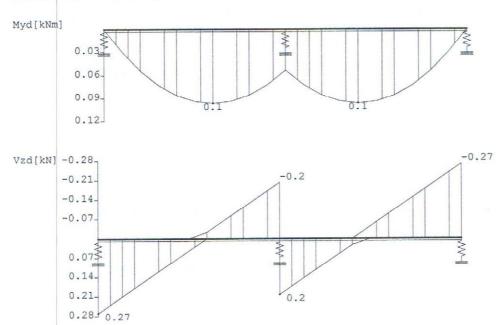
								-
Feldr	momente Maximu	ım				(kNm	, kN)
Feld 1 2	x0 = 0.720 x0 = 0.480			M re 0.04 0.00	V li 0.18 0.12		kor	mb 3
Stütz	zmomente Maxim	num				(kNm	, kN)
Stütz 1 2 3	0.00	M re 0.00 0.00 0.00		V re 0.18 0.14 0.00	max F 0.18 0.24 0.18	0.00	kor	mb 3 4 3
Aufla	agerkräfte						(kN)
Stütz 1 2 3 Summe	0.00 0.00 0.00 0.00	max q 0.18 0.24 0.18 0.60	min q 0.00 0.00 0.00 0.00	Vollast 0.18 0.24 0.18 0.60	max 0.18 0.24 0.18 0.60	min 0.00 0.00 0.00 0.00	/ 1-27	1
Aufla	agerkräfte						(kN)
EG g A	0.0	Stütz n max 0.0 0.0 0.0	0.0	max 0.0	min 0.0			
Sum	0.2	0.2	0.0	0.2	0.0			
_	onisse fürγ-f sicherheitsbei			erlänge ko	onstant			
Feldr	momente Maximu	ım				(kNm	, kN)
Feld 1 2	x0 = 0.720 x0 = 0.480	Mfd 0.10 0.10	Mdli 0.00 0.05	Mdre 0.05 0.00	V li 0.27 0.18	V re -0.18 -0.27	kor A A	3
Stütz	zmomente Maxim	num				(kNm	, kN)
Stütz 1 2 3	ze Mdli 0.00 0.00 0.00	Mdre 0.00 0.00 0.00	Vdli 0.00 -0.20 -0.27	Vdre 0.27 0.20 0.00	max F 0.27 0.36 0.27	min F 0.00 0.00 0.00	kor A A	mb 3 4 3

Durchlaufträger DLT 04/2008/B WinXP Bl. 3

PROJEKT: SDE POS: PV-Profil-unten-wind

170.17

Maßstab 1:25



Bemessung: S 235 $f_y,d = f_y,k / 1.1 = 218.2 \text{ N/mm2}$

Feld Nr.	x (m)	My,d (kNm)	Vz,d (kN)	σ ₀	σu N/m	τ m2	σV)	η	ko	mb
1	0.000	0.0	0.3	0	0	3	***	0.02	А	3
-	0.720	0.1	0.0	-175	78	0	***	0.80	A	3
	1.200	0.1	-0.2	-96	43	2	***	0.44	A	3
2	0.000	0.1	0.2	-96	43	2	***	0.44	A	3
are.	0.480	0.1	0.0	-175	78	0	***	0.80	A	3
	1.200	0.0	-0.3	0	0	3	***	0.02	A	3

*** Nachweis SigmaV nicht erforderlich (Element 747)

L-Profile sind mit schenkelparallelen Achsen gerechnet. Die Spannungen sind ggf. analog DIN 18800 (751) um 30% zu erhöhen.

Der Druckgurt ist kontinuierlich gehalten. NACHWEIS Biegedrillknicken ist nicht erforderlich.

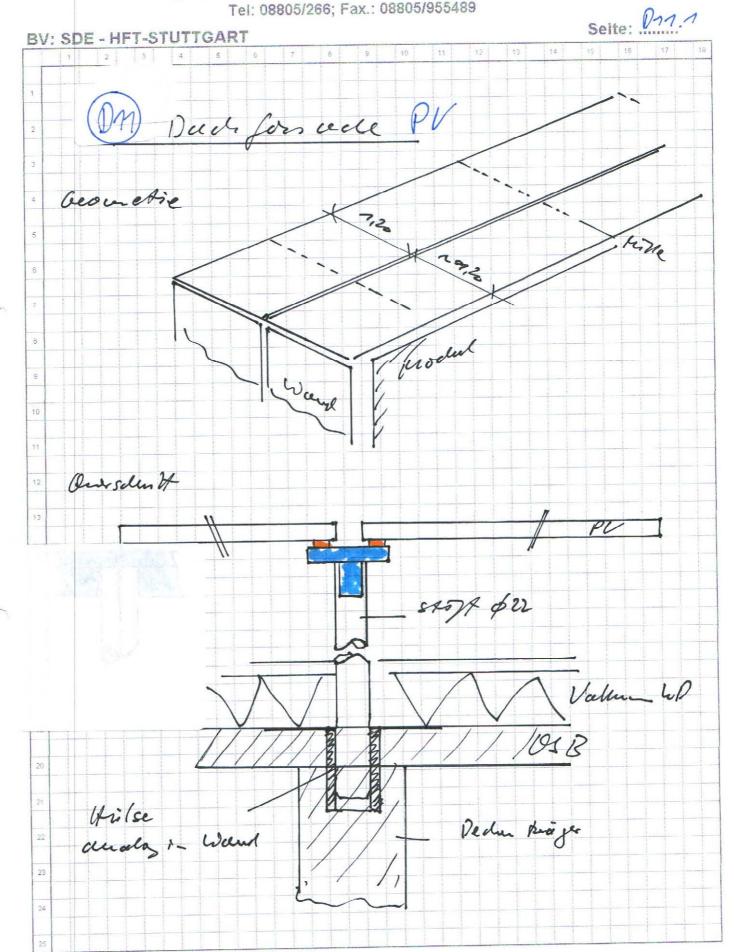
Zulässige Durchbiegungen: im Feld zul f = L / 300

Feld Nr.	x (m)	fg (cm)	ftot (cm)	f (cm)	zulf (cm)	η	komb
1 2	1.200	0.00	2.41	2.410 2.410	0.400	6.02!!	3

Ingenieurbüro Dr Hartmann

Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

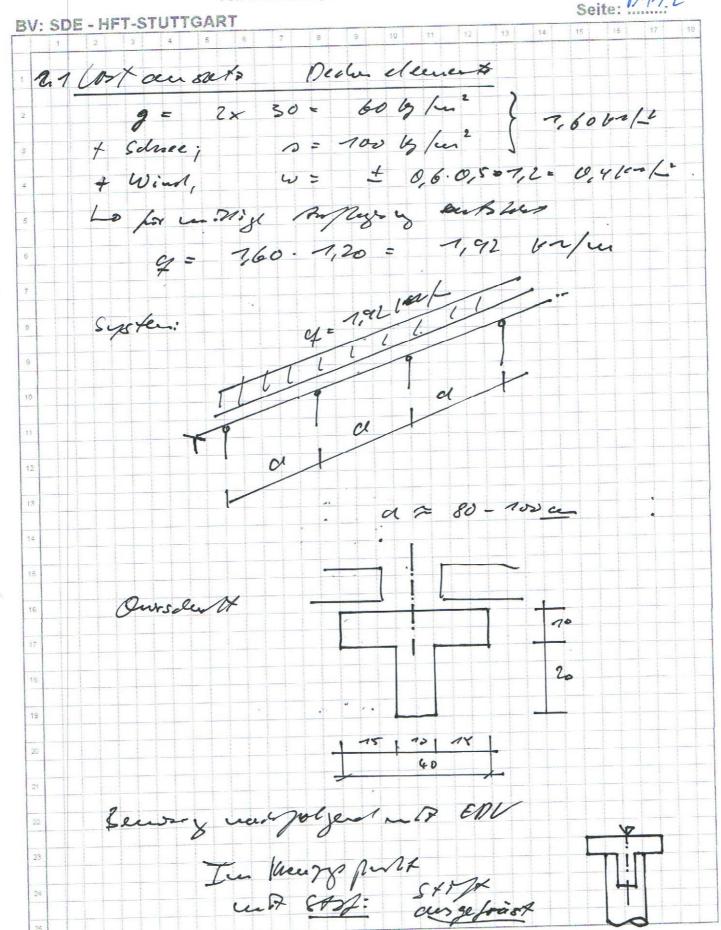
Tel: 08805/266; Fax.: 08805/955489



Ingenieurbüro Dr Hartmann

Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

Tel: 08805/266; Fax.: 08805/955489



Prof. Dr.-Ing. Heiner Hartmann, Hochschule für Technik Stuttgart Durchlaufträger DLT 04/2008/B WinXP B1. 017.3 POS: PV-Dachprofil PROJEKT: SDE Variante dos d'alapades T- Profo7 1:33 Maßstab 0.9 1,00 1,00 1,00 1,00 5,00 Stahlträger über 5 Felder S 235 E-Modul E = 21000 kN/cm2Ouerschnittswerte SYSTEM Länge Wo (cm3) Wu (cm3) I(cm4)QNr. L (m) Feld 2.0 Iu30(sd) 4.0 4.0 1 konstant 1 1.000 2.0 Iu30(sd) 4.0 1 4.0 1.000 konstant 2 2.0 Iu30(sd) 4.0 4.0 1 konstant 1.000 3 2.0 Iu30(sd) 4.0 4.0 1 konstant 1.000 4 2.0 Iu30(sd) 4.0 4.0 1 konstant 1.000 Querschnittsabmessungen: mit Profilhöhe = h , a oder D Wanddicken Radius unten Außenmaße Profil Quersch. bu tu r t b S h Nr. (mm) (mm) (mm) (mm) (mm) (mm) (mm) 0 0.0 10.0 10.0 40 30 Iu 30 (sd) 7 BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b (kN, m)5=Dreieckslast über L, 6=Trapezlast über L Feld Typ EG Gr g_l/r q_l/r Faktor Abstand Länge ausPOS Phi 1.000 1.000 0.900 1 0.400 1.000 0.000 T 1 1.000 1.000 0.400 1.000 0.900 A 1 2 0.000 1.000 1.000 0.900 A 3 0.400 1.000 0.000 1 I 0.900 1.000 1.000 1 A 4

Durchlaufträger DLT 04/2008/B WinXP

B1. 2

017.4

PROJEKT: SDE

POS: PV-Dachprofil

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a

(kN, m)

3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

q_l/r Faktor Abstand Länge ausPOS Phi Feld Typ EG Gr g_l/r $\overline{0.400}$ 1.000 0.000 1 1.000 1.000 0.900 5 1 A 0.400 1.000 0.000 T 1

Finwirkungen:

	Bezeichnung	ΨΟ	Ψ1	ψ2	γ
	Wohnräume Windlasten			0.30	

Alle Einwirkungen werden als unabhängige betrachtet.

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

Feldm	nomente Maxim	am				(kNm ,	kN)
Feld 1 2 3 4 5	x0 = 0.430 x0 = 0.520 x0 = 0.500 x0 = 0.480 x0 = 0.570	Mf 0.21 0.14 0.16 0.14 0.21	M li 0.00 -0.17 -0.13 -0.13 -0.17	M re -0.17 -0.13 -0.13 -0.17 0.00	V li 0.98 1.19 1.15 1.11 1.32	V re -1.32 -1.11 -1.15 -1.19 -0.98	komb 3 4 3 4 3
Stütz	zmomente Maxi	mum				(kNm	, kN)
Stütz 1 2 3 4 5	ze M li 0.00 -0.26 -0.23 -0.23 -0.26 0.00	M re 0.00 -0.26 -0.23 -0.23 -0.26 0.00	V 1i 0.00 -1.41 -1.23 -1.28 -1.31 -0.98	V re 0.98 1.31 1.28 1.23 1.41 0.00	max F 0.98 2.72 2.51 2.51 2.72 0.98	min F 0.28 0.90 0.61 0.61 0.90 0.28	komb 3 9 14 18 22

Durchlaufträger DLT 04/2008/B WinXP

Bl. 3 Dn.5

PROJEKT: SDE

POS: PV-Dachprofil

Aufla	gerkräfte
-------	-----------

(kN)

Stütze 1 2 3 4 5	aus g 0.36 1.02 0.88 0.88	max q 0.63 1.70 1.63 1.63	min q -0.07 -0.12 -0.27 -0.27 -0.12	Vollast 0.91 2.60 2.24 2.24 2.60	max 0.98 2.72 2.51 2.51 2.72	min 0.28 0.90 0.61 0.61 0.90	
5	0.36	0.63	-0.07	0.91	0.98	0.28	
Summe:	4.50	7.93	-0.93	11.50	12.43	3.37	

Auflagerkräfte

(kN)

EG g A I	Stütze 1 max 0.4 0.4 0.2	min 0.4 -0.1 0.0	Stütze max 1.0 1.2 0.5	min 1.0 -0.1 0.0	Stütze max 0.9 1.2 0.5	min 0.9 -0.2 -0.1	Stütze max 0.9 1.2 0.5	4 min 0.9 -0.2 -0.1
Sum	1.0	0.3	2.7	0.9	2.5	0.6	2.5	0.6
Duni	1.0							(kN)

Auflagerkräfte

	Stütze	5	Stütze	6		
EG g A I	max 1.0 1.2 0.5	min 1.0 -0.1 0.0	max 0.4 0.4 0.2	min 0.4 -0.1 0.0		
Sum	2.7	0.9	1.0	0.3		

Ergebnisse fürγ-fache Lasten

Teilsicherheitsbeiwert γ G über Trägerlänge konstant

Feldmomente	Maximum
-------------	---------

(kNm , kN)

Feld		Mfd	Mdli	Mdre	V li	V re	komb
1	x0 = 0.430	0.28	0.00	-0.23	1.31	-1.76	A 3
2	x0 = 0.430 x0 = 0.520	0.19	-0.23	-0.17	1.59	-1.48	A 4
2	x0 = 0.520 x0 = 0.500	0.22	-0.17	-0.17	1.54	-1.54	A 3
7	x0 = 0.300 x0 = 0.480	0.19	-0.17	-0.23	1.48	-1.59	A 4
4	x0 = 0.400 x0 = 0.570	0.28	-0.23	0.00	1.76	-1.31	A 3

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Durchlaufträger DLT 04/2008/B WinXP

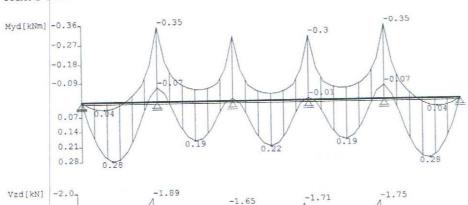
Bl. 4

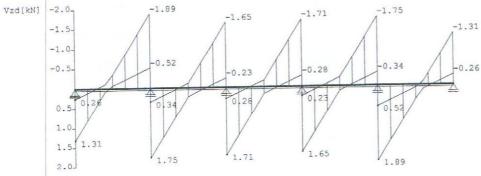
017.6

PROJEKT: SDE POS: PV-Dachprofil

tützmome	ente Maxim	um				(kNm ,	kN)
tütze 1 2 3 4	Mdli 0.00 -0.35 -0.30 -0.30	Mdre 0.00 -0.35 -0.30 -0.30	Vdli 0.00 -1.89 -1.65 -1.71	Vdre 1.31 1.75 1.71 1.65	max F 1.31 3.64 3.35 3.35 3.64	min F 0.26 0.86 0.52 0.52 0.86	komb A 3 A 9 A 14 A 18 A 22
	-0.30	-0.30		The state of the s		3.35 3.64	3.35 0.52 3.64 0.86

Maßstab 1:50





Bemessung: S 235 $f_y, d = f_y, k / 1.1 = 218.2 \text{ N/mm2}$

Feld Nr.	x (m)	My,d (kNm)	Vz,d (kN)	σο (σu N/r	τ nm2	σV)	η	komb
1	0.000	0.0	1.3	0	0	7	***	0.05	A 3
1	0.430	0.3	0.0	-70	140	0	***	0.64	A 3
	1.000	-0.4	-1.9	88	-175	9	***	0.80	A 9
2	0.000	-0.4	1.8	88	-175	9	***	0.80	A 9
2	0.520	0.2	0.0	-47	94	0	***	0.43	A 4
	1.000	-0.3	-1.6	76	-151	8	***	0.69	A 14
3	0.000	-0.3	1.7	76	-151	9	***	0.69	A 14
3	0.500	0.2	0.0	-54	108	0	***	0.49	A 3
	1.000	-0.3	-1.7	76	-151	9	***	0.69	A 18
1	0.000	-0.3	1.6	76	-151	8	***	0.69	A 18
4	0.480	0.2	0.0	-47	94	0	***	0.43	A 4

Durchlaufträger DLT 04/2008/B WinXP

Bl. 5

Om.7

PROJEKT: SDE

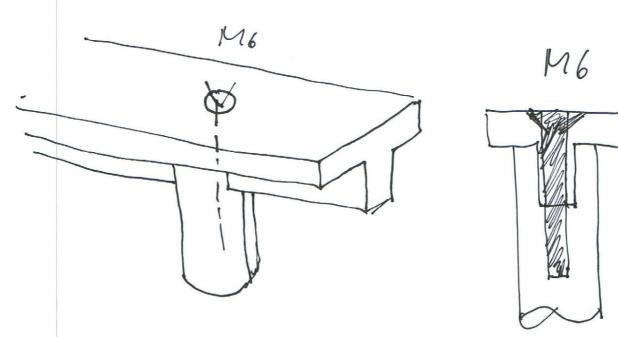
POS: PV-Dachprofil

Feld Nr.	X (m)	My,d (kNm)	Vz,d (kN)	σο (σu N/m	τ nm2	σV)	η	komb
5	1.000 0.000 0.570 1.000	-0.4 -0.4 0.3 0.0	-1.8 1.9 0.0 -1.3	88 88 -70 0	-175 -175 140 0	9 9 0 7	*** *** ***	0.80 0.80 0.64 0.05	A 22 A 22 A 3 A 3
***	Nachweis	SigmaV	nicht erf	order	lich (El	ement	747)		

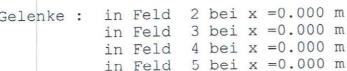
Der Druckgurt ist kontinuierlich gehalten. NACHWEIS Biegedrillknicken ist nicht erforderlich.

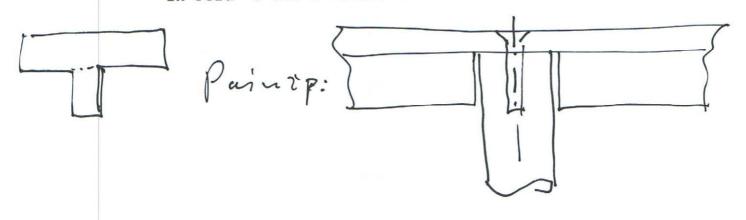
Zulässige Durchbiegungen: im Feld zul f = L / 300

Feld Nr.	x (m)	fg (cm)	ftot (cm)	f (cm)	zulf (cm)	η	komb
1	0.500	0.07	0.23	0.231	0.333	0.69	3
2	0.500	0.02	0.14	0.137	0.333	0.41	4
2	0.500	0.03	0.17	0.169	0.333	0.51	3
4	0.500	0.02	0.14	0.137	0.333	0.41	4
5	0.500	0.07	0.23	0.231	0.333	0.69	3



Prof. Dr.-Ing. Heiner Hartmann, Hochschule für Technik Stuttgart Bl. 1 M.8 Durchlaufträger DLT 04/2008/B WinXP POS: PV-Dachprofil PROJEKT: SDE Vorianti und Stege Maßstab 1:33 0.4 1,00 1,00 1,00 5,00 Stahlträger über 5 Felder S 235 E-Modul E = 21000 kN/cm2Querschnittswerte SYSTEM Länge QNr. I (cm4) Wo (cm3) Wu (cm3) L (m) Feld 2.0 Iu30(sd)1 4.0 4.0 konstant 1.000 1 4.0 2.0 Iu30(sd) 4.0 1 1.000 konstant 2 2.0 Iu30(sd) 4.0 4.0 1 konstant 3 1.000 2.0 Iu30(sd) 4.0 4.0 1 konstant 1.000 4 2.0 Iu30(sd) 4.0 1 4.0 konstant 1.000 Querschnittsabmessungen: mit Profilhöhe = h , a oder D Wanddicken Radius unten Außenmaße Quersch. Profil s t bu tu r h b Nr. (mm) (mm) (mm) (mm) (mm) (mm) (mm) 0.0 40 10.0 10.0 0.0 Iu 30 (sd) 30 1 Gelenke: in Feld 2 bei x = 0.000 m





Prof. Dr.-Ing. Heiner Hartmann, Hochschule für Technik Stuttgart

Durchlaufträger DLT 04/2008/B WinXP

Bl. 2

029

PROJEKT: SDE

POS: PV-Dachprofil

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a (kN,m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b

(kN	1, m)		3=E 5=I	inzelmoment reieckslast	über	L, 6=T:	rapezla	ast über L	4.2
Feld	Тур	EG Gr	g_1/r	q_l/r Fakt	or Ab	stand :	Länge	ausPOS	Phi
1	1	A	0.900	1.000 1.0 0.400 1.0					
2	1	A	0.900	1.000 1.0 0.400 1.0					
3	1 1	A I	0.900	1.000 1.0 0.400 1.0					
4	1	A	0.900	1.000 1.0					
5	1	A	0.900	1.000 1.0					
		ngen: zeichn	ung		ψ0	ψ1	ψ2	γ	
A 1 I 4		hnräum ndlast			0.70	0.50	0.30	1.50 1.50	

Alle Einwirkungen werden als unabhängige betrachtet.

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

	te Maximu	111				(kNm ,	kN)
Feld x0	= 0.500	Mf 0.29	M li 0.00	M re 0.00	V li 1.15	V re -1.15	komb 2
3. x0	= 0.500 $= 0.500$ $= 0.500$	0.29 0.29 0.29	0.00 0.00 0.00	0.00	1.15 1.15 1.15	-1.15 -1.15 -1.15	6 8

Durchlaufträger DLT 04/2008/B WinXP

B1. 3 D17.70

PROJEKT: SDE

POS: PV-Dachprofil

Stützm	nomente Max	imum					(kNm	, kN)
Stütze 1 2 3 4 5	M li 0.00 0.00 0.00 0.00 0.00	0 0 0 0 0 0 0 0 0	.00	V li 0.00 -1.15 -1.15 -1.15 -1.15	V re 1.15 1.15 1.15 1.15 1.15 0.00	max F 1.15 2.30 2.30 2.30 2.30 1.15	min F 0.45 0.90 0.90 0.90 0.90 0.45	komb 2 4 6 8 10 10
Auflag	gerkräfte							(kN)
Stütze 1 2 3 4 5 6 Summe	0.45 0.90 0.90 0.90 0.90	6 0 0 1 0 1 0 1 0 1	x q .70 .40 .40 .40 .70	min q 0.00 0.00 0.00 0.00 0.00 0.00	Vollast 1.15 2.30 2.30 2.30 2.30 1.15 11.50	max 1.15 2.30 2.30 2.30 2.30 1.15	min 0.45 0.90 0.90 0.90 0.90 0.45 4.50	
	gerkräfte							(kN)
EG g A I	Stütze 1 max 0.5 0.5 0.2	min 0.5 0.0	Stütze max 0.9 1.0 0.4	min 0.9 0.0 0.0	Stütze max 0.9 1.0 0.4	3 min 0.9 0.0	Stütze max 0.9 1.0 0.4	min 0.9 0.0 0.0
Sum	1.2	0.5	2.3	0.9	2.3	0.9	2.3	0.9
Aufla	gerkräfte		-					(kN)
EG g A I	Stütze 5 max 0.9 1.0 0.4	min 0.9 0.0 0.0	Stütze max 0.5 0.5	min 0.5 0.0 0.0				
Sum	2.3	0.9	1.2	0.5				

Durchlaufträger DLT 04/2008/B WinXP

Bl. 4

017.11

PROJEKT: SDE

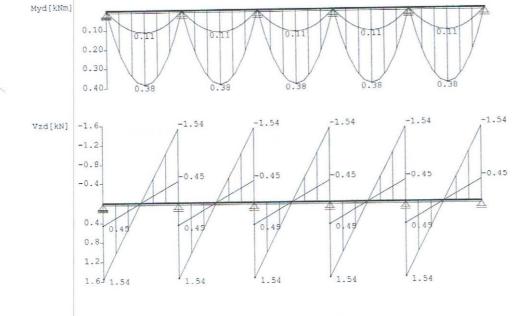
POS: PV-Dachprofil

(kNm, kN)

Ergebnisse für 7 - fache Lasten Teilsicherheitsbeiwert γ G über Trägerlänge konstant

Feldm	omente Maximu	m				(kNm ,	kN)
Feld 1 2 3 4 5	x0 = 0.500 x0 = 0.500 x0 = 0.500 x0 = 0.500 x0 = 0.500	Mfd 0.38 0.38 0.38 0.38 0.38	Mdli 0.00 0.00 0.00 0.00	Mdre 0.00 0.00 0.00 0.00 0.00	V li 1.54 1.54 1.54 1.54 1.54	V re -1.54 -1.54 -1.54 -1.54 -1.54	komb A 2 A 4 A 6 A 8 A 10
Stütz	momente Maxim	num				(kNm ,	kN)
Stütz 1 2 3 4 5	Mdli 0.00 0.00 0.00 0.00 0.00 0.00	Mdre 0.00 0.00 0.00 0.00 0.00	Vdli 0.00 -1.54 -1.54 -1.54 -1.54	Vdre 1.54 1.54 1.54 1.54 1.54	max F 1.54 3.08 3.08 3.08 3.08 1.54	min F 0.45 0.90 0.90 0.90 0.90 0.45	komb A 2 A 4 A 6 A 8 A 10 A 10

1:50 Maßstab



Durchlaufträger DLT 04/2008/B WinXP

B1. 5

D17.72

PROJEKT: SDE POS: PV-Dachprofil

Bemessung: S 235 $f_y, d = f_y, k / 1.1 = 218.2 N/mm2$

Feld Nr.	x (m)	My,d (kNm)	Vz,d (kN)	5 0	σu N/n	t nm2	σV)	η	ko	dmo
1	0.000	0.0	1.5	0	0	8	***	0.06	A	2
	0.500	0.4	0.0	-96	192	0	***	0.88	A	2
	1.000	0.0	-1.5	0	0	8	***	0.06	A	2
2	0.000	0.0	1.5	0	0	8	***	0.06	A	4
4	0.500	0.4	0.0	-96	192	0	***	0.88	A	4
	1.000	0.0	-1.5	0	0	8	***	0.06	A	4
3	0.000	0.0	1.5	0	0	8	***	0.06	A	6
3	0.500	0.4	0.0	-96	192	0	***	0.88	A	6
	1.000	0.0	-1.5	0	0	8	***	0.06	A	6
4	0.000	0.0	1.5	0	0	8	***	0.06	A	8
4	0.500	0.4	0.0	-96	192	0	***	0.88	A	8
		0.0	-1.5	0	0	8	***	0.06	A	8
_	1.000	0.0	1.5	0	0	8	***	0.06	A	10
5	0.000		0.0	-96	192	0	***	0.88	A	10
	0.500	0.4	-1.5	0	0	8	***	0.06	A	10

Größte Ausnutzung $\eta = 0.88$

*** Nachweis SigmaV nicht erforderlich (Element 747)

Der Druckgurt ist kontinuierlich gehalten. NACHWEIS Biegedrillknicken ist nicht erforderlich.

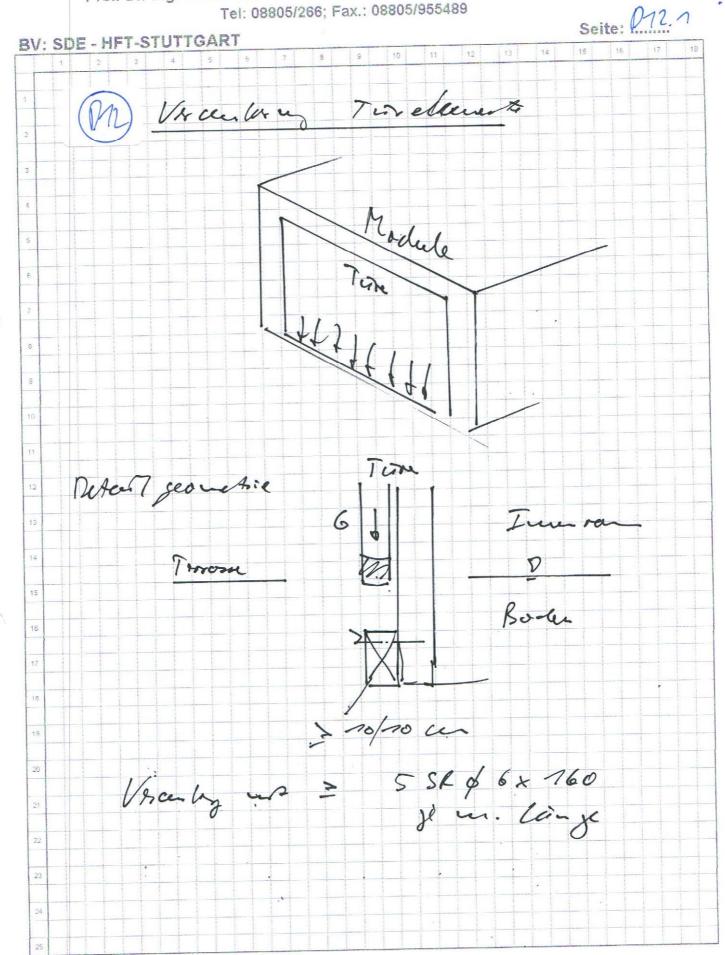
Zulässige Durchbiegungen: im Feld zul f = L / 300

Feld Nr.	X (m)	fg (cm)	ftot (cm)	f (cm)	zulf (cm)	η	komb
1 2 3 4 5	0.500 0.500 0.500 0.500 0.500	0.14 0.14 0.14 0.14	0.36 0.36 0.36 0.36 0.36	0.357 0.357 0.357 0.357 0.357	0.333 0.333 0.333 0.333	1.07!! 1.07!! 1.07!! 1.07!!	2 4 6 8 10

Ingenieurbüro Dr Hartmann

Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

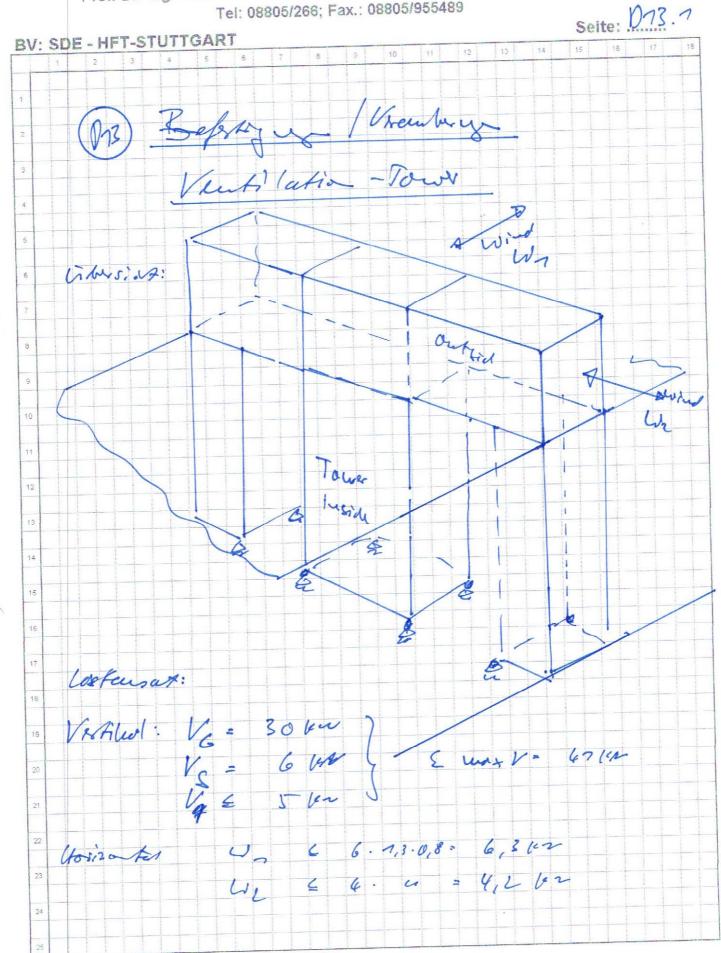
Tel: 08805/266; Fax.: 08805/955489

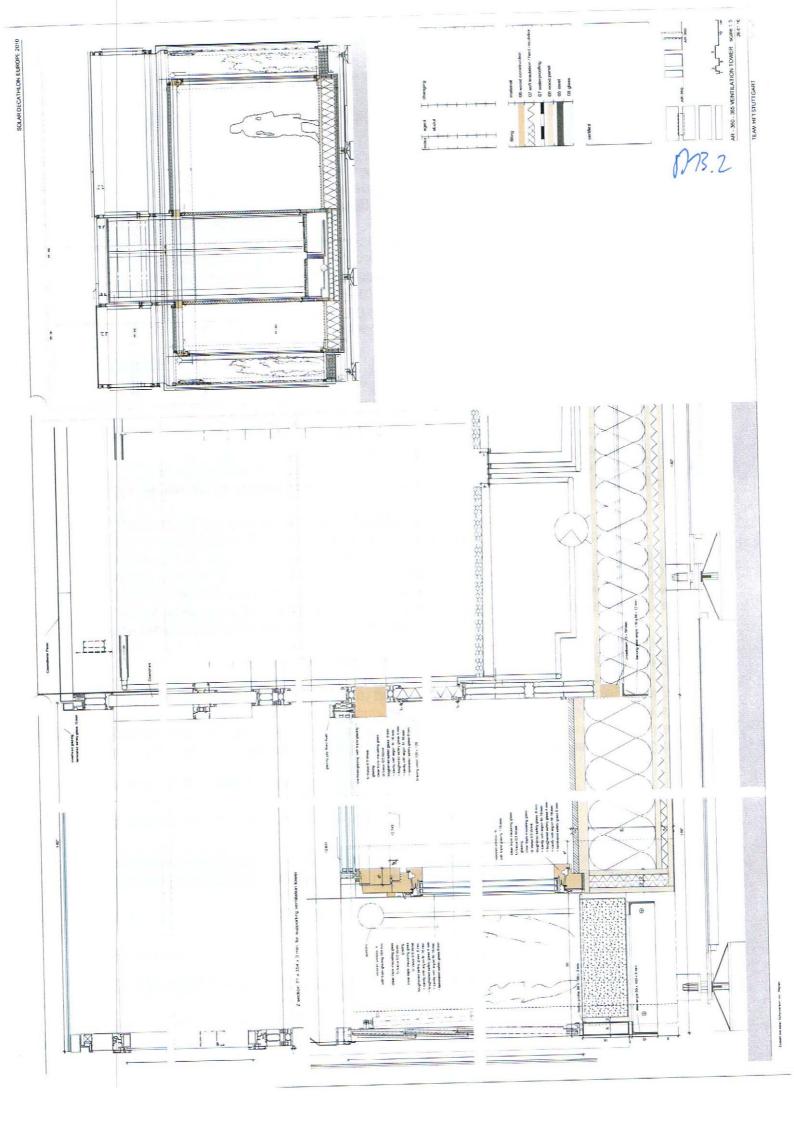


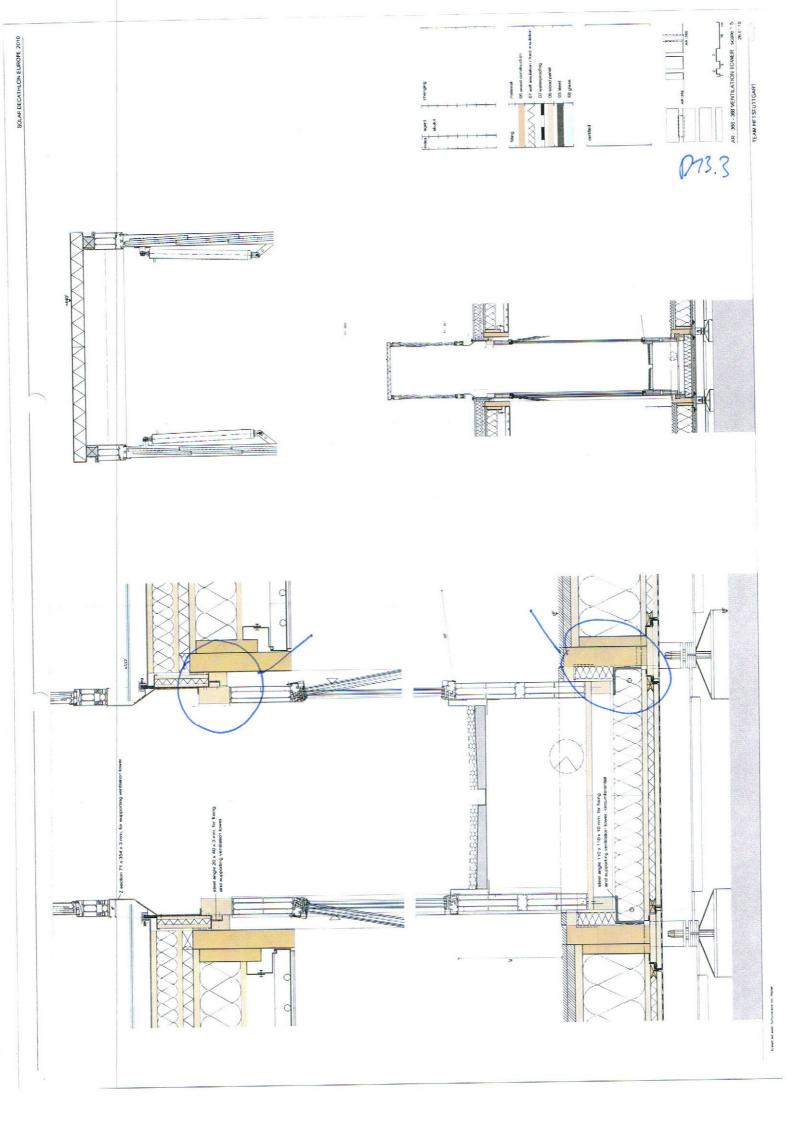
Ingenieurbüro Dr Hartmann

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Ingenieurbüro Dr Hartmann Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

Tel: 08805/266; Fax.: 08805/955489

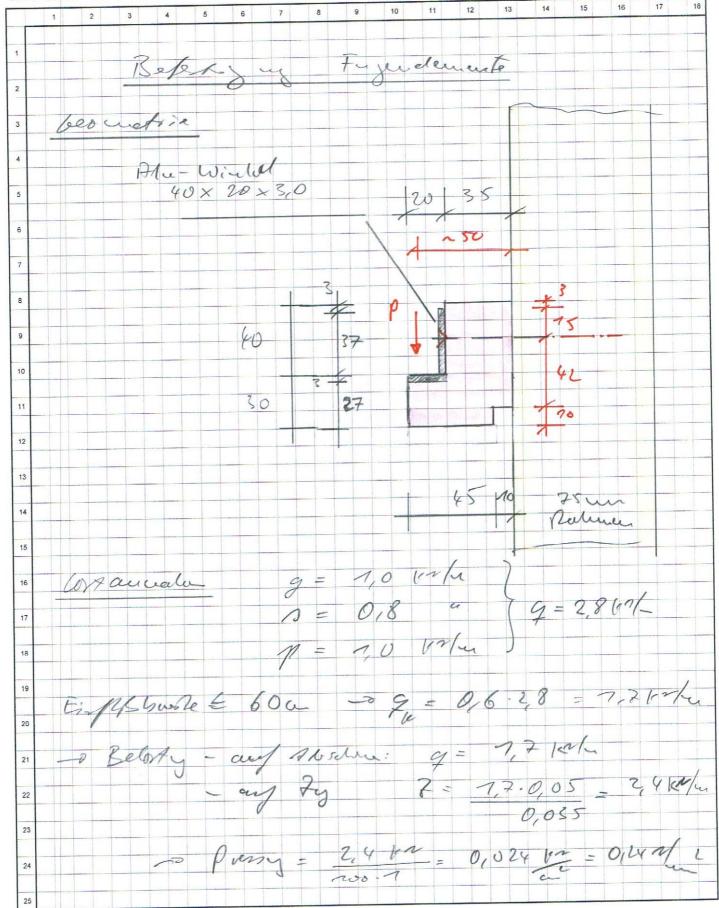
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a) absum Si7: 4 = 1,27

max L = 1,36 : 600 :

Ingenieurbüro Dr Hartmann Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

Tel: 08805/266; Fax.: 08805/955489



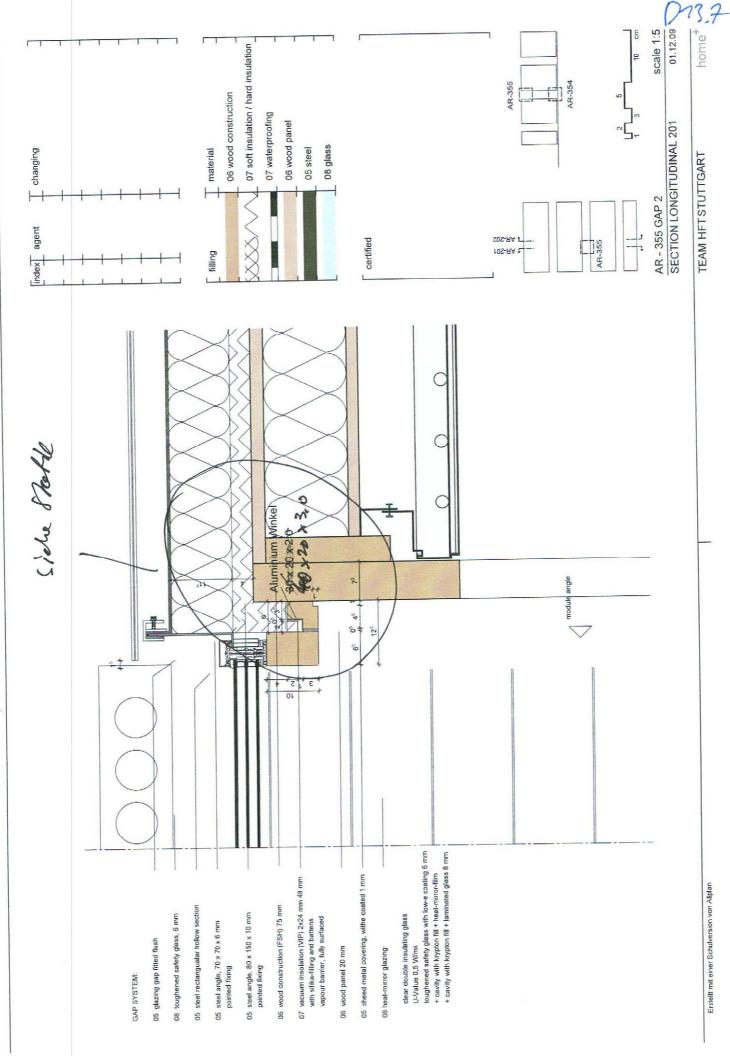
Ingenieurbüro Dr Hartmann

Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

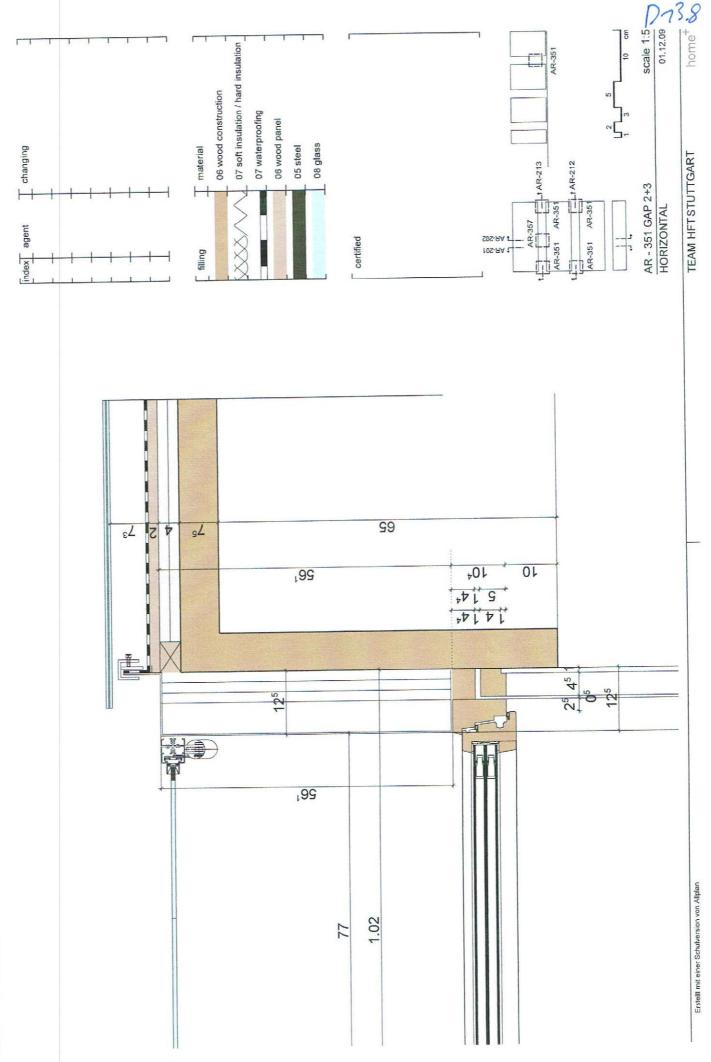
Tel: 08805/266; Fax.: 08805/955489

BV: SDE - HFT-STUTTGART

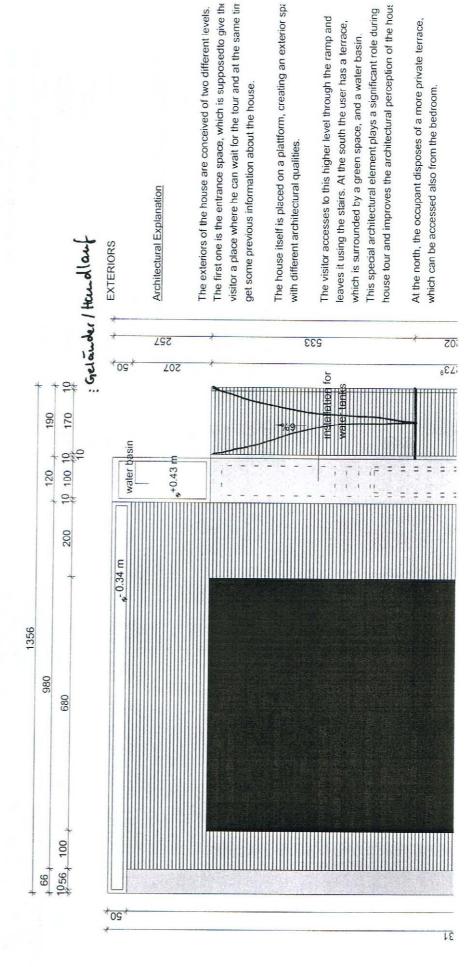
Seite: ... 073.6 Natur Scrale for Winte, 1854 \$ 6 × 100 T6, 2=900 3 le let = 100-35 = 65 mm -0 Ro-1 x = 3,8 lea y schoole -0 Px, d = 0, 8.3, 8 - 7,3 bx Lo 7 = 2,4. 1, 45 = . 3, 48 1 m/m + Alt scien 182 50% as well 3 clard 78 -> 2/2 e £ 2,3 (-22 - 0,33 un Warth \$ 6 × 100 Georg Celt Abstand e = 25 au + Alu- Wield FOX 20x3



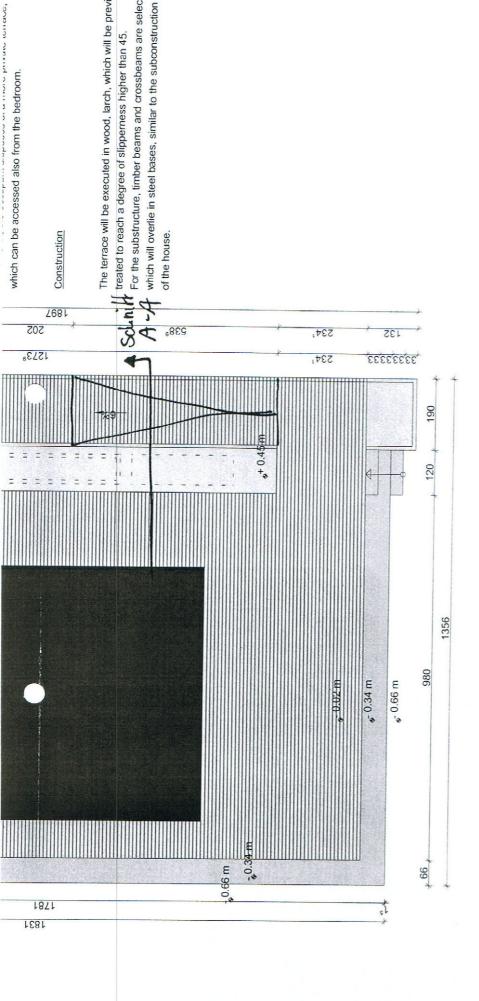
Erstellt mit einer Schulversion von Allplan

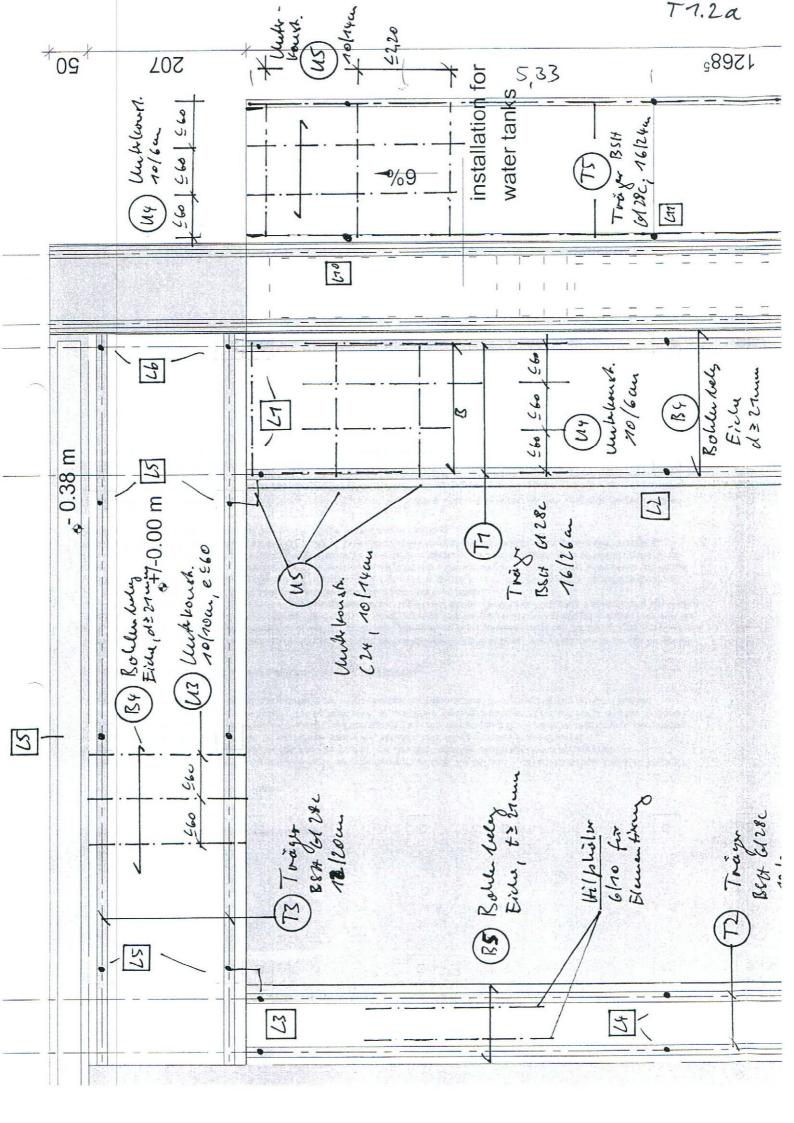


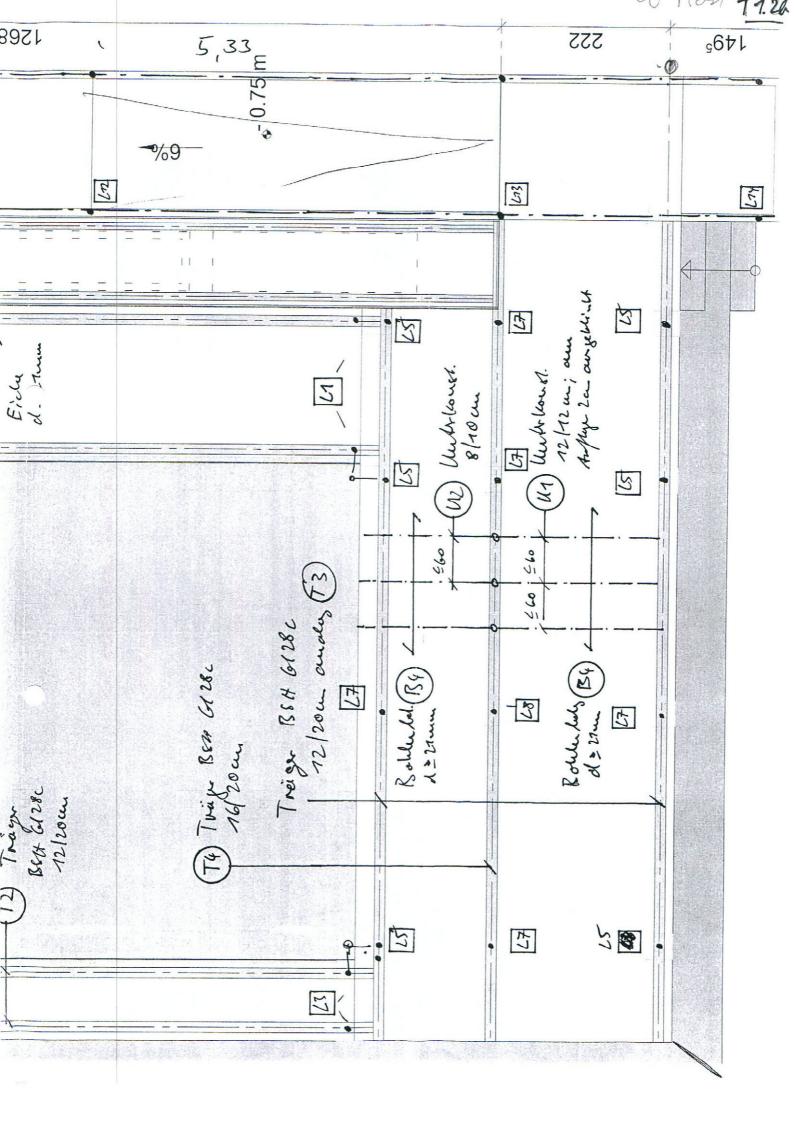
Skrizzen Außenanlagen



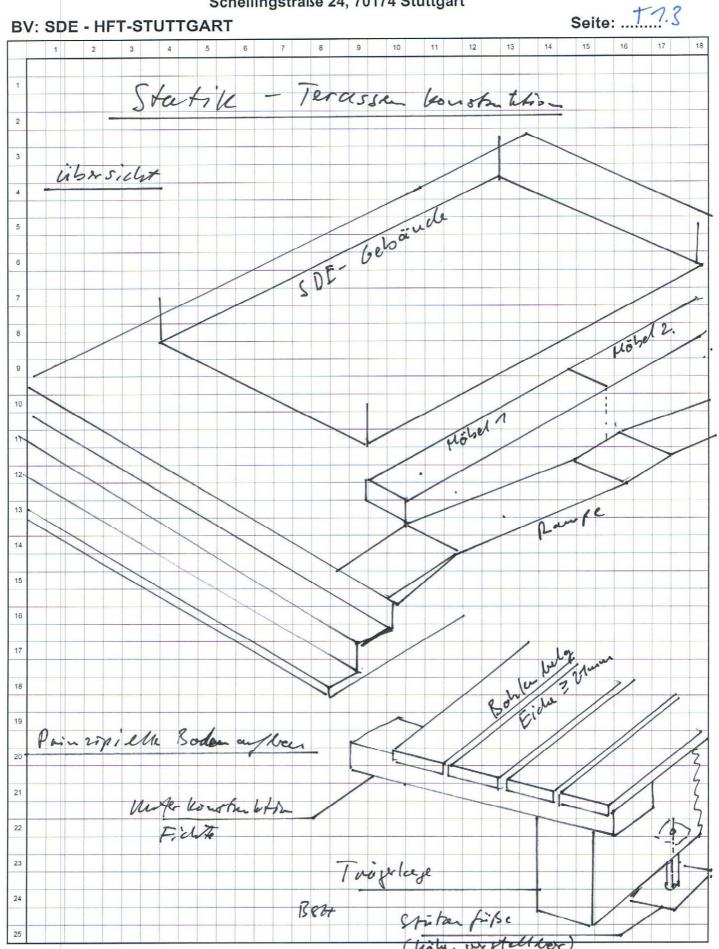
Grundriss H 1:100



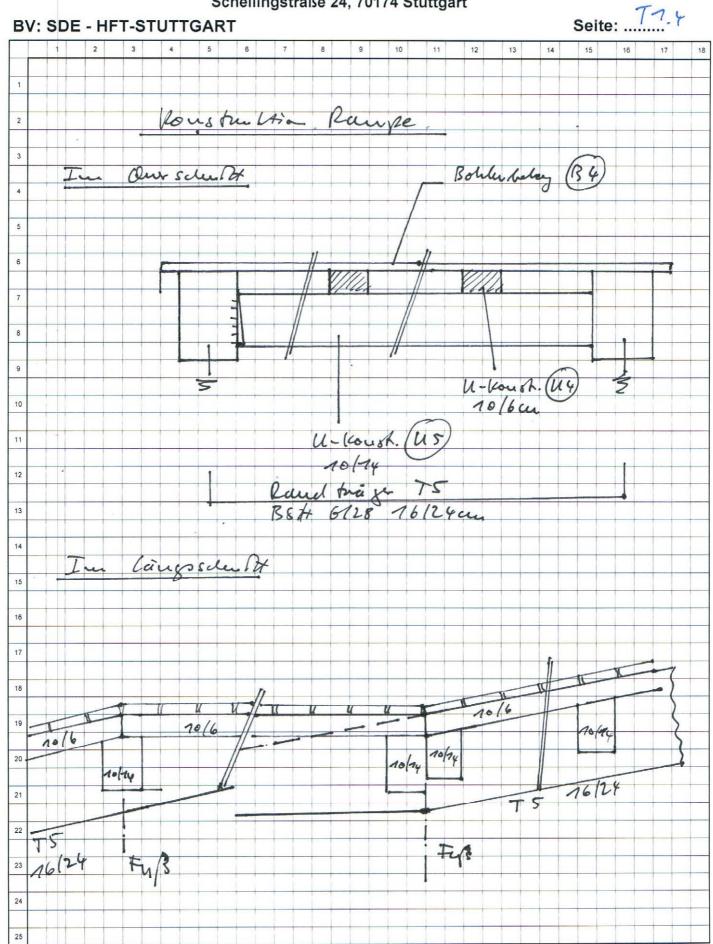




BV: SDE - HFT-STUTTGART



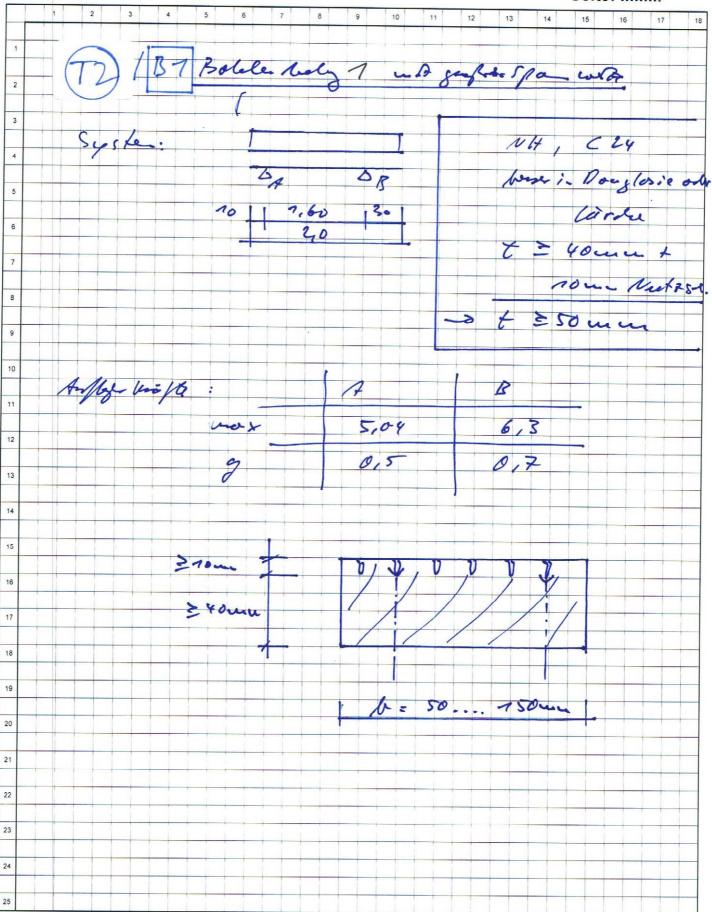
BV: SDE - HFT-STUTTGART



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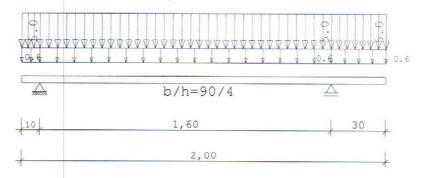
BV: SDE - HFT-STUTTGART Seite: 72.



в1. 1 722

PROJEKT: SDE POS: B1

Maßstab 1:20



Holzträger C24

SYSTEM	SYSTEM Länge		Querschni	ttswerte		
Feld 1	L (m) 1.60	konstant	b (cm) 90.0	h (cm) 4.0	Iy (cm4) 480.0	
Kragarm links rechts	0.10	konstant konstant	90.0	4.0	480.0 480.0	

Feld	Тур	EG Gr	g_1/r	q_l/r Fa	aktor	Abstand	Länge	ausPOS	Phi
		A	0.60	5.00	1.00				
Kraga									
Krli	1	A	0.60	5.00	1.00				
Krre	1	A	0.60	5.00	1.00				

Einwirkungen:

Nr	Kl	Bezeichnung	ΨΟ	Ψ1	Ψ2	Υ	Led
А	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

Feldm	omente	Maximu	m				(kNm ,	kN)
Feld 1	x0 =	0.80	Mf 1.78	M li 0.00	M re -0.03	V li 4.46	,	komb 3

Bl. 2

PROJEKT: SDE

POS: B1

Stützmom	ente Maxim	num				(kNm	, kN)
Stütze 1 2	M li -0.03 -0.25	M re -0.03 -0.25	V li -0.56 -4.64	V re 4.48 1.68	max F 5.04 6.32	min F 0.38 0.66	komb 2 2
Auflager	kräfte						(kN)
Stütze 1 2 Summe:	aus g 0.52 0.68 1.20	max q 4.52 5.64 10.16	min q -0.14 -0.02 -0.16	Vollast 4.90 6.30 11.20	max 5.04 6.32 11.36	min 0.38 0.66 1.04	

Auila	gerkrafte		(kN)
	Stütze 1	Stütze 2	

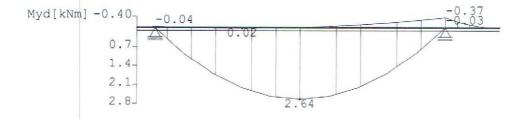
	Stütze	1	Stütze	2		
EG	max	min	max	min		
g	0.5	0.5	0.7	0.7		
A	4.5	-0.1	5.6	0.0		
Sum	5.0	0.4	6.3	0.7		

Ergebnisse fürγ-fache Lasten Teilsicherheitsbeiwert γG über Trägerlänge konstant

Feldmomente Maximum (kNm , kN)

							(//////// /	1211
Feld 1	x0 =	0.80	Mfd 2.64	Mdli 0.00	Mdre -0.04	V li 6.63	V re -6.67	komb A 3
Stützr	moment	e Maxim	ium				(kNm ,	kN)
Stütze 1 2	3	Mdli -0.04 -0.37	Mdre -0.04 -0.37	Vdli -0.83 -6.88	Vdre 6.65 2.49	max F 7.48 9.37	min F 0.31 0.65	komb A 2 A 2

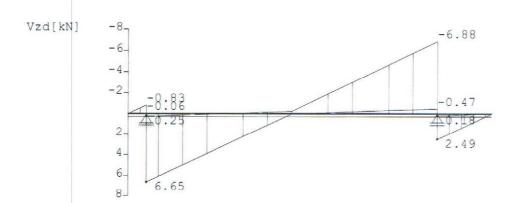
Maßstab 1:20



Bl. 3

PROJEKT: SDE

POS: B1



Bemessung: C24

 $E_{mean} = 1100 \text{ kN/cm2}$ $G_{mean} = 69 \text{ kN/cm2}$

DIN1052:2004

fm, k = 24.0 N/mm2fv, k = 2.0 N/mm2

 $\gamma M = 1.30$

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 90/4

Der Druckgurt ist kontinuierlich gehalten.

Feld	х	My, d	σd, 0	od, u	km	kmod	od/fm,d		
Nr.	(m)	(kNm)	(1	N/mm2)				ko	dmo
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.10	-0.04	0.17	-0.17	1.00	0.65	0.01	A	2
1	0.00	-0.04	0.17	-0.17	1.00	0.65	0.01	A	2
	0.80	2.64	-11.00	11.00	1.00	0.65	0.92	A	3
	1.60	-0.37	1.56	-1.56	1.00	0.65	0.13	A	6
Krre	0.00	-0.37	1.56	-1.56	1.00	0.65	0.13	A	2
	0.30	0.00	0.00	0.00	1.00	0.65	0.00	A	3

Schubspannungen

	ütze r.	e x (m)	Vz,d (kN)	τD (N/mm2)	kmod	τd/fv,d	ko	mb
1	li	0.040	-0.50	0.02	0.65	0.02	А	2
	re	0.040	6.32	0.26	0.65	0.26	A	7
2	li	0.040	-6.55	0.27	0.65	0.27	A	6
	re	0.040	2.16	0.09	0.65	0.09	A	6

Nachweis Gebrauchstauglichkeit nachDIN 1052:2004 9.2 kdef = 2.00 zul $w_{g,inst} < L/300 w_{fin,rare} - w_{g,inst} < L/200 w_{fin,perm} < L/200$

Feld Nr.		wg inst fin (cm)	inst (rare	fin perm cm)	η	kom	nb
1	0.80	-0.02 -0.05 0.09 0.26 -0.05 -0.15	0.81	1.29	0.73	1.56	0.99	1.84!!	A A A	-

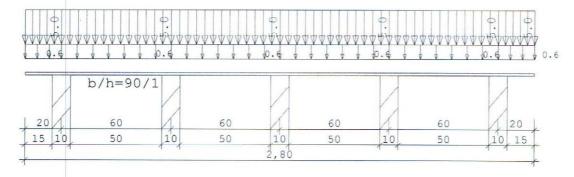
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Bl. 1

PROJEKT: SDE

POS: B2

Maßstab 1:20



Holzträger über 4 Felder C24

SYSTEM	Länge		Querschni	ttswerte		
Feld	L (m)	1	b (cm)	h (cm)	Iy (cm4)	
1	0.60	konstant	90.0	1.5	25.3	
2	0.60	konstant	90.0	1.5	25.3	1 11 11
3	0.60	konstant	90.0	1.5	25.3	2,5 1 1 1 1 7 7 5
4	0.60	konstant	90.0	1.5	25.3	7.5
Kragarm						
links	0.20	konstant	90.0	1.5	25.3	
rechts	0.20	konstant	90.0	1.5	25.3	

Elastische Lager

Stütze Nr. 2 Stütze Nr. 3 Stütze Nr. 4 1000.0 kN/m 1000.0 kN/m 1000.0 kN/m

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L (kN, m)

Feld	Тур	EG Gr	g_1/r	q_1/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1	A	0.60	5.00	1.00				
2	1	A	0.60	5.00	1.00				
3	1	A	0.60	5.00	1.00				
4 Kraga		A	0.60	5.00	1.00				
Krli Krre	1	A A	0.60	5.00 5.00	1.00				

Bl. 2

PROJEKT: SDE

POS: B2

Ei	nwi	rkungen:						
Nr	Kl	Bezeichnung	ΨΟ	Ψ1	Ψ2	γ	Led	
А	1	Wohnräume	0.70	0.50	0.30	1.50	mittel	

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

Feldmo	omente Maximu	ım				(kNm ,	, kN)
Feld 1 2 3 4	x0 = 0.28 x0 = 0.29 x0 = 0.31 x0 = 0.32	Mf 0.21 0.17 0.17 0.21	M li -0.01 -0.07 -0.09 -0.08	M re -0.08 -0.09 -0.07 -0.01	V li 1.56 1.64 1.72 1.80	V re -1.80 -1.72 -1.64 -1.56	komb 7 16 23
Stützm	nomente Maxim	num				(kNm ,	kN)
Stütze 1 2 3 4 5	M li -0.11 -0.16 -0.18 -0.16 -0.11	M re -0.11 -0.16 -0.18 -0.16 -0.11	V 1i -1.12 -1.93 -1.74 -1.79 -1.76	V re 1.76 1.79 1.74 1.93 1.12	max F 2.88 3.71 3.67 3.71 2.88	min F 0.16 0.00 0.18 0.00 0.16	komb 10 13 22 31 32
Auflag	gerkräfte					1	(kN)
Stütze 1 2 3 4 5 Summe:	0.29 0.36 0.37 0.36 0.29	max q 2.58 3.35 3.30 3.35 2.58 15.17	min q -0.13 -0.36 -0.19 -0.36 -0.13 -1.18	Vollast 2.75 3.35 3.48 3.35 2.75 15.68	max 2.88 3.71 3.67 3.71 2.88 16.85	min 0.16 0.00 0.18 0.00 0.16 0.50	
Auflag	gerkräfte						(kN)
EG g A	Stütze 1 max mi 0.3 0 2.6 -0		min 4 0.4	Stütze max 0.4 3.3	3 min 0.4 -0.2	Stütze 4 max 0.4 3.4	min 0.4 -0.4
Sum	2.9 0	.2 3.	7 0.0	3.7	0.2	3.7	0.0

T2.8

Durchlaufträger DLT 04/2008/B WinXP

Bl. 3

PROJEKT: SDE

POS: B2

Auflagerkräfte

(kN)

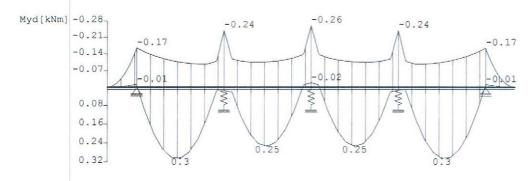
	Stütze	5		
EG	max	min		
g	0.3	0.3		
A	2.6	-0.1		
Sum	2.9	0.2		

Ergebnisse fürγ-fache Lasten

Teilsicherheitsbeiwert y G über Trägerlänge konstant

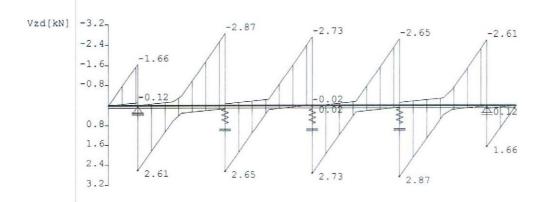
Feldm	nomer	nte	Maximu	ım				(kNm ,	kN)
Feld 1 2 3 4	x0	= = =	0.28 0.29 0.31 0.32	Mfd 0.31 0.25 0.25 0.31	Mdli -0.02 -0.10 -0.14 -0.12	Mdre -0.12 -0.14 -0.10 -0.02	V li 2.32 2.44 2.55 2.67	V re -2.67 -2.55 -2.44 -2.32	komb A 7 A 16 A 23 A 7
Stütz	mome	ent	e Maxim	ium				(kNm ,	kN)
Stütz 1 2 3 4 5	е		Mdli -0.17 -0.24 -0.26 -0.24 -0.17	Mdre -0.17 -0.24 -0.26 -0.24 -0.17	Vdli -1.66 -2.87 -2.58 -2.65 -2.61	Vdre 2.61 2.65 2.58 2.87 1.66	max F 4.27 5.52 5.45 5.52 4.27	min F 0.10 -0.18 0.08 -0.18 0.10	komb A 10 A 13 A 22 A 31 A 32

Maßstab 1:25



Bl. 4

PROJEKT: SDE POS: B2



Bemessung: C24

 $E_{mean} = 1100 \text{ kN/cm2}$ $G_{mean} = 69 \text{ kN/cm2}$

 $\gamma M = 1.30$

DIN1052:2004

fm, k = 24.0 N/mm2

fv, k = 2.0 N/mm2

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 90/1.5

Der Druckgurt ist kontinuierlich gehalten.

Feld	X	My, d	σd, o	σd, u	km	kmod	od/fm,d		
Nr.	(m)	(kNm)	()	1/mm2)				k	omk
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.20	-0.17	4.92	-4.92	1.00	0.65	0.41	A	2
1	0.00	-0.17	4.92	-4.92	1.00	0.65	0.41	A	2
	0.28	0.31*	-9.08	9.08	1.00	0.65	0.76	A	17
	0.60	-0.22*	6.48	-6.48	1.00	0.65	0.54	A	13
2	0.00	-0.22*	6.48	-6.48	1.00	0.65	0.54	A	13
	0.29	0.25*	-7.55	7.55	1.00	0.65	0.63	A	26
	0.60	-0.24*	7.04	-7.04	1.00	0.65	0.59	A	22
3	0.00	-0.24*	7.04	-7.04	1.00	0.65	0.59	A	22
	0.31	0.25*	-7.55	7.55	1.00	0.65	0.63	A	17
	0.60	-0.22*	6.48	-6.48	1.00	0.65	0.54	A	31
4	0.00	-0.22*	6.48	-6.48	1.00	0.65	0.54	A	31
	0.32	0.31	-9.08	9.08	1.00	0.65	0.76	A	24
	0.60	-0.17	4.92	-4.92	1.00	0.65	0.41	A	18
Krre	0.00	-0.17	4.92	-4.92	1.00	0.65	0.41	A	10
	0.20	0.00	0.00	0.00	1.00	0.65	0.00	A	18

^{* -&}gt; umgelagert nach DIN1052:2004 8.1 (6)

BV: SDE - HFT-STUTTGART

Seite: 15 Bolele belog 1 hei Spa 0 680 Po 0,35 0,5 12 3,50 13 15 Boble: 1-≥3~ 17 19 20 21 22 23 24 25

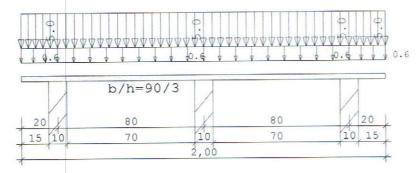
Bl. 1

12.11

PROJEKT: SDE

POS: B3





Holzträger über 2 Felder C24

SYSTEM	Länge	Querschni	tts	swerte			
Feld 1 2	L (m) 0.80 0.80	konstant konstant	b (cm) 90.0 90.0	h	(cm) 3.0 3.0	Iy (cm4) 202.5 202.5	
Kragarm links rechts	0.20	konstant konstant	90.0		3.0	202.5	

Elastische Lager

Stütze Nr. 2 2000.0 kN/m

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L (kN, m)

Feld	Тур	EG Gr	g_l/r	q_l/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1	А	0.60	5.00	1.00				
2 Kraga		A	0.60	5.00	1.00				
Krli		А	0.60	5.00	1.00				
VITT	Τ.	A	0.60	5.00	1.00				
Krre	1	A	0.60	5.00	1.00				

Finwirkungen:

		Bezeichnung	ΨΟ	Ψ1	ψ2	γ	Led	
А	1	Wohnräume	0.70	0.50	0.30	1.50	mittel	

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Bl. 2

POS: B3 PROJEKT: SDE

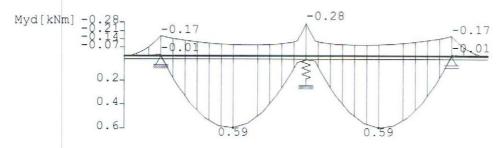
Ergebnisse für	l-fache	Lasten
----------------	---------	--------

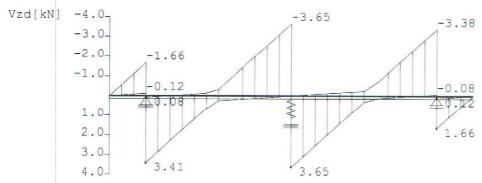
Ergen	nisse iui i-ia	ache Last	en				
Feldm	omente Maximur	m				(kNm ,	kN)
Feld 1 2	x0 = 0.38 x0 = 0.42			M re -0.08 -0.01		-2.33	komb 6 7
Stütz	momente Maximu	ım				(kNm ,	kN)
Stütz 1 2 3	e M li -0.11 -0.19 -0.11	-0.19	-1.12 -2.46	V re 2.29 2.46 1.12	max F 3.41 4.91 3.41	min F 0.25 0.16 0.25	komb 7 3 9
Aufla	gerkräfte						(kN)
Stütze 1 2 3 Summe	0.35 0.49 0.35 : 1.20	max q 3.06 4.42 3.06 10.54	min q -0.11 -0.33 -0.11 -0.54	Vollast 3.31 4.58 3.31 11.20	max 3.41 4.91 3.41 11.74	min 0.25 0.16 0.25 0.66	
Aufla	gerkräfte		1 (22)			(kN)
EG g A	Stütze 1 max mir 0.4 0. 3.1 -0.	4 0.5		0.4	min 0.4		
Sum	3.4 0.	2 4.9	0.2	3.4	0.2		
	nisse fürγ-fa icherheitsbeiw			rlänge ko	onstant		
Feldmo	omente Maximum	1				(kNm ,	kN)
Feld 1 2	x0 = 0.38 x0 = 0.42	Mfd 0.60 0.60		Mdre -0.12 -0.02	V li 3.19 3.46	V re -3.46 -3.19	komb A 6 A 7
Stützn	nomente Maximu	m				(kNm ,	kN)
Stütze 1 2 3	Mdli -0.17 -0.28 -0.17	Mdre -0.17 -0.28 -0.17	Vdli -1.66 -3.65 -3.38	Vdre 3.41 3.65 1.66	max F 5.07 7.30 5.07	min F 0.20 -0.01 0.20	komb A 7 A 3 A 9

B1. 3

PROJEKT: SDE POS: B3

Maßstab 1:20





 $E_{mean} = 1100 \text{ kN/cm2}$ Bemessung: C24 DIN1052:2004

 $\gamma M = 1.30$ fm, k = 24.0 N/mm2

fv, k = 2.0 N/mm2

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 90/3

Der Druckgurt ist kontinuierlich gehalten.

DCI	ruckgur	C ISC MONE.	LIIULCLIL	on genun	CCII.				
Feld	X	My, d	σd, o	σd, u	km	kmod	$\sigma d/fm,d$		
Nr.	(m)	(kNm)	(1	J/mm2)				ko	dmo
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.20	-0.17	1.23	-1.23	1.00	0.65	0.10	A	2
1	0.00	-0.17	1.23	-1.23	1.00	0.65	0.10	A	2
	0.38	0.60	-4.41	4.41	1.00	0.65	0.37	A	6
	0.80	-0.25*	1.84	-1.84	1.00	0.65	0.15	A	3
2	0.00	-0.25*	1.84	-1.84	1.00	0.65	0.15	A	3
	0.42	0.60	-4.41	4.41	1.00	0.65	0.37	A	7
	0.80	-0.17	1.23	-1.23	1.00	0.65	0.10	A	13
Krre	0.00	-0.17	1.23	-1.23	1.00	0.65	0.10	A	6
	0.20	0.00	0.00	0.00	1.00	0.65	0.00	A	3
* ->	umgelag	ert nach Di	IN1052:20	004 8.1	(6)				

 $G_{mean} = 69 \text{ kN/cm2}$

T2.74

BV: SDE - HFT-STUTTGART

Seite: 15 16 14 By Boble belgg; Eide, &= 21 mm 3 8ysten: UU- Abotand & 57 cm 4 5 6 | ≥ 57 | ≥ 57 1 352 8 Anflye: 3 Feating to fig look on all und a 72 Houn for Mt 10/10, l = 2 - 1 \in h = C = 48.E1 = 49. 1000.0,7 - 0,55 M2

L²

2³

12 10 12 - 550 bester 4000 best wood Cox der colo por 7553 Einwirkey: - Aboeh. T2: p = 5,0 k-4 } 5,6 keples
g = 0,8 " \ 5,6 keples 15 17 of My wayte 19 Max un 20 21 0,30 3,60 22 23 25

POS: B4 72.75 PROJEKT: SDE

Maßstab 1:20

VVVV	P. VVVV . 6		φ. Ψγγ ο. 6	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	0.6	V	0.6	PV*********	0. p. 6	0. (2)	0.6
		b/h=95/2									
20	1	60	1	60	1	60		60	13	20	
15	10	50	10	50	10	50	10	50	10	15	

2,80

Holzträger über 4 Felder D30

SYSTEM	Länge		Querschni	ttswerte		
Feld 1 2 3 4	L (m) 0.60 0.60 0.60 0.60	konstant konstant konstant konstant	b (cm) 95.0 95.0 95.0 95.0	h (cm) 2.1 2.1 2.1 2.1	Iy (cm4) 73.3 73.3 73.3 73.3	
Kragarm links rechts	0.20	konstant konstant	95.0 95.0	2.1	73.3 73.3	

Elastische Lager

Stütze	Nr.	1	4000.0	kN/m		
Stütze	Nr.	2	550.0	kN/m		
Stütze	Nr.	3	550.0	kN/m		
Stütze	Nr.	4	550.0	kN/m		
Stütze	Nr.	5	4000.0	kN/m		

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b (kN, m)5-Dreieckslast über L, 6-Trapezlast über L

Feld	Тур	EG Gr	g_l/r	q_l/r Fakto	er Abstand Länge	ausPOS Phi
1	1	А	0.60	5.00 1.0	0	
2	1	A	0.60	5.00 1.0	0	
3	1	А	0.60	5.00 1.0	0	
4	1	А	0.60	5.00 1.0	0	
Kraga Krli Krre	1 1	A A	0.60	5.00 1.0 5.00 1.0		

T 2.76

PROJEKT: SDE POS: B4

Einwirk Nr Kl E	ungen: Bezeichnu	ng			ψ0	ψ1	ψ2	γ :	Led		
A 1 W	ohnräume				0.70	0.50	0.30	1.50 m	itt	el	
die Num In Tabe	en folgenden Tabellen steht am Ende der Zeilen ein Verwei Nummer der zug. Überlagerung (siehe unten). abellen mit Gammafachen Schnittgrößen steht zusätzlich ei eis auf die Leiteinwirkung.									uf	
Ergebni	sse für			n 							
Feldmon	ente Max	imum						(kNm	,	kN)	
2 ×	0 = 0.3	0 (0.26	-0.03	0.0	02	1.67	V re -1.63 -1.69 -1.67		15	
Stützmo	mente Ma	ximum						(kNm	,	kN)	
Stütze 1 2 3 4 5	-0.1 -0.0 -0.1 -0.0	1 -(9 -(9 -(9 -(9 -(9 -(9 -(9 -(9 -(9 -(9	0.11 0.09 0.17 0.09	-1.12	1.9	90 64 86 14	3.02 3.34 3.72 3.34	0.11		11	
Auflage	erkräfte								(kN)	
Stütze 1 2 3 4 5 Summe:	0.3 0.3 0.3 0.3	13 3 19 3 13 3	2.71 3.01 3.32 3.01 2.71	-0.04	2.8 3.3 3.3 2.8	88 12 68 12 88	3.02 3.34 3.72 3.34 3.02	0.17 0.11 0.35 0.11 0.17			
Auflage	erkräfte								(kN)	
EG g A	max 0.3 2.7	min 0.3 -0.1	max 0.3 3.0	min 0.3 -0.2	ma B	ax 0.4 3.3	0.4	Stütze max 0.3 3.0		min 0.3 -0.2	
Sum	3.0	0.2						3.3		0.1	

T2.77

(kNm , kN)

PROJEKT: SDE POS: B4

Auflagerkräfte	(kN)
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EG	Stütze max 0.3	5 min 0.3	
Ă 	2.7	-0.1	
Sum	3.0	0.2	

Ergebnisse für γ-fache Lasten

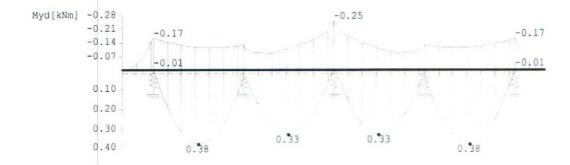
Teilsicherheitsbeiwert γG über Trägerlänge konstant

Feldm	noment	e Maximu	ım				(kNm	, kN)
Feld			Mfd	Mdli	Mdre	V li	V re	komb
1	x0 =	0.31	0.38	-0.02	0.03	2.57	-2.42	A 10
2	x0 =	0.30	0.33	-0.04	-0.04	2.49	-2.50	A 15
3	x0 =	0.30	0.33	-0.04	-0.04	2.50	-2.49	A 20
4	x0 =	0 29	0.38	0.03	-0.02	2 42	-2.57	A 5

|--|--|

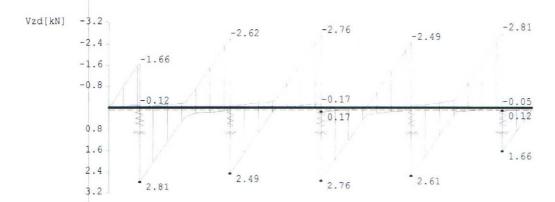
Stütze	Mdli	Mdre	Vdli	Vdre	max F	min F	komb
1	-0.17	-0.17	-1.66	2.81	4.48	0.11	A 9
2	-0.13	-0.13	-0.19	2.44	4.96	0.00	A 9
3	-0.25	-0.25	-2.76	2.76	5.52	0.33	A 18
4	-0.13	-0.13	-2.44	0.19	4.96	0.00	A 11
5	-0.17	-0.17	-2.81	1.66	4.48	0.11	A 10

1:25 Maßstab



PROJEKT: SDE

POS: B4



Bemessung: D30

 E_{mean}

= 1000 kN/cm2

 $G_{mean} =$

60 kN/cm2

 $\gamma M = 1.30$

DIN1052:2004

fm, k = 30.0 N/mm2

fv, k = 3.0 N/mm2

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 95/2.1

Der Druckgurt ist kontinuierlich gehalten.

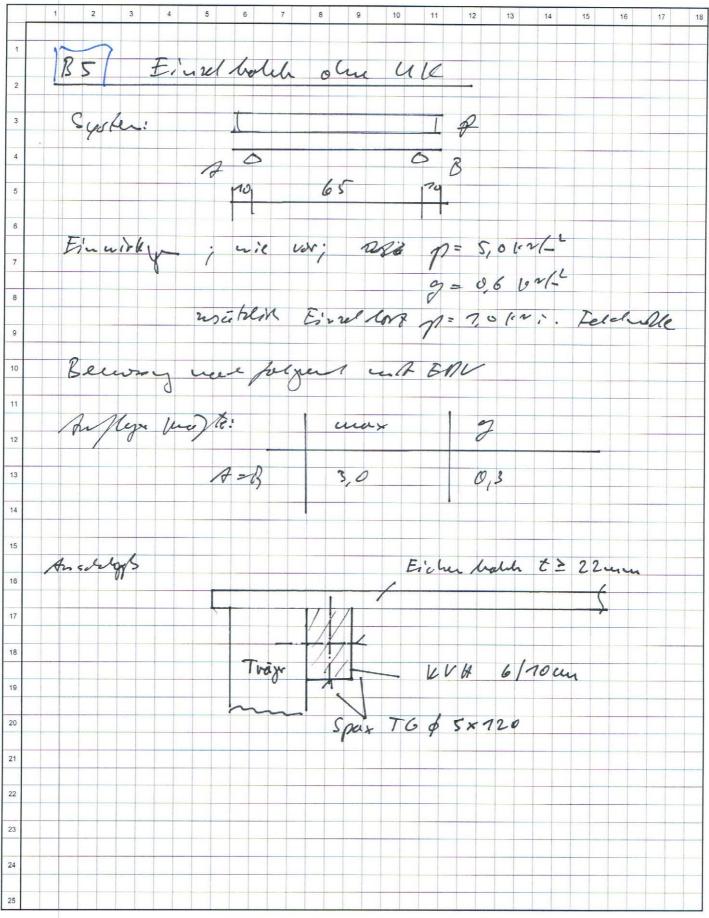
Feld	X	My, d	$\sigma d, o$	σd, u	km	kmod	σ d/fm,d		
Nr.	(m)	(kNm)	(N	1/mm2)				ko	dmc
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.20	-0.17	2.38	-2.38	1.00	0.65	0.16	A	2
1	0.00	-0.17	2.38	-2.38	1.00	0.65	0.16	A	2
	0.31	0.38	-5.45	5.45	1.00	0.65	0.36	A	8
	0.60	-0.12*	1.71	-1.71	1.00	0.65	0.11	A	9
2	0.00	-0.12*	1.71	-1.71	1.00	0.65	0.11	A	9
	0.30	0.33	-4.79	4.79	1.00	0.65	0.32	A	15
	0.60	-0.23*	3.26	-3.26	1.00	0.65	0.22	A	18
3	0.00	-0.23*	3.26	-3.26	1.00	0.65	0.22	A	18
	0.30	0.33	-4.79	4.79	1.00	0.65	0.32	A	20
	0.60	-0.12*	1.71	-1.71	1.00	0.65	0.11	A	11
4	0.00	-0.12*	1.71	-1.71	1.00	0.65	0.11	A	11
	0.29	0.38	-5.45	5.45	1.00	0.65	0.36	A	5
	0.60	-0.17	2.38	-2.38	1.00	0.65	0.16	A	26
Krre	0.00	-0.17	2.38	-2.38	1.00	0.65	0.16	A	10
	0.20	0.00	0.00	0.00	1.00	0.65	0.00	A	25
+ \	umaalaa	ant nach D	TN1052.20	001 8 1	(6)				

^{* -&}gt; umgelagert nach DIN1052:2004 8.1 (6)

T2.19

BV: SDE - HFT-STUTTGART

Seite:

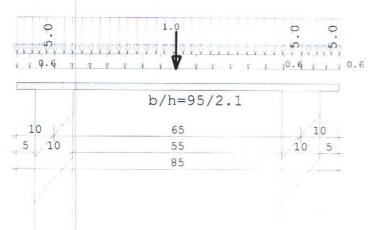


T2.20

PROJEKT: SDE

POS: B5





Holzträger D30

SYSTEM	Länge		Querschnittswerte	
Feld 1 Kragarm	L (m) 0.65	konstant	b (cm) h (cm) 95.0 2.1	Iy (cm4) 73.3
links rechts	0.10 0.10	konstant konstant	95.0 2.1 95.0 2.1	73.3 73.3

Elastische Lager

Stütze Nr. 1 Stütze Nr. 2 $4000.0 \, kN/m$ 2 $4000.0 \, kN/m$

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a

3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L (kN, m)

Feld Typ EG Gr	g_1/r	q_l/r Faktor	Abstand Länge	ausPOS	Phi
1 1 A 2 A	0.60	5.00 1.00 1.00 1.00	0.32		
Kragarm					
Krli 1 A	0.60	5.00 1.00			
Krre 1 A	0.60	5.00 1.00			

Einwirkungen:

Nr	Kl	Bezeichnung	ψ٥	ψ1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein

Durchlaufträger DLT 04/2008/B WinXP

T2.21

PROJEKT: SDE POS: B5

Verweis	auf	die	Leiteinwirkung.
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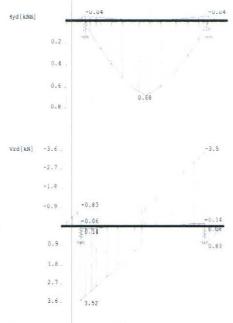
Ergebnisse	fiir	1-fache	Tagton
TIGENIII	LUL	I-Tacile	Lastell

Ergebnisse für 1-fache Lasten												
Feldmon	mente Maximu	m 				(kNm ,	kN)					
Feld		Mf	M li	M re	V li	V re	komb					
	mente Maxim					(kNm ,	kN)					
Stütze 1	M li -0.03 -0.03	M re -0.03	V li -0.56	2.37	max F 2.93	0.22	5					
Auflage	erkräfte					(kN)					
Stütze 1 2	aus g 0.26 0.26 0.51	max q 2.67 2.66	min q -0.04 -0.04	Vollast 2.89 2.87	max 2.93 2.91	min 0.22 0.22						
	rkräfte						kN)					
EG g A	Stütze 1 max mir 0.3 0 2.7 0	max .3 0.1	min 3 0.3 7 0.0									
	2.9 0											
	sse für γ-fa herheitsbei			erlänge ko	onstant							
Feldmom	ente Maximur	n 				(kNm ,	kN)					
Feld 1 x	0 = 0.32	Mfd 0.68	Mdli 0.00	Mdre 0.00	V li 3.46	V re -3.44	komb A 3					
Stützmo	mente Maximu	ım				(kNm ,	kN)					
Stütze 1 2	-0.04	-0.04	-0.83		4.35	0.20	A 5					

T2.12

PROJEKT: SDE POS: B5

Maßstab 1:20



Bemessung: D30 $E_{mean} = 1000 \text{ kN/cm2}$ $G_{mean} = 60 \text{ kN/cm2}$

DIN1052:2004 fm, k = 30.0 N/mm2 $\gamma M = 1.30$

fv, k = 3.0 N/mm2

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 95/2.1

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	σd, o	σd,u N/mm2)	km	kmod	σ d/fm,d	ko	mb
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.10	-0.04	0.60	-0.60	1.00	0.65	0.04	A	2
1	0.00	-0.04	0.60	-0.60	1.00	0.65	0.04	A	2
	0.32	0.68	-9.71	9.71	1.00	0.65	0.65	A	3
	0.65	-0.04	0.60	-0.60	1.00	0.65	0.04	A	7
Krre	0.00	-0.04	0.60	-0.60	1.00	0.65	0.04	A	5
	0.10	0.00	0.00	0.00	1.00	0.65	0.00	A	7

Schubspannungen

Sti Ni	itze r.	x (m)	Vz,d (kN)	τD (N/mm2)	kmod	τd/fv,d	ko	mb
1	re	0.054	3.07	0.23	0.65	0.15	Α	4
2	li	0.054	-3.05	0.23	0.65	0.15	A	7
	re	0.071	0.24	0.02	0.65	0.01	A	7

3V:	: SI	DE -	HF	T-8	STL	JTT				ling	str	aße	24	, 70	1/4	Stu	ittga	art					S	eite	. T	3.	7	
T	1		2	3		4	5		6		7	8		9	10		11	3	12	13		14		15	16	17		
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Hft-Stuttgart

Durchlaufträger DLT 04/2008/B WinXP

Bl. 1

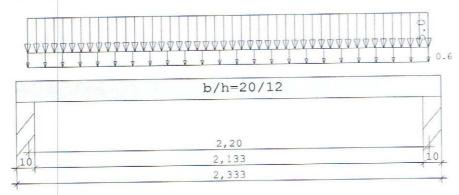
T3.2

PROJEKT: SDE

1

POS: U1

Maßstab 1:20



Holzträger C24

Ouerschnittswerte SYSTEM Länge Iy (cm4) b (cm) h (cm) L(m)Feld 20.0 12.0 2880.0

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b (kN, m)5=Dreieckslast über L, 6=Trapezlast über L

Feld Typ EG Gr g_l/r q_l/r Faktor Abstand Länge ausPOS Phi

0.60 5.00 1.00 1 1 A

2.20 konstant

Einwirkungen: $\psi 0$ $\psi 1$ $\psi 2$ γ Led Nr Kl Bezeichnung 0.70 0.50 0.30 1.50 mittel A 1 Wohnräume

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

Feldmome	nte Maximu	m				(kNm ,	kN)
Feld x0	= 1.10	Mf 3.39	M li 0.00	M re 0.00	V li 6.16	V re -6.16	komb 2
Stützmom	ente Maxim	num				(kNm ,	kN)
Stütze 1 2	M li 0.00 0.00	M re 0.00 0.00	V li 0.00 -6.16	V re 6.16 0.00	max F 6.16 6.16	min F 0.66 0.66	komb 2 2

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Durchlaufträger DLT 04/2008/B WinXP Bl. 2
PROJEKT: SDE POS: U1

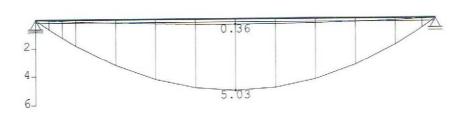
Stütze	aus	a m	ax q	min q	Vollast	max	min	
5 LULZE	0.6	2	5.50	0.00	6.16	6.16	0.66	
2	0.6		5.50	0.00	6.16	6.16	0.66	
Summe:		W ==	1.00	0.00	12.32	12.32	1.32	
Auflag	gerkräfte							(kN
Auflag	gerkräfte Stütze 1		Stütze	e 2				(KN
		min	Stütze	e 2 min				(KN
EG	Stütze 1							(KN
Auflag EG g A	Stütze 1	min	max	min				(KN

Ergebnisse fürγ-fache Lasten Teilsicherheitsbeiwert γG über Trägerlänge konstant

Feldm	omente	Maximu	m				(kNm ,	kN)
Feld 1	x0 =	1.10	Mfd 5.03	Mdli 0.00	Mdre 0.00	V li 9.14	V re -9.14	komb A 2
Stütz	moment	e Maxim	ium				(kNm ,	kN)
Stütz	0	Mdli	Mdre	Vdli	Vdre	max F	min F	komb
1	C	0.00	0.00	0.00	9.14	9.14	0.66	A 2
2		0.00	0.00	-9.14	0.00	9.14	0.66	A 2

Maßstab 1:20

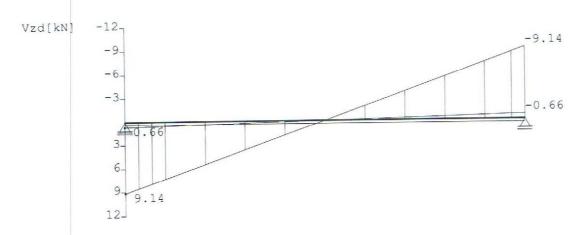
Myd[kNm]



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Durchlaufträger DLT 04/2008/B WinXP Bl. 3 73.4

PROJEKT: SDE POS: U1



Bemessung: C24 $E_{mean} = 1100 \text{ kN/cm2}$ $G_{mean} = 69 \text{ kN/cm2}$

DIN1052:2004 fm, k = 24.0 N/mm2 $\gamma M = 1.30$ fv, k = 2.0 N/mm2

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 20/12

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	X (m)	My,d (kNm)	σd, o (1	σd,u N/mm2)	km	kmod	σd/fm,d	ko	dm
1	0.00 1.10 2.20	0.00 5.03 0.00	0.00 -10.47 0.00	0.00 10.47 0.00	1.00 1.00 1.00	0.00 0.65 0.65	0.00 0.87 0.00	A A	1 2 2

Schubspannungen

Stütze Nr.	x (m)	Vz,d (kN)	τ D (N/mm2)	kmod	τd/fv,d	ko	mb
1 re 2 li	0.153 0.153	7.87 -7.87	0.49	0.65 0.65	0.49	A A	2

Auflager fc, 90, k = 2.50 N/mm2

Stütz	ze b	d	max F	kmod	kc90	σc,90,d	fc,90,d	η		
Nr.	2 4	(cm)	(kN)			(N/m	ım2)		ko	mb
1	10.0	90.0	9.1	0.65	1.00	0.35	1.25			
2	10.0	90.0	9.1	0.65	1.00	0.35	1.25	0.28	A	2
Die 6	effektiven	Auflag	erlänge	n sind	nach	10.2.4 (48) verg	rößert.		

Nachweis Gebrauchstauglichkeit nach DIN 1052:2004 9.2 kdef = 2.00 zul $w_{q,inst}$ < L/300 $w_{fin,rare}$ - $w_{g,inst}$ < L/200 $w_{fin,perm}$ < L/200

		W	q	wq			wf				
Feld Nr.	x (m)	inst (c			rare cm			perm cm)	η	ko	mb
1	1.10	0.06	0.17	0.48	0.77	0.43	0.94	0.61	0.81	А	2

BV: SDE - HFT-STUTTGART

Meste los In the 1 ides Fold & thought Curre, Day love Einwicky: Bus plongen glister te 13 e=40a e = 50 cm e = 60 cm 16/8 e = 80 c

Hft-Stuttgart

Durchlaufträger DLT 04/2008/B WinXP

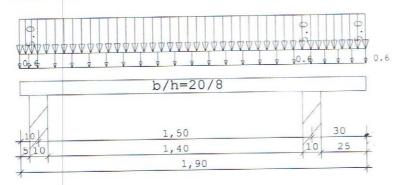
Bl. 1

73.6

PROJEKT: SDE

POS: U2

Maßstab 1:20



Holzträger C24

SYSTEM	Länge		Querschni	ttswerte	9		
Feld 1	L (m)	konstant	b (cm) 20.0	h (cm) 8.0	Iy (cm4) 853.3		
Kragarm links rechts	0.10	konstant konstant	20.0	8.0	853.3 853.3		
BELASTUM (kN,m)			chlast üb zelmoment l leckslast	bei a ,	2=Einzellast 4=Trapezlast 6=Trapezlast	von a -	a+b

Feld	Тур	EG Gr	g_1/r	q_l/r Faktor	Abstand Länge	ausPOS	Phi
1	1	A	0.60	5.00 1.00)		
Kraga Krli Krre	1		0.60	5.00 1.00 5.00 1.00			

	inwirkungen: r Kl Bezeichnung		ψΟ	ψ1	ψ2	γ	Led
А	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

Feldm	nomente	Maximu	m				(kNm ,	kN)
Feld	×0 =	0.75	Mf 1.56	M li 0.00	M re -0.03	V li 4.18	V re -4.22	komb 3

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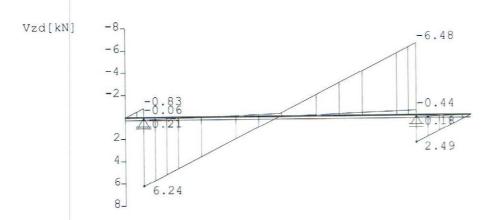
Durchla	aufträger	DLT 04/2	2008/B	WinXP		B1. 2 POS: U2	7
PROJEK'	r: SDE					PO3. 02	
Stützmo	omente Maxim	um				(kNm ,	kN)
Stütze 1 2	M li -0.03 -0.25	M re -0.03 -0.25	V li -0.56 -4.37	V re 4.20 1.68	max F 4.76 6.05	min F 0.34 0.63	komb 2 2
Auflag	erkräfte					(kN)
Stütze 1 2 Summe:	0.49	max q 4.27 5.40 9.67	-0.02		max 4.76 6.05 10.81	min 0.34 0.63 0.97	
Auflag	erkräfte						(kN)
EG g A	Stütze 1 max mi 0.5 0 4.3 -0		min 6 0.6				
Sum		0.3 6.		5			
Ergebn Teilsi	isse fürγ-f cherheitsbei	ache Laste .wert γ G	en über Träg	erlänge k	onstant		
Feldmo	mente Maximu	ım				(kNm	, kN)
Feld 1	x0 = 0.75	Mfd 2.32	Mdli 0.00	Mdre -0.04	V li 6.21	V re -6.25	komb A 3
Stützm	nomente Maxim	num				(kNm	, kN)
Stütze 1 2	Mdli -0.04 -0.37		Vdli -0.83 -6.48		max F 7.07 8.97	min F 0.27 0.62	komb A 2 A 2
Maßsta	ab 1 : 20						
	n] -0.40 ₇ -0.0			-().37 -03		

B1. 3

T 3.8

PROJEKT: SDE

POS: U2



Bemessung: C24 $E_{mean} = 1100 \text{ kN/cm2}$ $G_{mean} = 69 \text{ kN/cm2}$

DIN1052:2004

fm, k = 24.0 N/mm2fv, k = 2.0 N/mm2

 $\gamma M = 1.30$

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 20/8

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	σd, o	σd, u N/mm2)	km	kmod	σd/fm,	, d	ko	mb
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00			1
	0.10	-0.04	0.19	-0.19	1.00	0.65	0.02		A	2
1	0.00	-0.04	0.19	-0.19	1.00	0.65	0.02	1	A	2
	0.75	2.32	-10.86	10.86	1.00	0.65	0.91	L	A	3
	1.50	-0.37	1.75	-1.75	1.00	0.65	0.15		A	6
Krre	0.00	-0.37	1.75	-1.75	1.00	0.65	0.15		A	2
70,000,000,000	0.30	0.00	0.00	0.00	1.00	0.65	0.00		A	3

Schubspannungen

Stütze Nr.	X (m)	Vz,d (kN)	τ D (N/mm2)	kmod	τd/fv,d	kor	mb
1 re	0.113	5.29	0.50	0.65	0.50	А	7
2 li	0.130	-5.40	0.51	0.65	0.51	A	6
re	0.130	1.41	0.13	0.65	0.13	A	6

Auflager fc, 90, k = 2.50 N/mm2

Stütz	ze b	d	max F	kmod	kc90	σc, 90, d	fc,90,d	η η		
Nr.		(cm)				(N/mr			ko	mb
1	what fe	90.0	7.1	0.65	1.00	0.22	1.25	0.18	A	7
2		90.0	9.0	0.65	1.00	0.28	1.25	0.22	A	6
Die e	effektiven	Auflac	gerlänge	n sind	nach	10.2.4 (48) verd	größert.		

Hft-Stuttgart

Durchlaufträger DLT 04/2008/B WinXP

Bl. 4

T 3.9

PROJEKT: SDE

POS: U2

Nachweis Gebrauchstauglichkeit nachDIN 1052:2004 9.2 kdef = 2.00 zul $w_{g,inst}$ < L/300 $w_{fin,rare}$ - $w_{g,inst}$ < L/200 $w_{fin,perm}$ < L/200

		wg		wq		W	fin			
Feld Nr.	x (m)	inst fin (cm)	inst (rare	perm	rare (perm)	η	koi	dm
1	0.75	-0.01 -0.02 0.04 0.11 -0.02 -0.07	0.35	0.56	0.32	0.67	0.43	0.85	A A A	3 3

Größte Durchbiegung nach DIN 1052:2004 9.3 in Feld 1 f = 1.5 mmDurchbiegung infolge F = 1.0 kN in Feld 1 f = 0.7 mm

BV: SDE - HFT-STUTTGART

Seite: 73.10 Unite los shouten 1 ile & 1,70m Syste: 7120 max 5,9 A=B 0,6 14 Our selets and Absterned 6/h- 76/20a e=1,00 b/4= 10/10 cm e = 60 a e = 50 alter watis alu= 14/8cc e = 60 elli = 12/8 au e = 50:

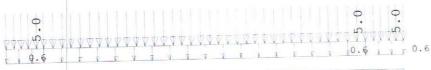
Hft-Stuttgart

Durchlaufträger DLT 04/2008/B WinXP

PROJEKT: SDE

POS: U3 73.71

Maßstab 1:20



	b/h=16/10	
20 /	1,70	20
15 10	1,60	10 15
	2,10	

Holzträger C24

SYSTEM	Länge		Querschnittswe	rte 	
Feld	L (m) 1.70	konstant	D (01)	m) Iy (cm4) .0 1333.3	
Kragarm links rechts	0.20	konstant konstant	10.0	1333.3 1333.3	

Einwirkungen:

		Bezeichnung	ψ0	ψ1	ψ2	γ	Led
 А	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

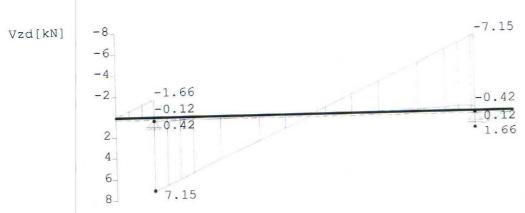
Ergebnisse für 1-fache Lasten

Feldm	omente	Maximu	m				(kNm	, kN)
Feld		0.85	Mf 2.01	M li -0.01	M re -0.01	V li 4.76		re 4.76	komb 3

POS: U3 T3-72 PROJEKT: SDE

Stützmo	mente Maxim	am				(kNm ,	kN)
Stütze 1 2	-0.11	M re -0.11 -0.11	-1.12	4.82	max F 5.94 5.94	0.57	2
	erkräfte						kN)
Stütze 1 2 Summe:	aus g 0.63 0.63 1.26	max q 5.31 5.31 10.62	min q -0.06 -0.06 -0.12	Vollast 5.88 5.88 11.76	max 5.94 5.94 11.88	min 0.57 0.57 1.14	
	erkräfte					(kN)
	Stütze 1 max mi 0.6 0 5.3 -0	Stüt	ze 2				
Sum	5.9).6 5.	9 0.6	5			
Ergebn. Teilsi	isse für γ-i cherheitsbei	fache Last wert γG	en über Träg	erlänge k	onstant		
Feldmo	mente Maximu	ım				(kNm ,	kN)
Feld 1	x0 = 0.85	Mfd 2.99	Mdli -0.02	Mdre -0.02	V li 7.06	V re -7.06	komb A 3
Stützm	omente Maxi	num				(kNm ,	kN)
Stütze 1 2	Mdli -0.17 -0.17	Mdre -0.17 -0.17	Vdli -1.66 -7.15	Vdre 7.15 1.66	max F 8.81 8.81	min F 0.54 0.54	komb A 2 A 2
Maßsta	b 1:20						
Myd[kNm	0.8 1.6 2.4 3.2	1:07	2.99		=9:07		

T3.13 POS: U3 PROJEKT: SDE



 $E_{mean} = 1100 \text{ kN/cm2}$ $G_{mean} = 69 \text{ kN/cm2}$ fm, k = 24.0 N/mm2 $\gamma M = 1.30$ Bemessung: C24 DIN1052:2004

fv, k = 2.0 N/mm2

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 16/10

Der Druckgurt ist kontinuierlich gehalten.

Der Dr Feld Nr.	x (m)	My, d (kNm)	$\sigma d, o$	σd, u 1/mm2)	km	kmod	σd/fm,d	kor	nb
Krli 1 Krre	0.00 0.20 0.00 0.85 1.70 0.00	0.00 -0.17 -0.17 2.99 -0.17 -0.17	0.00 0.62 0.62 -11.20 0.62 0.62 0.00	0.00 -0.62 -0.62 11.20 -0.62 -0.62 0.00	1.00 1.00 1.00 1.00 1.00 1.00	0.00 0.65 0.65 0.65 0.65 0.65	0.00 0.05 0.05 0.93 0.05 0.05	A A A A	1 2 2 3 2 2 3

Schubspannungen

Stütze Nr.	x (m)	Vz,d (kN)	τD (N/mm2)	kmod	τd/fv,d	komb
1 li	0.150	-0.42	0.04	0.65	0.04	A 2
re	0.150	5.91	0.55	0.65	0.55	A 6
2 li	0.150	-5.91	0.55	0.65	0.55	A 7
re	0.150	0.42	0.04	0.65	0.04	A 7

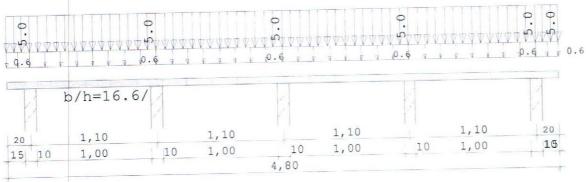
Auflager fc, 90, k = 2.50 N/mm2

		d	max F	kmod	kc90	σc, 90,	d fc,90,d	η		
Stüt		a (cm)	(kN)	ALITO G			mm2)		koi	mb
Nr.	(cm) 10.0	90.0		0.65	1.00	0.34	1.25	0.28	A	6
2	100	00 0	8 8	0 65	1.00	0.34	1.25	0.28	A	7
Die	effektiven	Auflag	erlänge	n sind	nach	10.2.4	(48) verg	rößert.		

BV: SDE - HFT-STUTTGART There (con che lor 7 NH, WUH 10/6 un Systen. = \$30 1 = 1.40 1 = 1.40 1 = 10 6 Einunky wie vor 13 14 20 22

T3.75 POS: U4 PROJEKT: SDE

Maßstab 1:33



Holzträger über 4 Felder C24

SYSTEM	Länge		Querschnittswerte	
Feld 1 2 3 4	L (m) 1.10 1.10 1.10	konstant konstant konstant konstant	16.6 6.0 16.6 6.0 16.6 6.0	Iy (cm4) 298.8 298.8 298.8 298.8
Kragarm links rechts	0.20	konstant konstant	10.0	298.8 298.8

Elastische Lager

Diabor				
Stütze Stütze Stütze	Nr. Nr.	1 2 3	600.0 600.0 600.0	kN/m kN/m
Stütze	Nr.	4	600.0	
Stütze	Nr.	5	600.0	kN/m

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b (kN, m)5=Dreieckslast über L, 6=Trapezlast über L

			0 -						
Feld T	yp	EG Gr	g_l/r	q_l/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1	A	0.60	5.00	1.00				
2	1	А	0.60	5.00	1.00				
3	1	А	0.60	5.00	1.00				
4	1	A	0.60	5.00	1.00				
Kragar Krli Krre	1 1	A A	0.60	5.00	1.00				

PROJEKT: SDE

POS: U4 T3.16

		ungen ezeic		ı				Ψ	0	ψ1	ψ2	γ	Le	ed	
 A	1 W	ohnrä	 ume					0	.70	0.50	0.30	1.5	0 mit	ct	el
die In Ver	Num Tabe weis	mer d llen auf	er zu mit G die I	ar III	erla Eache .nwir	geru n Sc kung	ing chni	(Sle	ne u	nten)	eilen e: nt zusät			a ·	uf
												(kNm		kN)
Fel	dmom	ente	Maxir	mum -											
2	2 x 3 x	= 0 $= 0$ $= 0$ $= 0$ $= 0$ $= 0$	0.55	((0.66		-0.2		-0. -0.	18 20 18	V li 2.92 3.07 3.09 3.24	-	7 re -3.24 -3.09 -3.07 -2.92		
Sti	itzmo	mente	e Max	imum									(kNm	, 	kN)
2	 ütze 1 2 3 4	-	M li -0.11 -0.50 -0.61 -0.50	- - -	0.50 0.61 0.50		-3.4 -3.2 -3.1	.2 13 23 10	2. 3. 3.	. 23	max F 4.09 6.54 6.46 6.54 4.09		0.17 0.55 0.59 0.55 0.17		komb 8 14 22 29 9
Au	flage	erkräi	fte											(kN)
	ütze 1 2 3 4 5 mme:		aus g 0.41 0.69 0.68 0.69 0.41 2.88		E 06		-0.0	24 14 09	3 6 6	.40	max 4.09 6.54 6.46 6.54 4.09 27.73) 1 5 1	0.55 0.59 0.55		
Au	flag	erkrä	fte											(kN)
EG 9 A				min 0.4 -0.2	m	ax 0.7 5.9	1	min 0.7 -0.1	1	0.7 5.8	min 0.7	7 1	0.7 5.9		min 0.7 -0.1
 Su											0.				

PROJEKT: SDE

POS: U4

T3-77

(kN) Auflagerkräfte

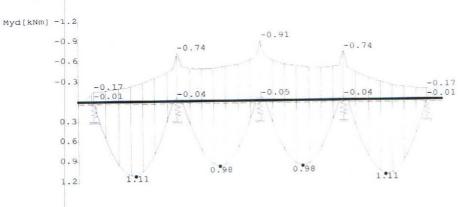
	Stütze	5			
EG	max 0.4	0.4			
A	3.7	-0.2	 	 	_
Sum	4.1	0.2			

Ergebnisse für γ -fache Lasten Teilsicherheitsbeiwert γG über Trägerlänge konstant

Feldm	omente	Maximu	m				(kNm ,	KN)
Feld 1 2 3 4	x0 = x0 = x0 = x0 =	0.52 0.55 0.55 0.55	Mfd 1.12 0.98 0.98 1.12	Mdli -0.02 -0.27 -0.29 -0.27	Mdre -0.27 -0.29 -0.27 -0.02	V li 4.34 4.55 4.59 4.80	V re -4.80 -4.59 -4.55 -4.34	komb A 9 A 17 A 24 A 2

Stützmome	ente Maxim	um				(kNm ,	kN)
Stütze 1 2 3 4 5	Mdli	Mdre	Vdli	Vdre	max F	min F	komb
	-0.17	-0.17	-1.66	4.41	6.08	0.05	A 8
	-0.74	-0.74	-5.09	4.61	9.71	0.48	A 14
	-0.91	-0.91	-4.79	4.79	9.59	0.54	A 22
	-0.74	-0.74	-4.61	5.09	9.71	0.48	A 29
	-0.17	-0.17	-4.41	1.66	6.08	0.05	A 9

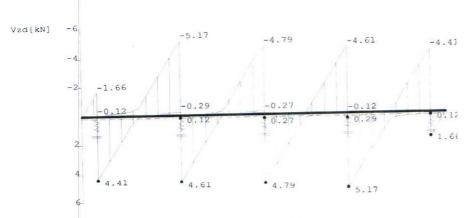
1:50 Maßstab



PROJEKT: SDE

POS: U4

7 3.78



Bemessung: C24

 $E_{mean} = 1100 \text{ kN/cm2}$

 $G_{mean} = 69 \text{ kN/cm2}$

 $\gamma M = 1.30$

DIN1052:2004

fm, k = 24.0 N/mm2fv, k = 2.0 N/mm2

Nutzungsklasse 3 kdef = 2.00

Normalspannungen b/h = 16.6/6

Der Druckgurt ist kontinuierlich gehalten.

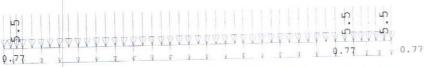
Feld Nr.	x (m)	My, d (kNm)	od, o	σd, u /mm2)	km	kmod	σd/fm,d	kc	dmo
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00	7)	1 2
	0.20	-0.17	1.67	-1.67	1.00	0.65	0.14	A	2
1	0.00	-0.17	1.67	-1.67	1.00	0.65	0.14	A	9
	0.52	1.12	-11.23	11.23	1.00	0.65	0.94		14
	1.10	-0.67*	6.72	-6.72	1.00	0.65	0.56		14
2	0.00	-0.67*	6.72	-6.72	1.00	0.65	0.82		16
	0.55	0.98	-9.82	9.82	1.00	0.65	0.62		22
	1.10	-0.82*	8.25	-8.25	1.00	0.65	0.69		22
3	0.00	-0.82*	8.25	-8.25	1.00	0.65	0.82		24
	0.55	0.98	-9.82	9.82	1.00	0.65	0.56		29
	1.10	-0.67*	6.72	-6.72	1.00		0.56	A	2.25
4	0.00	-0.67*	6.72	-6.72	1.00	0.65	0.94	A	
	0.58	1.12	-11.23	11.23	1.00	0.65	0.14	A	
	1.10	-0.17	1.67	-1.67	1.00		0.14	A	
Krre	0.00	-0.17	1.67	-1.67	1.00	0.65	0.00	A	
	0.20	0.00	0.00	0.00	1.00	0.05	0.00	11)

^{* -&}gt; umgelagert nach DIN1052:2004 8.1 (6)

Seite: . **BV: SDE - HFT-STUTTGART** Unito low for this Cage Systen: nsdy 2 legt: 5 = 0 70 4 Benesy un ENV Bobler Eile 6 (10, e 50 000 660 10/14, e = 1,10m Tväge 20 Traje 10/14 cm, e = 170 m 24

PROJEKT: SDE

Maßstab 1:20



	b/h=10/14	
	1,75	1 20
10		20 15
5 10	1,65	10 15
	2,05	

Holzträger C24

SYSTEM	Länge		Querschnittswerte	
Feld 1	L (m) 1.75	konstant	b (cm) h (cm) Iy (cm4) 10.0 14.0 2286.7	
Kragarm links rechts	0.10	konstant konstant	10.0 14.0 2286.7 10.0 14.0 2286.7	

T3.20

POS: U5

Einwirkungen:

		Bezeichnung	ψ0	ψ1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

Feldmo	oment	te	Maximum					(kNm	, 	kN)
Feld	×0 =	- - - =	0.88	Mf 2.39	M li 0.00	M re -0.02	V li 5.48		re 5.49		kom	nb 3

PROJEKT: SDE POS: U5

Stützme	omente Maxim	um				(kNm ,	kN)
Stütze 1 2	M li -0.03 -0.13	M re -0.03 -0.13	V li -0.63 -5.56	V re 5.50 1.25	max F 6.12 6.81	min F 0.68 0.82	komb 5 2
Auflag	erkräfte						kN)
1	aus g 0.74 0.83 1.58	5.38	min q -0.06 -0.02	Vollast 6.06 6.79	max 6.12 6.81	min 0.68 0.82	
Auflag	erkräfte						kN)
F.G	Stütze 1 max mi 0.7 0 5.4 -0	n max	min 8 0.8				
Sum	6.1).7 6.	8 0.8	3			
Ergebn Teilsi	isse für γ-i cherheitsbei	Eache Last wert γG	en über Träg	erlänge ko	onstant		
	mente Maximu					(kNm ,	kN)
Feld	x0 = 0.88	Mfd	Mdli	Mdre	V li 8.12	V re -8.14	komb A 3
Stützm	nomente Maxir	num				(kNm ,	kN)
Stütze 1 2	Mdli -0.05 -0.19	Mdre -0.05 -0.19	Vdli -0.93 -8.23	Vdre 8.14 1.86	max F 9.07 10.09	min F 0.65 0.81	komb A 5 A 2
Maßsta	ab 1:20						
Myd[kNi	0.9 1.8 2.7 3.6		3.54		=0:02		

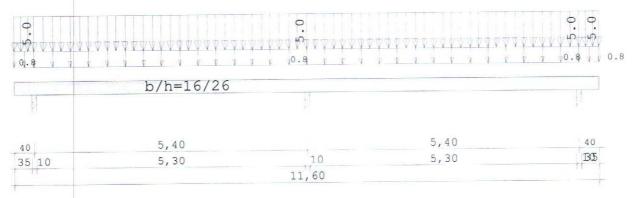
73.21

v.	Schellingstraße 24, 70174 Stuttgart SDE - HFT-STUTTGART Seite:																											
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PROJEKT: SDE

POS: T1 74.2

Magatah	7	75
Maßstab	1	10



Holzträger über 2 Felder GL28c

SYSTEM	Länge		Querschnit	tswerte		
Feld 1 2	L (m) 5.40 5.40	konstant konstant	b (cm) 16.0 16.0	h (cm) 26.0 26.0	Iy (cm4) 23434.7 23434.7	
Kragarm links rechts	0.40	konstant konstant	16.0 16.0	26.0 26.0	23434.7 23434.7	

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b (kN, m)5=Dreieckslast über L, 6=Trapezlast über L

Feld	Тур	EG Gr	g_1/r	q_l/r Fa	aktor	Abstand	Länge	ausPOS	Phi
1	1	А	0.80	5.00	1.00				
		А	0.80	5.00	1.00				
Kraga	arm								
Krli	1	A	0.80	5.00	1.00				
Krre	1	A	0.80	5.00	1.00				
	1 2 Kraga Krli	1 1 2 1 Kragarm Krli 1	1 1 A 2 1 A	1 1 A 0.80 2 1 A 0.80 Kragarm Krli 1 A 0.80	1 1 A 0.80 5.00 2 1 A 0.80 5.00 Kragarm Krli 1 A 0.80 5.00	1 1 A 0.80 5.00 1.00 2 1 A 0.80 5.00 1.00 Kragarm Krli 1 A 0.80 5.00 1.00	1 1 A 0.80 5.00 1.00 2 1 A 0.80 5.00 1.00 Kragarm Krli 1 A 0.80 5.00 1.00	1 1 A 0.80 5.00 1.00 2 1 A 0.80 5.00 1.00 Kragarm Krli 1 A 0.80 5.00 1.00	1 1 A 0.80 5.00 1.00 2 1 A 0.80 5.00 1.00 Kragarm Krli 1 A 0.80 5.00 1.00

Einwirkungen:

Nr	Kl	Bezeichnung	ΨΟ	ψ 1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

PROJEKT: SDE

Durchlaufträger DLT 04/2008/B WinXP

Ergebnisse für 1-fache Lasten (kNm , kN) Feldmomente Maximum Teld Mf M li M re V li V re komb $1 \times 0 = 2.32 \quad 15.57 \quad -0.06 \quad -11.90 \quad 13.47 \quad -17.85 \quad 3 \\ 2 \times 0 = 3.08 \quad 15.57 \quad -11.90 \quad -0.06 \quad 17.85 \quad -13.47 \quad 2$ (kNm , kN) Stützmomente Maximum -----______

 Stütze
 M li
 M re
 V li
 V re
 max F
 min F
 komb

 1
 -0.46
 -0.46
 -2.32
 13.56
 15.88
 0.27
 2

 2
 -21.11
 -21.11
 -19.56
 19.56
 39.11
 5.14
 7

 3
 -0.46
 -0.46
 -0.04
 2.32
 15.88
 0.27
 3

 (kN) Auflagerkräfte _____
 Stütze
 aus g
 max q
 min q
 Vollast
 max
 min

 1
 1.96
 13.92
 -1.69
 14.19
 15.88
 0.27

 2
 5.36
 33.75
 -0.22
 38.89
 39.11
 5.14

 3
 1.96
 13.92
 -1.69
 14.19
 15.88
 0.27

 Summe:
 9.28
 61.60
 -3.60
 67.28
 70.88
 5.68
 Auflagerkräfte _____ Stütze 1 Stütze 2 Stütze 3

EG max min max min max min
g 2.0 2.0 5.4 5.4 2.0 2.0
A 13.9 -1.7 33.7 -0.2 13.9 -1.7 15.9 0.3 39.1 5.1 15.9 0.3 Sum Ergebnisse für γ-fache Lasten Teilsicherheitsbeiwert yG über Trägerlänge konstant (kNm , kN) Feldmomente Maximum _____ (kNm , kN) Stützmomente Maximum

 Stütze
 Mdli
 Mdre
 Vdli
 Vdre
 max F
 min F
 komb

 1
 -0.69
 -0.69
 -3.43
 20.10
 23.53
 -0.57
 A 2

 2
 -31.23
 -31.23
 -28.93
 28.93
 57.87
 5.03
 A 7

 3
 -0.69
 -0.69
 0.18
 3.43
 23.53
 -0.57
 A 3

74.3

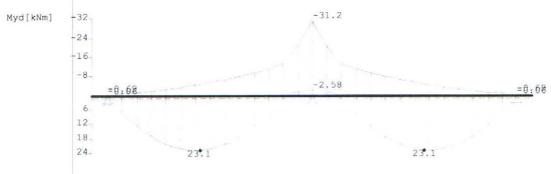
POS: T1

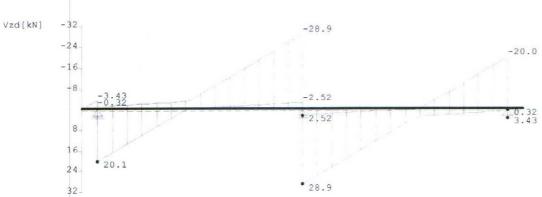
PROJEKT: SDE

POS: T1

T4.4

Maßstab 1:100





Bemessung: GL28c $E_{mean} = 1260 \text{ kN/cm2}$ $G_{mean} =$ 72 kN/cm2

 $\gamma M = 1.30$ DIN1052:2004 fm, k = 28.0 N/mm2

fv, k = 2.5 N/mm2kdef = 2.00Nutzungsklasse 3

Normalspannungen b/h = 16/26

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	σd , o	-	km	kmod	σ d/fm,d	ko	dmc
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.40	-0.69	0.38	-0.38	1.00	0.65	0.02	A	2
1	0.00	-0.69	0.38	-0.38	1.00	0.65	0.02	A	2
	2.33	23.12	-12.83	12.83	1.00	0.65	0.83	A	5
	5.40	-28.11*	15.59	-15.59	1.00	0.65	1.01!	A	7
2	0.00	-28.11*	15.59	-15.59	1.00	0.65	1.01!	A	7
	3.07	23.12	-12.83	12.83	1.00	0.65	0.83	A	6
	5.40	-0.69	0.38	-0.38	1.00	0.65	0.02	A	11
Krre	0.00	-0.69	0.38	-0.38	1.00	0.65	0.02	A	3
	0.40	0.00	0.00	0.00	1.00	0.65	0.00	A	2

* -> umgelagert nach DIN1052:2004 8.1 (6)

Der Faktor kh nach Tabelle F.9 Anmerkung b ist berücksichtigt.

PROJEKT: SDE

POS: T1

T4.5

Schubspannungen

Stütze Nr.	x (m)	Vz,d (kN)	τD (N/mm2)	kmod	τd/fv,d	komb
1 li re 2 li	0.310 0.310 0.310	-0.77 17.44 -26.27	0.03 0.63 0.95	0.65 0.65	0.02 0.50 0.76	A 2 A 10 A 7
re 3 li re	0.310 0.310 0.310	26.27 -17.44 0.77	0.95 0.63 0.03	0.65 0.65 0.65	0.76 0.50 0.02	A 7 A 11 A 11

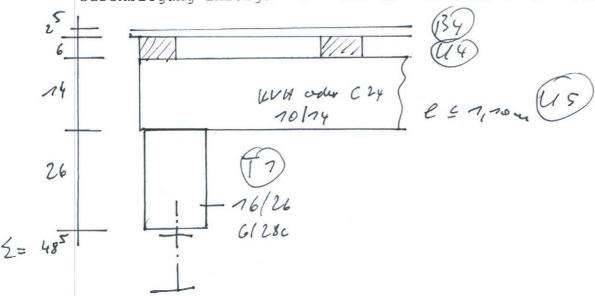
Auflager fc, 90, $k = 2.70 \text{ N/mm}^2$

Stüt	ze b	d	max F	kmod	kc90	σc,90,d	fc,90,d	η		
Nr.	(cm)	(cm)	(kN)			(N/mr	n2)		koı	mb
1	10.0	90.0	23.5	0.65	1.00	0.92				
2	10.0	90.0					1.35			
3	10.0	90.0	23.5	0.65	1.00	0.92	1.35	0.68	A	11
Die	effektiven	Auflag	erlängen	sind	nach	10.2.4 (4	48) verg	rößert.		

Nachweis Gebrauchstauglichkeit nachDIN 1052:2004 9.2 kdef = 2.00 zul w $_{\rm q,inst}$ < L/300 $_{\rm wfin,rare}$ - $_{\rm wg,inst}$ < L/200 $_{\rm wfin,perm}$ < L/200

		wg			wq			fin			
Feld	X	inst	fin	inst	rare	perm	rare	perm	η		
Nr.	(m)	((cm)	(cm)	(cm)		ko	mb
Krli	0.00	-0.03	-0.10	-0.33	-0.54	-0.30	-0.64	-0.40		A	3
1	2.43	0.12	0.37	1.32	2.11	1.19	2.48	1.55	0.87	A	3
2	2.97	0.12	0.37	1.32	2.11	1.19	2.48	1.55	0.87	A	2
Krre	0.40	-0.03	-0.10	-0.33	-0.54	-0.30	-0.64	-0.40		A	2

Größte Durchbiegung nach DIN 1052:2004 9.3 in Feld 1 f = 6.0 mmDurchbiegung infolge F = 1.0 kNin Feld 1 f = 0.8 mm



BV: SDE - HFT-STUTTGART

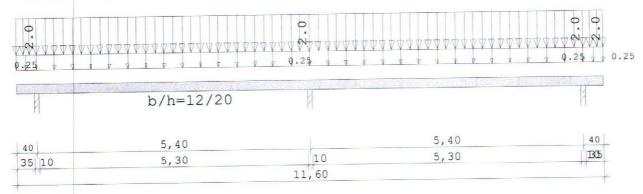
Traileday antlay SDE - West Einwork up gesigt way Meiner Ere pystowers g = 0,6 km/2 3 x 0, qu = 20,25 km/2

p - 5,0 u 3 -> g = 0,25 km/2 Shuldyriper und Benery un BAV. Bolile Nely Eine Vousturation Holp lin bu 6/10 Toci y- a/ 28c ≥ 12/20 cm 21 22 24

PROJEKT: SDE

POS: T2 74.7

Maßstab 1:75



Holzträger über 2 Felder GL28c

SYSTEM	Länge		Querschnittswerte	
Feld 1 2	L (m) 5.40 5.40	konstant konstant	b (cm) h (cm) Iy (cm4) 12.0 20.0 8000.0 12.0 20.0 8000.0	
Kragarm links rechts	0.40 0.40	konstant konstant	12.0 20.0 8000.0 12.0 20.0 8000.0	

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b (kN, m)5=Dreieckslast über L, 6=Trapezlast über L

Feld '	Гур	EG Gr	g_l/r	q_l/r Faktor	Abstand Länge	ausPOS	Phi
1	1	A	0.25	2.00 1.00			
2		A	0.25	2.00 1.00			
Kraga Krli Krre	1		0.25 0.25	2.00 1.00 2.00 1.00			

		rkungen: Bezeichnung	ψ0	ψ1 	ψ2	γ	Led
 А	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

PROJEKT: SDE

Durchlaufträger DLT 04/2008/B WinXP

Ergebnisse für 1-fache Lasten (kNm , kN) Feldmomente Maximum _____ Feld Mf M li M re V li V re komb $1 \times 0 = 2.33 \times 0 = 3.07 \times 0.09 \times 0.02 \times 0.02 \times 0.09 \times 0.09 \times 0.02 (kNm , kN) Stützmomente Maximum _____

 Stütze
 M li
 M re
 V li
 V re
 max F
 min F
 komb

 1
 -0.18
 -0.18
 -0.90
 5.27
 6.17
 -0.06
 2

 2
 -8.19
 -8.19
 -7.59
 7.59
 15.18
 1.59
 7

 3
 -0.18
 -0.18
 0.13
 0.90
 6.17
 -0.06
 9

 (kN) Auflagerkräfte _____
 Stütze
 aus g
 max q
 min q
 Vollast
 max
 min

 1
 0.61
 5.56
 -0.68
 5.51
 6.17
 -0.06

 2
 1.68
 13.50
 -0.09
 15.09
 15.18
 1.59

 3
 0.61
 5.56
 -0.67
 5.51
 6.17
 -0.06

 Summe:
 2.90
 24.62
 -1.44
 26.10
 27.52
 1.46
 Auflagerkräfte _____ Stütze 1 Stütze 2 Stütze 3

EG max min max min max min

g 0.6 0.6 1.7 1.7 0.6 0.6

A 5.6 -0.7 13.5 -0.1 5.6 -0.7 EG _____ Sum 6.2 -0.1 15.2 1.6 6.2 -0.1 Ergebnisse für γ-fache Lasten Teilsicherheitsbeiwert γG über Trägerlänge konstant (kNm , kN) Feldmomente Maximum _____ (kNm , kN) Stützmomente Maximum _____
 Stütze
 Mdli
 Mdre
 Vdli
 Vdre
 max F
 min F
 komb

 1
 -0.27
 -0.27
 -1.34
 7.83
 9.17
 -0.40
 A 2

 2
 -12.15
 -12.15
 -11.26
 11.26
 22.51
 1.54
 A 7

 3
 -0.27
 -0.27
 0.27
 1.34
 9.17
 -0.40
 A 9

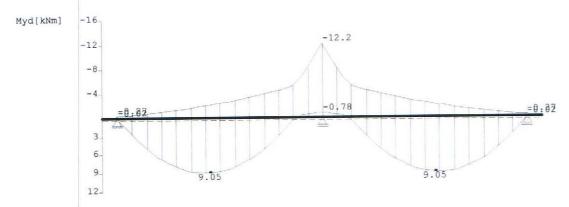
T4.8

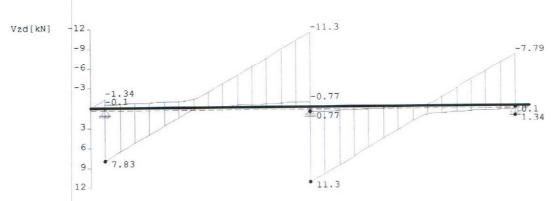
POS: T2

PROJEKT: SDE

POS: T2







Bemessung: GL28c

 $E_{mean} = 1260 \text{ kN/cm2}$

72 kN/cm2 $G_{mean} =$ $\gamma M = 1.30$

DIN1052:2004

fm, k = 28.0 N/mm2

fv, k = 2.5 N/mm2

Nutzungsklasse 3

kdef = 2.00

Normalspannungen b/h = 12/20

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	$\sigma d, o$	σd, u N/mm2)		kmod	σd/fm,d	ko	omb
Krli	0.00	0.00 -0.27	0.00	0.00	1.00	0.00	0.00	A	1 2
1	0.40	-0.27	0.33	-0.33	1.00	0.65	0.02	A	2
	2.33 5.40	9.06 -10.94*	-11.33 13.67	11.33 -13.67	1.00	0.65	0.89	A	7
2	0.00	-10.94* 9.06	13.67 -11.33	-13.67 11.33	1.00	0.65	0.89	A A	7
7/	5.40	-0.27 -0.27	0.33	-0.33 -0.33	1.00	0.65	0.02	A	3
Krre	0.40	0.00	0.00	0.00	1.00	0.65	0.00		11
1	7	and mach D	TMI OFO. O	001 9 1	(6)				

* -> umgelagert nach DIN1052:2004 8.1 (6)

Der Faktor kh nach Tabelle F.9 Anmerkung b ist berücksichtigt.

T4.70

BV: SDE - HFT-STUTTGART

Seite: ... 2 I veige and Nordsite BS 27 System: G128c GA GB 12/20cm 11,30 1 3,20 3,20 6 Einwirkey: g= 0,6 v=/m² +0,20 ? Eings boose

p= 5,0 v2/2 > 0,950 - 9 = 0,95.0,6 +0,20 = 0,80 le-1-M = 0,95.5,0 = 4,80 11 Selen Proper wel Benezon with BM loce s per ation 18 UK4 10/100, e £ 60 Tooge B8H 61280 12/200 20 21 22 23 24

PROJEKT: SDE

POS: T3 74.11

Maßstab 1:75

7(17(17(1)))	a		~	, D D D D D D D D D D D D D D D D D D D	2	7000000	ωω
		b/h=12/20					h h
		2 20	1	3,20	T.	2,10	2
1,30		3,20		3,20		2,10	- 4

Holzträger über 3 Felder GL28c

SYSTEM	Länge		Querschnitts	swerte		2
Feld 1 2 3	L (m) 3.20 3.20 2.10	konstant konstant konstant	b (cm) h 12.0 12.0 12.0	(cm) 20.0 20.0 20.0	Iy (cm4) 8000.0 8000.0 8000.0	
Kragarm links rechts	1.30	konstant konstant	12.0 12.0	20.0	8000.0 8000.0	

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a 3=Einzelmoment bei a , 4=Trapezlast von a - a+b (kN, m)5=Dreieckslast über L, 6=Trapezlast über L

_____ Feld Typ EG Gr g_l/r q_l/r Faktor Abstand Länge ausPOS Phi 1 1 A 4.80 1.00 0.80 2 1 A 0.80 4.80 1.00 3 1 A 0.80 4.80 1.00 Kragarm 0.80 4.80 1.00 0.80 4.80 1.00 Krli 1 A Krre 1 A

Einwirkungen:

Nr	Kl	Bezeichnung	ψ0	ψ1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

PROJEKT: SDE

Durchlaufträger DLT 04/2008/B WinXP

POS: T3

Ergebnisse für 1-fache Lasten Feldmomente Maximum (kNm , kN) Feld Mf M li M re V li V re komb $1 \times 0 = 1.43 \times 0.504 \times 0.68 \times 0.75 \times 0.000 \times 0.0000 \times 0.0000 \times 0.0$ (kNm , kN) Stützmomente Maximum _____ M li M re V li V re max F min F komb -4.73 -4.73 -7.28 9.61 16.89 1.58 7 -6.36 -6.36 -10.74 10.15 20.88 0.03 10 -5.05 -5.05 -10.02 8.28 18.30 0.45 12 -0.11 -0.11 0.96 1.12 6.73 -0.86 14 Stütze 1 2 3 (kN) Auflagerkräfte _____
 Stütze
 aus g
 max q
 min q
 Vollast
 max
 min

 1
 2.31
 14.58
 -0.72
 16.16
 16.89
 1.58

 2
 2.61
 18.27
 -2.59
 18.29
 20.88
 0.03

 3
 2.34
 15.96
 -1.89
 16.41
 18.30
 0.45

 4
 0.73
 5.99
 -1.59
 5.14
 6.73
 -0.86

 Summe:
 8.00
 54.80
 -6.80
 56.00
 62.80
 1.20
 Auflagerkräfte ______ Stütze 1 Stütze 2 Stütze 3 Stütze 4

EG max min max min max min max min
g 2.3 2.3 2.6 2.6 2.3 2.3 0.7 0.7
A 14.6 -0.7 18.3 -2.6 16.0 -1.9 6.0 -1.6 _____ 16.9 1.6 20.9 0.0 18.3 0.5 6.7 -0.9 Sum Ergebnisse für γ-fache Lasten Teilsicherheitsbeiwert yG über Trägerlänge konstant Feldmomente Maximum (kNm , kN) _____ Mfd Mdli Mdre V li V re komb 1 $\times 0 = 1.43$ 7.51 -0.91 -5.52 11.81 -14.69 A 3 2 $\times 0 = 1.49$ 6.37 -2.80 -5.76 12.32 -14.17 A 7 3 $\times 0 = 1.10$ 4.08 -0.97 -0.02 9.15 -8.24 A 3 Feld

T4.12

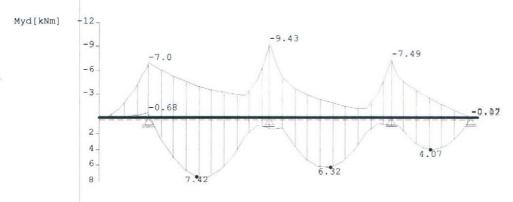
PROJEKT: SDE

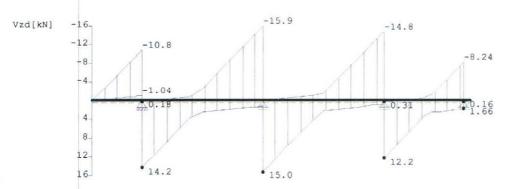
POS: T3

T4.13

Stützmom	ente Maxim	ıum				(kNm	, kN)
Stütze	Mdli	Mdre	Vdli	Vdre	max F	min F	komb
1	-7.00	-7.00	-10.76	14.22	24.99	1.22	A 7
2	-9.43	-9.43	-15.91	15.02	30.93	-1.27	A 10
3	-7.49	-7.49	-14.85	12.25	27.10	-0.50	A 12
4	-0.17	-0.17	1.53	1.66	9.98	-1.65	A 14

Maßstab 1:100





Bemessung: GL28c

 $E_{mean} = 1260 \text{ kN/cm}2$

 $G_{mean} = 72 \text{ kN/cm2}$

DIN1052:2004

fm, k = 28.0 N/mm2

 $\gamma M = 1.30$ fv, k = 2.5 N/mm2

Nutzungsklasse 3

kdef = 2.00

Normalspannungen b/h = 12/20

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	σ d, α	σd,u N/mm2)	km	kmod	σ d/fm,d	ko	omb
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	1.30	-7.00	8.75	-8.75	1.00	0.65	0.57	A	2
1	0.00	-7.00	8.75	-8.75	1.00	0.65	0.57	A	2
	1.43	7.51*	-9.38	9.38	1.00	0.65	0.61	A	11
	3.20	-8.49*	10.61	-10.61	1.00	0.65	0.69	A	10
2	0.00	-8.49*	10.61	-10.61	1.00	0.65	0.69	A	10
	1.49	6.37	-7.97	7.97	1.00	0.65	0.52	A	2
	3.20	-6.74*	8.42	-8.42	1.00	0.65	0.55	A	12

PROJEKT: SDE POS: T3 T4.14

Normalspannungen b/h = 12/20

Der Druckgurt ist kontinuierlich gehalten.

Feld	X	My, d	$\sigma d, o$	$\sigma d, u$	km	kmod	σd/fm,d		
Nr.	(m)	(kNm)	(N/mm2)					kc	dmo
3	0.00	-6.74*	8.42	-8.42	1.00	0.65	0.55	 А	12
	1.10	4.08	-5.10	5.10	1.00	0.65	0.33	A	3
	2.10	-0.17	0.21	-0.21	1.00	0.65	0.01	A	7
Krre	0.00	-0.17	0.21	-0.21	1.00	0.65	0.01	A	7
	0.20	0.00	0.00	0.00	1.00	0.65	0.00	A	3
1	7	1 0	T1110F0 00	001 0 1	101				

* -> umgelagert nach DIN1052:2004 8.1 (6)

Der Faktor kh nach Tabelle F.9 Anmerkung b ist berücksichtigt.

Schubspannungen

Stütze Nr.	x (m)	Vz,d (kN)	τD (N/mm2)	kmod	τd/fv,d	komb
1 li	0.250	-8.69	0.54	0.65	0.43	A 2
re	0.250	12.15	0.76	0.65	0.61	A 15
2 li	0.250	-13.84	0.87	0.65	0.69	A 10
re	0.250	12.95	0.81	0.65	0.65	A 10
3 li	0.250	-12.78	0.80	0.65	0.64	A 12
re	0.250	10.18	0.64	0.65	0.51	A 12
4 li	0.250	-6.25	0.39	0.65	0.31	A 16
re	0.200	0.00	0.00	0.65	0.00	A 7

Auflager fc, 90, k = 2.70 N/mm2

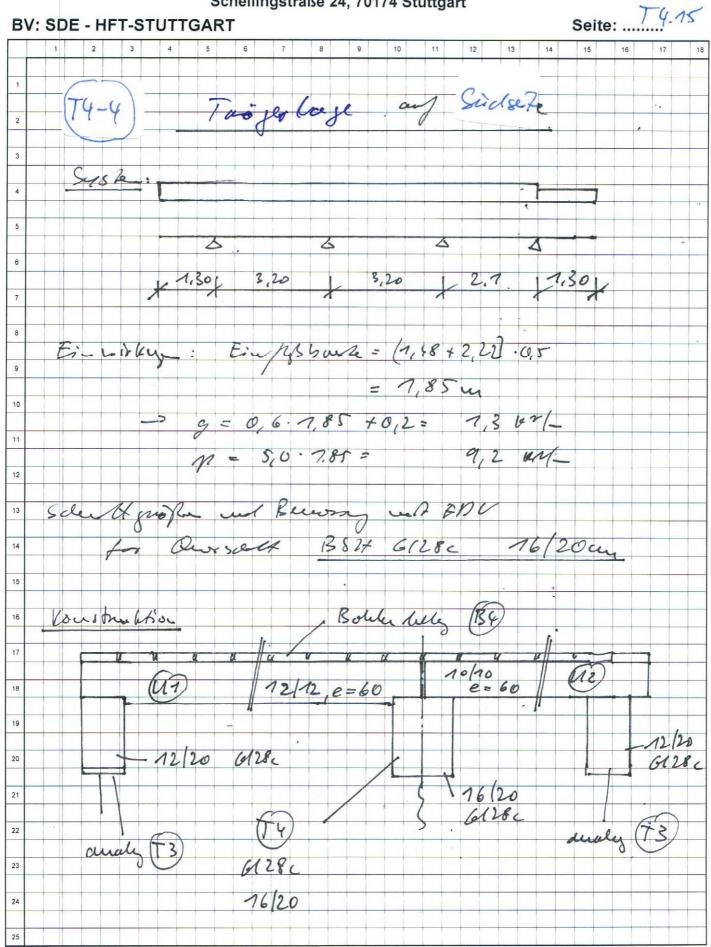
Stüt	ze b	d	max F	kmod	kc90	σc, 90, d	fc,90,d	η		
Nr.	(cm)	(cm)	(kN)			(N/m	m2)		ko	dmo
1	10.0	90.0	25.0	0.65	1.00	1.30	1.35	0.96	A	15
2	10.0	90.0	30.9	0.65	1.50	1.61	1.35	0.80	A	10
3	10.0	90.0	27.1	0.65	1.50	1.41	1.35	0.70	A	12
4	10.0	90.0	10.0	0.65	1.00	0.52	1.35	0.39	A	16
Die	effektiver	Aufla	gerlänge	n sind	nach	10.2.4 (48) verg	rößert.		

Nachweis Gebrauchstauglichkeit nachDIN 1052:2004 9.2 kdef = 2.00 zul w $_{g,inst}$ < L/300 $w_{fin,rare}$ - $w_{g,inst}$ < L/200 $w_{fin,perm}$ < L/200

		1	wg		wq		W	fin			
Feld	X	inst	fin	inst	rare	perm	rare	perm	η		
Nr.	(m)	((cm)	(cm)	(cm)		ko	mb
Krli	0 00	0 03	0.09	0 81	1 30	0 73	1 30	0.82		Δ	7
1			0.06						0.48	A	
			0.08				0.66		0.39	A	
3	1.05	0.00	0.01	0.12	0.19	0.11	0.20	0.12	0.19	A	3
Krre	0.20	0.00	-0.01	-0.04	-0.06	-0.03	-0.06	-0.04		A	3

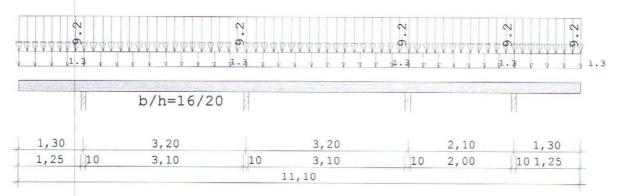
Größte Durchbiegung nach DIN 1052:2004 9.3 in Feld 1 $\,$ f = 2.0 mm Durchbiegung infolge $\,$ F = 1.0 $\,$ kN $\,$ in Feld 1 $\,$ f = 0.5 $\,$ mm

BV: SDE - HFT-STUTTGART



PROJEKT: SDE POS: T4 T4.76

Maßstab 1:75



Holzträger über 3 Felder GL28c

SYSTEM	Länge		Querschnit	tswerte		
Feld 1 2 3	L (m) 3.20 3.20 2.10	konstant konstant konstant	b (cm) 16.0 16.0 16.0	h (cm) 20.0 20.0 20.0	Iy (cm4) 10666.7 10666.7 10666.7	
Kragarm links rechts	1.30	konstant konstant	16.0	20.0	10666.7 10666.7	

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a (kN,m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

Feld	Тур	EG Gr	g_l/r	q_1/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1	А	1.30	9.20	1.00				
2	1	A	1.30	9.20	1.00				
3		А	1.30	9.20	1.00				
Kraga Krli Krre	1	A A	1.30 1.30	9.20 9.20	1.00				

Einwirkungen:

Nr	Kl	Bezeichnung	ψ0	ψ1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

PROJEKT: SDE

Durchlaufträger DLT 04/2008/B WinXP

Ergebnisse für 1-fache Lasten

Ergebn	isse für 1-:	fache Las	ten 				
Feldmon	mente Maximu	ım				(kNm ,	kN)
2 2	x0 = 1.42 x0 = 1.56 x0 = 1.04	8.74	M li -1.10 -3.97 -0.96	-7.04 -5.44	14.94 16.34	-17.26	2
Stützmo	omente Maxim	num				(kNm ,	kN)
Stütze 1 2 3 4	-8.87 -12.44 -9.28	-8.87 -12.44 -9.28	V 1i -13.65 -20.35 -18.76 -15.59	18.03 19.79 14.92	31.68 40.13 33.68	min F 2.21 -0.61 -5.55 0.19	komb 2 8 10 2
Auflage	rkräfte					(kN)
Stütze 1 2 3 4 Summe:	3.73 4.35 3.10	27.95 35.78 30.58 26.00	min q -1.52 -4.96 -8.65 -3.05 -18.18	30.16 35.17 25.03 26.19	31.68 40.13 33.68 29.24	-5.55 0.19	
Auflage	rkräfte					(kN)
EG g	Stütze 1 max mi 3.7 3 27.9 -1	n max .7 4.	ze 2 min 4 4.4 8 -5.0	max 3.1	min	3 2	min 3.2 -3.0
Sum	31.7 2	.2 40.	1 -0.6	33.7	-5.6	29.2	0.2
Ergebni Teilsic	sse für γ-f herheitsbei	ache Last wert γG i	en über Träge	rlänge ko	nstant		
Feldmom	ente Maximur	n 				(kNm ,	kN)
Feld	0 = 1.42 0 = 1.55 0 = 1.05	Mfd	Mdli	Mdre	V li	V re	

POS: T4 74.77

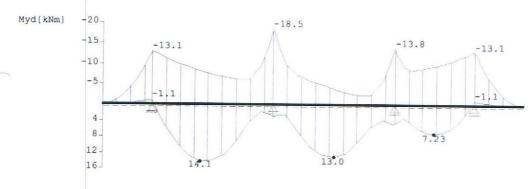
PROJEKT: SDE

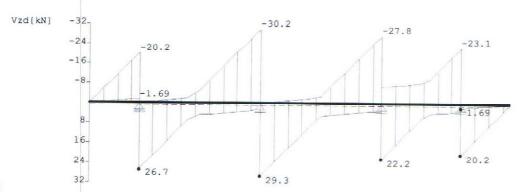
POS: T4

T4.78

Stützmo	mente Maxi 	mum 				(kNm	, kN)
Stütze 1 2 3 4	Mdli	Mdre	Vdli	Vdre	max F	min F	komb
	-13.14	-13.14	-20.22	26.74	46.96	1.45	A 2
	-18.48	-18.48	-30.20	29.35	59.55	-3.09	A 8
	-13.82	-13.82	-27.85	22.21	50.05	-9.88	A 10
	-13.14	-13.14	-23.15	20.22	43.37	-1.33	A 2

1:100 Maßstab





Bemessung: GL28c

 $E_{mean} = 1260 \text{ kN/cm}2$

 $G_{mean} = 72 \text{ kN/cm2}$ $\gamma M = 1.30$

DIN1052:2004

fm, k = 28.0 N/mm2

fv, k = 2.5 N/mm2 kdef = 2.00

Nutzungsklasse 3

Normalspannungen b/h = 16/20

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	σd,	o σd, u N/mm2)	km	kmod	σ d/fm,d	ko	dmc
Krli	0.00	0.00 -13.14	0.00	0.00 -12.32	1.00	0.00 0.65	0.00	 А	1 2
1	0.00 1.42 3.20	-13.14 14.23* -16.64*	12.32 -13.34 15.60	-12.32 13.34 -15.60	1.00 1.00 1.00	0.65 0.65 0.65	0.80 0.87 1.01!	A	2 12 8
2	0.00 1.55 3.20	-16.64* 13.01 -12.43*	15.60 -12.20 11.66	-15.60 12.20 -11.66	1.00 1.00 1.00	0.65 0.65 0.65	1.01! 0.79 0.76	A A	8 2

PROJEKT: SDE

POS: T4 74.19

Normalspannungen b/h = 16/20

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	(m)	My,d (kNm)	σ d, ο	σd,u N/mm2)	km	kmod	σ d/fm,d	k	dmc
3	0.00	-12.43* -9.23*	8.65	-11.66 -8.65	1.00	0.65 0.65	0.76 0.56	A	10
Krre	2.10 0.00 1.30	-13.14 -13.14 0.00	0.00	0.00	1.00 1.00 1.00	0.65 0.65 0.65	0.80 0.80 0.00		12 2 2

* -> umgelagert nach DIN1052:2004 8.1 (6)

Der Faktor kh nach Tabelle F.9 Anmerkung b ist berücksichtigt.

Schubspannungen

Stütze Nr.	x (m)	Vz,d (kN)	τD (N/mm2)	kmod	τd/fv,d	ko	dmc
re 3 li	0.250 0.250 0.250 0.250 0.250 0.250 0.250 0.250	-16.33 22.85 -26.31 25.46 -23.96 18.32 -19.26 16.33	0.77 1.07 1.23 1.19 1.12 0.86 0.90 0.77	0.65 0.65 0.65 0.65 0.65 0.65 0.65	0.61 0.86 0.99 0.95 0.90 0.69 0.72 0.61	A A	2 5 8 10 10 12

Auflager fc, 90, $k = 2.70 \text{ N/mm}^2$

Stüt	ze	b	d	max F	kmod	kc90	σc, 90,	d fc,90,d	n		
Nr.		(cm)	(cm)	(kN)			(N/mm2)			komb	
1		10.0	90.0	47.0	0.65	1.00	1.83		1.36!!		
2		10.0	90.0	59.5	0.65	1.50	2.33	1.35	1.15!!	A	8
3		10.0	90.0	50.1	0.65	1.50	1.96	1.35	0.97	A	10
4		10.0	90.0	43.4	0.65	1.00	1.69	1.35	1.25!!	A	12
Die	effe	ektiven	Auflage	rlänger	sind	nach	10.2.4	(48) verar			

Nachweis Gebrauchstauglichkeit nachDIN 1052:2004 9.2 kdef = 2.00 zul w $_{\rm q,inst}$ < L/300 $_{\rm wfin,rare}$ - $_{\rm wg,inst}$ < L/200 $_{\rm wfin,perm}$ < L/200

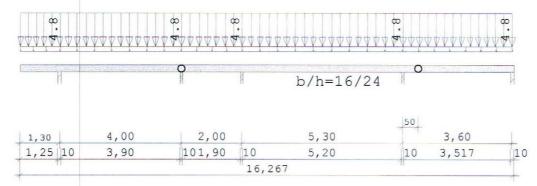
Feld Nr.	x (m)	wg inst fin (cm)		inst (rare	-	wfin rare perm (cm)		η	komb		
1	1.60 1.60 1.05	0.02 0.04 -0.01	0.07 0.12 -0.04	0.58	1.05 0.92 -0.41	0.59 0.52 -0.23	1.12 1.05	0.64	0.68		2	

Größte Durchbiegung nach DIN 1052:2004 9.3 in Feld 1 f = 2.8 mmDurchbiegung infolge F = 1.0 kN in Feld 1 f = 0.4 mm

Seite: TS. 1 **BV: SDE - HFT-STUTTGART** Rampen Dei ger System, 1: orler 2: Syste 513 Infloan unit - Robber bely gen = B& Einwirky: - Untriconst. e= 60e 114 - luke kon fr. 2 £7,700 US Ei 145 liverte = 1,90/2 = 0,95m -> g = 0,6.0,85 +0,2 = 0,80 671-M = 0,95.5,0 = 4,82 m Re14 61286 Ren 61280 16/24 cm 16/240 15

POS: T3.2 PROJEKT: SDE

Maßstab 1: 125



Holzträger über 4 Felder GL28c

SYSTEM	Länge		Querschnitt	swerte		
Feld 1 2 3 4	L (m) 4.00 2.00 5.30 3.60	konstant konstant konstant konstant	b (cm) h 16.0 16.0 16.0 16.0	(cm) 24.0 24.0 24.0 24.0	Iy (cm4) 18432.0 18432.0 18432.0 18432.0	
Kragarm links	1.30	konstant	16.0	24.0	18432.0	

Gelenke : in Feld 2 bei x = 0.00 min Feld 4 bei x = 0.50 m

BELASTUNG Lasttyp : 1=Gleichlast über L $\,$, 2=Einzellast bei a

3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L (kN,m)

			J=D	relecksi	ast up	er L, 6=	rrapezi	ast uber	. Т
Feld	Тур	EG Gr	g_1/r	q_1/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1	А	0.80	4.80	1.00				
2	1	A	0.80	4.80	1.00				
3	1	А	0.80	4.80	1.00				
4 Kraga	1	A	0.80	4.80	1.00				
Krli	1	A	0.80	4.80	1.00				
Einwi Nr Kl		ngen: zeichnur	ng		ψ0	ψ1	ψ2	γ	Led

Einw	irk	inna	an.
TTTTTAA T	T T 17	ung	-11.

Nr	Kl	Bezeichnung	Ψ0	Ψ1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten).

T 5.3

PROJEKT: SDE

POS: T3

In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache	e Lasten
------------------------	----------

Ergebn:	isse für 1	-fache Last	en				
Feldmor	mente Maxi	mum				(kNm ,	kN)
2 2	x0 = 3.10 x0 = 2.05 x = 0.50	Mf 10.86 2.33 12.81 6.73 0.00 0.01	-14.12 -5.04	-0.98 -0.72	17.37 11.48	-6.09 -12.31 -8.68	5 6 5
Stützmo	omente Max	imum				(kNm ,	kN)
Stütze 1 2 3 4 5	-4.73 0.00 -14.78 -5.04	M re -4.73 0.00 -14.78 -5.04 0.00	-7.28 -11.03 -12.99 -13.42	5.11 17.49 11.48	19.66 16.14 30.48 24.90	2.81 -5.85 2.19 3.42	komb 2 5 8 5 7
Auflage	erkräfte					((kN)
Stütze 1 2 3 4 5 Summe:	2.81 1.29 4.08 3.54 1.24	max q 16.85 14.86 26.40 21.36 7.44 86.91	0.00 -7.13 -1.90 -0.12 0.00	9.01 28.59 24.78 8.68	19.66 16.14 30.48 24.90 8.68	2.19	
Auflage	erkräfte					(kN)
EG g A	max 2.8	Stüt min max 2.8 1. 0.0 14.	min 1.3	max 4.1	min 4.1	max 3.5	min 3.5
Sum	19.7	2.8 16.	1 -5.8	30.5	2.2	24.9	3.4

POS: T5 75.4

PROJEKT: SDE

Auflagerkräfte	(kN)

EG g A	Stütze max 1.2 7.4	5 min 1.2 0.0	
Sum	8.7	1.2	

Ergebnisse für γ -fache Lasten Teilsicherheitsbeiwert γG über Trägerlänge konstant

Feldmo	omen	ite	Maximum					(kNm ,	kN)
Feld 1 2 3 4	x0 x0 x0	= = =	2.03 0.97 3.10 2.05 0.50	Mfd 16.11 3.74 18.99 9.95 0.00 0.01	Mdli -0.91 0.00 -20.90 -7.45	Mdre 0.00 -0.52 -0.97 0.00 zug V = zug V =	V li 16.79 7.74 25.70 16.97 1.24 12.83	V re -16.33 -8.26 -18.18 -12.83 1.24 12.83		mb 3 5 6 5 1 5

Stützmom	ente Maxir	mum				(kNm ,	kN)
Stütze	Mdli	Mdre	 Vdli	Vdre	max F	min F	ko	mb
1	-7.00	-7.00	-10.76	18.31	29.07	2.81	A	2
2	0.00	0.00	-16.33	7.74	24.02	-9.41	A	5
3	-21.89	-21.89	-19.22	25.89	45.11	1.24	A	8
4	-7.45	-7.45	-19.85	16.97	36.82	3.35	A	5

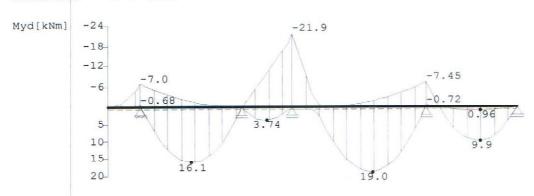
0.00

12.83 1.24

A

Maßstab 1:150

0.00



0.00 -12.83

PROJEKT: SDE

POS: T\$ 75.5

-19.8 -20-Vzd[kN] -16.3 -12.8 -15 -10.8 -10--5 -1.71 1.24 1.04 1.64 7.74 8 16-• 17.0 18.3 24-25.9 32-

Bemessung: GL28c

 $E_{mean} = 1260 \text{ kN/cm}2$

72 kN/cm2 $G_{mean} =$ yM = 1.30

DIN1052:2004

fm, k = 28.0 N/mm2

fv, k = 2.5 N/mm2

kdef = 2.00Nutzungsklasse 3

Normalspannungen b/h = 16/24

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	σd, o	σd,u N/mm2)	km	kmod	σ d/fm,d	ko	mb
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	1.30	-7.00	4.56	-4.56	1.00	0.65	0.30	A	2
1	0.00	-7.00	4.56	-4.56	1.00	0.65	0.30	A	2
	2.03	16.11	-10.49	10.49	1.00	0.65	0.68	A	3
	4.00	0.00	0.00	0.00	1.00	0.65	0.00	A	4
2	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.97	-8.58*	5.59	-5.59	1.00	0.65	0.36	A	6
	2.00	-19.70*	12.83	-12.83	1.00	0.65	0.83	A	8
3	0.00	-20.90*	13.61	-13.61	1.00	0.65	0.88	A	8
	3.10	18.99	-12.36	12.36	1.00	0.65	0.80	A	6
	5.30	-6.71*	4.37	-4.37	1.00	0.65	0.28	A	5
4	0.00	-7.45	4.85	-4.85	1.00	0.65	0.32	A	5
	0.50	-0.01	0.01	-0.01	1.00	0.65	0.00	A	9
	0.50	0.01	-0.01	0.01	1.00	0.65	0.00	A	5
	2.05	9.95	-6.48	6.48	1.00	0.65	0.42	A	5
	3.60	0.00	0.00	0.00	1.00	0.65	0.00	A	6

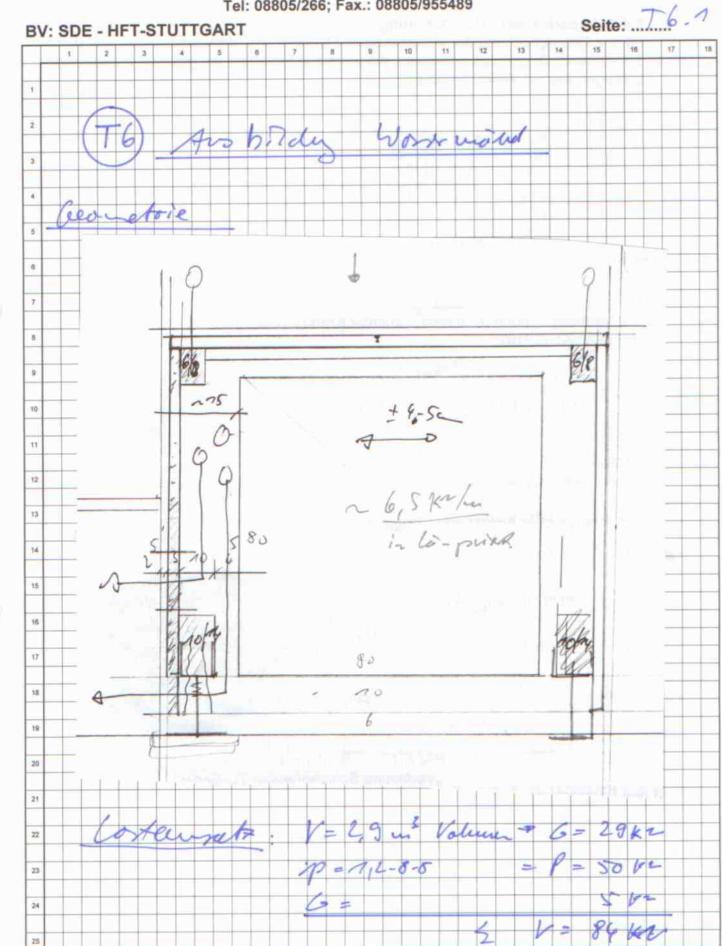
^{* -&}gt; umgelagert nach DIN1052:2004 8.1 (6)

Der Faktor kh nach Tabelle F.9 Anmerkung b ist berücksichtigt.

Ingenieurbüro Dr Hartmann

Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

Tel: 08805/266; Fax.: 08805/955489



ELEMENT 6e

0/10, e ≤0.60 m 0/14, e ≤1.10 m 1e (2x11Stk.) 16/26 _Eichenbohlen
d≥21mm, b=90mm

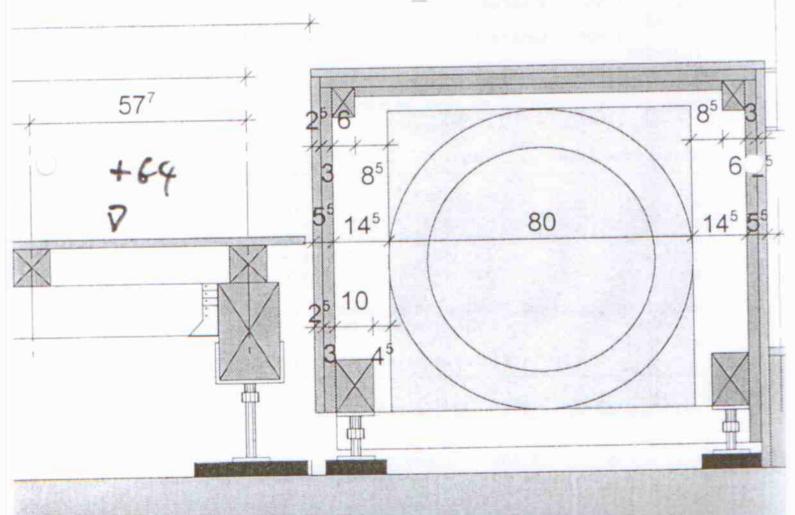
OSB d=30mm

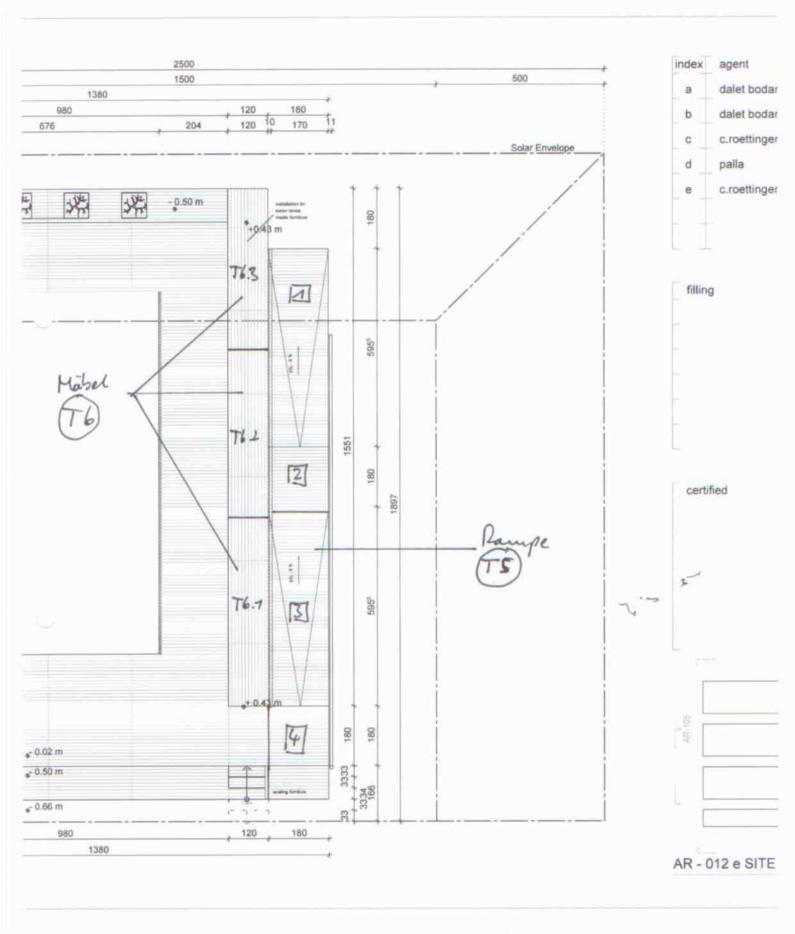
KVH 3/10

KVH 6/8

KVH 10/14

KVH 8/10, e=?



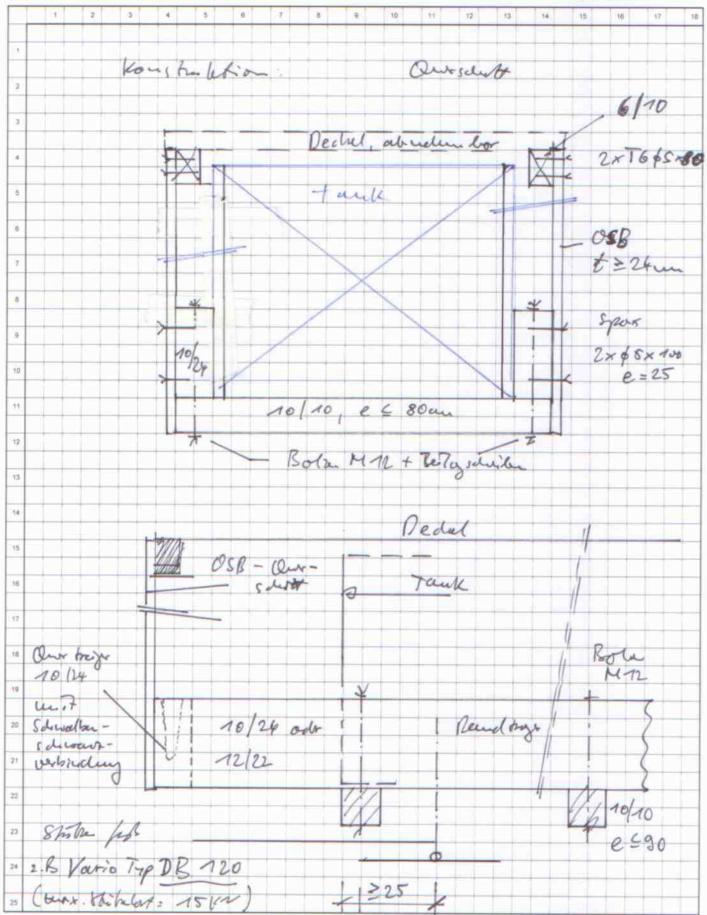


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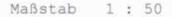
Schellingstraße 24, 70174 Stuttgart

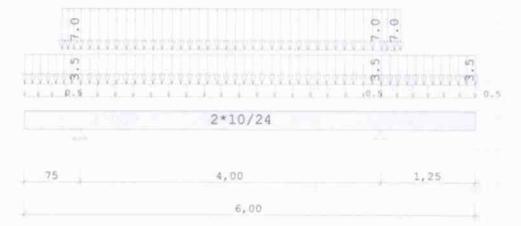
BV: SDE - HFT-STUTTGART



PROJEKT: SDE

POS: T6.1-coolwater





Holzträger C24

Feld	L (m)		b	(cm)	h	(cm)	Iy (cm4)	
1	4.00	konstant		10.0		24.0	23040.0 2	
Kragarm								
inks	0.75	konstant		10.0		24.0	23040.0 2	*
rechts	1.25	konstant		10.0		24.0	23040.0 2	*

(kN, m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

Feld	Тур	EG	Gr g_1/r	q_l/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1		0.50 0.00 0.00	3.50 7.00 7.00		0.00	4.00		
Kraga	rm								
Krli		A	0.50	3.50	1.00				
	4	A	0.00	7.00	1.00	0.50	0.25		
Krre	1	A	0.50	3.50	1.00				
	4	A	0.00	7.00	1.00	0.00	0.25		

Einwirkungen:

Nr	K1	Bezeichnung	ΨΟ	Ψ1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

PROJEKT: SDE

POS: T6.1-coolwater

Ergebnisse für 1-f	ache Last	en 				
Feldmomente Maximu	m				(kNm ,	kN)
Feld 1 x0 = 1.99			M re -0.39			komb 3
Stützmomente Maxim	um				(kNm ,	kN)
Stütze M li 1 -1.34 2 -3.34	-1.34	-4.75	22.24	26.99	0.57	2
Auflagerkräfte						(kN)
Stütze aus g 1 1.31 2 1.69 Summe: 3.00 Auflagerkräfte	25.68 27.86	-0.74 -0.30	26.25 29.25	26.99 29.55	1.39	(kN)
	Stüt					
Stütze 1 EG max mi g 1.3 1 A 25.7 -0	n max .3 1.	min 7 1.7				
Sum 27.0 0	.6 29.	6 1.4				
Ergebnisse für γ-f Teilsicherheitsbei			erlänge ko	onstant		
Feldmomente Maximu	m				(kNm ,	kN)
Feld 1 x0 = 1.99			Mdre -0.53			
Stützmomente Maxim					_ (kNm ,	kN)
	Mdre -1.99	Vdli -7.07		40.29	0.21	A 2

Durchlaufträger

DLT 04/2008/B

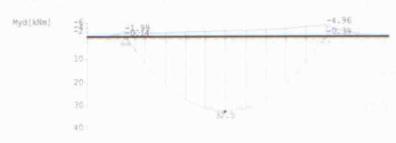
WinXP

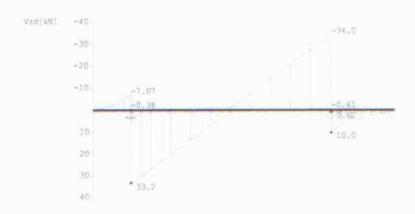
T6.8

PROJEKT: SDE

POS: T6.1-coolwater

Maßstab 1:75





Bemessung: C24

 $E_{mean} = 1100 \text{ kN/cm2}$

 $G_{mean} = \gamma M = 1.30$

DIN1052:2004

fm,k = 24.0 N/mm2fv, k = 2.0 N/mm2

Nutzungsklasse 1 kdef = 0.60

Normalspannungen b/h = 2 * 10/24

matel. Kont. - clant. 20 or free V.

69 kN/cm2

Der Druckgurt ist kontinuierlich gehalten.

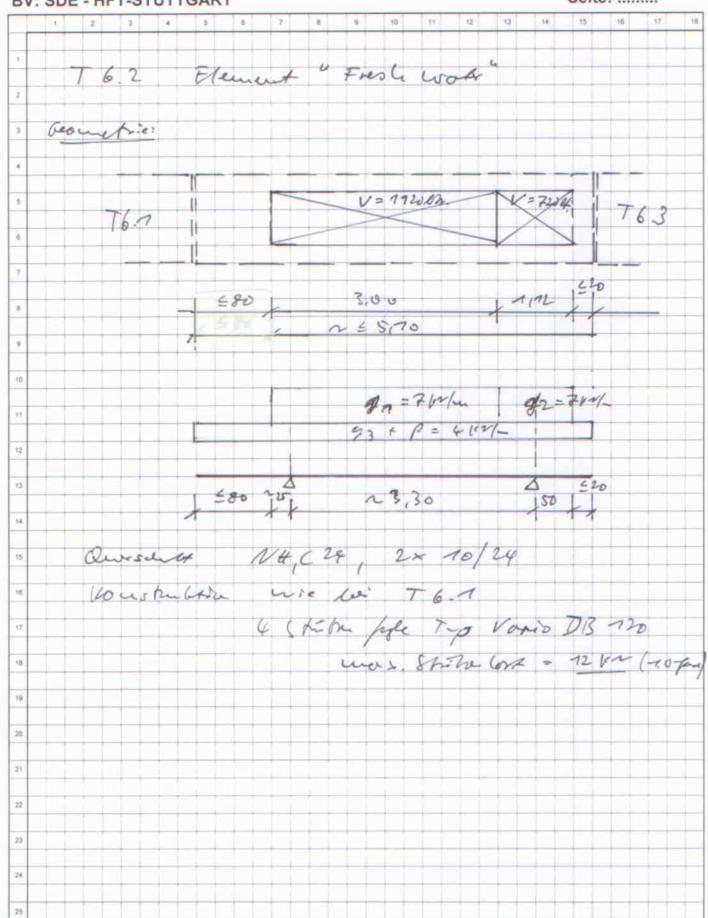
Feld Nr.	(m)	My,d (kNm)	σd, o	σd,u N/mm2)	km	kmod	σd/fm,d	ko	mb
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.75	-1.99	1.04	-1.04	1.00	0.80	0.07	A	2
1	0.00	-1.99	1.04	-1.04	1.00	0.80	0.073	A	2
	1.99	32.49	-16.92	16.92	1.00	0.80	(1.15!)	A	3
	4.00	-4.96	2.58	-2.58	1.00	0.80	0.17	A	2
Krre	0.00	-4.96	2.58	-2.58	1.00	0.80	0.17	A	2
	1.25	0.00	0.00	0.00	1.00	0.80	0.00	A	3

Schubspannungen

Stütze Nr.	(m)	Vz,d (kN)	τD (N/mm2)	kmod	td/fv,d	komb
1 li	0.240	-3.13	0.10	0.80	0.08	A 2
re	0.240	29.27	0.91	0.80	0.74	A 5
2 li	0.240	-30.10	0.94	0.80	0.76	A 7
re	0.240	6.09	0.19	0.80	0.15	A 2

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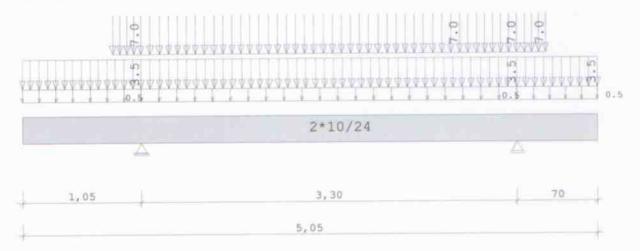
BV: SDE - HFT-STUTTGART Seite: 76.9



PROJEKT: SDE

POS: T6.2-freshwater

Maßstab 1:33



Holzträger C24

SYSTEM	Länge		Que	rschni	tt:	swerte			
Feld	L (m)		b	(cm)	h	(cm)	Iy (cr	n4)	
1	3.30	konstant		10.0		24.0	23040.0	2 *	
Kragarm									
links	1.05	konstant		10.0		24.0	23040.0	2 *	
rechts	0.70	konstant		10.0		24.0	23040.0	2 *	

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a (kN,m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

Feld	Тур	EG Gr	g_1/r	q_1/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1	A	0.50	3.50	1.00				
	4	A	0.00	7.00	1.00	0.00	2.80		
	4	A	0.00	7.00	1.00	2.80	0.50		
Kraga	arm								
Krli		A	0.50	3.50	1.00				
	4	A	0.00	7.00	1.00	0.80	0.25		
Krre	1	A	0.50	3.50	1.00				
	4	A	0.00	7.00	1.00	0.00	0.25		

Einwi	rkungen:					
	Bezeichnung	ψ0	Ψ1	ψ2	γ	Led
76 11	Mahariuma	0.70	0.50	0 30	1 50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

PROJEKT: SDE

POS: T6.2-freshwater

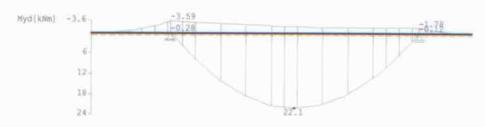
Ergebni	Lsse für 1-fa	ache Last	en				
Feldmon	mente Maximur	n				(kNm	, kN)
Feld 1 x	0 = 1.65					V re -18.10	
Stützmo	omente Maximu	ım				(kNm	, kN)
Stütze 1 2		-2.42	-5.95	18.85	24.80	min F 1.07 0.48	- 2
Auflage	erkräfte						(kN)
Stütze 1 2 Summe:	1.13	23.40	min q -0.33 -0.65 -0.98	24.47	24.80	1.07	
Auflage	erkräfte						(kN)
g A	Stütze 1 max min 1.4 1 23.4 -0	max .4 1. .3 21.	min 1 1.1 9 -0.7				
	24.8 1						
	isse für γ -fa cherheitsbei			erlänge ko	onstant		
Feldmon	mente Maximur	n				(kNm	, kN)
Feld 1 >	κ0 = 1.65					V re -27.04	
Stützmo	omente Maxim	m				(kNm	, kN)
Stütze 1 2	Mdli -3.59 -1.78	-3.59	-8.85	28.14	36.99	min F 0.91 0.15	A 2

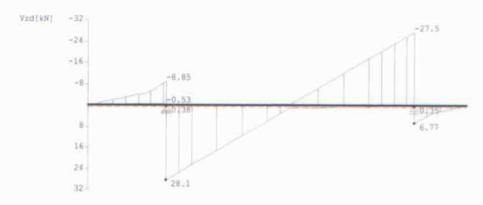
T6.72

PROJEKT: SDE

POS: T6.2-freshwater

Maßstab 1:50





Bemessung: C24

 $E_{mean} = 1100 \text{ kN/cm2}$

 $G_{mean} = 69 \text{ kN/cm2}$

yM = 1.30

DIN1052:2004

fm, k = 24.0 N/mm2fv, k = 2.0 N/mm2

Nutzungsklasse 1 kdef = 0.60

Normalspannungen b/h = 2 * 10/24

Der Druckgurt ist kontinuierlich gehalten.

Feld Nr.	x (m)	My,d (kNm)	σd, (o o d,u N/mm2)	km	kmod	σd/fm,d	ko	dmo
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	1.05	-3.59	1.87	-1.87	1.00	0.80	0.13	A	2
1	0.00	-3.59	1.87	-1.87	1.00	0.80	0.13	A	2
	1.65	22.09	-11.51	11.51	1.00	0.80	0.78	A	3
	3.30	-1.78	0.93	-0.93	1.00	0.80	0.06	A	2
Krre	0.00	-1.78	0.93	-0.93	1.00	0.80	0.06	A	2
	0.70	0.00	0.00	0.00	1.00	0.80	0.00	A	3

Schubspannungen

	ütze	1 2 1 2	Vz,d	τD	kmod	τd/fv,d		
N.	r.	(m)	(kN)	(N/mm2)			kor	mb
								-
1	li	0.240	-4.90	0.15	0.80	0.12	A	2
	re	0.240	24.20	0.76	0.80	0.61	A	5
2	li	0.240	-23.59	0.74	0.80	0.60	A	7
	re	0.240	2.83	0.09	0.80	0.07	A	2

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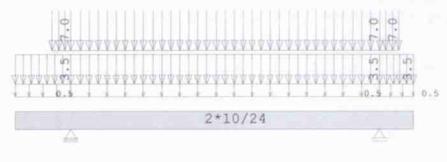
BV: SDE - HFT-STUTTGART

Seite: 76.73 1 2 3 4 5 6 7 6 9 10 16.3 Element " Greywate" beometie V= 2920 Rts 60,5 gr = 0.2 1.1/- 1 = 3.5 1.1/-2 4,10 12 =15 Koustullin wie T 6-1 Rund proje 8 -10/24 + OSB-Phelle t = 24mm + 4 Stile fife, 2.8. Vorio Typ DB 760 wax Stilu Cox = 14 (12 (10 pag) 22

PROJEKT: SDE

POS: T6.3-greywater

Maßstab 1:50



75 4,10 45 5,30

Holzträger C24

SYSTEM	Länge		Que	rschni	tt	swerte			
Feld 1	L (m) 4.10	konstant	b	(cm)	h	(cm) 24.0	Iy (cr 23040.0	n4) 2 *	
Kragarm links rechts	0.75	konstant konstant		10.0		24.0 24.0	23040.0		

WinXP

BELASTUNG Lasttyp: 1=Gleichlast über L , 2=Einzellast bei a (kN,m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

Feld	Тур	EG Gr	g_1/r	q_1/r F	aktor	Abstand	Länge	ausPOS	Phi
1	1	A	0.50	3.50	1.00				
	4	A	0.00	7.00	1.00	0.00	4.10		
Kraga	arm								
Krli	1	A	0.50	3.50	1.00				
	4	A	0.00	7.00	1.00	0.50	0.25		
Krre	1	A	0.50	3.50	1.00				
	4	A	0.00	7.00 7.00	1,00	0.00	0.25		

Ei	nwi	rkungen:					
Nr	Kl	Bezeichnung	ψ0	Ψ1	ψ2	γ	Led
A	1	Wohnräume	0.70	0.50	0.30	1.50	mittel

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

T6.75

PROJEKT: SDE

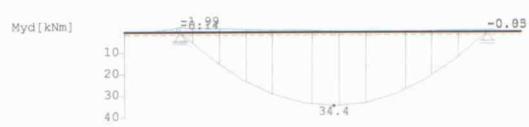
POS: T6.3-greywater

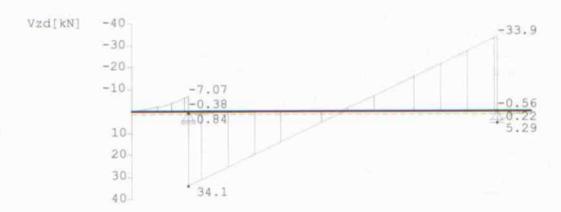
Feldmomente Ma	ximum				(kNm ,	kN
	Mf 05 23.02					
Stützmomente M	faximum				(kNm ,	kN)
	li M re 34 -1.34 62 -0.62	-4.75	22.87	27.62	1.28	2
Auflagerkräfte					(kN)
	42 26.19 23 24.99	-0.14 -0.29	27.48 25.92	27.62 26.22	1.28	
Auflagerkräfte					(kN)
EG max g 1.4	1.4 1.1 -0.1 25.	min 2 1.2 0 -0.3				
Sum 27.6	1.3 26.					
Ergebnisse für Teilsicherheit			erlänge ko	onstant		
Feldmomente Ma					(kNm ,	kN)
Feld $1 \times 0 = 2$.	Mfd	Mdli	Mdre	V li	V re	
Stützmomente M	aximum				(kNm ,	kN)
Stütze Md 1 -1. 2 -0.	li Mdre 99 -1.99 93 -0.93	-7.07	34.14	41.21	1.21	A 2

PROJEKT: SDE

POS: T6.3-greywater

Maßstab 1:50





Bemessung: C24

 $E_{mean} = 1100 \text{ kN/cm2}$

Gmean = $\gamma M = 1.30$

DIN1052:2004

fm, k = 24.0 N/mm2fv, k = 2.0 N/mm2 69 kN/cm2

OSB-Beplankung 20 vertreten

Nutzungsklasse 1 kdef = 0.60

Normalspannungen b/h = 2 * 10/24

Der D Feld Nr.	ruckgurt x (m)	ist kont My,d (kNm)	σd, o	ch gehalt σd,u N/mm2)	en. km	kmod	σd/fm,d	ko	omb
Krli	0.00	0.00	0.00	0.00	1.00	0.00	0.00		1
	0.75	-1.99	1.04	-1.04	1.00	0.80	0.07	A	2
1	0.00	-1.99	1.04	-1.04	1.00	0.80	8.07	A	2
	2.05	34.38	-17.91	17.91	1.00	0.80	(1.21)	A	3
	4.10	-0.93	0.48	-0.48	1.00	0.80	0.03	A	2
Krre	0.00	-0.93	0.48	-0.48	1.00	0.80	0.03	A	2
	0.45	0.00	0.00	0.00	1.00	0.80	0.00	A	7

Schubspannungen

Stüt Nr.		x (m)	Vz,d (kN)	τD (N/mm2)	kmod	τd/fv,d	ko	dm
1 1	li ce	0.240	-3.13 30.20	0.10	0.80	0.08	A A	2 5
2]	li ce	0.240	-29.91 1.35	0.93	0.80	0.76	A A	7 2

Ingenieurbüro Dr Hartmann

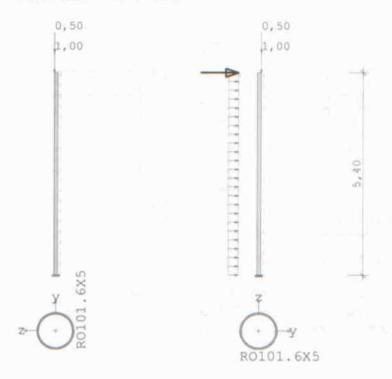
Prof. Dr.-Ing. Heiner Hartmann, Bergstraße 3, 82383 Hohenpeißenberg,

Tel: 08805/266; Fax.: 08805/955489

Seite: T7.1 **BV: SDE - HFT-STUTTGART** A 1 Mestation don 5,40 0,2.0,3 - 0,31 kg Wind Clarke colu 0,36.0,8 73 = 0,38 /22 Mu= Jul

PROJEKT: SDE POS: Wetterma

Maßstab 1:100



(Die Lasten werden nicht an ihren Lastangriffspunkten dargestellt

KRAGSTÜTZE

RO 101.6 X 5

h = 5.40 m S235

Teilsicherheitsbeiwert GammaM = 1.10 Eigengewicht = 0.119 kN

AUFLAGER: -1 = starr, 0 = frei, > 0 = elastisch (kN/m , kN Knoten in z in y um y Kopf 0 O 0 -1 -1 Fuss -1-1

EINWIRKUNG Grp.1 Wohnräume

GammaF=1.5 veränderli

EINFACHE LASTEN (q-Anteile : Einwirkungsgruppe 1 , zp : Oberseite

Vertikallast Nr. 1 : VG 1.00 kN VO 0.50 kN 5.00 cm ez 5.00 cm ey = Streckenlast Nr. 2 : gy 0.00 kN/m gy 0.10 kN/m EINZELLASTEN Ric zp G Abst Q von Gruppen Nr. (kN) (kN) (m) EwG Zus A

3 0.38 5.40 0.00 Fuß zp = 0 : Schubmittelpunkt , zp = 1 : Oberseite , zp = 2 : Untersei

GRUNDKOMBINATION

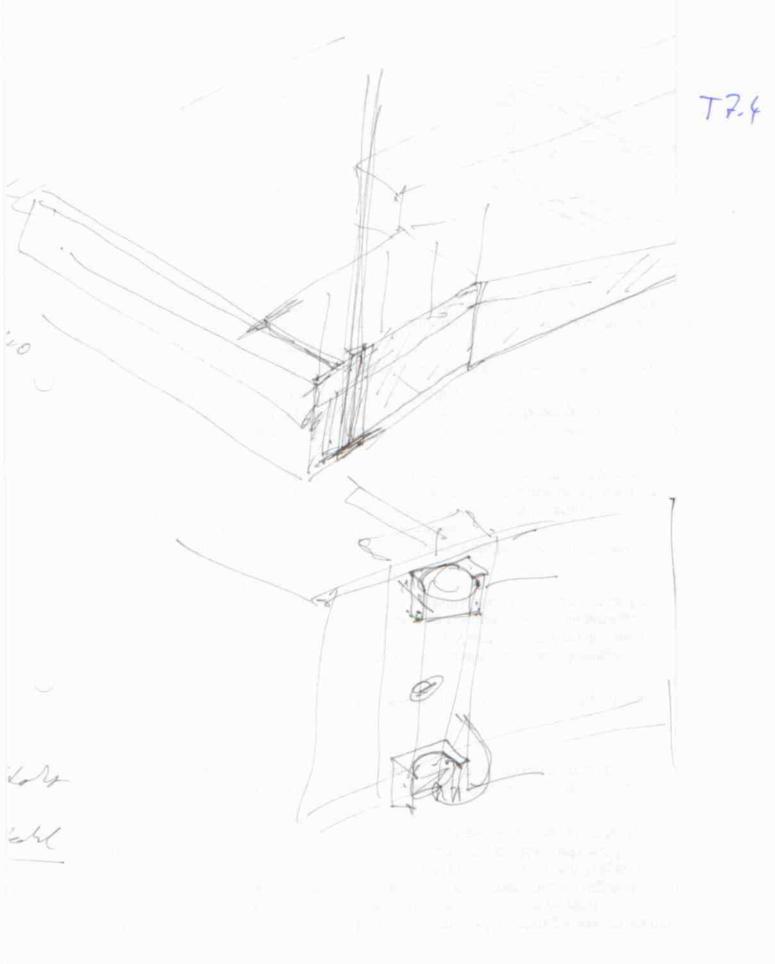
zugehörige Lasten: 123

Stahlstütze ST1 01/2008 WinXP

PROJEKT: SDE

POS: Wetterma

AUFLAC	GERKRÄFTE	Grundkomb.	(ohne	GammaF)		77
Lager	Ew	V	Hz	Ну	Му	Mz
		(kN)	(kN)	(kN)	(kNm)	
Kopf	G	0.00	0.00	0.00	0.00	0.
	Q	0.00	0.00	0.00	0.00	0.
Fuß	G	1.64	-0.00	0.00	0.05	-0.
	Q		-0.00		0.03	-3.
SCHNI'	TTGRÖSSEN	Grundkomb.	nach T	n.1.0. , h =	0.00 m Ga	ammaF-fa
Nd =	-2.97	kN Myd =	0.	ll kNm Mzd =	-5.3	7 kNm
				00 kN Vyd		
SPANN	UNGEN Gru	ndkomb. na	ch Th.1.	0. , h = 0.0	00 m G	ammaF-fa
vorh.	SigmaX /	fyd = 156.07	/ 218.2	= 0.72 < 1		
vorh.	Tau / Tau	uRd = 1.82	/ 126.0	= 0.01 < 1		
vorh.	SigmaV /	fyd = 156.07	/ 218.2	= 0.72 < 1		
NACHW	EIS BIEGE	KNICKEN DIN 18	3800 T2			
Grund	komb.	Nd = 2.9	97 kN	Myd = 0.	11 Mzd =	5.37 k
				Vzd = 0.	00 Vyd =	1.38
Gleic	hung 29:	Eta = 0.6	59 < 1			
					J' v	
NACHW	EIS BIEGE	DRILLKNICKEN I	DIN 18800	T2 (Ersatzs	tab nach B	LTT)
Grund	komb.	: Nachweis fi	ir Bieged	rillknicken	nicht erfo	rderlich
DURCH	BIEGUNGEN	für 1-fache 1	Lasten ,	h = 5.40 m	zul f	= L /
_						
vorh.	fRes / zu	1 f = 8.52	/ 3.60	= 2.37 >	l unzuläs	sig!



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Prof. Dr.-Ing. Heiner Hartmann, HOCHSCHULE FÜR TECHNIK STUTTGART Schellingstraße 24, 70174 Stuttgart

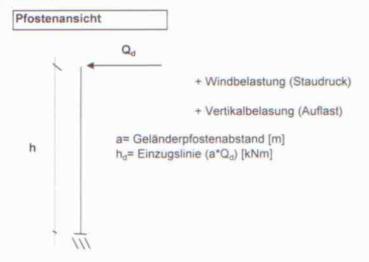
BV: SDE - HFT-STUTTGART

Seite: T8-7 3 4 5 6 Gel ander 3 Alter votion 1 Cellande cels found = 7,00 Hope so tol lugt 1+= 1,6 Km/m (SDE-Pules) Wito = 1,20m H = 1,60 VY/-Herry ley 11 Feder, C= 165 km/ 17.0 17.0 17.0 13 Hotivortal Flew Stell 70x 15m 14 the 15x70 1.2 Pforter 19 \$ 12 × 70 mm 20 21 Einwilly as a=7,00, 1+=7,660/-23 Starvatile 2: Pforta dolan 1 = 2 on a Oursely 16 80 m 1- 5235

BEMESSUNG Pfostenbemessung von Geländern

at 1,0- Abolano les

Skizzen:

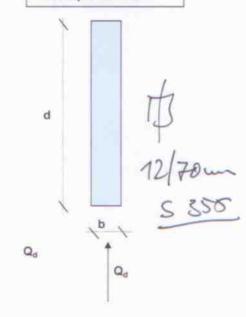




a = Geländerpfostenabstand [m]

h_d = Einzugslinie (a*Qd) [kNm]

Pfostenquerschnitt



Eingabe:

Horizont	tal- q [kN/m]	=	1,60	q _d [kN]	=	2,40
	al- v [kN/m]	=	0.10	v _a [kN]	=	0,15
Wir	nd- w [kN/m²]	=	0.00	Wd [kN]	=	0,00
Geländerfüllur	ng- Beiwert c	=	0,00 (0.	1,0)		
	nd- a [m]	=	1	H _d [kNm]	=	2,40
	h [m]	=	1,25	M _d [kNm]	=	3,00
	b [cm]	=	1,2			
	d [cm]	Ξ	7	W [cm ³]	=	9,80
Stahlgsorte	37 od. 52	=	52			
	YF	=	1,1	σ_{zul}	=	32,73 N/mm²
				Geff.	=	30,61 N/mm²

Nachweis	Spannungen	σ _{eff.} / σ _{zul.}	=	0,935
Nacilweis	Spannungen	Geff. / Gzul.	_	0,533

Nachweis Verformung elastisch f=P*I3/3*EI

Ersatzfeder

1/150

Р 1,6 kN El 0,07203 MNm² f 14,46 mm 6,25 mm zul.f 110,6381 kN/m C

System ist zulässig

Nachweis Verankerung

Nachweis mit Verankerung in Halfenschiene / Verdübelung

= Druckplatte Höhe h 12,00 cm Druck/Zug für Dübel/Halfen Hebelarm a (cm) 10,00 cm Zd/Dd = 30,00 kN

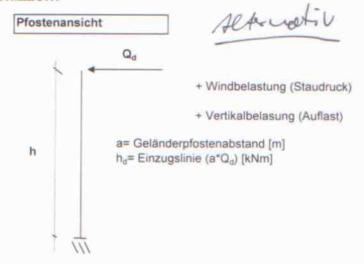
Prof. Dr.-Ing. Heiner Hartmann, HOCHSCHULE FÜR TECHNIK STUTTGART Schellingstraße 24, 70174 Stuttgart

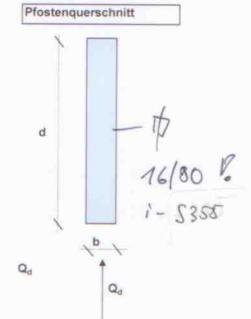
Schellingstraße 24, 70174 Stuttgart T8.3 Seite: BV: SDE - HFT-STUTTGART 2 3 4 5 6 7 15 believe before y with 2 wys. 18.2, Md = 3 18 mm, Wabel or = 10m ~ 7d= 30 ler -> 4 x V6 612 x 140 ? 5 2.B. SPAX \$ 12 , V6, w.7 ly = 120m (lef = 10 hum) -0 Raxid = 14,17 (1258) 4. 14, 17. 0,538 = 30,3602 > max 2d = 3062 1150x75x9 Abstavde a = 5d - 6a 10 beametic do Asolyse 12 13. 106 Pand pryv boppplalle 12/24 Ploster \$12× 120× 170 #12x70 5355 Schwat In borg 11 12×100 SL35 2 Hes pairey 16 m Hef + Wellwalt 15 mm 21 ca 16x 20cm

BEMESSUNG Pfostenbemessung von Geländern

bei a = 7,85m. Abstand

Skizzen:





Erläuterung:

a = Geländerpfostenabstand [m]

h_d = Einzugslinie (a*Qd) [kNm]

Eingabe:

Horizontal-	q [kN/m]	=	1,60	q _d [kN]	=	2,40
Vertikal-	v [kN/m]	=	0,10	Vd [kN]	=	0,15
Wind-	w [kN/m²]	=	0,00	Wd [kN]	=	0,00
Geländerfüllung-	Beiwert c	=	0,00 (0	1,0)		
Abstand-	a [m]	=	1,85	H _d [kNm]	=	4,44
	h [m]	=	1,25	M _d [kNm]	=	5,55
	b [cm]	=	1,6			
	d [cm]	=	8	W [cm ³]	=	17,07
Stahlgsorte	37 od. 52	=	52			
	Ϋ́F	=	1,1	σ _{zul} .	=	32,73 N/mm²
				σ _{eff.}	=	32,52 N/mm²

Nachweis	Spannungen	σ _{eff.} / σ _{zul.}		=	0,994
Nachweis	Verformung	elastisch			
	f=P*I3/3*EI	P	=	2,96	kN
		El	=	0,14336	MNm ²
		f	=	13,44	mm
	1/150	zul.f	=	6,25	mm

System ist zulässig

Nachweis Verankerung

Ersatzfeder

Nachweis mit Verankerung in Halfenschiene / Verdübelung

Druckplatte	Höhe h	=	12,00 cm	Druc	k/Zug fi	ir Dübel/Halfen
Hebelarm	a (cm)	=	10,00 cm	Zd/Dd	=	55,50 kN

220,201 kN/m

T8.5

Durchlaufträger DLT 04/2008/B WinXP

PROJEKT: SDE POS: Handlauf

Maßstab 1:33



Stahlträger über 4 Felder 2-achsig S 235

E-Modul E = 21000 kN/cm2

SYSTEM	Länge	3	Querso	hnittswer	te		
Feld	L (m)		QNr.	I (cm4)	Wo (cm3)	Wu (c	m3)
1	1.000	konstant	1	42.9	12.3	12.3	FL70X15*
2	1.000	konstant	1	42.9	12.3	12.3	FL70X15*
3	1.000	konstant	1	42.9	12.3	12.3	FL70X15*
4	1.000	konstant	1	42.9	12.3	12.3	FL70X15*
Profile	mit *	sind um 90	Grad ged	reht.			

Elasti			vert.	horiz.
Stütze	Nr.	1	165.0	1000.0 kN/m
Stütze	Nr.	2	165.0	1000.0 kN/m
Stütze	Nr.	3	165.0	1000.0 kN/m
Stütze	Nr.	4	165.0	1000.0 kN/m
Stütze	Nr.	5	165.0	1000.0 kN/m

BELASTUNG Lasttyp : 1=Gleichlast über L , 2=Einzellast bei a (kN,m) 3=Einzelmoment bei a , 4=Trapezlast von a - a+b 5=Dreieckslast über L, 6=Trapezlast über L

Phi	ausPOS	Abstand Länge	q_l/r Faktor	g_1/r	Typ EG Gr	Feld
90.0			1.600 1.000 0.000 1.000	0.000	1 A 1 A	1
90.0			1.600 1.000 0.000 1.000	0.000	1 A 1 A	2
90.0			1.600 1.000 0.000 1.000	0.000 0.100	1 A 1 A	3
90.0			1.600 1.000 0.000 1.000	0.000	1 A 1 A	4

PROJEKT: SDE

POS: Handlauf

Ei	nwi	rkungen:				
Nr	K1	Bezeichnung	Ψ0	Ψ1	ψ2	γ
A	1	Wohnräume	0.70	0.50	0.30	1.50

In den folgenden Tabellen steht am Ende der Zeilen ein Verweis auf die Nummer der zug. Überlagerung (siehe unten). In Tabellen mit Gammafachen Schnittgrößen steht zusätzlich ein Verweis auf die Leiteinwirkung.

Ergebnisse für 1-fache Lasten

SCHNITTGRÖßEN	max/min	My	(kNm ,	kN)

Feld	x	maxMy	zugMz	zugVz	zugVy	minMy	zugMz	zugVz	zugVy
1	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.60	0.3	0.0	0.1	0.0	-0.1	0.0	-0.1	0.0
	1.00	0.2	0.0	-0.6	-0.1	-0.1	0.0	-0.1	-0.1
2	0.00	0.2	0.0	0.6	0.1	-0.1	0.0	0.2	0.1
	0.60	0.4	0.0	0.0	0.0	-0.2	0.0	-0.2	0.0
	1.00	0.3	0.0	-0.6	0.0	-0.3	0.0	-0.2	0.0
3	0.00	0.3	0.0	0.6	0.0	-0.3	0.0	0.2	0.0
	0.40	0.4	0.0	0.0	0.0	-0.2	0.0	0.2	0.0
	1.00	0.2	0.0	-0.6	-0.1	-0.1	0.0	-0.2	-0.1
-4	0.00	0.2	0.0	0.6	0.1	-0.1	0.0	0.1	0.1
	0.40	0.3	0.0	-0.1	0.0	-0.1	0.0	0.1	0.0
	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Aufl	ager	kräfte						(kN)
Stüt	ze	aus g	max q	min q	Vollast	max	min	
1	Z	0.00	1.02	-0.12	0.90	1.02	-0.12	
	У	0.04	0.00	0.00	0.04	0.04	0.04	
2	Z	0.00	1.47	0.00	1.47	1.47	0.00	
	У	0.11	0.00	0.00	0.11	0.11	0.11	
3	z	0.00	1.66	0.00	1.66	1.66	0.00	
	У	0.10	0.00	0.00	0.10	0.10	0.10	
4	Z	0.00	1.47	0.00	1.47	1.47	0.00	
	У	0.11	0.00	0.00	0.11	0.11	0.11	
5	z	0.00	1.02	-0.12	0.90	1.02	-0.12	
	У	0.04	0.00	0.00	0.04	0.04	0.04	

PROJEKT: SDE POS: Handlauf

Au	0.7				20	A	
A) 1.1.	T	30	63 V	V 30	-3	T . T	- 63
23.54	4	αu	-	70.4	a	-	- 500

(kN)

	Stütze	1	Stütze	2	Stütze	3	Stütze	4
EG	max	min	max	min	max	min	max	min
g z	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
У	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Az	1.0	-0.1	1.5	0.0	1.7	0.0	1.5	0.0
У	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sumz	1.0	-0.1	1.5	0.0	1.7	0.0	1.5	0.0
У	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1

Auflagerkräfte

		Stütze			
EG		max	min		
g	Z	0.0	0.0		
	У	0.0	0.0		
A	Z	1.0	-0.1		
	У	0.0	0.0		
Sur	nz	1.0	-0.1		

y 0.0 0.0

Ergebnisse für γ-fache Lasten

SCHNITTGRÖßEN max/min My

(kNm , kN)

Feld	×	maxMy	zugMz	zugVz	zug∇y	minMy	zugMz	zugVz	zugVy
1	0.00	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
	0.60	0.5	0.0	0.1	0.0	-0.1	0.0	-0.2	0.0
	1.00	0.3	0.0	-0.9	-0.1	-0.2	0.0	-0.2	-0.1
2	0.00	0.3	0.0	0.9	0.1	-0.2	0.0	0.2	0.1
	0.60	0.7	0.0	0.0	0.0	-0.2	0.0	-0.3	0.0
	1.00	0.5	0.0	-0.9	-0.1	-0.4	0.0	-0.3	-0.1
3	0.00	0.5	0.0	0.9	0.1	-0.4	0.0	0.3	0.1
	0.40	0.7	0.0	0.0	0.0	-0.2	0.0	0.3	0.0
	1.00	0.3	0.0	-0.9	-0.1	-0.2	0.0	-0.2	-0.1
4	0.00	0.3	0.0	0.9	0.1	-0.2	0.0	0.2	0.1
	0.40	0.5	0.0	-0.1	0.0	-0.1	0.0	0.2	0.0
	1.00	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1

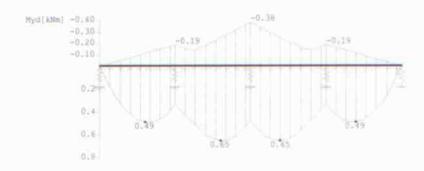
Maßstab 1:50

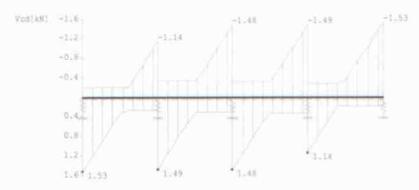


Vyd[kN]

PROJEKT: SDE

POS: Handlauf





f y, d = f y, k / 1.1 = 218.2 N/mm2Bemessung: S 235

Bemessungsschnittgrößen

Feld Nr.	x (m)	Myd (kNm)	Qzd (kN)	Mzd (kNm)	Qyd (kN)		ko	dm
1	0.000	0.0	1.5	0.0	0.1	 	Α	2
	0.600	0.5	0.1	0.0	0.0		A	2
	1.000	0.3	-0.9	0.0	-0.1		A	2
2	0.000	0.3	0.9	0.0	0.1		A	2
	0.600	0.7	0.0	0.0	0.0		A	9
	1.000	0.5	-0.9	0.0	-0.1		A	9
3	0.000	0.5	0.9	0.0	0.1		A	9
	0.400	0.7	0.0	0.0	0.0		A	9
	0.600	0.6	-0.5	0.0	0.0		A	9
	1.000	0.3	-0.9	0.0	-0.1		A	3
4	0.000	0.3	0.9	0.0	0.1		A	3
	0.400	0.5	-0.1	0.0	0.0		A	3
	0.600	0.4	-0.6	0.0	0.0		A	3
	1.000	0.0	-1.5	0.0	-0.1		A	3

Normalspannungen

Feld Nr.	x (m)	σΖ	σD (N/m	τ m2)	σV	η	ko	mb
1	0.000 0.600 1.000	0.0 42.7 32.2	0.0 -42.7 -32.2	2.3 0.2 1.4	3.9 42.7 32.3	0.02 0.20 0.15	A A A	2 2 2
2	0.000 0.600 1.000	32.2 54.8 42.9	-32.2 -54.8 -42.9	1.4 0.1 1.4	32.3 54.8 43.0	0.15 0.25 0.20	A A	2 9 9

PROJEKT: SDE

POS: Handlauf

Normalspannungen

Feld Nr.	× (m)	σΖ	σD (N/m	τ m2)	σ∀	η	ko	mb
4	0.400 0.600 1.000 0.000 0.400 0.600 1.000	54.8 49.9 32.2 32.2 42.7 38.3 0.0	-54.8 -49.9 -32.2 -32.2 -42.7 -38.3 0.0	0.1 0.8 1.4 1.4 0.2 0.8 2.3	54.8 49.9 32.3 32.3 42.7 38.4 3.9	0.25 0.23 0.15 0.15 0.20 0.18 0.02	A A A A A	9933333

Zulässige Durchbiegungen: im Feld zul f = L / 300

Feld Nr.	(m)	fg (cm)	ftot (cm)	f (cm)	zulf (cm)	η	komb
1 y	1.000	0.00	0.89	0.892	0.333	2.68!!	8
2 y	1.000	0.00	1.01	1.008	0.333	3.02!!	8
3 y z	0.000	0.00	1.01	1.008	0.333	3.02!!	8
4 y	0.000	0.00	0.89	0.892	0.333	2.68!!	8

wirtwaßelen J D

Solar Decathlou

Fassady v tranker unj mit , Rampa" - Muffen

Wand fassade

Stahllinese \$ 26,3 x 3,15 + Rampa - Muffer L= 20 mm Tyo A. M20 L

Rampa - Muffr Typ A, M20, L= 40mm 5.1. F2

(21. F3 (01 FO15)

ans vorh. Statik: max. Gy = 0,6 kM

Anskragung

140 mm

be unidest ange M20 Hade bes siehe vorh. Statik

Huèse + Muffe: Veranhrung in Holz Loch levsung, Piessung:

 $M = 0.6 \cdot 0.14 = 0.084 \text{ km}$ Md = 0.113 km $U = 2.63 \cdot 6.0^{2} = 15.8 \text{ cm}^{3}$ $d = 1.5 \cdot

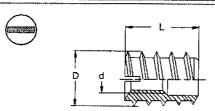
te,0 = 115/1 = 7,15 H/mm2 <2 + 19/1 d





www.rampa.com





RAMPA-Muffen Typ A DIN 7965, mit Schlitz und Ausnehmung zur Aufnahme anfallender Späne, geeignet zum automatischen Einschrauben

RAMPA Inserts Type A DIN 7965, slotted and with recess accommodation for excess wood shavings, suitable for easy automatic insertion

	Λ					Preise / prices in € per 100 St./pcs.		
A					Stahl/Steel	Stahl/Steel	Messing/Brass	
Art.	D	L	d	kg/1.000	bjank plain	verzinkt zinc plated	blank plain	
001 308	6	8	М 3	0.6	8,10	8,40	12,85	
001 310	6	10	М 3	0,8	8,85	9.05	13,55	
001 312	6	12	M 3	1,0	9,80	10,10	15,20	
001 408	8	8	M 4	1,1	6,50	6.85	11,45	
001 410	8	10	M 4	1,2	6,85	7,15	12,60	
001 412	8	12	M 4	1,5	7,90	8,30	15,10	
001 415	8	15	M 4	1,8	10,00	10,50	17,75	
001 510	10	10	M 5	2,3	8,40	9,00	16,85	
001 512	10	12	M 5	2,4	9,00	9,70	18,75	
001 515	10	15	M 5	2,8	17,10	11.90	21,80	
001 518	10	18	M 5	3,6	13.40	14.45	in Time	
001 520	10	20	M 5	4,2	16,00	17,25	31,65	
001 540	10	40	M 5	8,4	38,40	39.40		
001 612	12	12	M 6	4,5	11.35	12,80	22,50	
001 615	12	15	M 6	5,1	13,15	14,65	26,45	
816 100	12	18	M 6	5,5	15,85	17,55	32,00	
001 620	12	20	M 6	6,0	18,10	19.85	35,00	
DO1 625	12	25	M 6	6,5	23,80	25,80	45,65	
001 630	12	30	M 6	7,3	38.75	41,00	72,95	
001 855	14	15	M 8	6,3	22,00	24,00		
001 858	14	18	M 8	7,6	24,85	27,25		
818 100	16	18	M 8	9,6	31,05	34,35	58,05	
001 823	16	23	M 8	11,9	37 30	41,25	69.20	
301 830	16	30	M 8	14,0	51,25	55,70	101,30	
001 120	18,5	20	M 10	14,7	42,20	46,95	81,65	
001 1 2 5	18,5	25	M 10	18,0	52,85	58,70	99,45	
001 130	18,5	30	M 10	20,3	61,85	68,45	118,30	
001 140	18,5	40	M 10	26,5	83,70	92,35	161,45	
001 225	22	25	M 12	26,0	92,85	102.95	164,55	
001 230	22	30	M 12	29,5	110,90	122,45	197,80	
001 235	22	35	M 12	32,0	134,30	146,75		
001 651	25	25	M 16	28,7	118,40	129,55	202,80	
001,652	25	30	M 16	34,6	136,00	149,45	234,35	
101 653	25	35	M 16	39,0	151.15	166,40	266.05	
001 930	30	30	M 20	53,8	227,05	246.80	424,00	
01 940	30	40	M 20	68.0	385,70	409,60		

001 Stahl verzinkt / Steel zinc plated

01 Messing blank / Brass plain

Bitte ergänzen / Please complete

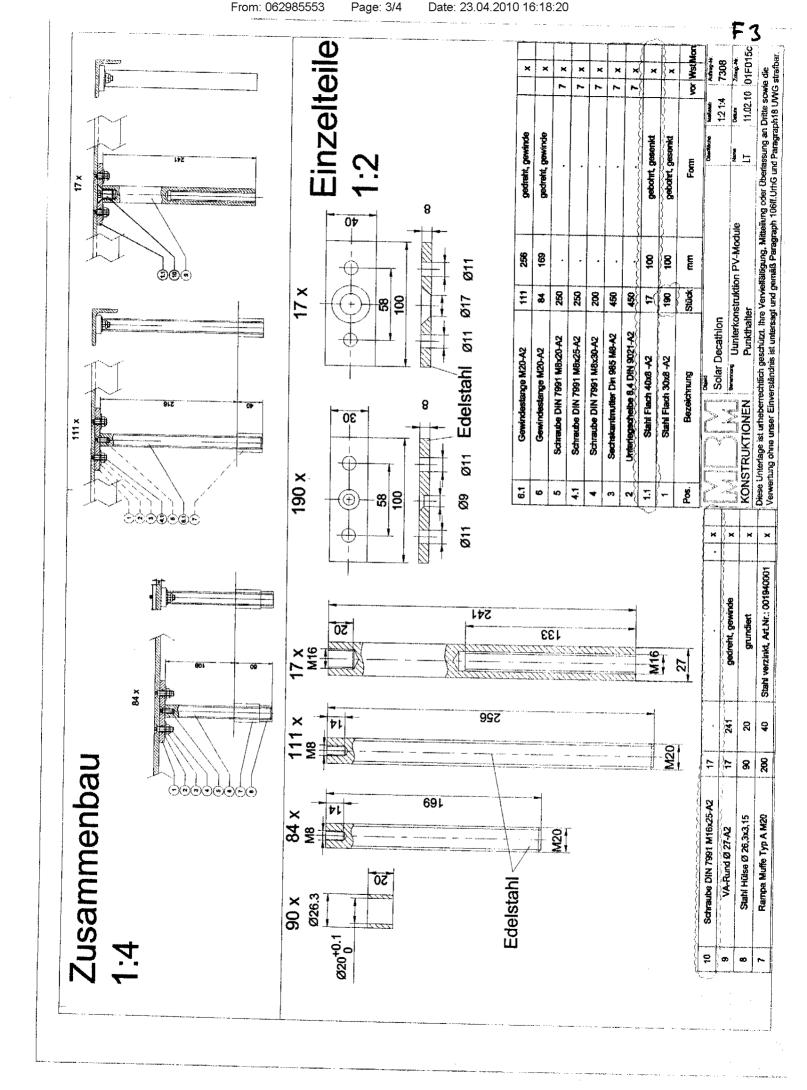
001 Stahi verzinkt / Steel zinc plated

01 Messing blank / Brass plain

02 Stahl rostfrei / Stainless Steel 1,4104

03 Stahl rostfrei / Stainless Steel 1.4305

*Hinwels / Please note Ausführung mit 2 Schlitzen Double slotted type



From: 062985553

Date: 23.04.2010 16:18:20

F4 Valz

Solar Decathlou

Wulle Lichti Walz

Dach fassade

Rampa" - Muffle Typ A, M 20; 2 = 40 mm

aus vorh. Statile Dach female: mer V - Lost

max. H ≤ 2,72 kN

\$ 30 mm

A = 706 mm² + bewide

\$ 706 = 3,85 Mm² = < + Mm² + bewide

0. ω. Had way

Wulle Lichti Walz

BERATENDE INGENIEURE

Wulle Lichti Walz Grobh
Ruchsener Strasse 12

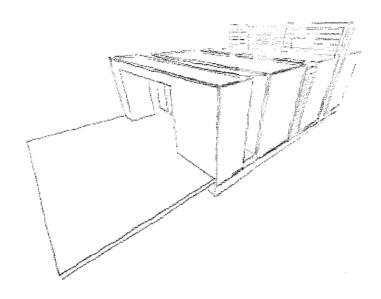
7421P Moskmun
Telefon 042 98 / 1208





Structural Analysis

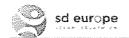
Solar Decathlon Europe



3. Fire-Resistance

Prof. Dr.-Ing. Heiner Hartmann

(Timberconstruktion, Statik and Stability)





Structural Design

1. Basics:

The construction was designed on the base of the national Building Codes of Germany, on the base of partial safety factors and by an ultimate limit state design.

If there were more loads by the SDE-Building-Code, the Loads of the SDE-Code were based for design. In all other situations with more loads of the national Code, the national Code of Germany ist based. In this description, the design bases were listed.

In this way, the compliance of the national building codes and , as far as the SD-Building-Code, was countersigned.

Acording zu SDE-Building-Code § 40.3, the Fire resistance of the structure will be R30.

This resistance is also according zu Eurocode EN 1 1991-1-2 (actions on structures exposed to fire) and EN 1995-1-2 (Design of timber structures – structural fire design associate with EN 1990

The module will be proved as a single, self-supporting load-bearing structure, not being connected to the neighbouring modules. The load of the glass-joints will be distributed in equal parts to the neighbouring modules.

The bracing in the longitudinal axis or in the frame respectively will be ensured by two frames, restrained in every corner. The modules will be built from veneer plywood "Kerto-S".

In the lateral axis or perpendicular to the frame respectively, the structure is braced by the shear walls at the fronts. Those shear walls are manufactured as post-and-beam structures from coniferous wood with OSB-Platten paneling. by symmetrical arrangement of the walls, twisting for the whole system is not to be expected.

The roof loads (superstructure, snow) are transmitted to auxiliary girders, here cross girders, made of coniferous wood. These pass the loads on to the pricipal girders, here frames from Kerto-S. On the bottom of the modules, cross girders are used to accept the loads from dead weight (superstructure, floor covering, etc.) and the imposed load. Those loads are likewise transmitted to the frame.

To obtain a clear load transmission into the soil, the loads are concentrated to four steel footings per frame.



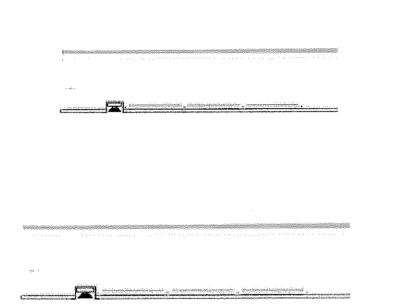


2. Loading Assumption for fire resistance

2.1 Charge of modules (timber structure)

The basis for the structural design is the German Industrial Standard DIN 1055. The modules will be built as timber structures. In the following, the loading assumption will be determined according to the German Industrial Standard DIN 1055, Part 1-5.

2.1.1 Structure and loading



Photovoltaic
Bitumen
Vaccum insulation
Paneling
Construction
Suspended ceiling

Photovoltaic
Bitumen
Vaccum insulation
Paneling
Construction
Suspended ceiling

Graph 1: Superstructure of ceiling

2.1.2 Dead loads

a) Permanent load

Turret:

-	Photovoltaic		g k	$= 0.50 \text{ kN/m}^2$
-	Bitumen		$g_k = 3 \times 0.06$	$= 0.18 \text{ kN/m}^2$
-	Vaccum insulation (6	3.0 cm)	g k	$= 0.10 \text{ kN/m}^2$
-	Paneling (2.0 cm OS	B)	$g_k = 2.0x0.06$	$= 0.12 \text{ kN/m}^2$
-	Construction		g _k	$= 0.06 \text{ kN/m}^2$
-	Suspended ceiling		<u>g_k</u>	$= 0.50 \text{ kN/m}^2$
		Total:	g _k	= 1.46 kN/m ²
		Line load:	$g_k = 1.5 \times 2.4$	/2= 1.80 kN/m





b) Floor covering:

Floor (4,0 cm)	g k	$= 0.22 \text{ kN/m}^2$
Vapour-proof barrier (single-layer)	g _k	$= 0.05 \text{ kN/m}^2$
Vaccum insulation (6.0 cm)	g k	$= 0.10 \text{ kN/m}^2$
Construction	g k	$= 0.10 \text{ kN/m}^2$
Water tank h = 10 cm (incl. lines)	<u>g_k</u>	= 1.00 kN/m ²
Total:	g _k	$= 1.47 \text{ kN/m}^2$

Line load:

 $g_k = 1.47 \times 2.4/2 = 1.76 \text{ kN/m}$

2.1.3 Live Loads

The roof area is not accessible; maintenance is only to be conducted when the area is free of snow and after clearing the roof from snow respectively.

a) Category A3 = domestic room, but without sufficient lateral distribution of the loads (wooden beams).

	Residential Areas	German Code DIN 1055	$p = 2.0 \text{ kN/m}^2$
b)	Roof for private Acess	German Code DIN 1055	$p = 1.0 \text{ kN/m}^2$
c)	Area of the Decks	German Code DIN 1055	$p = 5.0 \text{ kN/m}^2$

2.1.4 Snow Loads

a) Roof German Code DIN 1055 Category: $2 s_k = 0,60 \text{ kN/m}^2$ $s = 1,0 \text{ kN/m}^2$

2.1.5 Wind Loads

SDE-Building German Code DIN 1055

Category (Windzone) 1 Midland Flat roof $q = 0.5 \text{ kN/m}^2$ Simplified velocity pressure: $q = 0.5 \text{ kN/m}^2$

The wind pressure for the exterior walls acts constantly upon the entire height of the

wall. Wind pressure: $wk = 0.8 \times 0.5 \text{ kN/m2} = 0.40 \text{kN/m}^2$

Line load: $wk = 0.4 \times 2.4/2 = 0.48 \text{ kN/m}$

Wind suction: wk = $-0.50 \times 0.5 \text{ kN/m2} = -0.25 \text{kN/m2}$

Line load: wk = $-0.25 \times 2.4/2 = -0.3 \text{ kN/m}$

The height/width ratio of the structure amounts to h/d = 3.6 / 6.8 = 0.5.





Roof:

Geometry (roof): d = 6,80m

b = 2,40m, e/10 = 0,24m, e/2 = 1,20m

Coefficient for external pressure on flat roofs:

Area F: $c_{pe,10} = -1.8$

Area G: Cpe,10 = -1,2

Area H: $c_{pe,10} = -0.7$

Area I: $c_{pe,10} = -0.6$

or Area I: cpe,10 = +0,2

Surface loads:

Area F: $w_k = -1.8 \times 0.5 \text{ kN/m}_2 = -0.90 \text{ kN/m}_2$

Area G: $w_k = -1.2 \times 0.5 \text{ kN/m}_2 = -0.60 \text{ kN/m}_2$

Area H: $w_k = -0.7 \times 0.5 \text{ kN/m}_2 = -0.35 \text{ kN/m}_2$

Area I: $w_k = -0.6 \times 0.5 \text{ kN/m}_2 = -0.30 \text{ kN/m}_2$

or Area I: $w_k = 0.2 \times 0.5 \text{ kN/m}_2 = +0.10 \text{ kN/m}_2$

Line loads:

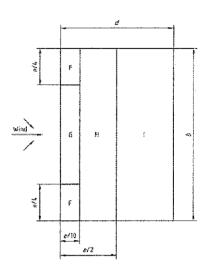
Area F: $w_k = -0.90 \text{ kN/m}_2 \times 2.40/2 = -1.08 \text{ kN/m}$

Area G: $w_k = -0.60 \text{ kN/m}_2 \times 2.40/2 = -0.72 \text{ kN/m}$

Area H: $w_k = -0.35 \text{ kN/m}_2 \times 2.40/2 = -0.42 \text{ kN/m}$

Area I: $w_k = -0.30 \text{ kN/m}_2 \times 2.40/2 = -0.36 \text{ kN/m}$

or Area I: $w_k = +0,10 \text{ kN/m}_2 \times 2,40/2 = +0,12 \text{ kN/m}$



Glass-joints

The glass elements have a width of 80cm and will be fixed laterally to the timber modules in the roof areas. The glass joints act as superimposed loads to the timber modules. Identical surface loads will be used. The load of the floor construction is transmitted to the ground through distinct supports.

The line loads result from a respective width of 0.80m/2 for the every wooden frame.

2.1.6 Horizontal forces

Based on SD-Building-Code, al force of 1,6 kN/m in the hight of 1,20 m was the base for design the handrails and the colums for the handrails

2.1.7 Load Combination for fire resistance

Based on EN 1991-1-2 to associate with EN 1990 there are rules for the extraordinary Load of fire resistance. Also, the flow-chart of the design of fire restance to R 30 according zu EN 1991-1-2 is followed.





1. Safety factors

3.1 Safety factors of material

For nomal design, the German Code DIN 1052:2008 an all other national codes are based on the partial safety factors for Strength of material und by a design of an ultimate limit state design.

The safety factors for fire resistance ist based on EN 1990:2002 in associate with EN 1990/A1 (2006) and EN 1990/NA (2009) and

EN 1995-1-2 with

material	Code	factor	factor R30
- concrete	DIN 1045	1,5	1,0
- Steel	DIN 68 800	1,1	1,0
- Timber	DIN 1052:2008	1,3	1,0

EN 1995-1-2:2004 + AC:2006 (D)

Dabei ist

 $f_{\text{d,fi}}$ Bernessungswert der Festigkeit im Brandfall;

 $S_{d,8}$ Bernessungswert der Steifigkeitseigenschaft (Elastizitätsmodul $E_{d,6}$ oder Schubmodul $G_{d,6}$) im Brandfall;

20 %-Fraktile einer Festigkeitseigenschaft bei Normaltemperatur;

20 %-Fraktile einer Steifigkeitseigenschaft (Elastizitätsmodul E_{0,2} oder Schubmodul G_{0,2}) bei Normaltemperatur;

 $k_{mod,i}$ Modifikationsbeiwert im Brandfall;

Teilsicherheitsbeiwert für Holz im Brandfall.

ANMERKUNG 1. Der Modifikationsbeiwert für den Brandfall berücksichtigt die Abminderung der Festigkeits- und Steitigkeitseigenschaften bei erhöhlen Temperaturen. Der Modifikationsbeiwert für den Brandfall ersetzt den in EN 1995-1-1 für Normaltemperatur angegebenen Modifikationsbeiwert k_{mod} . Werte für $k_{\text{mod},ft}$ werden in den relevanten Abschnitten gegeben.

ANMERKUNG 2. Der empfohlene Teilsicherheitsbeiwert für Materialeigenschaften im Brandfall ist $\chi_{MS} = 1.0$. Informationen zu nationalen Anforderungen können im Nationalen Anhang enthalten sein.

Display detail from EN 1995-1-2:2004

y-factor R30





3.2 Safety factors of Loads and actions

According zu DIN 1055: 100 an EC 1, the national codes based on the following safety factors:

	norma	l design	fire design EN 1990
~ Dead loads	γg	= 1,35	= 1,35
- Imposed load	γg	= 1,50	= 1,00 (First Load)
- Wind- and Snow loads	y s,w	= 1,50	= 1,00

EN 1990:2002 (D)

A.1.3.2 Bemessungswerte für Einwirkungen in außergewöhnlichen Bemessungssituationen und bei Erdbeben

(1) Die Teilsicherheitsbeiwerte für Einwirkungen in Tragsicherheitsnachweisen für außergewöhnliche Bemessungssituationen (Gleichungen 6.11a bis 6.12b) sollten mit 1,0 angesetzt werden. Die Kombinationsbeiwerte sind in der Tabelle A.1.1 angegeben.

ANMERKUNG Zu Bemessungssituationen bei Erdbeben, siehe auch EN 1998.

Tabelle A.1.3 — Bemessungswerte der Einwirkungen in außergewöhnlichen Bemessungssituationen und bei Erdbeben

Bemessungs- situation	Ständige Ei	nwirkungen	Leiteinwirkung ^b	Begleiteinv	virkungen ^b
	Ungünstig	Günstig		Haupt (fälls vorhänden)	Weitere
Außergewöhnlich⁴ (Gleichung 6.11a/b)	$G_{\mathbf{k}, cop}$	$G_{ m kj,in}$	de	\$\psi_{11} \text{ oder} \\ \psi_{21} \mathcal{Q}_{11} \end{array}	ψzi Qri
Erdbeben (Gleichung 6.12a/b)	$G_{\mathrm{lg},\mathrm{sup}}$	$G_{ m kj,inf}$	$\% I_{\Xi k}$ oder $A_{\Xi d}$		ψ23 Q k3

^a Im Falle außergewöhnlicher Bernessungssituationen darf die vorhenschende Begleiteinwirkung mit ihrem h\u00e4ufigen Wert beruitzt werden oder wie bei Erdbeben mit ihrem quasi-st\u00e4ndigen Wert. Die Festlegung erfolgt f\u00fcr die verschiedenen außergew\u00f6hnlichen Einwirkungen im Nationalen Anhang, siehe auch EN 1991-1-7.

Display detail from EN 1990:2002 γ-factor for Loads

Die veränderlichen Einwirkungen sind in Tabelle A.1.1 angegeben.





3.3 Load combination

Die Load combinations (normal design) are according zu DIN 1055 – 100 and EC-1 and based on the probabilistic factors of combinations.

$$E_{\mathbf{d}} = E\left\{ \sum_{j \ge 1} \gamma_{G,j} \cdot G_{k,j} \oplus 1.35 \cdot \sum_{i \ge 1} Q_{k,i} \right\}$$

The Load-combination factors for fire resistance are according EN 1990:2002

EN 1990:2002 (D)

Tabelle A.1.1 — Empfehlungen für Zahlenwerte für Kombinationsbeiwerte im Hochbau

Einwirkung	\$%	ψ,	¢⁄2
Nutzlasten im Hochbau (siehe EN 1991-1-1)			
Kategorie A: Wohngebäude	0,7	0,5	0,3
Kategorie B: Bürogebäude	0,7	0,5	0,3
Kategorie C: Versammlungsbereiche	0,7	0,7	0,6
Kategorie D: Verkaufsflächen	0,7	0,7	0,6
Kategorie E: Lagerflächen	1,0	0,9	0,8
Fahrzeugverkehr im Hochbau Kategorie F: Fahrzeuggewicht ≤ 30kN	0,7	0,7	0,6
Kategorie G: 30kN < Fahrzeuggewicht ≤ 160kN	0,7	0,5	0,3
Kategorie H : Dācher	0	0	0
Schneelasten im Hochbau (siehe EN 1991-1-3) ^a			
Finnland, Island, Norwegen, Schweden	0,7	0,5	0,2
Für Orte in CEN-Mitgliedstaaten mit einer Höhe über 1 900 m ü. NN	0,7	0,5	0,2
Für Orte in CEN-Mitgliedstaaten mit einer Höhe niedriger als 1 000 m ü. NN	0,5	0,2	0
Windlasten im Hochbau (siehe EN 1991-1-4)	0,6	0,2	0
Temperaturanwendungen (ohne Brand) im Hochbau, siehe EN 1991-1-5	0,6	0,5	0
ANMERKUNG Die Festlegung der Kombinationsbeiwerte erfolgt im Nationalen Anhang.			
Bei nicht ausdrücklich genannten L\u00e4ndern sollten die ma\u00e4gebenden \u00f6rtlichen Bedingungen betrachte	t werden.		

Display detail from EN 1990:2002 ψ-factor for Loadcombination





3.4 Fire design

Based on EN 1991-1-2 to associate with EN 1990 there are rules for the extraordinary Load of fire resistance.

The Load-combination for fire resistance is allowed to

$$E_{\mathrm{d,fi}} = G_{\mathrm{k,fi}} \cdot \gamma_{\mathrm{g,fi}} + \psi_{\mathrm{i,1}} \cdot Q_{\mathrm{i}} + \sum \psi_{\mathrm{2,i}} \cdot Q_{\mathrm{i}}$$

The design is than followed with

$$\eta_{\rm fi} = \frac{\sigma_{\rm m,d,fi}}{f_{\rm m,d,fi}} \quad \text{or} = \frac{\sigma_{\rm 0,d,fi}}{f_{\rm 0,d,fi}} \qquad \text{with} \quad f_{\rm m,d,fi} = k_{\rm mod,fi} \cdot \frac{f_{\rm 0,2}}{\gamma_{\rm m}}$$

with f 0,2 = resistance 20 % Fraktile of a material bei normal temperature

The $k_{mod.fi}$ is according EN 1995-1-2

EN 1995-1-2:2004 + AC:2006 (D)

Dabei ist

f₂₀ 20 %-Fraktile einer Festigkeitseigenschaft bei Normaltemperatur;

S₂₀ 20 %-Fraktilwert einer Steifigkeitseigenschaft (Elastizit\u00e4tsmodul E_{0.2} oder Schubmodul G_{0.2}) bei Normaltemperatur;

S₀₅ 5 %-Fraktilwert einer Steifigkeitseigenschaft (Elastizitätsmodul E_{0,2} oder Schubmodul G_{0,2}) bei Normaltemperatur;

k_s entsprechend Tabelle 2.1

Tabelle 2.1 — Werte für k

Material	k _a
Massivholz	1,25
Brettschichtholz	1,15
Holzwerkstoffe	1,15
Fumierschichtholz	1,1
Auf Abscheren beanspruchte Verbindungen mit Seitenteilen aus Holz oder Holzwerkstoffen	1,15
Auf Abscheren beanspruchte Verbindungen mit außen liegenden Stahlblechen	1,05
Auf Herausziehen beanspruchte Verbindungsmittel	1,05

Display detail from EN 1995-1-2 k mod,fi - factor for fire resistance

With our material of the beams and columns, the design is going up to

$$\eta_{\rm fi,beams} = \frac{\sigma_{\rm m,d,fi}}{f_{\rm m,d,fi}} \quad with \quad f_{\rm m,d,fi} = 1,0 \cdot 1,15 \cdot \frac{48}{1,0} = 55 N \, / \, mm^2$$

$$\eta_{\text{fi,columns}} = \frac{\sigma_{0,d,\text{fi}}}{f_{0,d,\text{fi}}} \quad \text{with} \quad f_{0,d,\text{fi}} = 1,0 \cdot 1,15 \cdot \frac{38}{1,0} = 44 \text{N/mm}^2$$





EN 1995-1-2:2004 + AC:2006 (D)

Anhang F (informativ)

Anleitung für Benutzer dieses Tells des Eurocodes

) In diesem Anhang sind Ablaufdiagramme als Anleitung für Benutzer dieser Europäischen Norm enthalten, she Bilder F.1 und F.2.

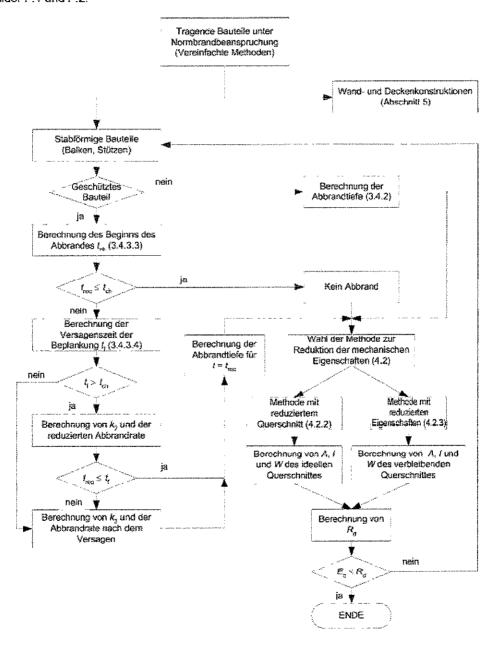


Bild F.1 — Ablaufdiagramm für die Bemessung der Beanspruchbarkeit tragender Bauteile



EN 1995-1-2:2004 + AC:2006 (D)

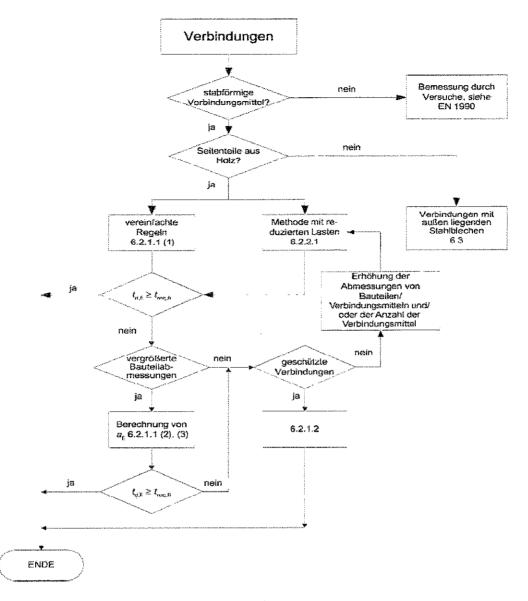


Bild F.2 — Ablaufdiagramm für die Bemessung von Verbindungen

4. Description of materials

look at Statik Strukture, Part 1

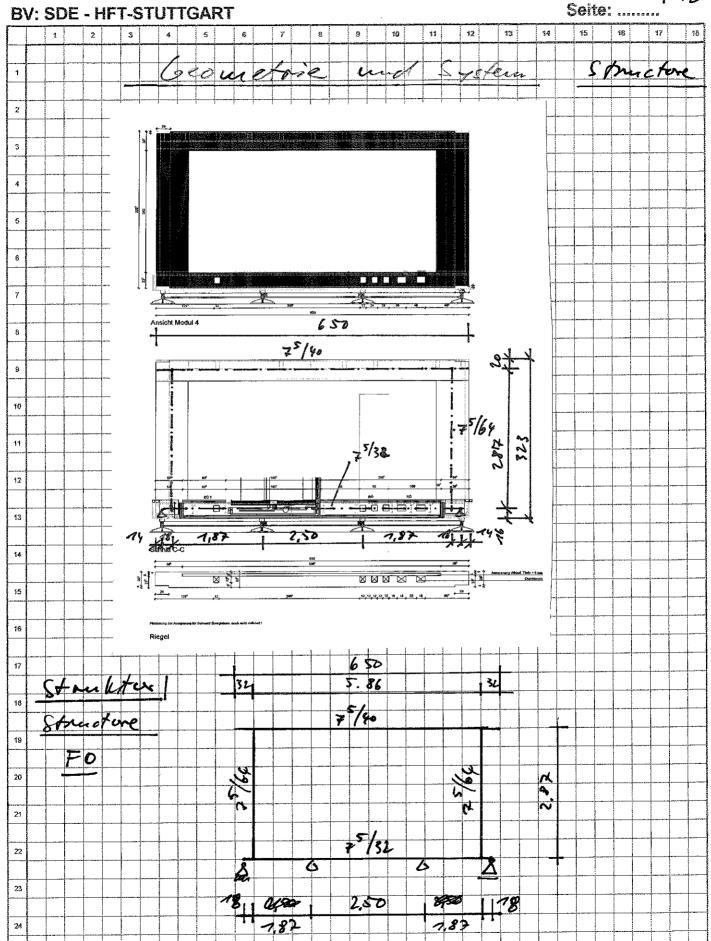
5. Fundation

look at Statik Strukture, Part 1

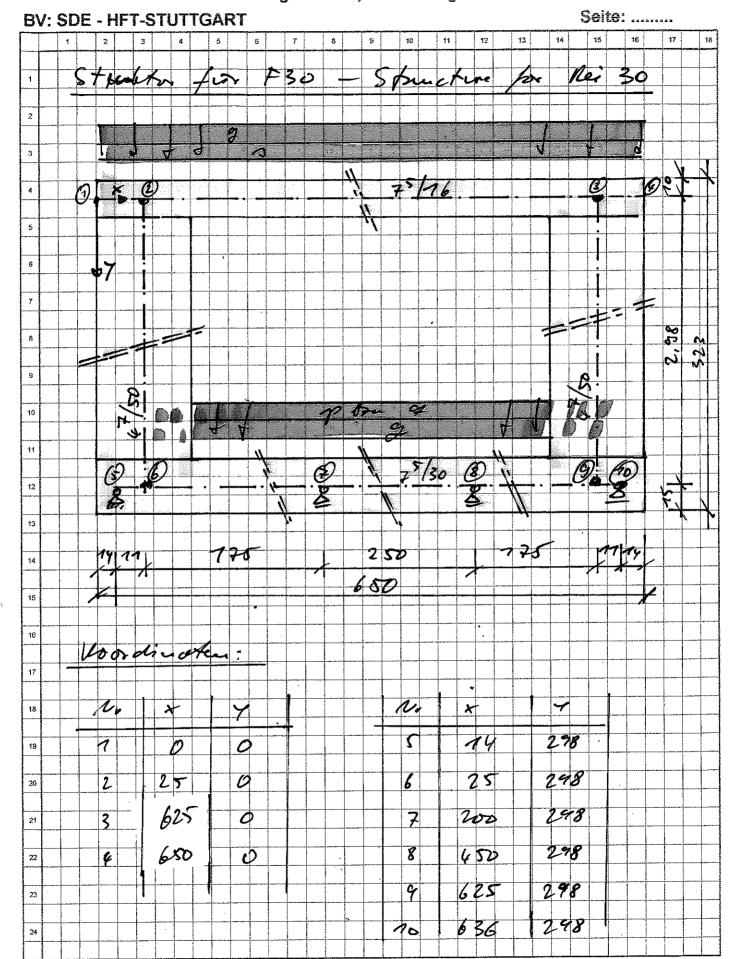
Stuttgart, 26.04.2010

Prof. Dr. Heiner Hartmann
Civil Engenieer, HFT-Stuttgart

9174 Stuttgart F72



F73



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Prof. Dr.-Ing. Heiner Hartmann, HOCHSCHULE FÜR TECHNIK STUTTGART

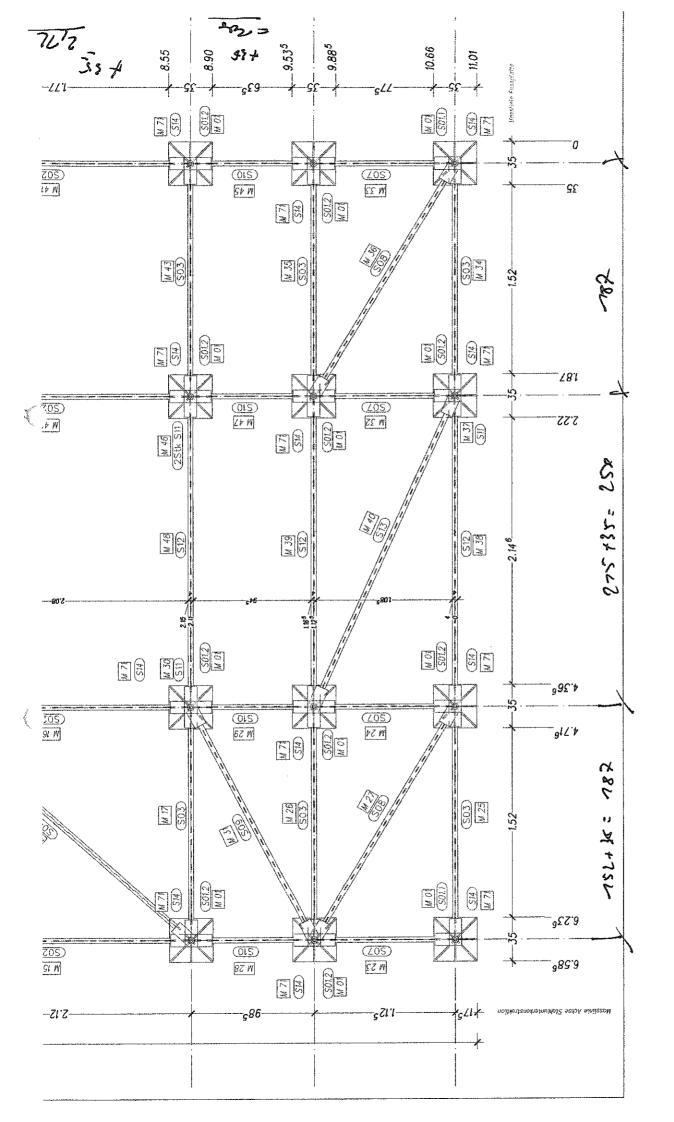
Schellingstraße 24, 70174 Stuttgart

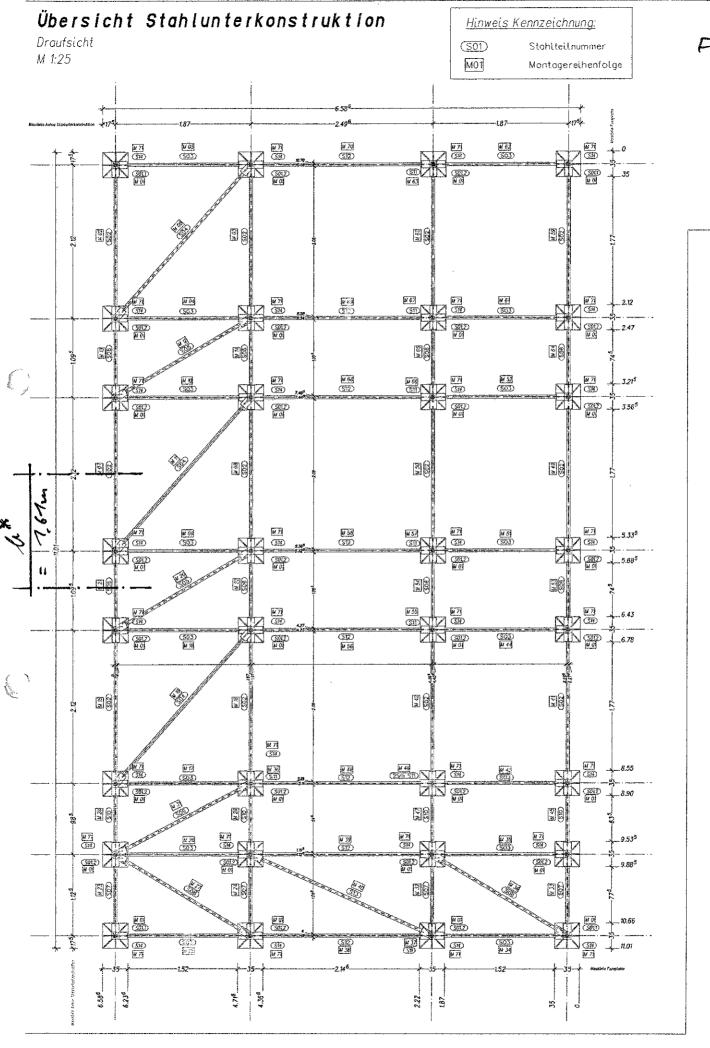
Seite: **BV: SDE - HFT-STUTTGART** /ouds EN 1997-7-2 Esperiale of (Oedu): 8 = 7,0, 34 = 20 Elsquide Rosa (Plan) Com Coro que - 1,76 00 7,80 (-0/ Varlach last; line Coads; 8=7,0, 7,= 0,5, 7/2=0 10 Schreeter , Seron - Coasts; 8 = 70, 4 = 0,2, 4 = 0 Wind; wind - lack 16 17 18 19 20 21 22

Prof. Dr.-Ing. Heiner Hartmann, HOCHSCHULE FÜR TECHNIK STUTTGART

Schellingstraße 24, 70174 Stuttgart

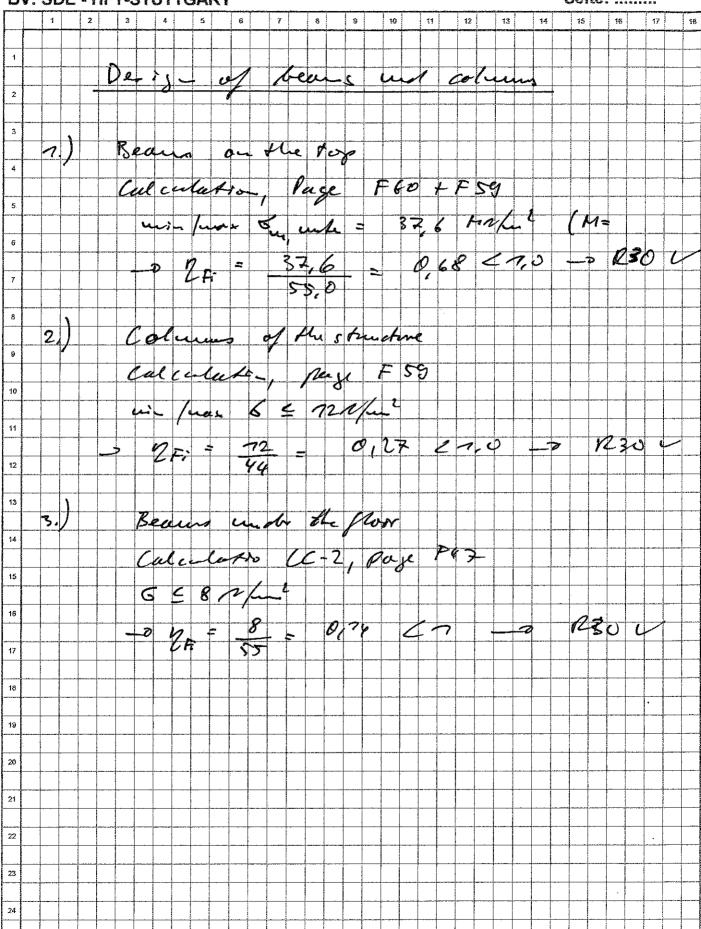
F76 Seite:i... **BV: SDE - HFT-STUTTGART** Louds / Las A. Ralcure puo ses of the propose & 7,6 hu > 7,40 = 7,20 4 = 0,2 4 31 5. 4=01 92 4 = 0,5 91 **Z**> 9 180. 7,69 -135. 70=3,26 42/-10 11 1 12 1.80 . 1.67 . 1.0 · 20 = 2,42 km/ 13 (mas) = 0,48.767.0, L= 0,73 lm/ 17 local - Cauchi Cort Ween licedo 18 19 ECT = EN 1997-1-2 20 9+3+4+4 LC-1-R30: 21 22 9 + 9 + 0 + 40 16-2-230: LC-3-1230: tw + 9 + 1 24





F78

BV: SDE - HFT-STUTTGART Seite:



Electronic Calcutation

Statische Berechnung eines 2D-Rahmens

Koordinatensysteme:



3D-Koordinatensystem X und Y spennen eine horizontale Filiëche auf. Z zeigt in Richtung Erdmittelpunkt. artsfestes, globales



ortsfestes Ebenen-Koordinafensystem (x = X, y = Z) alle Knoten und Stäbe sind in dieser Ebene definiert

I zeigt stets vom Antangs-knoten zum Endknoten. n zeigt stets in Richtung der gestrichelten Zone.

Stabkoordinatensystem

Knotenlasten

Temperaturiasten

Linlenlasten

Belastungen:

Linienlasten voin Typ W zeigen stets in n-Richtung

Linienlasten vom Typ G und S zeigen stets in y=Z-Richtung

positiv bel Erwärmung

Zwangs-verformungen

positive Momente erzeugen an dar gestrichelten Zone Zug

Schnittgrößen:

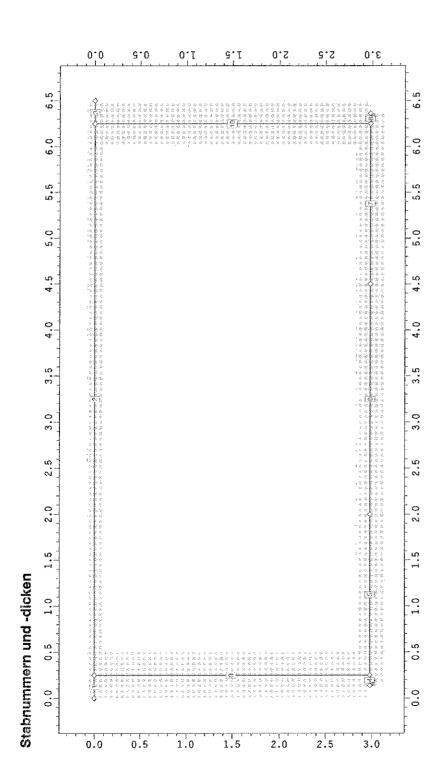
positive Normalkräfte erzeugen Zugspannungen

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Momentengelenke: premarand premarad brane

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sections

Die Ausmitten verstehen sich als Abstände von den Knoten und legen fest, welcher Bereich des Stabes bemessen bzw. nachgewiesen werden soll. Ausmitten Stabverzeichnis

Stab	Knoten	en	Länge	Gelenke	Ausmit	Ausmitten am	Druck -	Bettung	pg	Bezeichnung
	Anfang	Ende			Anfang	Ende	ausfall	1		
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ro	မ	7	1.750	į	0.000	0.000	1	,	ì	
တ	_	œ	2.500	ı	0.000	0.000	ı	•		
~	œ	6	1.750	ŧ	0.000	0.000	ı	ī		
60	on	20	0.110	1	0.000	0.000	,	•	ı	
G)	8	9	2.980	1	0.000	0.000	1	•	1	
10	ю	Ó	2.980		0.000	0.000	ı	,		



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Kreis

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Plattenbalken

Skizze: typisierte Holzquerschnitte

Rechteck

Stäbe aus Holz mit typisiertem Querschnitt

Bei gevouteten Querschnitten weist die Zeile (A) die Werte am Anfang, und die Zeile (E) die Werte am Ende des Stabes aus. Zur Bedeutung der Abkürzungen vgt. o. a. Skizze.

Stab	Material	Тур	<u>-</u>	рo	þ	pn	'n	臣
1	,	,	Cm	CIM	cm	CM	E	CJ.
	BS18 (trocken)	Rechteck	16.50	7.50	1 1	,	;	ı
~	BS18 (trocken)	Rechteck	16.50	7.50	1	t i	;	ì
က	BS18 (trocken)	Rechteck	16.50	7.50	:	:	;	1
4	BS18 (trocken)	Rechteck	30.00	7.50	:	;	E ;	1
цO	BS18 (trocken)	Rechteck	30.00	7.50	1	;	:	1
9	BS18 (trocken)	Rechteck	30.00	7.50	:	:	;	j ì

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Stäbe aus Holz mit typisiertem Querschnitt

Bei gevouteten Querschnitten weist die Zelie (A) die Werte am Anfang, und die Zelie (E) die Werte am Ende des Stabes aus. Zur Bedeutung der Abkürzungen vgl. o. a. Skizze.

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Typ		Rechteck	Rechteck	Rechteck	Rechteck
Typ		œ	~	Α Α	~
Material	E	BS18 (trocken	BS18 (trocken)	BS18 (trocken	BS18 (trocken)
Stab	1	7	α,	თ	ន

elastische Kennwerte der Stäbe
Die hier aufgelisteten Konwerte sind die Eingangsparameter für die ilheare Berechnung. Die Querschnittswerte wurden entweder direkt vorgegeben, aus den typisierten Querschnittsangaben (entspr. der vorangegangenen Tabellen) berechnet, der paze-Profitdate enthormen oder aus den Querschnittswerteprogramm 4H-QUER importiert. Bei gevourten Querschnitten weist die Zeile (A) die Werte am Stabende aus. Da das 4H-NISI-Bechenprogramm die Querschnitten aus der Profitdatel und die Pyteisenen Querschnitten and der Profit datel und die Pyteisenen Querschnitte in seine Einzelelemente auffolst, können die vom Rechenprogramm rihren verwendeten Kennwerte bei diesen Querschnitten von den hier angegebenen geringfügig abweichen. Der E-Modul von Stahl wurde ggiße, mit yn reduzient,

Stab	Materia	តែ]	E-Modul	∢ ′	н	o _k	n _×	Quelle
	'		MN/m²	cm ²	cm ⁴	cm ³	сш3	1
-	Holz:	BS18 (trocken)	14000	123.8	2807.6	340.3	340.3	berechnet
7	Ho1z:	BS18 (trocken)	14000	123.8	2807.6	340.3	340.3	
ო	Holz:		14000	123.8	2807.6	340.3	340.3	-3-4
4	Holz:		14000	225.0	16875.0	1125.0	1125.0	
ည	Holz:		14000	225.0	16875.0	1125.0	1125.0	
တ	Holz:		14000	225.0	16875.0	1125.0	1125.0	berechnet
1	Holz:		14000	225.0	16875.0	1125.0	1125.0	
හ	Holz:	BS18 (trocken)	14000	225.0	16875.0	1125.0	1125.0	.Ω
თ	Holz:		14000	235.0	48958.3	1958.3	1958.3	-4-2
10	Ho] Z:	BS18 (trocken)	14000	235.0	48958.3	1952 3	105A	

STRUKTUR DER BELASTUNG

Bezeichnungen der alternativen Gruppen

Gruppe	Bezelchnung	
≪	unterschied]iche	e Schneefelder
മാ	unterschiedliche	Windrichtungen



Beschreibung der Belastungsstruktur

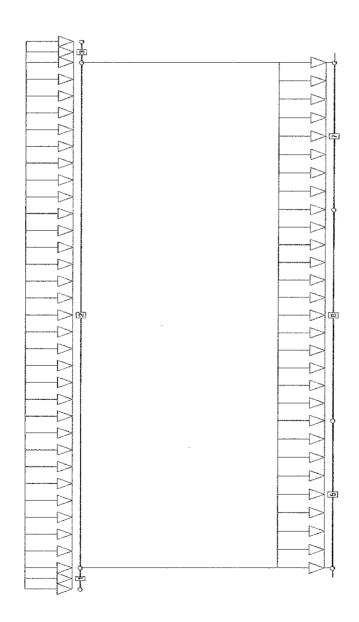
Signal Control

Auf der linken Seite sind die Beziehungen der Einwirkungen, Lasitaliordner und Lasitälie zuehander in einer Baumsfruktur dargestellt. Auf der rechten Seite sind die überfagerungsspezifischen Eigenschaften den links stehenden Objekten zugeordnet angegeben. Ein Lasitaliordner entspricht überfagerungstechnisch einer Extremierung der in ihm definierten Objekte und kann seinerseits wiederum additiv oder alternativ überfagert werden.

rechten Seite sind die überlagerungsspezifischen Eigenschaften den links stehenden Objekten zugeordnet angegeben. Ein Lasfatiordin überlagerungstechnisch einer Extremierung der in ihm definierten Objekte und kann seinerseits wiederum additiv oder alternativ überla	Eigenschaften den links stehenden Objekten Ihm definierten Objekte und kann seinerseits	zugeordnet angegeben. Ein Lastfallord) wiederum addilfv oder alternafiv überla
verwendete Symbole歐 Einwirkung 廊 Lastfallordner [III Lastfall	Lastfallordner ↓ Lastfall	Imperfektionsfälle
歐 1: ständige Lasten 「瓜」1: Eigengewicht (1)	ständige Lasten additiv	
歐 2: Nutzlasten (1) 「頂 2: Nutzlasten (1/1)	veränderliche Nutzlasten in Wohn-, Büroräumen additiv	ohn-, Büroräumen
(数) 3: Schneelasten し口。3: Schneelast (1)	veränderliche Schneelasten alternativ in Gruppe A	
歐山 4: Windlasten L 山 4: Windlast (1)	veränderliche Windlasten alternativ in Gruppe B	

belastete Objekte in Lastfall 1

LASTBILDER IN LASTFALL 1: EIGENGEWICHT (1)



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Erläuterung der Lastbildtypen und Lastrichtungen

Lastrichtung G	Lastrichtung S Lastrichtung S Werden mit dem Faktor oss a Lastrichtung W	
qa da	4a da	
qa (3)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
2 Ge	(10) q ₀	
(1) qa	6 qa -a - 1 - e - 1	—a——e—

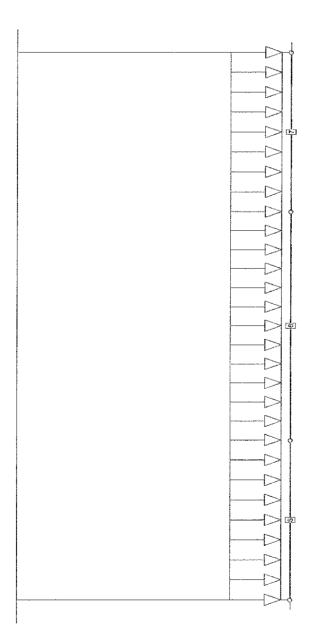
Streckenlasten in Lastfall 1

~~ E	1.750 2.500 1.750
छ	5 J 1
qe kN/m	1 5 1
qa kN/m	2.420 2.420 2.420
Typ.	16 16 16
Stab	5 /
oξ	1 7 1
- E	0.250 6.000 0.250
c ∈	F A 4
qe kN/m	J i i
qa KN/⊞	2.420 2.420 2.420
Typ _	16 16
Stab	-1 e

CF2? Live boad

belastete Objekte in Lastfall 2

LASTBILDER IN LASTFALL 2: NUTZLASTEN (1/1)



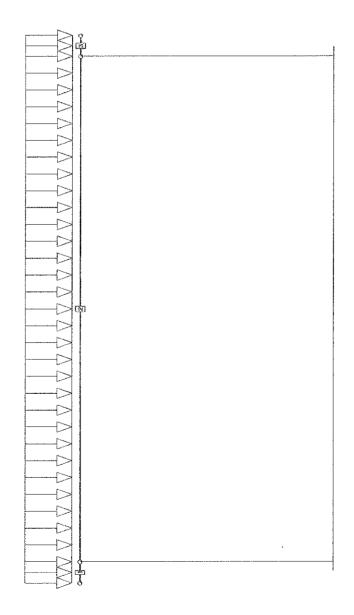
Streckenlasten in Lastfall 2 (vgl. Erläuterungsskizza Solle 8)

æ	Ε	,	,	1	
- -	E	1.750	2.500	1.750	
æ	ш	ı	ŧ		
ďe	kN/m		,		
qa	kN/m	3.220	3.220	3.220	
Typ	-	16	16	16	
Stab	,	'n	9	^	

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LASTBILDER IN LASTFALL 3: SCHNEELAST (1)

belastete Objekte in Lastfall 3



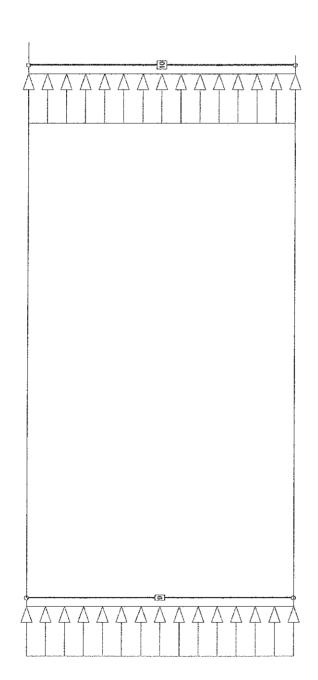
Streckenlasten in Lastfall 3 (vg. Erläuterungsskizze Selle 8)

Stab	Тур	G	de de	ĸ	,	Ф
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2	15	1.000			6.000	١
က	13	1.000	,	3	0.250	1

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belastete Objekte in Lastfall 4

LASTBILDER IN LASTFALL 4: WINDLAST (1)



Streckenlasten in Lastfall 4 (vg. Enturerungsskitzse Selte 8)

- E	2.980
ø E	ı t
qe kN/m	1 1
qa kN/m	-0.650 -0.650
Typ ,	# #
Stab	10

e E | • •

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BESCHREIBUNG DER GEFORDERTEN NACHWEISE

Im Nachfolgenden bedeuten:

bel Überlagerungsregel DIN 1055-100: Kombinationsbeiwert für eine nichtführ. Verkehrslasteinwirkung DIN 1055-100: Kombinationsbelwert für eine führende Verkehrslasteinwirkung DIN 18800: Kombinationsbelwert für eine Nebenkombination Kombinationsbeiwert für eine Hauptkombination Teilsicherheitsbeiwert für ungünstig wirkende Laststellungen Teilsicherheitsbeiwert für günstig wirkende Laststellungen DIN 18800: bei Überlagerungsregel bei Überlagerungsregel bei Überlagerungsregel Hoom H₈ub

Überlagerungsregeln FB101 und Eurocode verhalten sich wie DIN 1055-100 Bei nichtlinearer Berechnung bleiben Extremalbildungsvorschriften unberücksichtigt

Nachweis 1: DIN 1052-2008

DIN 1052 Lastfall H (Th. I. Ord.); Tragfähigkeit Lastfall H nach DIN 1052 4.88, 6.x

1: LC-1-REI30-max-s

Extremalbilidungsvorschrift zum Nachweis 1, Typ: benutzerdefinlert, Überlagerungsregel: alte Norm

Leval - condination LC-1 CC-2 LC-3

Yin	1.00	0.00	00.0	0.00
увир	1,35	0.50	1.00	0.20
1				

2: LC-2-REI30-max-q

Extremabildungsvorschrift zum Nachweis 1, Typ. benutzerdefinlert, Überlagerungsragel: alte Norm

	•	(-//	しし	
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Yaup	1.35		0.20	0.20
Einw.	₩	21	က	4

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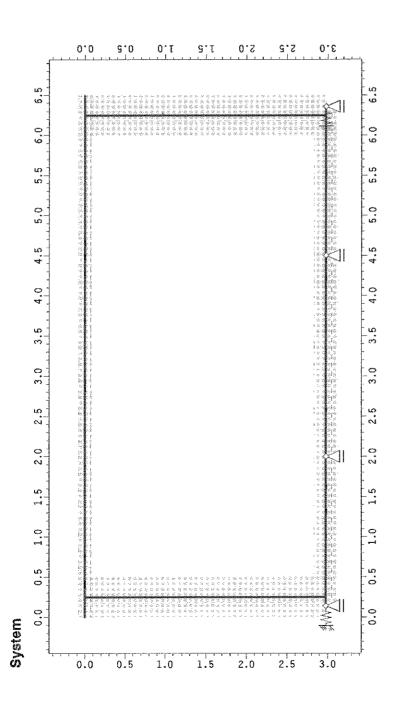
3: LC-3-REI30-max-w

Extremabilibungsvorschrift zum Nachweis 1, Typ: benutzerdefiniert, Überlagerungsregel: alte Norm

			`	Š
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Einw.	,1	~	က	7

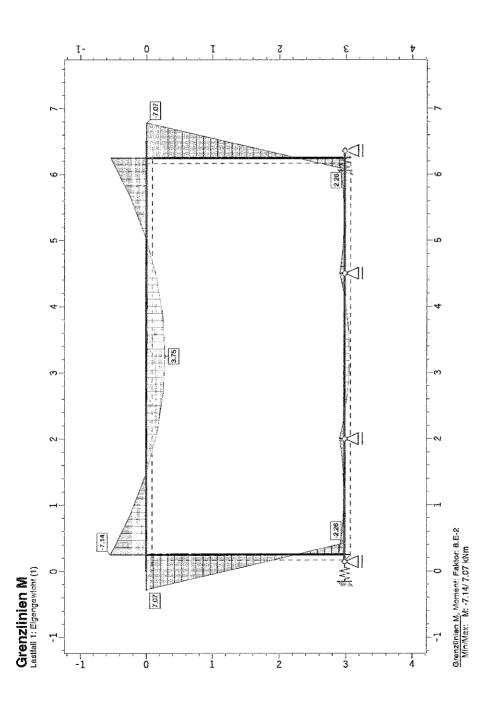
zeich n etzten S _i	lis zu. Spalte	Stabverzeichnis zum Nachweis 1: Ist in der Ietzten Spalte ein Wert für a angegeben, so wird dieses a beim Normals	ls 1: angegeben,	so wird di	eses a beim N	eg.	snachweis	nnungsnachweis verwendet			
	,	Normal- Schub-	8	Stab	Stab Normal- Schub-	Schub-	8	Stab	Normal-	Schub-	8
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		ja	ı	_	Ja	ja			_	•	
Ça		ţ	,	ω	Ja	jà	•				



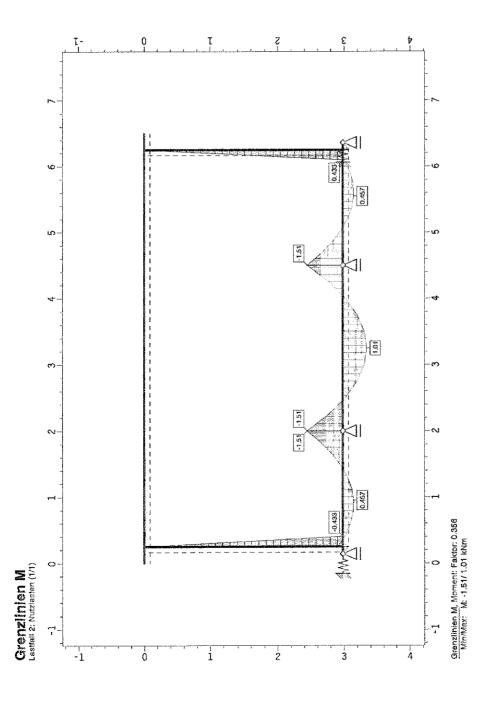


H-NISI2 3/2005 / pcae-GmbH / Kopernikusstraße 4A / 30167 Hamover / Tel. (0511) 700830 / Fax. (0511) 700838 / Dit0411989

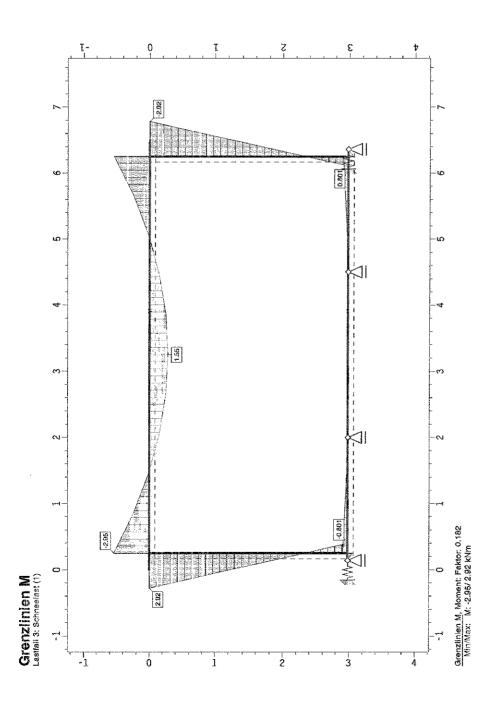
CF1- Moment



(1968) 41-NISIZ 3/2005 / prze-GmbH / Kepernikurstraße 4A / 20187 Harneyer / Tel (0511) 700030 / Fax: (0511) 7203399 / DAIO411899

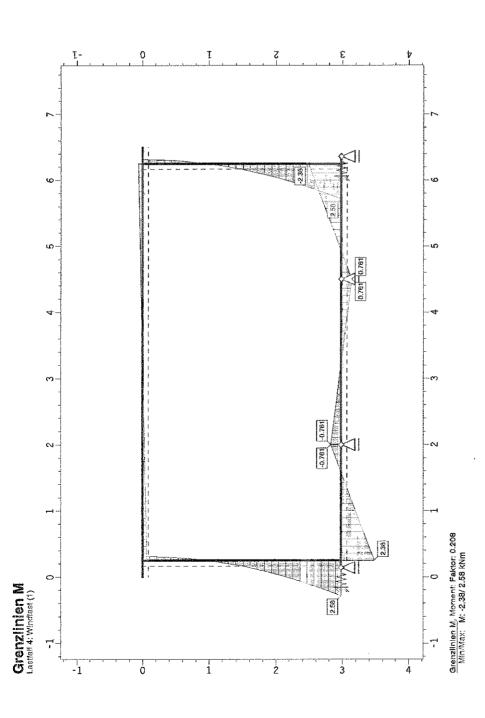


PS 41-NISI2 3/2005 / pcae-GmbH / Koperntkusstrate 4A / 30187 Hannover / Tel. (0511) 700830 / Fax. (0511) 7008390 / DillO41999



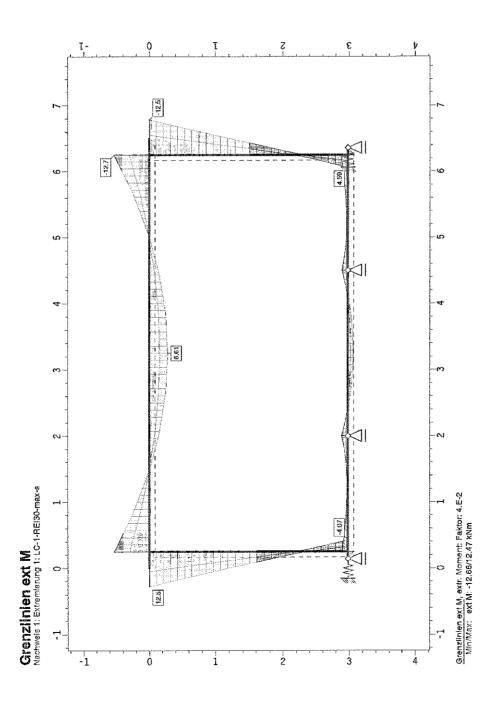
PRE 4H-NISIZ 3/2005 / pcae-GinbH / Koperniturstrate 4A / 30167 Harmover / Tel (0511) 700630 / Fax (0511) 7006399 / DRID411999

LF4 - Mount



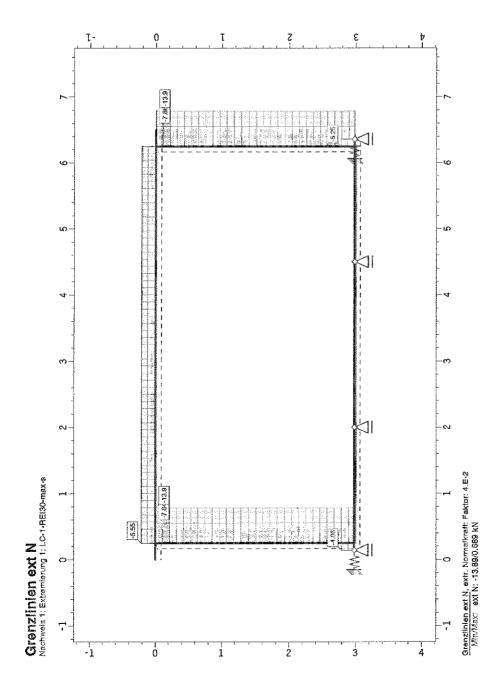
44-NISI2 3/2005 / p.cae-GmbH / Knpomikussiraßs 4A / 30167 Hamaver / Tel. (0511) 700830 / Fax. (0511) 7008399 / DM041999

CC-1; Kount (F)

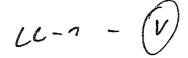


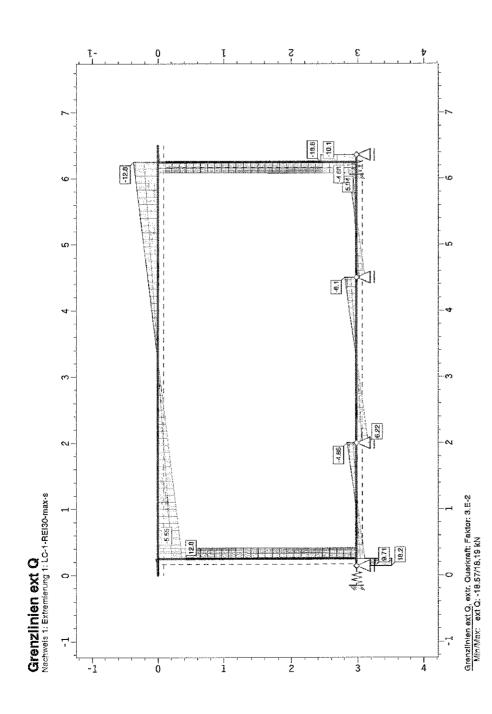
PS 41-NISI2 3/2005 / pcae-Gmb/ / Kopernikusetrafe 4A / 30167 Hannover / Tel. (0511) 700330 / Fax. (0511) 7008389 / DIN0411999

LC-7 - (N)



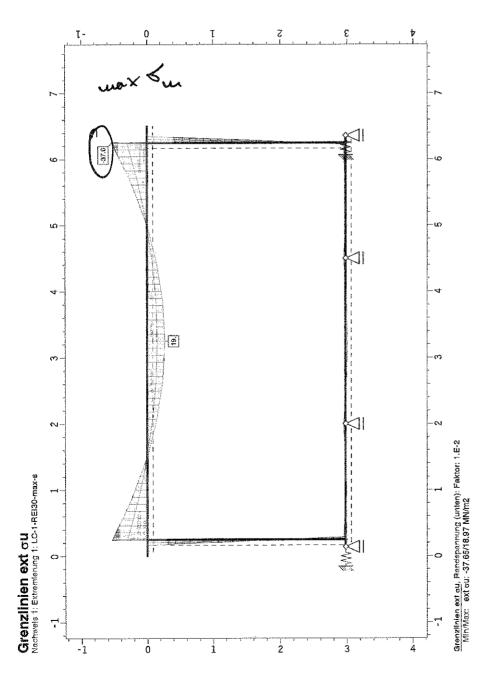
PS 4H-NISI2 92005 / pcae-GmbH / Kopernikusatraße 4A / 30167 Hannover / Tel. (0511) 700830 / Fexc (0511) 7008389 / Dillo411989





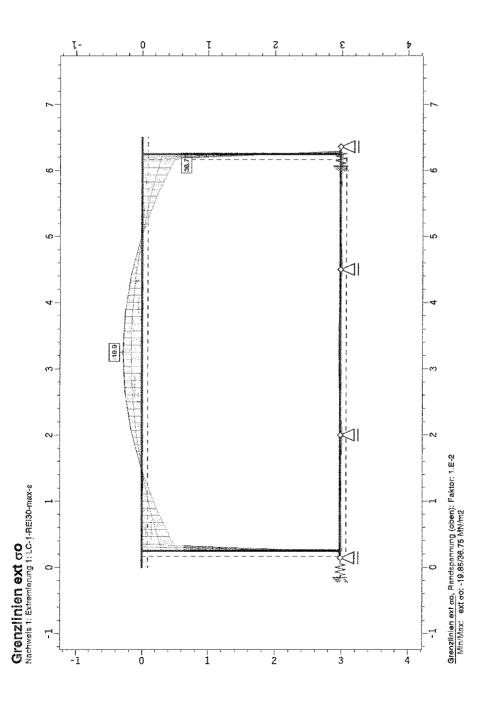
PR 4H-NISIR 3/2005 / pcae-GmbH / Kopernikusstraße 4A / 30197 Hannover / Tek. (0511) 700830 / Fax. (0511) 7008399 / Diu0411999

LC-1: Sun, unter

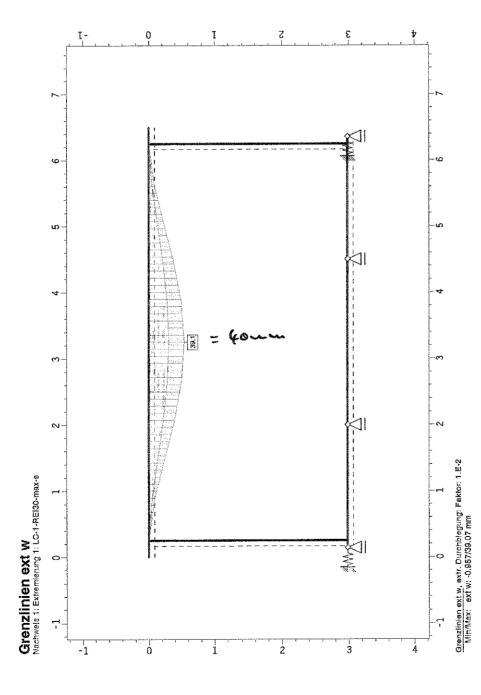


POS 4H-NISI2 3/2005 / pose-GmbH / Kopernikurshtaße 4A / 90167 Hammyer / Tel. (0511) 700680 / Fax. (0511) 7006399 / Dilt0411999

LC-7, Suroben

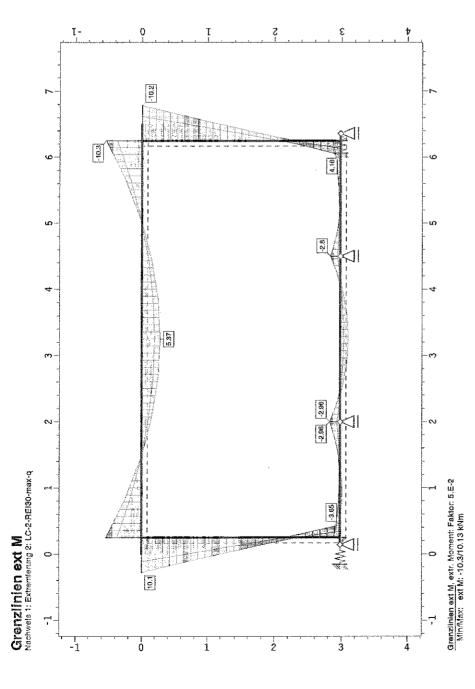


4H-NISIZ 3/2005 / pcae-GmbH / Kopernikusstraße 4A / 30147 Hammer / Tel. (0511) 700330 / Fax. (0511) 7003303 / Dino411909



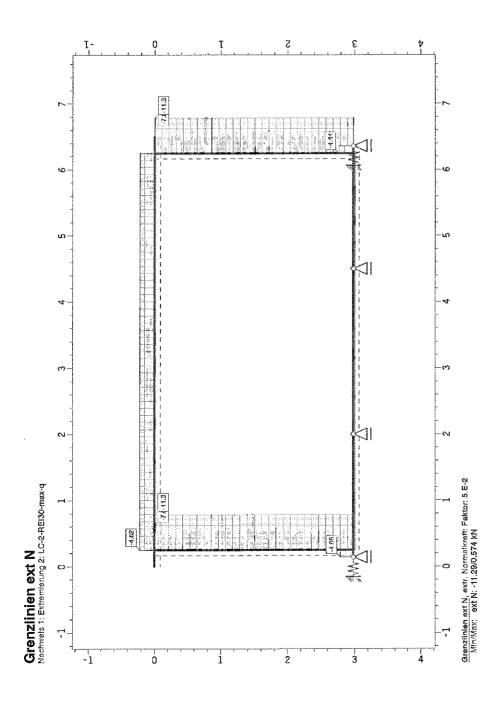
PS 41-NISI2 3/2005 / pcae-GmbH / Kepernikusstrafis 4A / 30167 Hannever / Tel: (0511) 70830 / Fax. (0511) 7606369 / CHIO411999

LC-2 -(H)



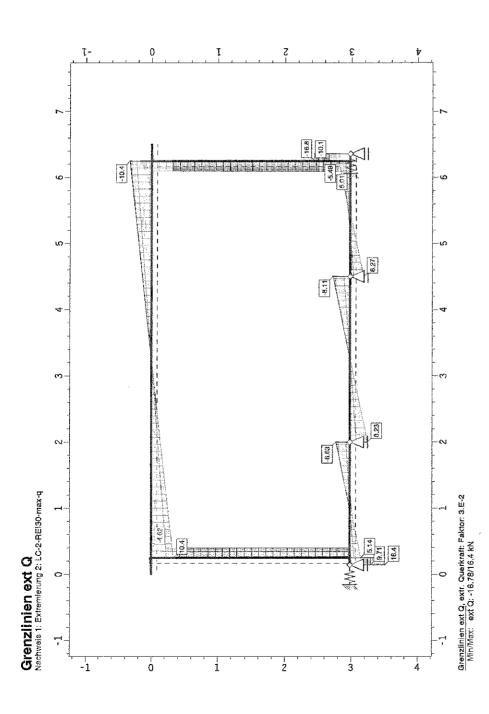
सिक्क 4H-NISI2 3/2005 / pcae-Gmbh / Kopemikuserriks 4A / 30187 Hannover / Tel: (0511) 700830 / Fax: (0511) 700838 / DiH0411999

CC-2 - (2)

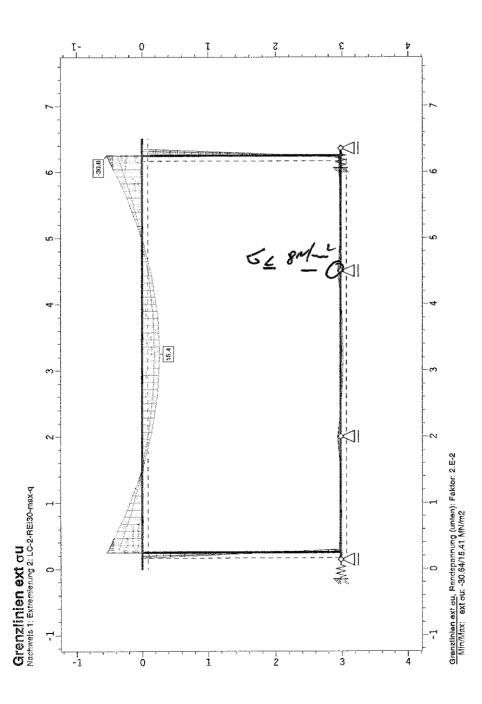


| 44-NISI2 3/2005 / pcae-Grubh / Kopernikussirn8e 4A / 3/0187 Hammover / Tel. (US11) 700830 / Fax. (1511) 700830 / Dillo411989

cc-2 - (v)

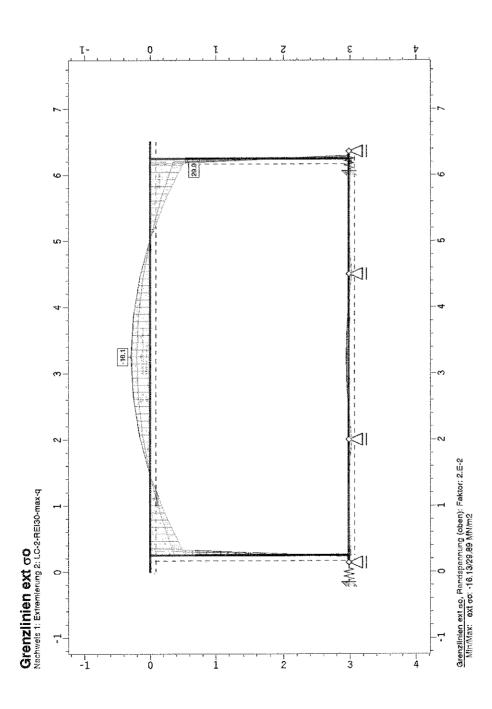


PR 41-NISI2 3/2005 / pcae-GmbH / Kupernikussiraho 4A / 39197 Hannover / Tek (0511) 700830 / Fax: (0511) 700839 / DIII0411999



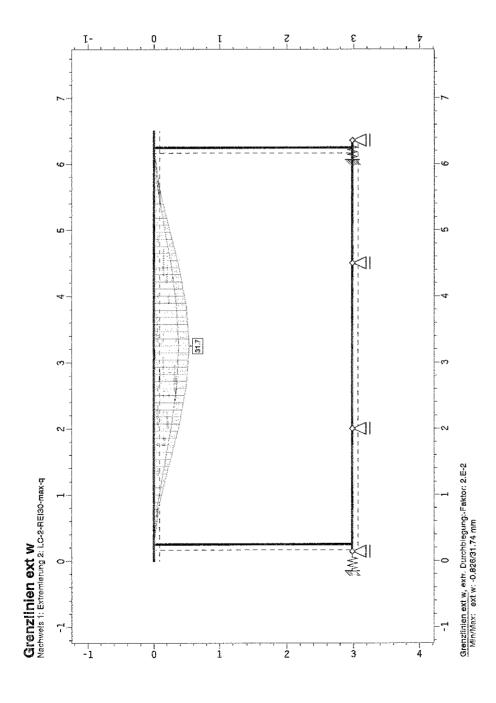
3. 4H-NISI2 3/2005 / pcae-Gribh / Kopernikusstraße 4A / 30167 Hannover / Tal: (0511) 700830 / Fax: (0511) 7008309 / Ditt0411989

LC-2, Su-oba



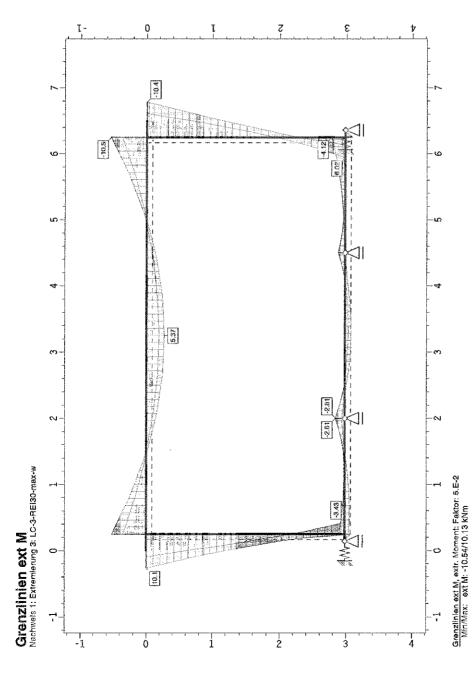
(25) 41-MSI2 3/2005 / pcae-GmbH / Knpernikusstrafa 4A / 30197 Hannover / Tel. (0511) 700830 / Fax. (0511) 700839 / Disput1989

LC-2; max f



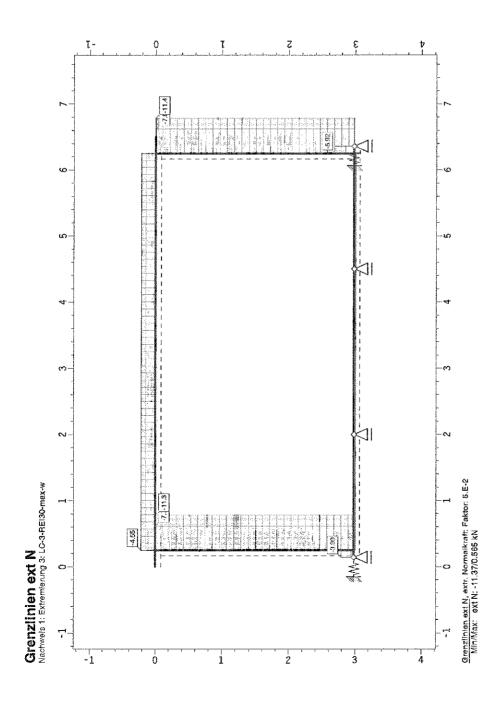
PSS 41-NISI2 3/2005 / poae-GmbH / Kepernikusstrats 4A / 20167 Hannover / Tel (0511) 700830 / Fax: (0511) 7003389 / Dill0411999

LC3 - (9)



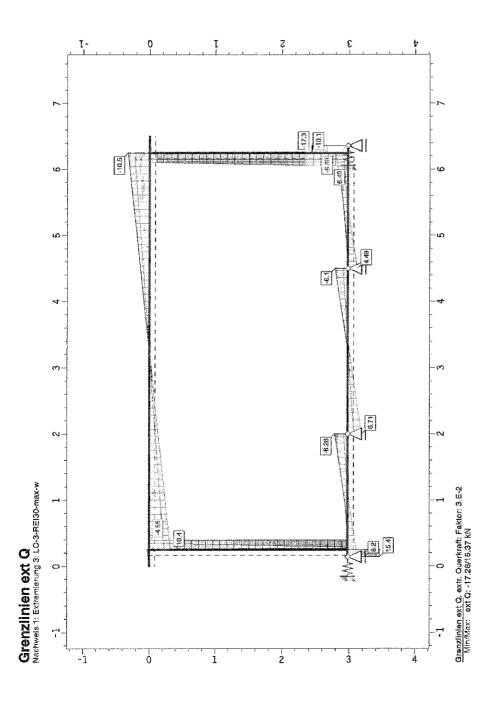
4H-NISI2 3/2005 / prose GmbH / Kapemikussitabe 4A / 30187 Hannover / Tet (0511) 700830 / Fax (0511) 700030 / Dull0411999

U-3, (N)



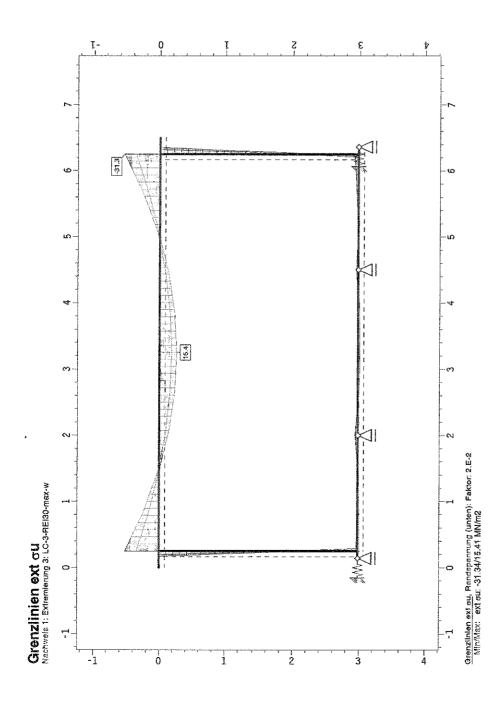
िल्क 4H-NISI2 3/2005 / pcae-GmbH / Kopernikusstraße 4A / 30167 Harmaver / Tel: (0511) 700830 / Fax: (0511) 7008388 / Dilindx11980

CC-3-W



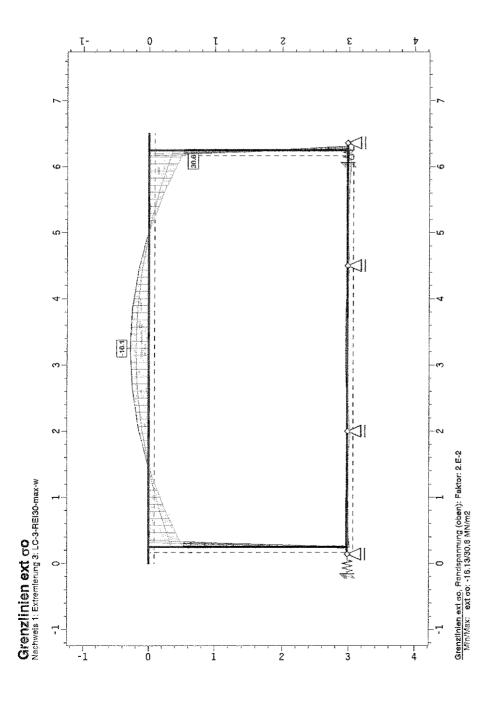
PS 4H-NISI2 3/2005 / pcae-GmbH / Kopernikusstratie 4A / 30167 Hamrover / Tel. (0511) 700830 / Fax. (0511) 7008399 / Dill0411999

CC-3- nax bujuk



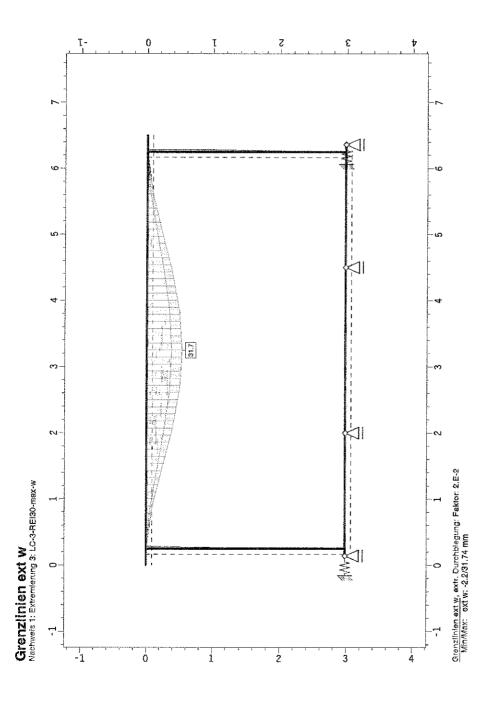
44-NISI2 9/2005 / pcee-CambH / Kopernikusstrabe 4A / 30167 Hannoyer / Tek (0511) 700830 / Fax: (0511) 700838 / DuiO411999

CC-3, nos Su, oben



PRS 41-NISI2 3/2005 / prose-GmbH / Kopernikusstraße 4A / 301-87 Hambyer / Tel. (0511) 700639 / Fax. (0511) 7006389 / DM0411999

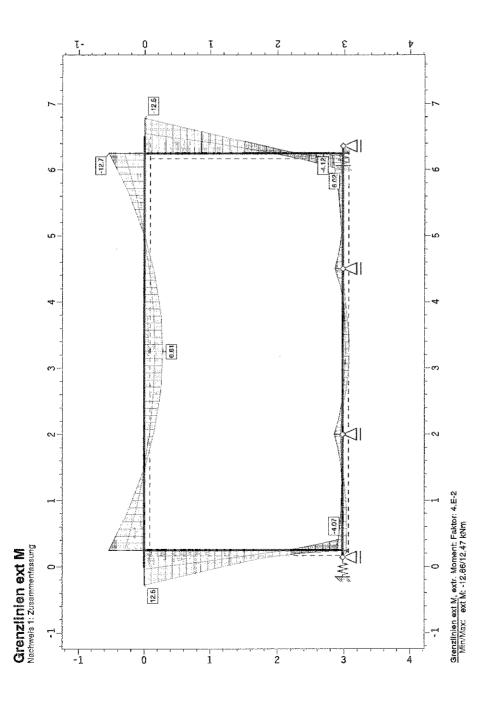
LC-3, mex £



Pose 4HANSI2 3/2005 / pcae-GmbH / Knperniknsetraß 4A / 30187 Hermower / Tel. (0611) 700830 / Fax (0511) 7008399 / Dillo411989

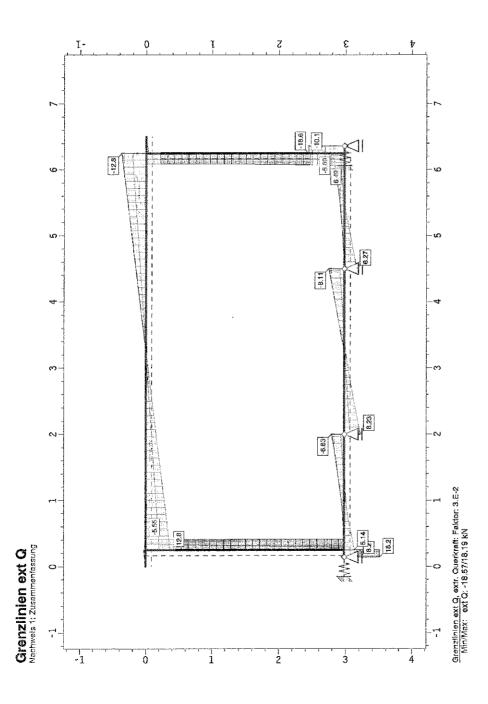
LC-7.-.3

wax/wie (9)



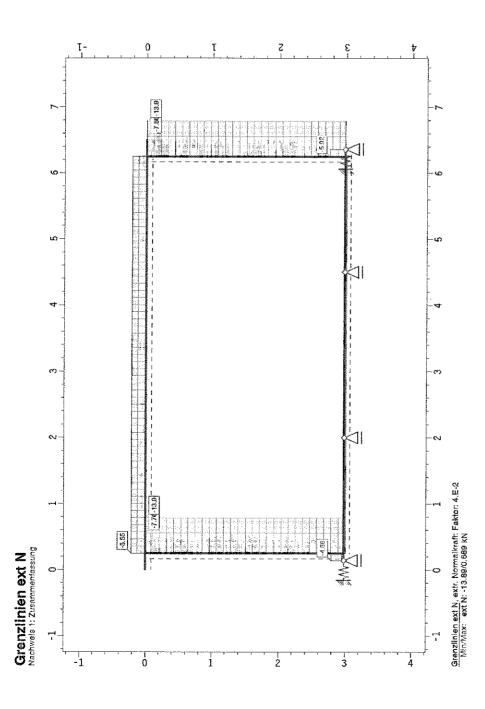
(1998) 4H-NISIZ 3/2005 / pcae-Gribh / Kopermikussitate 4A / 30187 Hannover / Tek (0511) 700830 / Fax: (0511) 700839 / DMI0411999

LC 1.. 3, wax/wir (V)



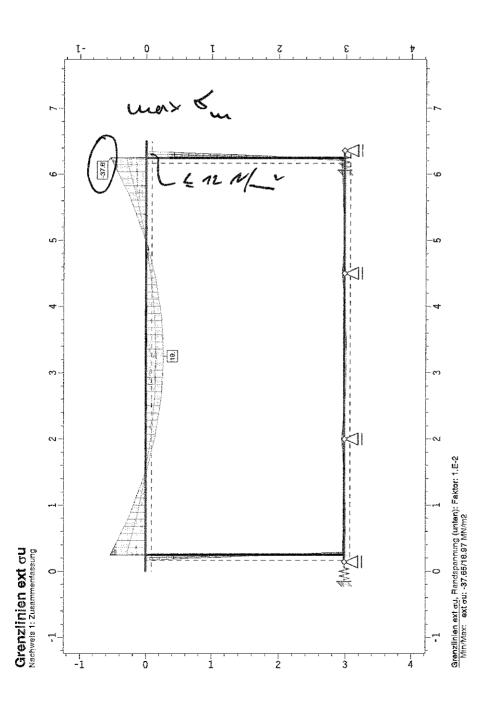
AH-NISIS 3/2005 / pcae-GribH / Kripernikussitate 4A / 30187 Hamover / Tel (0511) 700880 / Fax: (0511) 709830 / Disto41899

LC 1.3; waxpir (V)



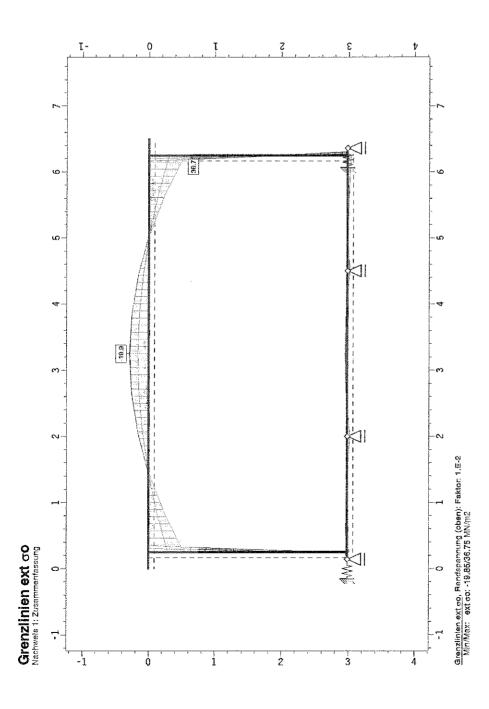
PRES. 4H-NISIZ 3/2005 / picae-GmbH / Kippernikusstrate 4A / 20167 Hannover / Tel: (0511) 700630 / Fax; (0511) 700639 / Dilli0411999

LC 1.- 3; wax/wi- Eu, unter



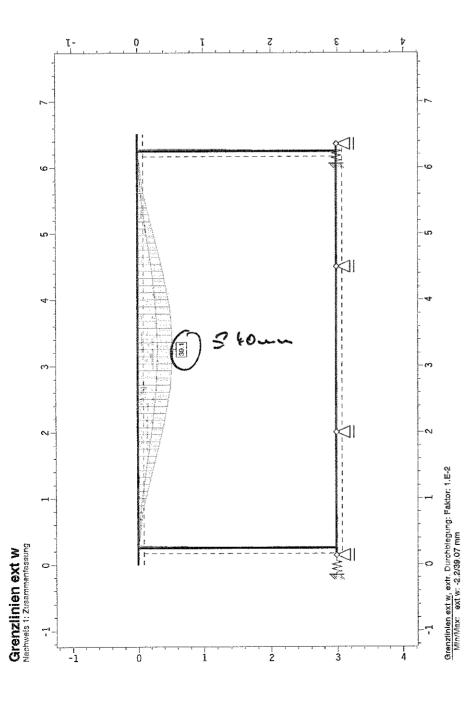
1001 | 1001 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 10

LC 1.3; nax/min & m, olsen



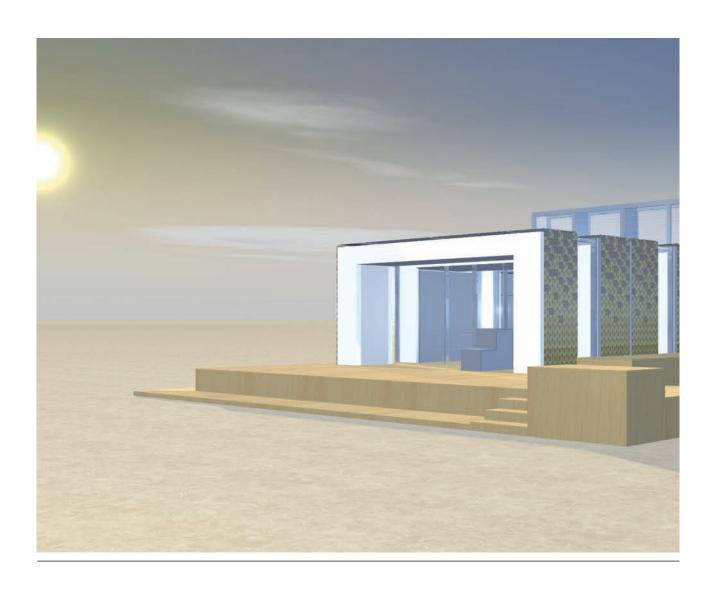
PR AH-NISIS 3/2006 / prose-Garbi+ / Kopenikalisatede 4A + 30187 Hamever / Tel: (0511) 700830 / Fax: (0511) 700830 / Dillo4118B

W1.3, waxf



| 1968 | 41-MISIZ 9/2005 / рсав-GmbH / Kopernikusshale 4A / 30187 Hamover / Тві. (0511) 700830 / Гас (0511) 7006399 / Dill0411999

Appendix 3 Press Releases



eur			1		CONTEST	T 7: COM	MUNICATION	AND SOCIA	L AWAR	ENESS		
	of the team	Team HFT Stuttga	art									
f No.	FORMAT	TYPE	NAME OF THE MEDIA/EVENT	CONTENT/TOPIC	SCOPE	DATE	DISSEMINATION/AUDIENCE/ NO. ATTENDEES	PUBLICATION	PROFILE	ADVERTISING VALUE	LINK	COMMENTS
												HFT took part TU Darmstadt SI
1	Media	Digital Press	region-stuttgart.de	SDE 2007 HFT	Regional	19.02.2008	Public		medium	560	http://www.region-stuttgart.de/sixcms/detail.php/268877	2007
2	Maratia	Disital Navialettas	UET	ODE 2040 LIET	Danisası	04.44.0000	LIET Dublis	0.2.000		000	004404 UET	
3	Media Media	Digital Newsletter Digital Press	HFT press hft-stuttgart.de	SDE 2010 HFT SDE 2010 HFT	Regional National	01.11.2008	HFT, Public	C:3.000 C:3.000	medium medium	630 560	081101_HFT	
	iviedia	Digital Pless	mi-stuttgart.de	SDE 2010 HF1	National	12.11.2006	HFT, Public	C.3.000	medium	560	stuttgart.de/Aktuell/Rueckblick/2008/SolarDecathlon/de https://www.missrackorg. report.de/html/berichte/architektur_bauwesen/solar_decathlon_eu_	
1	Media	Digital Press	innovations-report.de	SDE 2010 HFT	National	24.11.2008	Engineers, Public		high	480	rope 2010 baut beste solar 122982.html	
5	Media	Digital Press	baukalender.de	SDE 2010 HFT	National	25.11.2008	Architects, Public		high	960	http://www.baukalender.de/nachrichten_detail2.php?nr=2770	
5	Media	Digital Press	umweltjournal.de	SDE 2010 HFT	National	25.11.2008	Public		high	980	http://www.umweltjournal.de/AfA_bauenwohnengarten/14962.php	
7	Media	Digital Press	ibau.de	SDE 2010 HFT	National	25.11.2008	Public		high	850	(http://www.ibau.de/wirtschaftsnachrichten.php)	
3	Media	Digital Press	hft-stuttgart.de	Visit TU Darmstadt	Regional	27.11.2008	Students, Supporters, Public		medium	560	http://www.hft- stuttgart.de/Aktuell/Rueckblick/2008/SolarDecathlon1/de	
9	Media	Digital Press	solarserver.de	SDE 2010 HFT	National	29.11.2008	Public		high	870	081129_solarserver	
0	Media	Digital Press	energie-portal.info	SDE 2010 HFT	National	01.12.2008	Engineers, Public		high	1.020	nttb://www.energie- portal.info/cms/front_content.php?idcat=119&idart=1558	
1	Media	Printed press	aud!max ING	SDE 2010 HFT	National	01.01.2009	Engineers, Public	Circulation: 400.000	medium	3.235	Solares Kräftemessen	Name of article: Solares Kräftemessen
	ivieula	i iliteu press	audinax ing	SDE 2010 FI	radional	01.01.2009	Engineers, Public	On Culation. 400.000	medium	0.233	Oddies Mallemessell	Name of article: Solar Decathle
2	Media	Printed press	horizonte	SDE 2010 HFT	National	20.01.2009	Scientifics, Public	Circulation: 19.965	medium	3.400	horizonte Sept. 2009	Europe 2010
3	Media	Printed press	Deutsche Bauzeitung	SDE 2010 HFT	National	20.01.2009	Architects, Public	Circulation: 34.100	high	1.895	090120_db	Name of article: Solar Decathle Europe 2010
									9			
4	Media	Printed press	Stuttgarter Wochenblatt	process of project	Regional	22.01.2009	Public	Circulation: 37.160	medium	190	090122_STW	Name of article: Sonne nutzen
5	Media	Printed press	Bauwelt	SDE 2010 HFT	National	23.01.2009	Architects, Public	Circulation: 13.600	medium	320	090123_bauwelt	Name of article: Klobige Thermoskannen
6												Name: Die ersten Entwürfe sin
	Media		HFT press	SDE 2010 HFT	HFT, Regional	01.02.2009	Internal, Public	C. 3.000	medium	560	090201_HFT	abgegeben
7 8	Media Media	Digital Press Digital Press	iwr.de solarserver.de	SDE 2010 HFT SDE 2010 HFT	National National	10.02.2009	Engineers, Public Engineers, Public		high high	920 920	http://www.iwr.de/news.php?id=13808 http://www.solarserver.de/news/news-10189.html	
9	Media	Digital Press	idw-online.de	SDE 2010 HFT	National	10.02.2009	Scientifics, Public		high	865	http://idw-online.de/pages/de/news300216	
0.	Media	Digital Press	innovations-report.de	SDE 2010 HFT	National	10.02.2009	Public		high	915	report.de/html/berichte/preise_foerderungen/solar_decathlon_eur ope_2010_ersten_entwuerfe_126991.html	
1	Media	Digital Press	fona.de	SDE 2010 HFT	National	11.02.2009	Public		high	875	http://www.fona.de/de/7323	
2	Marilla	Drinte de cocce	Chatter to a March archiest	CDE 0040 LIET	Danisası	40.00.0000	Dublic	Circulation, 40,040		80	000040 CTM	Name of article: Solarer
	Media	Printed press	Stuttgarter Wochenblatt	SDE 2010 HFT	Regional	12.02.2009	Public	Circulation: 42.010	medium	80	090212_STW	Zehnkampf Name of article: Solarer
3	Media	Printed press	Gerlinger Wochenblatt	SDE 2010 HFT	Regional	12.02.2009	Public	Circ: 8220	medium	25	gerlinger wochenblatt	Zehnkampf
4	Media	Digital Press	dbz.de	SDE 2010 HFT	National	15.02.2009	Architects, Public		high	1.120	ersten Entwuerfe sind abgegeben 84070.html	
5	Media	Digital Press	energie-portal.info	SDE 2010 HFT	National	18.02.2009	Engineers, Public		high	1.300	portal_info/cms/front_content.php?idcat=119&idart=1703	
:6	Media	Digital Press	baunetzwissen.de	SDE 2010 HFT	National	19.02.2009	Engineers, Public		high	Sep 02	(http://www.baunetzwissen.de/standardartikel/Solar-Solar- Decathlon_726033.html)	
7	Media	Digital Press	arcquide.de	SDE 2010 HFT	National	19.02.2009	Architects, Public		high	960	090219_arcguide	
	Modia	Digital 1 1000	ur oguluoluo	052 20101111	rational	10.02.2000	/ Horntooto, i abno		g.,	000	000210_u.oguido	
28	Media	Printed press	Staatsanzeiger Baden- Württemberg	SDE 2010 HFT	Regional	20.02.2009	Public	Circulation: 15.215	high	5.150	090220 Staatsanzeiger	Name of article: Studenten plat das solare Wohnen der Zukunf
_	ivieuia	Filited press	wurtternberg	SDE 2010 HFT	Regional	20.02.2009	Fublic	Circulation, 13.213	nign	3.130	090220_Staatsanzeigei	Name: Newsletter 03/10 - Tear
29	Media	Digital Newsletter	Newsletter SDE home+	SDE 2010 HFT		01.03.2009			medium	380	newsletter2	HFT Stuttgart
30	Media	Printed press	Bundesbaublatt	SDE 2010 HFT	National	02.03.2009	Public	Circulation: 11711	high	860	090301_bundesbaublatt	Name of article: Solar Decathlo Europe 2010 - Erste Entwürfe
31												Name of article: Wir sehen uns
,1	Media	Printed press	Stallgeflüster	SDE 2010 HFT	Local	15.03.2009	HFT, Public	Circulation: 3.000	medium	2.500	0903_stallgeflüster 31	2010 in Madrid!
32	Event	Presentation	Kick-Off Event	general information	Local (Intern)	18.03.2009	home+ Team	120	low	0	http://www.sdeurope.de/?lng=de&action=news&news=20090318	
3	Media	Digital Press	hft-stuttgart.de	SDE 2010 HFT	HFT, Regional	04.03.2009			high	560	http://www.nic- stuttgart.de/Aktuell/Rueckblick/2009/SolarDecathlon/de	
4	Maratia	Drietada	Moderne Oak Frankstank with	CDE COACHIET	Madagal	04.04.0000	Duklis	Circulatia 10.000	Link	0.400		Name of article: Solar Decathlo
	Media	Printed press	Gebäudetechnik Intelligente Architektur	SDE 2010 HFT	National	01.04.2009	Public	Circulation: 12.000	nign	2.180	090401_moderne gebaeudetechnik	Europe 2010 Name of article: Solar Decathlo
35	Media	Printed press	(XIA)	SDE 2010 HFT	National	04-06.2009	Engineers, Public	C: 15.700	high	6.331	XIA	Europe 2010
6	Event	Presentation	Workshop I	home+	Local (Intern)	15.04.2009	home+ Team	120	low	0	http://www.sdeurope.de/?lng=de&action=news&news=20090415	
7	Event	Presentation	Workshop II	home+	Local (Intern)	06.05.2009	home+ Team	120	low	0	http://www.sdeurope.de/?lng=de&action=news&news=20090505	
8												
	Event	Presentation	Workshop III	home+	Local (Intern)	10.06.2009	home+ Team	120	low	0	http://www.sdeurope.de/?lng=de&action=news&news=20090604	Name of article: Studierende
			Staatsanzeiger Baden-									präsentieren für den Solar

40												Name: Wohnungsbau der Zuku
	Media	Digital Newsletter		SDE 2010 HFT	HFT, Regional	19.06.2009	HFT, Public		medium	560	090619_HFT	mit home+
41	Media	Digital Press	uni-protokolle.de	SDE 2010 HFT	National	19.06.2009	Scientifics, Public		high	380	http://www.uni-protokolle.de/nachrichten/id/179420/	
42	Media	Digital Press	idw-online.de	SDE 2010 HFT	National	19.06.2009	Scientifics, Public		high	1.220	http://idw-online.de/pages/de/news321555 http://www.uniwenjourna.de/py/arcmy/xxx-dadenwonnengarteny	
13	Media	Digital Press	umweltjournal.de	SDE 2010 HFT	National	20.06.2009	Engineers, Public		high	860	<u>15769.php</u>	
14	Media	Digital Press	ibau.de	SDE 2010 HFT	National	22.06.2009	architects, Public		high	1.200	http://www.ibau.de/kunden/meldung.php?nld=10004114 mup.r/www.soiaraniagen-portaruer/wordpress/internationaler-	
45	Media	Digital Press	solaranlagen-portal.de	SDE 2010 HFT	National	23.06.2009	Engineers, Public		high	990	wettbewerb-solar-decathlon-europe-2010	
16	Media	Digital Press	detail.de	SDE 2010 HFT	National	24.06.2009	Architects, Public		high	1.580	http://www.oetaix.de/community/biogsydser-biogs/womidingsoad- der-zukunft-mit-home	
17	Event	Presentation	Solar Decathlon Studentevent at the HFT Stuttgart	HFT, general information	Local	39990	HFT	500	medium	400	http://www.sdeurope.de/?lng=en&action=n ews&news=20090625	
8	Media	Printed press	Gerlinger Wochenblatt	process of project	Regional	25.06.2009	Public	Circulation:8.085	medium	310	090625_STW	Name of article: Wie wohnt ma der Zukunft?
9	Event	Fair	Consense Stuttgart	sustainability	National	2324.06.2009	Visitors	3.000	high	3.000	http://www.messe- stuttgart.de/cms/index.php?id=69546&L=1	
)	Event	Presentation	University Event	general information	Regional (Intern)	25.06.2009	HFT	500	medium	400	http://www.sdeurope.de/?ing=de&action=news&news=20090625	
1	Media	Digital Newsletter	Newsletter greenbuilding		National	07.08.2009	Engineers, Public		high	365	090807_newslettergreenbuilding	Name: eMail Newsletter with lit to article
2			Intelligente Architektur									Name of article: Solar Decathlo
	Media	Printed press	(XIA)	SDE 2010 HFT	National	07-08.2009	Engineers, Public	17.500	high	4.238	090701_XIA	Europe 2010
3	NA - di-	Driete de sesse	In a control of the DVV	d-4-11- d 1-6	National	07.00.0000	Carianas Dabia	0. 40 000	L:LL	5 500	00.04 (Name of article: Hochschule für Technik Stuttgart - Solar
	Media	Printed press	Ingenieurblatt für BW	detailed Information	National	07-08.2009	Engineers, Public	C: 48.380	high	5.520	09-04_Ingenieurblatt	Decathlon Europe 2010 Name of article: Der Sonne
1	Media	Printed press	greenbuilding	detailed Information	National	07-09.2009	Engineers, Public	C: 6.000	high	7.280	090807_greenbuilding	entgegen
5	Media	Digital Press	solarserver.de	general information	National	12.07.2009	engineers, Public		high	530	http://www.solarserver.de/solarmagazin/newsa2009m02.html	
6	Media	Digital Press	detail.de	SDE HFT Stuttgart	National	14.07.2009	Architects, Public		high	1.280	http://www.detail.de/artikel_solar-decathlon-europa- madrid_24122_De.htm	
,	Media	Digital Press	stuttgarter-zeitung.de	general information	Regional	15.07.2009	Public		medium	5.430	<u>v</u>	
3	Media	Digital Press	german-architects.com	detailed Information	National	15.07.2009	Architects, Public		high	2.300	http://www.magazin-world- architects.com/de 09 29 onlinemagazin sd de.html	
,	Media	Digital Press	dbz.de	detailed Information	National	15.07.2009	Architects, Public		high	2.470	http://www.dbz.de/artikel/dbz Wir wollen gewinnnen HFT Stuttg art_beim_Architekturwettbewerb_Solar_157672.html	
0	Media	Digital Press	hft-stuttgart.de	general information	HFT, National	16.07.2009	Intern, Public		high	620	http://www.hft- stuttgart.de/Aktuell/Rueckblick/2009/SolarDecathlon06_09/de	
1	Event	Presentation	VIP-Event at the Architectural Association Baden-Württemberg	general information	Regional	40007	Potential Sponsors, Politics, Scientifics	150	high	8.000	http://www.sdeurope.de/?lng=de&action=news&news=20090713	
2	Media	Printed press	Stuttgarter Zeitung	general information	Regional	15.07.2009	Public	Circulation: 441.643	medium	8.100	090715_STZ_Entdecken	Name of article: Ein Haus als (Kraftwerk
3	Media	Printed press	Staatsanzeiger	general information	Regional	17.07.2009	Public	Circulation: 15.215	medium	1.090	090717_staatsanzeiger1	Name of article: Eine Hochsch im Wettbewerbsfieber
1	Media	Printed press	Conno Wind 9 Märm-	SDE 2010 HFT	National	22.07.2000	Engineero Dublic	C: 20 212	high	5.830	000729 \$14/14/	Name of article: Solar Decatho 2010 erstmals in Europe
	iviedia	Printed press	Sonne, Wind & Wärme	3DE 2010 HF1	ivational	22.07.2009	Engineers, Public	C: 20.313	mgn	3.030	090728_SWW	2010 ersunais in Europe
	Media	Digital Press	fensterplatz.de	general information	National	24.07.2009	Engineers, Public		high	1.320	meset&Frame=Mainframe&Src=/fenster/fenster.nsf/0/606A78D789 23F1A9C12575F500425152?OpenDocument	
,	Media	Digital Press	arcguide.de	SDE HFT Stuttgart	National	05.08.2009	Architects, Public		high	630	090805_Arcguide	
			Sustainable Energy Technologies 2009			31.08-						
_	Event	Conference	Aachen	sustainability	National	03.09.2009	Visitors	5.000	high	2.000	090902_SET	Name of article: Wohnen von
9	Media	Printed press	horizonte	general information	National	01.09.2009	Engineers, Public	C: 19.965	high	24.450	090901_Horizonte 34	morgen schon heute - home+ Name of article: Wohnungsbar
_	Media	Printed press	Heldenheft	general information	Local	05.09.2009	Public	C: 10.000	medium	3.350	090904_Heldenheft	der Zukuft mit home+ Name of article: home+ - Unse
1	Media	Printed press	Stallgeflüster		Local	15.09.2009	HFT, Public	C: 3.000	medium	2.500	0909_stallgeflüster 32	Beitrag zum Solar Decathlon Europe 2010
2	Media	Digital Press	hft-stuttgart.de	Information about VIP Event	Regional	23.09.2009	Public		high	520	http://www.hft- stuttgart.de/Aktuell/Rueckblick/2009/SolarDecathlon0709/de	
3	Media	Printed press	Intelligente Architektur (XIA)	cooling systems	National	10-12.2009	Engineers, Public		high	2.500	091210 XIA	
4			Solar Summits 2009,								http://www.sdeurope.de/?lng=de&action=n	
	Event	Symposium	Freiburg Gebäudeintegrierte	solar technologies	International	1416.10.2009		500	high	1.000	ews&news=20091016	
5	_						I\/ioitoro	1.000	Ihiah	14 500	Plakat web	
5 6	Event	Exhibition	Solartechnik	solar technologies	National	40107	Visitors	1.000	high	1.500	http://www.hft-	

			European Symposium									
77			"90 Years Bauhaus - New challnges of the									
	Event	Symposium	european energy politics" , Bad Langensalza	new technologies	International	2728.10.2009	Visitors	1.000	high	1.500	Bauhaus_BadLangensalza1 , Bauhaus_BadLangensalza2	
78												
	Event	Symposium	Presentation at the Long	solar technologies	International	1112.11.2009	VISITORS	3.000	high	1.800	Programm_BauhausSOLAR_2009	
79	Event	Exibition	Night of Museums in Sindelfingen	general information	Regional	40131	Public	3.500	high	1.200	http://www.sdeurope.de/?lng=de&action=news&news=20091124	
80			Ü								http://www.sdeurope.de/?lng=de&action=n	
_	Event	Conference	Building Physics Meeting	energy concept	Regional	40133	Visitors	300	high	400	ews&news=20091127 091116 baunetzwissen Solar Decathlon	
81	Media	Digital Press	baunetzwissen.de	SDE 2010 HFT	National	16.11.2009	Public		high	980	Europe 2010	
82	Event	Presentation	Construction Engineer Day	building engineering	Regional (Intern)	23.11.2009	HFT Students	60	medium	0		
			Annual Conference Forschungsverbund									
83	E	0	Erneuerbare Energien		Matical	04 05 44 0000	Minister No. 200	500	Link.	500	004404 5\/55 - #	
	Event	Conference	(FVEE) 2009	sustainability	National	2425.11.2009	Visitors, No 300	500	high	500	091124_FVEE.pdf	
84	Event	Presentation	Deutsche Bank	SDE 2010 HFT	Regional	40142	Potential Sponsors, Politics, Scientifics	100	medium	2.000	http://www.sdeurope.de/?lng=de&action=news&news=20091125	
	LVEIII	i resentation		ODE 20101111	regional	40142	T Ontics, ocientinos	100	medium	2.000	ewsuriews=20031123	
			Project presentation at the BMWi - Federal									
85			Ministry of Economics and Technology in Berlin									
			together with all german								http://www.sdeurope.de/?lng=de&action=n	
	Event	Presentation	teams	general information	Intern	40144	team home +	120	high	0	ews&news=20091204	
86	Media	Digital Press	sonnenseite.de	general information	National	30.11.2009	Public Sponsors, Public,		high	735	081130_sonnenseite	Name: Newsletter 12/09 - Team
87	Media	Digital Newsletter	Newsletter SDE home+	Project Progess	Regional	01.12.2009	HFT		medium	1.300	Newsletter1	HFT Stuttgart
88	Media	Digital Press	bmwi.de	general information	National	04.12.2009	Public		high	840	http://www.bmwi.de/BMWi/Navigation/Presse/pressemitteilungen, did=322536.html	
89	Media	Digital Press	enob.info	general information	National	04.12.2009	Public		high	520	http://www.enob.info/de/news/news/details/solar-decathlon- europe-startschuss-fuer-madrid/	
90	Media	Digital Press	handwerkermarkt.de	general information	National	06.12.2009	Public		high	670	handwerker/handwerk-in-politik-offentlichkeit/solar-decathlon- europe-2010-fuer-architekten-und-ingenieure/	
91	Media	Digital Press	baulinks.de	general information	National	06.12.2009	architects, Public		high	1.250	http://www.baulinks.de/webplugin/2009/2082.php4?n	
92	Media	Digital Press	europaticker.de		National	07.12.2009	Public		high	590	europaticker.de	
93											europaticker.ue	
	Media	Digital Press	pressbot.net	general information Information about	National	07.12.2009	Public		high	620	http://www.pressbot.net/article_l_l_i,93711.html http://www.presseanzeiger.de/meldungen/umwelt-	
94	Media	Digital Press	presseanzeiger.de	Event BMWi Information about	National	07.12.2009	Public		high	600	energie/311967.php	
95	Media	Digital Press	fair-news.de	Event BMWi	National	07.12.2009	Public		high	595	news.de/news/Teilinehmer+des+Solar+Decathlon+Europe+zum+Ges pr%C3%A4ch+beim+BMWI/40845.html	
96	Media	Digital Press	prcenter.de	Information about Event BMWi	National	07.12.2009	Public		high	620	http://www.prcenter.de/Teilnehmer-des-Solar-Decathlon-Europe- zum-Gespreech-beim-BMWi.97506.html	
97	Media	Digital Press	pressbot.de	Information about Event BMWi	National	07.12.2009	Public		high	620	091207_pressbot	
98	Media	Printed press	Heldenheft	process of project	Local	01/2010	Public	C: 10.000	medium	3.350	Lay-1-HH0110-RZ 4 , Lay-1-HH0110-RZ 5	Name of article: Solar Decathlor Juni 2010
99	Media	Printed press	Intelligent Glass Solutions	SDE 2010 HFT	International	01/2010	Engineers, Public	not known	high	50.000	100401_IGS	Name of article:Solar Decathlon goes European
	wedia	mited piess	Coldions	SDL ZOTOTIFT	International	01/2010	Engineers, Fubile	HOURIOWIT	riigii	00.000	100401_100	Name of article: Wie könnte
100	Media	Printed press	Lift	general information	Local	01.01.2010	Public	C: 20.625	medium	3.130	lift	Wohnungsbau in Zukunft aussehen?
101	Event	Fair	DeuBau Essen	new technologies	National	1216.01.2010	Visitors	10.000	high	3.000	http://www.sdeurope.de/?lng=de&action=n ews&news=20100120	
												Name of article: Studierende der
102			Staatsanzeiger Baden-									Hochschule für Technik planen
	Media	Printed press	Württemberg	process of project	Regional	29.01.2010	Public	C: 15.215	medium	1.090	100129_press_staatsanzeiger	und bauen Solarhaus der Zukun Name: Newsletter der Fakultät
103	Media	Digital Newsletter	Newsletter HFT	process of project	National	01.02.2010	HFT, Public		medium	560	2010-02	Architektur und Gestaltung: 201 No 2
104		Ü										110 2
	Media	Printed Press	Panorama	Roofing Ceremony	National	02/2010	Public		high	670	1002_04-11_PANORAMA_Meldungen	
105	Media	Printed Press	Dach und Holzbau	General information	National	02/2010	Public	C: 18.024	high	4.835	1002_01_Editorial_dach+holzbau	

106											http://www.greendiary.com/entry/sustainable-houses-for-the-solar-	
	Media	Digital Press	greendiary.com	General Information general information	International	08.02.2010	Public		high	530	decathlon-europe-2010/	
107	Media	Digital Press	sonnenseite.de	SDE	National	17.02.2009	Public		high	50	090217_sonnenseite	
108	Media	Digital Press	focus.de	General Information	National	18.02.2010	Public		high	2.540	17273/solarwettbewerb-stuttgart-vom-winde- gekuehlt_aid_481054.html	
109	Event	Presentation	Presentation at the TU München	general information	Regional	40218	Students, Profs.	300	high	0	TU München_Picture	
				7. Süddeutsches								
110	Media	Printed press	Energie Kompakt	Energieberaterforu m in Feuchtwangen	National	15.02.2010	Construction Business, Public	C: 12.600	high	4.200	Energie Kompakt 1-10	
111											http://www.sdeurope.de/?lng=de&action=n	
	Event	Fair	Bautec Berlin Presentation at the TU	new technologies	National	1620.02.2010	Visitors	15.000	high	3.500	ews&news=20100216 http://www.sdeurope.de/?lng=de&action=n	
112	Event Media	Presentation	Delft	general information	_	40228	Students	300	high	0	ews&news=20100219	
114	iviedia	Digital Press	hft-stuttgart.de	Deubau Essen	National	24.02.2010	HFT, Public		high		stuttgart.de/Aktuell/Rueckblick/2010/SolarDecathlon1 2010/de http://www.sdeurope.de/?lng=de&action=n	
_	Event	Fair	CEP Stuttgart	new technologies	National	2527.02.2010	Visitors	6.000	high	500	ews&news=20100225	Name: Wettbewerbshaus home+
115	Media	Digital Newsletter	HFT press	Project Progress	National	01.03.2010	Public		high	560	100301_HFT	kommt nach Stuttgart Name of article: Reise zum Solar
116	Media	Printed press	Gebäude Energieberater	Fan Trip to Madrid	National	01.03.2010	Construction Business, Public	C: 12.013	high	9.662	geb_03-2010	Decathlon Europe
447												Name of article: Decathlon Wettbewerb - Das Team der
117	Media	Printed press	horizonte	Project Progress	National	01.03.2010	Construction Business, Public	C: 19.965	high	970	horizonte März 2010	Hochschule für Technik Stuttgart kommt voran
118			bine.info	General Information							http://www.bine.info/hauptnavigation/publikationen/news/news/s	
	Media	Digital Press	12. Anwenderforum	SDE	National	02.03.2010	Public		high	1.110	olar-decathlon-europe/?artikel=3522	
119			Gebäudeintegrierte Photovoltaik, Kloster									
	Event	Forum	Banz	solar technologies General Information	National	40239	Visitors	250	high	500	GIPV_Picture	
120	Media	Digital Press	energieportal.de	SDE	National	03.03.2010	Public		high	140	100303_energieportal	N. C. C. L. ME I. L.
121	Media	Printed press	Stallgeflüster	Project Progress	Local	15.03.2010	HFT, Public	C:3.000	medium	2.500	1003_stallgeflüster 33	Name of article: Wir haben mit dem Bau von home+ begonnen!
122	Media	Digital Press	detail.de	General Information SDE	National	26.03.2010 (accessed)	architects, Public		high	1.060	http://www.detail.de/artikel_solar-decathlon-europa- madrid_24122_De.htm	
123	Media	Digital Press	baunetz.de	SDE 2010 HFT	National	29.03.2010	architects, Public		high	380	Imp.//www.baunetz.de/termine/Surar_becaunion_nome987289.i Iml	
124	Media	Digital Press	stuttgarter- nachrichten.de	SDE 2010 HFT	Regional	30.03.2010	Public		high	1.030	http://www.stuttgarter-nachrichten.de/inhalt.schoener-wohnen-im- kraftwerk.4d70eada-558e-45c2-9ad6-2357259a55d9.html	
125	Media	Printed press	Stuttgarter Nachrichten	general information	Regional	30.03.2010	Public	C: 441.643	medium	22.500	100330_Stuttgarter_Nachrichten	
126												Name of article: Hightechhaus ha
	Media	Printed press	Stuttgarter Zeitung	process of project	Regional	30.03.2010	Public	C: 441.643	medium	22.500	100330_press_stuttgarterzeitung	Energie im Überschuss
127	Media	Printed Press	Bine Informationsdienst	SDE 2010 HFT	National	04/10	Public	C: 10.000	medium	2.500	bine_info_0410	
128	Media	Digital Press	hft-stuttgart.de Intelligente Architektur	Project Progress Building	National	01.04.2010	Public		high	560	http://www.hft- stuttgart.de/Aktuell/Rueckblick/2010/SolarDecathlonSS10-1/de	
129	Media	Printed press	(XIA)	Performance	National	04-05.2010	Engineers, Public	C: 17.500	high	6.331	100301_XIA	
130	Media	Digital Press	ais-online.de	General Information SDE	National	12.04.2010	Public		high	830	http://www.ais-online.de/solar-decathlon-wird-erstmals-in-europa- ausgelobt-21497/neuheit.html	
131	Media	Digital Press	dailynet.de	Information about Presentation	National	12.04.2010	Public		high	240	http://www.dailynet.de/BauHandwerkWohnen/71664.php	
132	Media	Digital Press	pr-inside.de	Information about Presentation	National	12.04.2010	Public		high	200		
133				Information about							http://www.pr-inside.de/de/print1824885.htm	
	Media	Digital Press	firmenpresse.de	Presentation Information about	National	13.04.2010	Public		high	230	http://www.firmenpresse.de/print-pressinfo188082.htm	
134	Media	Digital Press	inar.de	Presentation	National	13.04.2010	Public		high	200	100413_inar	
135	Event	Lecture	University Lecture	general information	Local (Intern)	40282	HFT Students	120	medium	0		
136												Name of article: Hochschule such
130	Media	Printed press	Staatsanzeiger Baden- Württemberg	process of project	Regional	16.04.2010	Public	C: 15.215	medium	2.000	Staatsanzeiger 160410_Solar Decathlon_Standortsuche	Standort für das Wettbewerb des Solar Decathlon
137	Event	Presentation	Presentation at the FH Technikum Vienna	general information		40284	Students	450	high	0	http://www.sdeurope.de/?lng=de&action=n ews&news=20100416	
	LVOIL	. Accordation	Presentation at Haus		risgional	.0201	Cladonio	.50	- ngri			
138	Event	Fair	Stuttgart	building engineering	National	40285	Visitors	300	high	600	http://www.sdeurope.de/?lng=de&action=n ews&news=20100417	
139			Roofing Ceremony at the HFT Stuttgart and				Potential Sponsors,				http://www.sdeurope.de/?lng=de&action=n	
.55	Event	Ceremony		home+ project	Regional	40288	Politics, Scientifics	400	high	2.400	ews&news=20100420#	

140	Media	Digital Press	energie-experten.org	SDE 2010 HFT	National	20.04.2010	Public		high	360	energieturm-am-solar-decathlon-europe-2010-teil-523.html	
141		,	<u> </u>						3			Name of article: Solarhaus geht i den Zehnkampf. Richtfest: Architekturstudenten der Hochschule haben ein Energiesparhaus der Extraklasse
	Media	Printed press	Stuttgarter Zeitung	Roofing Ceremonys	Regional	21.04.2010		441.643	medium	22.500	Stuttgarter_Zeitung_21.4.2010_Richtfest	ausgetüftelt. Name of article: Haus mit
142	Media	Printed press	Leonberger Kreiszeitung	general information	Regional	21.04.2010	Public	C: 18014	medium	4.600	100421_Leonberger Kreiszeitung	Solarenergie
143				Roofing Ceremony-							http://www.stuttgarter-zeitung.de/stz/page/2461187_0_2147	
	Media	Digital Press	stuttgarter-zeitung.de	Internet Version	Regional	21.04.2010	Public		medium	2.400	<u>solarhaus-geht-in-den-zehnkampf.html</u>	
144	Media	Digital Press	energate.com	Roofing Ceremony	National	21.04.2010	Public		medium	480	www.energate.com/index.php?id=56&no_cache=1&tx_ttnews[tt_n ews]=83&tx_ttnews[backPid]=23&cHash=2a702bcda1_	
145	Media	Printed press	Sonnenenergie	General Information SDE	National	22.04.2010	Engineers, Public	C: 12.500	high	2.400	100301_Sonnenenergie	Name of article: Teil 1:Solar Decathlon Europe 2010
146	Media	Digital Press	swr.de	General Information	National	22.04.2010	Public		high	1.240	no more available	
147	Media	Digital press	sonnenenergie.de	SDE 2010 HFT	National	23.04.2010	Public		high	650	http://dastelle.somenenengie.de/index.php/id=sosnio_tache=180 x_threws[tr_news]=23	
148			Guided Tour "in situ" for								http://www.sdeurope.de/?lng=de&action=n	
140	Event	Guided Tour	Solarkreis Leonberg	home+	Regional	40291	Visitors, No 25	25	medium	400	ews&news=20100423	Name of articles Tail O. Calar
149	Media	Printed Press	Sonnenenergie	Photovoltaik	National	23.04.2010	Construction Business, Public	C: 12.500	high	2.400	100328_Sonnenenergie	Name of article: Teil 2: Solar Decathlon Europe 2010
150	Media	Digital press	dbz.de	SDE 2010 HFT	National	27.04.2010	architects, Public		high	3.600	Energiehaus der HFT Stuttgart Beim Wettbewerb fuer 898768.h tml	
151	Media	Digital press	hft-stuttgart.de	Roofing Ceremony	HFT, National	28.04.2010	HFT, Public		medium	560	http://www.hft-stuttgart.de/News/solardecathlon-richtfest/de_	
152			Open Day and Guided Tour for interested		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
	Event	Guided Tour	groups	home+	Regional	40298	Visitors	120	high	400		
153			EXPO 2010 in Shanghai, Filmpresentation oh home+ at the stand of Baden-Württember			01.05					http://www.wm.baden-	
	Event	Worldwide EXPO	(Germany)	general information	International	31.10.2010	Visitors	5000	high	1.000	wuerttemberg.de/sixcms/detail.php/230061	
154	Media	Digital press	detail.de	SDE 2010 HFT	National	02.05.2010 (accessed)	architects, Public		high	5.600	100112 detail	
155	Media	Digital press	vi.sualize.us	General Information SDE	International	02.05.2010 (accessed)	Public		high	140	http://vi.sualize.us/eco_oficina/solar%20houses/?page=2_	
156	Media	Digital press	detail.de	Project Progress	National	02.05.2010 (accessed)	architects, Public		high	630	http://www.detailx.de/hochschulen/hochschulnews/archiv/fortschr tt-der-projekte-zum-solar-decathlon/	-
157	Media	Digital press	kopenhagen.diplo.de	SDE 2010 HFT	National	02.05.2010 (accessed)	Public		high	540	nergie Klima/seite solar decathlon europe madrid 2010.h tml	
158	Media	Digital press	magazin-world- architects.com	SDE 2010 HFT	International	02.05.2010 (accessed)	architects, Public		high	2.300	http://www.magazin-world- architects.com/de 09 29 onlinemagazin sd de.html	
159			greenbuilding-			02.05.2010					http://greenbuilding-planning-schiele-	
160	Media		planning.de	SDE 2010 HFT	National	(accessed) 02.05.2010	Engineers, Public Construction		high	230	schoen.de/a14424/Solar Decathlon Europe 2010.html http://www.nemze.de/nbo/stypio_dozyobio_drzzssiyinodule_1271 /modulePageID_1/context_1/solar-decathlon-wird-erstmals-in-	
100	Media	Digital press	heinze.de	SDE 2010 HFT	National	(accessed)	Business, Public		high	250	europa-ausgelobt.html	
161	Media	Printed Press	Bauen mit Holz	Detailed Information SDE	National	05/2010	Construction Business, Public	C: 9.000	high	4.740	sde-Beiträge-bmh-05-2010	
162	Media	Digital press	welt.de	General Information SDE	National	02.05.2010	Public		high	270	http://www.welt.de/die-welt/wirtschaft/article7429078/Die- naechste-Solar-Generation-tritt-an.html	
163	Media		akbw.de	SDE 2010 HFT	National	02.05.2010 (accessed)	architects, Public		high	820	http://www.akbw.de/service/wohnungsbau-der- zukunft/artikel 5062.htm	
164	Media		bine.info	General Information SDE	National	20.05.2010 (accessed)	Public		high	385	100520 projektinfos.pdf	
165	Media	Digital press	licht-und-architektur.de	SDE 2010 HFT	National	02.05.2010 (accessed)	architects, Public		high	785	architektur.de/news/lat Wohnungsbau der Zukunft mit HOME 144610.html	
166			solardecathlon.tu-	General Information		02.05.2010					darmstadt.de/solardecathlon09070909/sdeurope/landingpagesdeur	
167	Media	Digital press	darmstadt.de	SDE	National	(accessed)	architects, Public		high	450	ope de jsp	
107	Media	Printed Press	Enbausan	process of project	National	05.05.2010	architects, Public		high	1.020	100505 enbausan	

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	1				Sighart Schmid,							
	1				president of the							
	4				architects							
168	1				chamber of							
	1				Baden-							
	1				Württemberg							
	1		Visit of President of		and Verein der						http://www.sdeurope.de/?lng=de&action=n	In the ocassion of a Guided Tour
	Event	Guided Tour	architects chamber	home+	Freunde	11.05.2010	Public	50	high	500	ews&news=20100510	to "Verein der Freunde"
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169	1		construction Stanicki		construction						http://www.sdeurope.de/?lng=de&action=n	
103	Event	Guided Tour	from Schorndorf	home+	Stanicki	11.05.2010	Public	30	medium	500	ews&news=20100511	
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170	Event	Guided Tour	delegation of Marocco	home+	Marocco	12.05.2010	Public	12	medium	0	ews&news=20100512	
			and games of the same of the s							-		
171							Construction					
	Media	Printed Press	Xia	Building Envelopes	National	12.05.2010	Business, Public	C: 17.500	high	6.331	xia71.pdf	
470				General Information		20.05.2010					http://www.architekten24.de/news/umweltschutz_energie/12592-	
172	Media	Digital Press	architekten24.de	SDE	National	(accessed)	architects, Public		high	580	solar-decathlon-europe-2010/index.html	
172						20.05.2010						
173	Media	Digital press	baden-wuerttemberg.de	home+	National	(accessed)	Public		medium	200	http://www.wm.baden-wuerttemberg.de/sixcms/detail.php/230061	
				Contribution to the							http://www.wm.baden-	
174				EXPO Shangai		20.05.2010					wuerttemberg.de/baden-wuerttemberg-auf-	
	Event	Exhibition	baden-wuerttemberg.de	2010	National	(accessed)	Public	5.000	high	2.000	der-expo-2010/230066.html	
175	Modio	Digital Press	architekton 24 da	General Information	National	14.05.2040	architagte Dublic		high	630		
	Media	Digital Press	architekten 24.de	General information	rvational	14.05.2010	architects, Public		high	030	100514_architekten24	
176												
110	Media	Digital Press	dbz.de	General Information	National	14.05.2010	architects, Public		high	3.280	Deutsche BauZeitschrift	
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177	Media	Digital press	dabonline.de	General Information	National	26.05.2010	architects, Public		medium	1.045	Zehnkampf » Print	
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178								Pagevisits per day				
				Support from				(numbers from			http://www.f-	
	Media	Press Portal *	f-tor.de	sunways	National	27.05.2010	Public	editorial): 16.427	high	860	tor.de/ftor/news_ots.php?do=detail&NEWS_ID=119143	
179				Support from				Pagevisits per day			http://www.sharewise.com/finanznachrichten/23159-Hochschule-	
	Media	Press Portal *	sharewise.com	sunways	International	27.05.2010	Public	2.649	medium	840	obs- Bau	
180				Support from				Pagevisits per day:			http://www.stock-world.de/nachrichten/aktuell/Sunways-foerdert-	
	Media	Press Portal *	stock-world.de	sunways	National	27.05.2010	Public	5.119	high	780	Einsatz-von-gebaeudeintegrierter-n3413172.html	
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181							Public; Pagevisits per	Pagevisits per day			http://www.wallstreet-online.de/nachrichten/nachricht/2956474-	
		D D *	and the second s	Support from	No. of Contract	27.05.2040	day (numbers from editorial): 122.662	(numbers from		2 700	sunways-foerdert-den-einsatz-von-gebaeudeintegrierter-	
	Media	Press Portal *	wallstreet-online.de	sunways	National	27.05.2010	euitoriai). 122.002	editorial): 122.662	high	3.700	photovoltaik-mit-bild.html	
182				Support from								
	Media	Press Portal *	city-xxl.com	sunways	National	27.05.2010	Public		high	780	http://www.city-xxl.com/d1;news;0;3001620795_10.htm	
183				Support from				Pagevisits per day:				
	Media	Press Portal *	photovoltaik-guide.de	sunways	National	27.05.2010	Public	986	medium	680	http://www.photovoltaik-guide.de/sunways-foerdert-den-einsatz- von-gebaeudeintegrierter-photovoltaik-10739	
	ivicula	r ress r Urtal	priotovoitaix-guide.de	Support from	Hational	27.03.2010	T dolla		medium	000	http://www.stockwateri.de/news/20100327-1445/5unways-	
184	Media	Press Portal *	stockwatch.de		National	27.05.2010	Public	Pagevisits per day: 3.285	medium	650	f%C3%B6rdert-den-Einsatz-von-geb%C3%A4udeintegrierter-	
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185	Media	Dross Dortel *	finanznachrichten de	Support from	National	27.05.2040	Public	Pagevisits per day: 110.927	high	3.500	sunways-foerdert-den-einsatz-von-gebaeudeintegrierter-	
	iviedia	Press Portal *	finanznachrichten.de	sunways	National	27.05.2010	rublic		high	3.300	photovoltaik-mit-bild-007.htm	
186			nowe und transfer de	Support from		27.05.2615	D. 1.12	Pagevisits per day:	modium:	CEO		
	Media	Press Portal *	news-und-trends.de	sunways	National	27.05.2010	Public	1.478	medium	650	http://www.news-und-trends.de/newsfeed.php?id=2661620795	
187			processorial de	Support from		27.05.2616	B 1.0	Pagevisits per day:	high	700		
	Media	Press Portal *	presseportal.de	sunways	National	27.05.2010	Public	6.406	high	780	http://www.presseportal.de/pm/57666/1620795/sunways_ag/rss_	
			are a	Support from				Pagevisits per day:		700		
188		Press Portal *	flife.de	sunways	National	27.05.2010	Public	3.945	medium	760	http://www.flife.de/cmp_nws.php?nws_id=1001915852	
188	Media	riess ruitai						Pagevisits per day:				
188			ti-l ti-l	Support from					Line .	7 700		
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189	Media	Press Portal *		sunways Support from				763.163 Pagevisits per day:			http://www.ptext.de/pressemitteilung/sunways-foerdert-einsatz-	
_	Media		newsticker.welt.de	sunways Support from sunways	National National	27.05.2010 27.05.2010	Public Public	763.163 Pagevisits per day: 559		7.700 790		
189	Media Media	Press Portal * Press Portal *	ptext.de	sunways Support from sunways Support from	National	27.05.2010	Public	763.163 Pagevisits per day: 559 Pagevisits per day:	low	790	http://www.ptext.de/pressemittellung/sunways-foordert-einsatz- gebaeideintegrierter-photovoltaik-bild-7.8958 http://www.boerse-po.de/nachricht/sunways-foordert-den-Einsatz-	
189	Media	Press Portal *		sunways Support from sunways Support from sunways				763.163 Pagevisits per day: 559 Pagevisits per day: 13.470			http://www.ptest.de/pressemittellung/sunways-foerdert-einsatz- gebæudeintegrerter-photovorbalk-bild-74958 http://www.boerse-po.de/rachricht/Sunways-foerdert-den-Einsatz- von-gebæudeintegrierter-Protovorbalk-mit-Bild-22180093-0229-htm	
189 190 191	Media Media Media	Press Portal * Press Portal * Press Portal *	ptext.de boersetogo.de	sunways Support from sunways Support from sunways Support from Support from	National National	27.05.2010 27.05.2010	Public Public	763.163 Pagevisits per day: 559 Pagevisits per day: 13.470 Pagevisits per day:	low high	790 670	http://www.ctext.de/pressensitellung/sunsays-foerdert-einsatz- gebassdeintegrierter-photovoltaik-bild-7,8558 http://www.boerse-po.de/nachricht/Sunsays-foerdert-der-Einsatz- gon-pobassdeintegrierte-Photovoltaik-mit-Bild-2,118009-9228 http: pobassdeintegrierte-Photovoltaik-mit-Bild-2,118009-9228 http:	
189	Media Media	Press Portal * Press Portal *	ptext.de	sunways Support from sunways Support from sunways	National	27.05.2010	Public	763.163 Pagevisits per day: 559 Pagevisits per day: 13.470	low	790	http://www.ptest.de/pressemittellung/sunways-foerdert-einsatz- gebæudeintegrerter-photovorbalk-bild-74958 http://www.boerse-po.de/rachricht/Sunways-foerdert-den-Einsatz- von-gebæudeintegrierter-Protovorbalk-mit-Bild-22180093-0229-htm	
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189 190 191 192 193	Media Media Media Media Media Media Media	Press Portal *	ptext.de boersetogo.de finanznachrichten.de news-buzz.de	sunways Support from sunways	National National National	27.05.2010 27.05.2010 27.05.2010 27.05.2010	Public Public Public	763.163 Pagevisits per day: 559 Pagevisits per day: 13.470 Pagevisits per day: 110.927 Pagevisits per day:	low high high	790 670 3.500 780	http://www.stext.de/pressentite/hand/aureaus.berders.dimati- gebeside-integrier ter photopostals 364.78658. http://www.berne.go.de/nachricht/berness-foorders.den.Eusatz- berness-berness-foorders.den.Eusatz- berness-berness-foorders.den.Eusatz- berness-berness-foorders-foorders-foorders-foorders-foorders- ter-foorders-foorders-foorders-foorders-foorders-foorders-foorders- -foodders-foorders-foorders-foorders-foorders-foorders-foorders- -foodders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foorders-foodders-foo	

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196	Media	Press Portal *	goyax.de	Support from sunways	National	27.05.2010	Public		high	730	http://www.goyax.de/nachricht/sunways-foerdert-den-einsatz-von-
	ivieula	riess roitai	goyax.de	Support from	Ivational	27.03.2010	rublic		riigii	730	gebaeudeintegrierter-photovoltaik-mit-bild 682021
197	Media	Press Portal*	stromkosten.de	sunways	National	27.05.2010	Public		high	780	http://www.stromkosten-senken.de/detail.php?id=198160
				Support from				Pagevisits per day:	ű		
198	Media	Press Portal*	presseecho.de	sunways	National	27.05.2010	Public	6.571	high	720	http://www.presseecho.de/wirtschaft/NA3731620795.htm
199				Support from							
133	Media	Press Portal*	boerse.welt.de	sunways	National	27.05.2010	Public		high	740	http://boerse.welt.de/news_detail.asp?pkNewsNr=1050504
200				Support from							http://appl.abendblatt.de/newsticker2/index.php?channel=all&fram
	Media	Press Portal*	appl.abendblatt.de	sunways	National	27.05.2010	Public		high	620	e=0&module=finanzen&id=1050504
201	Madia	Droop Dortol*	processortal ab	Support from		27.05.2040	0.13	Pagevisits per day:	hiab	1.030	http://www.presseportal.ch/de/pm/100005091/100604362/sunway
	Media	Press Portal*	presseportal.ch	sunways	International	27.05.2010	Public	8.481	high	1.030	5 88
202	Media	Press Portal*	finanzen.net	Support from sunways	National	27.05.2010	Public	Pagevisits per day: 284.227	high	4.970	http://www.finanzen.net/nachricht/aktien/Sunways-foerdert-den- Einsatz-von-gebaeudeintegrierter-Photovolitalik-mit-Bild-801738
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203	Media	Press Portal*	flife.de	sunways	National	27.05.2010	Public	3.945	high	870	http://www.flife.de/cmp_nwso.php?nws_id=10019158528.cmp_id=
204				Support from							http://www.direktbroker.de/news-
204	Media	Press Portal*	direktbroker.de	sunways	National	27.05.2010	Public		high	940	kurse/details/Marktberichte/Sunways+fördert+den+E/21346592
205				Support from				Pagevisits per day:			http://www.f-
	Media	Press Portal*	f-tor.de	sunways	National	27.05.2010	Public	16.427	high	680	tor.de/ftor/news_ots.php?do=detail&NEWS_ID=119143
206	Maratta	Deser Destalt	-1	Support from				Pagevisits per day:		070	http://www.sharewise.com/finanznachrichten/23159-Hochschule_
	Media	Press Portal*	sharewise.com	sunways	National	27.05.2010	Public	2.649	medium	670	<u>obs- Rau</u>
207	Media	Press Portal*	stock-world.de	Support from sunways	National	27.05.2010	Public	Pagevisits per day: 5.119	high	870	http://www.stock-world.de/nachrichten/aktuell/Sunways-foerdert_ Einsatz-von-gebaeudeintegrierter-n3413172.html
			T. Dit World. do	Support from		27.03.2010	. done	Pagevisits per day:	9		ITLID://www.waiistreer-online.de/fractinicitien/nactinicity/2956474-
208	Media	Press Portal*	wallstreet-online.de	sunways	National	27.05.2010	Public	122.662	high	4.800	sunways-foerdert-den-einsatz-von-gebaeudeintegrierter- photovoltaik-mit-bild.html
				Support from							
209	Media	Press Portal*	citiy-xxl.com	sunways	National	27.05.2010	Public		high	890	http://www.city-xxl.com/d1;news;0;3001620795_10.htm
210				Support from				Pagevisits per day:			http://www.photovoltaik-guide.de/sunways-foerdert-den-einsatz-
210	Media	Press Portal*	photovoltaik-guide.de	sunways	National	27.05.2010	Public	986	low	820	von-gebaeudeintegrierter-photovoltaik-10739
211		D D 1 15		Support from							http://www.direktbroker.de/news-
	Media	Press Portal*	direktbroker.de	sunways	National	27.05.2010	Public	December 1971	high	780	kurse/details/Marktberichte/Sunways+fördert+den+E/21346592 http://www.stockwatch.de/news-zo100527-1449-5unways-
212	Media	Press Portal*	stockwatch do	Support from	National	27.05.2010	Public	Pagevisits per dayr: 3.285	high	780	18C3WB6rdert-energinsstz-von-gebWC3WA4udeintegrierter-
	ivieuia	FIESS FUILAI	stockwatch.de	sunways Support from	Ivational	27.03.2010	Public	Pagevisits per day:	riigii	760	Photovoltaik-%28mit-8ild%29.html http://www.imaniznat.micriten.ce/nacimicnien-zo10-us/17/000874-
213	Media	Press Portal*	finanznachrichten.de	sunways	National	27.05.2010	Public	110.927	high	3.500	sunways-foerdert-den-einsatz-von-gebaeudeintegrierter- photovoltaik-mit-bild-007.htm
				Support from	- Tational	27.03.2010	- done	Pagevisits per day:	···g··		
214	Media	Press Portal*	new-und-trends.de	sunways	National	27.05.2010	Public	1.478	high	870	http://www.news-und-trends.de/newsfeed.php?id=2661620795
245				Support from				Pagevisits per day:			
215	Media	Press Portal*	presseportal-de.	sunways	National	27.05.2010	Public	6.406	high	690	http://www.presseportal.de/pm/57666/1620795/sunways_ag/rss
216				Support from				Pagevisits per day:			
	Media	Press Portal*	newsticker.welt.de	sunways	National	27.05.2010	Public	763.163	high	7.600	http://newsticker.welt.de/index.php?module=finanzen&id=1050504
217	Media	Droop Dortol*		Support from	Matina	27.05.2010	D. J. II.	Pagevisits per day:	low	810	http://www.ptext.de/pressemitteilung/sunways-foerdert-einsatz-
	ivieuia	Press Portal*	ptext.de	sunways Support from	National	27.05.2010	Public	555	low	810	gebaeudeintegrierter-photovoltaik-bild-74958
218	Media	Press Portal*	boerse-go.de	Support from sunways	National	27.05.2010	Public	Pagevisits per day: 13.470	high	810	http://www.boerse-go.de/nachricht/Sunways-foerdert-den-Einsatz- von-gebaeudeintegrierter-Photovoltaik-mit-Bild,a2186009,b229.html
	Modia	1 1000 1 01101	bocise go.de	Support from	National	27.03.2010	T dblic	Pagevisits per day:	g	010	mtp://www.iinanznacimcitien.ue/nacimcitien-zo10-us/17007018-
219	Media	Press Portal*	finanznachrichten.de	sunways	National	27.05.2010	Public	110.927	high	4.500	sunways-foerdert-den-einsatz-von-gebaeudeintegrierter- photovoltaik-mit-bild-006.htm
220				Support from							
220	Media	Press Portal*	newsbuzz.de	sunways	National	27.05.2010	Public		high	650	http://www.newsbuzz.de/node/88056
											http://www.aktien-
221				Support from				Pagevisits per day:			meldungen.de/Nachrichten/Nachrichtendienste/news- aktuell/Sunways-foerdert-den-Einsatz-von-gebaeudeintegrierter-
	Media	Press Portal*	aktien-meldungen.de	sunways	National	27.05.2010	Public	2.300	medium	690	Photovoltaik-mit-Bild-7959341
222	Marilla	D D 1*		Support from		27.05.2612	0.14	Pagevisits per day:	L. I. L.	620	http://www.cityvisits.de/index.cfm/Deutschland/News/0/0/1/31716
	Media	Press Portal*	cityvisits.de	sunways	National	27.05.2010	Public	8.706	high	620	20795/
223	Media	Press Portal*	goyax.de	Support from sunways	National	27.05.2010	Public		high	720	http://www.goyax.de/nachricht/sunways-foerdert-den-einsatz-von- gebaeudeintegrierter-photovoltaik-mit-bild_682021
	cuia	030 1 0101	goyan.uc	Support from	INGGOTIAL	27.03.2010	Tublic		9"	720	20000000000000000000000000000000000000
224	Media	Press Portal*	stromkosten-senken.de	sunways	National	27.05.2010	Public		high	590	http://www.stromkosten-senken.de/detail.php?id=198160
225				Support from				Pagevisits per day:			
	Media	Press Portal*	presseecho.de	sunways	National	27.05.2010	Public	6.571	high	690	http://www.presseecho.de/wirtschaft/NA3731620795.htm
226				Support from							
220	Media	Press Portal*	boerse.welt.de	sunways	National	27.05.2010	Public		high	910	http://boerse.welt.de/news_detail.asp?pkNewsNr=1050504_
227	Madia	Droop Dortals		Support from		27.05.2612	0.15		high	050	http://appl.abendblatt.de/newsticker2/index.php?channel=all&fram
	Media	Press Portal*	abendblatt.de	sunways	National	27.05.2010	Public		high	850	<u>e=0&module=finanzen&id=1050504</u>
228				Cupport from				Dagovisite			
226	Media	Press Portal*	presseportal.ch	Support from	International	27.05.2010	Public	Pagevisits per day: 8.481	high	1.100	http://www.presseportal.ch/de/pm/100005091/100604362/sunway
	ivieula	i iess Fullai	presseportal.cn	sunways Support from	mternational	27.03.2010	r ublic	Pagevisits per day:	mgn	1.100	
229	Media	Press Portal*	finanzen.net	sunways	National	27.05.2010	Public	284.227	high	2.670	http://www.finanzen.net/nachricht/aktien/Sunways-foerdert-den- Einsatz-von-gebaeudeintegrierter-Photovoltalik-mit-Bild-801738
000				Support from				Pagevisits per day:			
230	Media	Press Portal*	flife.de	sunways	National	27.05.2010	Public	3.945	medium	820	http://www.flife.de/cmp_nwso.php?nws_id=1001915852&cmp_id=

004				Support from				Pagevisits per day:				
231	Media	Press Portal*	www.solarserver.de	sunways	National	28.05.2010	Public	164.271	high	4.800	http://www.solarserver.de/news/news-12780.html	
232	Media	Press Portal*	www.oekonews.at	Support from sunways	National	28.05.2010	Public		high	630	http://www.oekonews.at/index.php?mdoc_id=1050665	
233	Media	Press Portal*	sonnenseite.com	Support from	Netices	21.05.2010	Dublic	Pagevisits per day: 841	low	300	http://www.sonnenseite.com/Aktuelle+News,Gebaeudeintegrierte+	
234				sunways	National	31.05.2010	Public	841	low		Photovoltaik+macht+Sinn,6,a16037.html	
.54	Media	Press Portal*	suelosolar.es	Interview	International	31.05.2010	ca. 20 000 persons		high	1.100	http://www.suelosolar.es/newsolares/newsol.asp?id=2507	Name of article: Studierende
235												präsentieren für den Solar
	Media	Printed Press	DETAIL	SDE 2010 HFT	National	06/10	architects, Public Construction	C: 35.297	high to be	6.110	1006_570_Ber_Buech_Auss_Cremers	Decathlon
236	Media	Printed Press	OTTOChemie magazin	SDE 2010 HFT	National	planned 09/10	Business, Public		published		OTTprofil10_HFTStuttgart_100531_2	
237	Media	Drinted proce	Campushunter	ganaral information	Local	04.06.2040	Public	C: 20.000	medium	5.180	Compusibilitari 006	orticle pending
	Media	Printed press	Campusnunter	general information	Local	01.06.2010	Public	C: 20.000	medium	5.180	Campushunter1006	article pending
38	Media	Radio	home+ on air!	Interview	Regional	01.12.2009	Public		medium	500	http://www.sdeurope.de/?lng=de&action=news&news=20091201	
39	Media	Printed Press and Digital Press	eta green	SDE 2010 HFT	National	04/10	Public, Professionals		high		04.10 solar decathlon europe.pdf	'home+, Innovationen für hohe Wohnkomfort'
	Would	and Bigitair 1000	ota groon	052 2010 111 1	reaction	0 1/10	r delie, r rereceiendie		riigi.		o mro_colar accamien carope.par	On the Earth's Day (22nd April
												2010= the german TV channel SWR Baden-Württemberg has
40												broadcasted a ummary of our
												roofing ceremony on the 20th A 2010 and also about the SDE
											http://www.swr.de/landesschau-bw/- /id=122182/did=6288436/pv=video/nid=122182/jn44rx/index.l	competition and out project
	Media	Television	Landesschau	Reportage	National	22.04.2010	Public		high	8.000	ml	home+.
41	Media	Metro-TV	Wettbewerb:HFT dabei!	General Information	Regional	April 2009	Public		high	1.200	http://www.sdeurope.de/?ing=de&action=news&news=20090720	
												Covers on trucks during the
												transport to Madrid with printed
42					pedestrins and							logos of the Sde and home+ a
				Logos and websites	car drivers along the way to						truckcover1, truckcover1, truckcover3,	websites, so that they will be so from cars and by pedestrians
	Advertiseme	n Truck covering	Truck covering	of the event	Madrid	May/June 2010	Public		high	2.400	truckcover4	along the way to Spain
43	Media	Digital press	StudyGuide.de	SDE 2010 HFT	National	02.06.2010	Students, Public		medium	320	http://inxmail.bw- i.net/inxmail/html mail.jsp?params=68111+newsletter%40st	
44	Media		4-4-11 4-	Detailed Information	Nedersel		Dubli-		Link.	3.450		
	Media	Digital press	detail.de	Detailed Information	National	03.06.2010	architects, Public		high	3.450	DETAIL.de 20100603 http://www.schiele-	
245	Media	Digital press	greenbuilding.de ipe-Kolloquium	Detailed Information Simulation von	National	04.07.2010	Scientifics, Public		high	2.890	schoen.de/schieleschoendata/files/divers/originals/gb 06-10 12.pd	
246	Event	Presentation	University Stuttgart	Photovoltaik	Regional	07.06.2010	Scientifics	340	medium	500		
247	Media	Television	Nano - Scientific			28.06.2010	Public		high	6.000	to be published	
	modia	10101101011			all visitors and	20.00.2010			riigi.	0.000	to be publicated	A Live Stream of Madrid will be
248	Media	Live Stream	Live Stream of SDE competition	Competition in Madrid	students of the HFT	June 2010	Public		medium	10.000	no link as it was a Live Stream	sent and shown on monitors at HFT during the competition
	Ividula	Live Otteam	Compounding	Madrid		00110 2010	1 dbilo		mediam	10.000	no mix as it was a live stream	
49	Media	Printed Press	Heldenheft	SDE 2010 HFT	Regional	June 2010	Public, Students		medium		Juni_Heldenheft-2-10-Solar-Decathlon.pdf	Name of article: Stuttgarter Tea auf dem Weg nach Madrid
	ivieuia	Fillited Fless		3DE 2010 HF1	Regional	Julie 2010	Fublic, Students		medium		Juni_neldennen-2-10-30lar-Decatilion.pur	Name of article: Solar Decathle
250	Media	Printed Press	XIA	SDE 2010 HFT	National	07-09/10	Public, professionals		high		pending	Europe entschieden
251	Media	Printed and Digital press	Espacio&Confort	SDE 2010	International	07-09/10	Public, professionals		high		http://www.espacioyconfort.com.ar/Medio- Ambiente/decatlon-solar-europa.html	Name of article: Decatlón Sola Europa
		, , , , ,									http://www.neues-	
252		Printed and									deutschland.de/artikel/174634.heisser- draht-zur-sonne.html?sstr=solarhaus-	
	Media	Digital press	NEUE DEUTSCHLAND	SDE 2010	National	06.07.2010	Public		high		weltmeisterschaft	Name of article: Heißer Draht
253												Name of article: Das kleine schwarze/Solarhaus-
	Media	Printed Press	Holz- & Ökohäuser	SDE 2010	National	2010/11	Public		medium		holz&öko.pdf	Weltmeisterschaft
												Name of article: 'Solar-Decathl
254												2010, Bauen für die Zukunft. home+, ein innovatives Netto-f
	Media	Printed Press	Fassade · Façade	SDE 2010 HFT	International	03/2010	Public		high		inhalt_Fassade.pdf	Energie-Haus aus Stuttgart'
255	Media	Printed Press	Sun, Wind & Energy	SDE 2010 HFT	International	08/2010	Professionals				Sun_Wind_Energy_8_2010.pdf	Name of article: Exciting but exhausting
	ivieuia	Fillied Press	Sun, wind & Energy	SDE 2010 HF1		06/2010	Fiolessionals		high		Sun_vvinu_Energy_o_Z010.par	Name of article: Zwischen
256	Media	Printed Press	Sonne, Wind & Wärme	SDE 2010 HFT	National	10/2010	Professionals		high		Sonne Wind und Wärme 10_2010.pdf	Innovation
257	Media	Printed Press	Stuttgarter Zeitung	SDE 2010 HFT	Regional	27.08.2010	Public		medium		100827_SZ.pdf	Name of article: Solarhaus von Studenten gewinnt einen Preis
258				Support from				Pagevisits per day:				J
	Media	Digital Press	presseportal.de	sunways	National	11.08.2010	Public	unknown	high		www.presseportal.de/meldung/1662656	

259				Support from				Pagevisits per day:			architektur-mit-gebaeudeintegrierter-photovoltaik-von-sunways-	
	Media	Digital Press	wallstreet-online.de	sunways Support from	International	11.08.2010	Public	113 580 Pagevisits per day:	high		erhaelt-ausreichnung-mit-bild	
260	Media	Digital Press	city-xxl.com	sunways	National	11.08.2010	Public	unknown	high		http://www.city-xxl.com/d1;news;0;3001662656_10.htm	
261	Media	Digital Press	ariva.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 113 115	high		http://www.ariva.de/news/Solar-Architektur-mit- gebaeudeintegrierter-Photovoltaik-von-3501434	
262	Media	Digital Press	stock-world.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 5 079	high		http://www.stock-world.de/nachrichten/aktuell/Solar-Architektur- gebaeudeintegrierter-Photovoltaik-von-n3486059.html	
263				Support from				Pagevisits per day:			solar-architektur-mit-gebaeudeintegrierter-photovoltaik-von-	
	Media	Digital Press	finanznachrichten.de	sunways Support from	National	11.08.2010	Public	108 1098 Pagevisits per day:	high		sunways-erhaelt-auszeichnung-mit-bild-007.htm	•
264	Media	Digital Press	internet-intelligenz.de	sunways	National	11.08.2010	Public	unknown	high		mit-gebaeudeintegrierter-photovoltaik-von-sunways-erhaelt- guszeichnung-mit-bild.html	
265	Media	Digital Press	photovoltaik-guide.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 986	high		gebaeudeintegrierter-photovoltaik-von-sunways-erhaelt- auszeichnung-12451	
266	Media	Digital Press	mindenerblatt.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: unknown	high		architektur-mit-gebaeudeintegrierter-photovoltaik-von-sunways- erhaelt-auszeichnung	
267				Support from				Pagevisits per day:			blatt.de/magazin/magazin/wohnen/11170152-solar-architektur-mit- gebaeudeintegrierter-photovoltalk-von-sunways-erhaelt-	
201	Media	Digital Press	paderborner-blatt.de	sunways	National	11.08.2010	Public	unknown	high		Buszeichnung http://www.netionec.uext.ue/magezhyma	
268	Media	Digital Press	herdorderblatt.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: unknown	high		solar-architektur-mit-gebaeudeintegrierter-photovoltaik-von- sunways-erhaelt-auszeichnung	
269	Media	Digital Press	guetersloherblatt.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: unknown	high		005-solar-architektur-mit-gebaeudeintegrierter-photovoltaik-von-	
270		, ,		Support from				Pagevisits per day:			solar-architektur-mit-gebaeudeintegrierter-photovoltaik-von-	
	Media	Digital Press	hoexterblatt.de	sunways Support from	National	11.08.2010	Public	unknown Pagevisits per day:	high		sunways-erhaelt-auszeichnung machaelt-auszeichnung machaelt-auszei	
271	Media	Digital Press	bielefelderblatt.de	sunways	National	11.08.2010	Public	unknown	high		73-solar-architektur-mit-gebaeudeintegrierter-photovoltaik-von- sunways-erhaelt-auszeichnung musyywww.mppeom.coeymogozmywomenymogozmywomenyxxxx	
272	Media	Digital Press	lippeblatt.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: unknown	high		2954-solar-architektur-mit-gebaeudeintegrierter-photovoltaik-von- sunways-erhaelt-auszeichnung	
273	Media	Digital Press	pressebox.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 257	high		http://www.pressebox.de/pressemeldungen/sunways-ag- photovoltaic-technology-konstanz/boxid/365425	
274	Maratia			Support from	Netional	44.00.0040		Pagevisits per day:			http://www.ad-hoc-news.de/solar-architektur-mit-	
	Media	Digital Press	ad-hc-news.de	sunways Support from	National	11.08.2010	Public	37 078 Pagevisits per day:	high		gebaeudeintegrierter-photovoltaik-von/de/News/21539135 http://www.comessumain.com/a-203417-30iai-vocumessumain.com/a-203417-30iai-	
275	Media	Digital Press	bakkaufmann.com	sunways Support from	National	11.08.2010	Public	4 271	high		Auszeichnung-mit-Bild.html	
276	Media	Digital Press	presseportal.de	sunways	National	11.08.2010	Public	Pagevisits per day: 6 642	high		http://www.presseportal.de/pm/57666/1662656/sunways_ag/rss	
277	Media	Digital Press	presseecho.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 6 571	high		http://www.presseecho.de/wirtschaft/NA3731662656.htm	
278	Media	Digital Press	flife.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 3 945	high		http://www.flife.de/cmp_nws.php?nws_id=1001932991	
279				Support from				Pagevisits per day:			gebaeudeintegrierter-photovoltaik-von-sunways-erhaelt-	
	Media	Digital Press	mittelstandcafe.de	sunways Support from	National	11.08.2010	Public	unknown Pagevisits per day:	high		auszeichnung-mit-bild-240855.html	
280	Media	Digital Press	newsbuzz.de	sunways	National	11.08.2010	Public	unknown	high		http://www.newsbuzz.de/node/105062	
281	Media	Digital Press	cityvisits.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 8 706	high		http://www.cityvisits.de/index.cfm/Deutschland/News/0/0/1/31716 62656/	
282	Media	Digital Press	goyax.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: unknown	high		gebaeudeintegrierter-photovoltaik-von-sunways-erhaelt- auszeichnung-mit-bild 713016	
283				Support from				Pagevisits per day:			http://appl.abendblatt.de/newsticker2/index.php?channel=all&fram	
	Media	Digital Press	appl.abendblatt.de	sunways Support from	National	11.08.2010	Public	unknown Pagevisits per day:	high		e=0&module=finanzen&id=1086530	
284	Media	Digital Press	stromkosten.de	sunways	National	11.08.2010	Public	unknown	high		http://www.stromkosten-senken.de/detail.php?id=207378	
285	Media	Digital Press	boerse.welt.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: unknown	high		http://boerse.welt.de/news_detail.asp?pkNewsNr=1086530	
286	Media	Digital Press	presseportal.ch	Support from sunways	International	11.08.2010	Public	Pagevisits per day: 8 481	high		http://www.presseportal.ch/de/pm/100005091/100608316/sunway 5_ag	
287	Media	, ,		Support from		11.08.2010		Pagevisits per day: 1 478	Ü			
288		Digital Press	news-und-trends.de	Support from	National		Public	Pagevisits per day:	high		http://www.news-und-trends.de/newsfeed.php?id=2661662656 http://www.news4press.com/Solar-Architektur-mit-	
	Media	Digital Press	news4press.com	sunways Support from	National	11.08.2010	Public	7 673 Pagevisits per day:	high		gebaeudeintegrierte_543745.html	
289	Media	Digital Press	finanzen.net	sunways	National	11.08.2010	Public	unknown	high		gebaeudeintegrierter-Photovoltaik-von-Sunways-erhaelt- Auszeichnung-mit-Bild-842871	
290	Media	Digital Press	kraftwerke-online.de	Support from sunways	National	11.08.2010	Public	Pagevisits per day: unknown	high		http://www.kraftwerke- online.de/news/dpa.php?deutsch&na01662656.txt	
291	Media	Digital Press	brd-info.net	Support from sunways	National	11.08.2010	Public	Pagevisits per day: 98 563	high		http://www.brd-info.net/nachrichten/wirtschaft- industrie/top 397667 1.html	
292	Media	Digital Press	ots.at	Support from	International	11.08.2010		Pagevisits per day: unknown			r-architektur-mit-gebaeudeintegrierter-photovoltaik-von-sunways-	
_				sunways Support from			Public	Pagevisits per day:	high		erhaelt-auszeichnung-mit-bild http://www.weit.ue/newsitcker/smarthouse-m/arthoeos/30/25/30/ ar-Architektur-mit-gebaeudeintegrierter-Photovoltaik-von-Sunways-	
293	Media	Digital Press	welt.de	sunways Support from	International	11.08.2010	Public	977 609 Pagevisits per day:	high		erhaelt-Auszeichnung-mit-Bild.html	
294	Media	Digital Press	sharewise.com	sunways	National	11.08.2010	Public	2 830	high		http://www.sharewise.com/finanznachrichten/26811-Auszeichnung- Energie- obs	
295	Media	Printed press	Book about all German Teams	general information	International	January 2011	Public		high	03.10.1954	to be published	in german
296	Media	Printed press	Welt am Sonntag	general information	National	to be published				20.000	to be published	article pending
	iviedia	r inted press	weit am Sonnag	general information	INAUUIIAI	to be published	Fublic		nigh	20.000	to be published	article periority

207			179 Standortmagazin der									
297		D :	Wirtschafsförderung		5		D 11					
	Media I	Printed press	Region Stuttgart STEICO Instruction	general information	Regional	to be published	Public		medium		to be published	article pending
298	Media	Printed Press	Manual	SDE 2010 HFT	National	to be published	Public		medium		to be published	manual pending
	Wedia	Tillited Fless	Special edition	ODE 2010 TIL 1	rvational	article	1 dblic		medium		to be published	manual pending
299			"Innovative			submitted,						
	Media	Printed Press	Fassadentechnik"	SDE 2010 HFT	National	pending	Public		high		to be published	article pending
						article						
300	L. I	D: 4 1D		ODE COLOUET	N. C. I	submitted,	D 1 "					
	Media F	Printed Press	Architectural Record	SDE 2010 HFT	National	peding	Public		high		to be published	article pending Video documentary of all the
												process of the competition and
301				Process and								the work of the German teams: to
			Film about all German	Competition in								be sended to a german national
	Media	Film	Teams	Madrid	National	to be published			high		to be published	channel ARD
		Symposium		SDE 2010 and home		28.0901.10.20			high		abstract accepted	Presentation
			Aktiv Solarhaus, Luzern (S			2224.09.2010			high		abstract submitted	Presentation
						2425.11.2010			high		abstract submitted	Presentation
306		Symposium Symposium	IRES 2010, Berlin (Germa Symposium Solar Building	SDE 2010 and germ		2224.11.2010 23.12.2010	Professionals		high high		abstract submitted abstract submitted	Presentation Presentation
		Trade Fair	Trade Fair Bau 2011 Mün				Public, Professionals		high		abstract accepted	Posters appearance
301		auo i uli	Saa Zori Wall	and germ	torrida		. Long i Tologolorialo		gii		and accopted	, ottoro appouranto
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			Intern Events				4				***	ENERGY
			Extern Events				- CONT.					SOLAR
	J. J.		Printed Press				GOE	BIERNO	MINISTERIO DE VIVIENDA	POLITÉCNICA		DICATHION
			Digital Press				S DE	ESPAÑA	DE VIVIENDA			
			Other				A WILLSON A				MADRID	in the same IDAE street
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Stuttgart, November 2008

Solar Decathlon Europe 2010 Wer baut das beste solar betriebene Wohnhaus?

Die Hochschule für Technik Stuttgart ist beim Solar Decathlon Europe 2010 dabei! Bei diesem "Solaren Zehnkampf"– Wettbewerb treten 15 bis 20 ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Zum Abschluss des Wettbewerbs werden die Häuser aller Teams in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet. Beim Solar Decathlon 2007 in den USA gewann die TU Darmstadt. Der Solar Decathlon Europe wird zum ersten Mal in Europa ausgetragen. Auslober des europäischen Wettbewerbs ist das spanische Wohnungsministerium in Zusammenarbeit mit dem amerikanischen Energieministerium.

Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinführung innovativer solarer Energietechnologien soll gefördert und der Beweis angetreten werden, dass energieeffizientes Bauen auch mit einer Steigerung des Komforts, sowie der Gestaltungsund Lebensqualität, einhergehen kann.

"Die HFT Stuttgart nimmt diese Herausforderung gerne an" erklärt Professor Andreas Löffler, Dekan der Fakultät Architektur und Gestaltung an der HFT Stuttgart. "Wir freuen uns auf diese komplexe Aufgabe und werden dafür die Kompetenzen der gesamten Hochschule im Bereich des energieeffizienten Bauens bündeln." Studierende, Mitarbeiter und Professoren der Fakultät Architektur und Gestaltung und der Fakultät Bauingenieurwesen, Bauphysik und Wirtschaft sowie dem Forschungszentrum zafh. net (Gebäudeenergieforschung) sind an dem Projekt beteiligt.

In interdisziplinären Teams wird ein leichtes Elementbausystem entwickelt und umgesetzt. Das ausschließlich solarbetriebene Gebäude muss einfach zu transportieren sein und soll mit seiner schlanken und transparenten Anmutung der vorherrschenden

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Bachelorstudiengänge

Architektur

Bauingenieurwesen

Bauphysik

Betriebswirtschaft

Informatik

Informationslogistik

Infrastrukturmanagement

Innenarchitektur

Mathematik

Vermessung und Geoinformatik

Wirtschaftsinformatik

Masterstudiengänge

Architektur

General Management

Grundbau/ Tunnelbau

Interior Architectual Design

Konstruktiver Ingenieurbau

Mathematik

Photogrammetry and Geoinformatics

Projektmanagement

Software Technology

Sustainable Energy Competence SENCE

Umweltschutz

Vermessung



Wahrnehmung energieeffizienter Gebäude als "klobige Thermoskanne" entschieden entgegenreten.

Der Startschuss ist bereits gefallen. Seit Anfang Oktober arbeiten Studierende des Masterstudiengangs Architektur am konzeptionellen Entwurf des Hauses, der bis Ende dieses Jahres abgeschlossen sein wird. Innovative Materialien und die intelligente Abstimmung von Gebäude, Anlagentechnik und Nutzung sind die Grundlagen für eine ansprechende Gestaltung, einen geringen Energieverbrauch und hohen Wohnkomfort.

Eine Projekt-Homepage wird in den nächsten Tagen gestartet, um aktuell über den Fortschritt des Projektes zu informieren. Darüber hinaus konzentrieren sich die Anstrengungen in der frühen Phase des Wettbewerbs darauf, Förderer und Sponsoren zu gewinnen, die das Team der HFT Stuttgart mit Erfahrungswissen, Sachleistungen und auch finanziell unterstützen.

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JØRN UTZON (1918–2008)

Im Opernhaus von Sydney gingen für eine Stunde die Lichter aus, als Huldigung an den großen danischen Architekten Jørn Utzon, der am 29. November neunzigjährig gestorben ist. So respekted gingen die Australier nicht immer mit dem Schöpfer ihres berühmtesten Bauwerks urn. Der Entwurf dieses Schalenbauwerks war ein Geniestreich. Dass Utzon mit ihm den Wettbewerb von 1957 gewann, hatte er dem amerikanischen Architekten Eero Saarinen zu verdanken. Der Fama zufolge zog Preisrichter Saarinen, selbst mit Schalenbauten wie dem TWA-Empfangsgebäude auf dem New Yorker Kennedy Airport beschäftigt, den Entwurf aus den schon abgelehnten Projekten wieder hervor und konnte seine Mitjuroren von dessen Qualitäten überzeugen.

Bei der Ausführung kam es zu unendlichen Schwierigkeiten. »Ich liebe es, am Rand des Möglichen zu arbeiten«, ließ Utzon verlauten. Berechenbar wurden die Dachschalen beim damaligen Stand digitaler Rechenkünste erst. als der ursprünglich parabelförmige Schnitt zu Segmenten einer Kugelschale umgearbeitet wurde. Auf diese Gestalt kam Utzon angeblich beim Schälen einer Apfelsine. Es folgten Umplanungen, Programmänderungen, Prozesse, enorme Baukostenüberschreitungen; das scheinen Musikhäuser an sich zu haben, wie die Hamburger seit ihrer Philharmonie-Planung wissen. 1966 gab Utzon entnervt auf und überließ sein Werk anderen Händen. Erst im hohen Alter zeichnete sich eine Versöhnung ab. Utzon und seine beiden Architektensöhne beteiligten sich wieder an Weiterplanung und Innenausbau

Nas heute »signature building« heißt, hat Utzon schon damals geboten, wenn auch in einer disziplinierten Variante. Sein bildkräftiger, sympolfähiger, assoziationsreicher Bau wurde bald zur Ikone des Kontinents. Pritzker-Preisträger Jtzon war ein Künstler, der sich von älteren Kollegen wie Asplund, Aalto, Frank Lloyd Vright inspirieren ließ, ja von ganzen Kulturen auch jenseits seiner skandinavischen Heimat. Die Terrassenarchitekturen Altmexikos zählen ebenso dazu wie die Wohngehöfte Arabiens. Beblendet von der Sensation der Sydney-Oper, hat man Utzons übriges Werk schmal genannt. Aber was heißt »schmal« angesichts einer Reihe wunderbarer Wohnhäuser - drei daon für sich selbst -, der intimen Ketten- und Hofhaus-Siedlungen in Helsingør und Frelensborg, des Parlaments in Kuwait mit seiien Betonzelten, der Kirche in Bagsværd, ausen wie ein landwirtschaftliches Silo, innen lurch abgehängte Putzschalen modelliert? Jeler dieser Bauten war eine Neuformulierung. eder bedeutete Abschied von einer bornierten Aoderne und Aufbruch in eine Welt der gebänligten Fantasie

~Wolfgang Pehnt

REALITY CHECK

Den Alltag im Architekurbüro hautnah erleben können vier Stipendiaten des Siemens Arts Program aus dem Fachbereich Kunsterziehung. Und es sind nicht irgendwelche Büros. die die angehenden Pädagogen eingeladen haben, sondern: Henn Architekten, Ebner/Ullmann, Kuehn Malvezzi und MVRDV, die sich ohnehin schon für neue Vermittlungsformen zeitgenössischer Architektur engagieren. Die Studenten bekommen Einblick in die Entwurfs- und Arbeitswelt der Architekten und werden bei der Erarbeitung einer Unterrichtseinheit Architektur für das Fach Kunst unterstützt. Der erste vorbereitende Workshop fand Ende November statt, der zweite folgt im Februar. Somit sind auch schon die ersten Kontakte zwischen Studenten und Architekten geknüpft. Wann und wie lange jeweils die Stipendiaten in den Büros sein werden, ist unterschiedlich. Im Herbst soll die Dokumentation der vier erarbeiteten Unterrichtseinheiten erscheinen

{www.siemensartsprogram.de

TANZENDER BETON

Neues von Mader Stublic Wiermann (siehe db. 11/06, Seite 50): Das Berliner Architekturbüro bespielte im Oktober den expressiven Torre Pompéia auf dem Gelande des Kulturzentrums Fábrica de Pompéia in São Paolo, den die italienisch-brasilianische Architektin Lina Bo Bardi von 1977–86 umbaute. Die Videoinstallation »folded space« verstarkt die spannungsreiche Konstellation aus massiven Gebäudeteilen und Brücken. Zwei Videobilder mit abstrakten Strukturen laufen in einer zwölfminütigen Choreografie über das Gebäude, verändern Perpektiven und Räumlichkeit und legen sich als neue, fließende Schicht auf das Gebäude. Der reale, haptische Aspekt der Betonfassade bleibt dabei erhalten.

www.webblick.de/folded_space/folded_space_
video.html

SOLAR DECATHLON EUROPE 2010

Nachdem der erste Solar Decathlon in den USA so ein großer Erfolg war, insbesondere für den Siegerentwurf der TU Darmstadt (siehe unter anderem db 11/07, Seite 70), findet er nun alle zwei Jahre auch in Europa statt. Zwanzig Hochschulteams aus Europa, Amerika und Asien wurden vom spanischen Wohnbauministerium und dem US-amerikanischen Energieministerium ausgewählt, bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. In Madrid sind die Häuser dann in einer Ausstellung zu sehen, und es wird ein Sieger gekürt. Ein interdisziplinäres Team der HfT Stuttgart arbeitet gegenwärtig an einem leichten Elementbausystem, das einfach zu transportieren ist und mit transparenter Optik einen Gegenentwurf zum gängigen Klischee der »klobigen Thermoskanne« energieeffizienter Gebäude entgegenwirken soll. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt sind entscheidende Kriterien Komfort, Gestaltung, Kommunikation und Marktfähigkeit. Darüber hinaus müssen die Studenten in der frühen Phase des Wettbewerbs Förderer und Sponsoren gewinnen, die die jeweiligen Projekte mit Fachwissen, Erfahrung, Sachleistungen und Geld unterstützen.

{www.sdeurope.org; www.sdeurope.de

AUSLAUFMODELL INGENIEUR?

Auch an der Bayerischen Ingenieurekammer-Bau ist das Unbehagen über die unzureichenden Bachelorstudiengange angekommen. Neben dem drohenden Verlust des Wortes »Ingenieur« - das durch den Bachelor oder Master »of Engineering« nur unzureichend ersetzt werde - konstatiert Norbert Gebbeken, 2. Vizepräsident der Kammer, eine Verschlechterung der Ausbildung. Im Bachelor-Studiengang sei zu wenig Zeit für eine vertiefende Beschäftigung mit den Inhalten. Die Studenten neigten dadurch zum »Bulimie-Lernen« und könnten durch den engen Zeitrahmen kaum noch Auslandserfahrungen während des Studiums machen. Berufsqualifizierend - und dem renommierten deutschen »Ingenieur« ebenbürtig sei letztendlich nur der Master. Gebbeken fordert das Recht eines »Master of Science«, sich in Deutschland gleichzeitig weiterhin »Diplom-Ingenieur« nennen zu dürfen.

22.01.2009 Seite: 4 Baden-Württemberg Anzeigenblatt wöchentlich

Stuttgarter Wochenblatt

Stuttgarter Wochenblatt Mitte-Süd

Auflage(vb) der genannten Quelle: 37160

(mediataress - medienaeobachtung und archiv - www.mediataress.de)

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Sonne nutzen

S-MITTE

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ger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet. Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern.

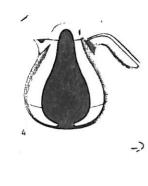
Nr. 4 - 23.1.2009 Seite: 4 überregional

Fachpublikation wöchentlich

Bauwelt

Bauwelt

Auflage(vb) der genannten Quelle: 13594



4 Klobige Thermoskannen | Die HFT Stuttgart wurde ausgewählt, am Wettbewerb "Solar Decathlon Europe 2010" teilzunehmen. Aufgabe ist es, ein solarbetriebenes Gebäude zu bauen, Mit ihrem Beitrag möchte die HFT dem Klischee entgegentreten, energieeffiziente Gebäude seien "klobige Thermoskannen" (Abb. daedal.design). Insgesamt wurden 20 Hochschulen für den Wettbewerb ausgewählt. Im Jahr 2007 hatte die TU Darmstadt den Wettbewerb in den USA gewonnen (Heft 1-2). ▶ www.sdeurope.org



Stuttgart, Februar 2009

Solar Decathlon Europe 2010: Die ersten Entwürfe sind abgegeben

Die HFT Stuttgart ist eine von 20 Hochschulen weltweit, die beim Solar Decathlon Europe 2010 dabei ist. Bei diesem "Solaren Zehnkampf"– Wettbewerb treten ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Die teilnehmenden Hochschulen kommen unter anderem aus Spanien, Großbritannien, den USA, Mexiko und China. Innerhalb Deutschlands steht die HFT Stuttgart im Wettbewerb mit drei weiteren Hochschulen.

Ende Januar haben alle Hochschulteams die Pläne und Konzepte ihrer Entwürfe in Madrid abgegeben. Damit ist die erste Phase abgeschlossen und es geht in die zweite Phase der Weiterentwicklung, Detailplanung und Bauvorbereitung.

An der HFT Stuttgart soll unter der Projektleitung von Professor Dr. Jan Cremers der Beweis angetreten werden, dass energieeffizientes Bauen mit einem hohen architektonischen Anspruch einhergehen kann. In interdisziplinären Teams wird ein leichtes Elementbausystem entwickelt und umgesetzt.

Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden der HFT Stuttgart einen wichtigen neuen Baustein ihrer interdisziplinären und praxisnahen Ausbildung anzubieten. Das Kernteam für den Beitrag der HFT Stuttgart stammt aus dem Master-Studiengang Architektur, welches den Wettbewerb kontinuierlich über seine Laufzeit bis in den Sommer 2010 bearbeiten und begleiten wird. Es wird dabei unterstützt und betreut durch zahlreiche Professoren der Fakultät Architektur und Gestaltung. Weitere beteiligte Studiengänge sind Sustainable Energy Competence (SENCE), Bauphysik, Innenarchitektur und Konstruktiver Ingenieurbau.

Momentan konzentrieren sich die Anstrengungen in der frühen Phase des Wettbewerbs besonders darauf, Förderer und Sponsoren zu gewinnen, die das Team der HFT Stuttgart mit Erfahrungswissen, Sachleistungen und auch finanziell unterstützen.

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Informationen www.sdeurope.de

Hochschule für Technik Stuttgart

Tradition und Innovation – das charakterisiert die Hochschule für Technik Stuttgart. 1832 als Winterschule für Bauhandwerker gegründet, bietet die HFT Stuttgart heute ein breites Spektrum an akkreditierten Bachelor-Master-Studiengängen an. In drei Fakultäten stehen insgesamt 11 Bachelor- und 13 Master-Studiengänge zur Wahl. An der HFT Stuttgart wird praxisnah und in kleinen Gruppen ausgebildet. Rund 100 Professorinnen und Professoren unterrichten zirka 2500 Studierende, unterstützt von über 170 Lehrbeauftragten. Praktische Studienprojekte oder ein Auslandsstudium an einer der 75 Partnerhochschulen weltweit sind in die Studiengänge integriert. Der Campus der HFT Stuttgart liegt, zwischen Stadtgarten und Liederhalle, mitten in der Stadt Stuttgart, dem Wirtschaftszentrum Südwestdeutschlands.

Studienbereiche

Architektur und Gestaltung

Bauingenieurwesen

Bauphysik

Informatik

Mathematik

Vermessung

Wirtschaft

12.02.2009 Seite: 22 Baden-Württemberg

Anzeigenblatt wöchentlich

Stuttgarter Wochenblatt

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STUTTGART IN KÜRZE

SOLARER ZEHNKAMPF

Stuttgarter Wochenblatt West-Nord

Die Hochschule für Technik Stuttgartist eine von 20 Hochschulen weltweit, die beim Solar Decathlon Europe 2010 dabei sind. Bei diesem solaren Zehnkampf-Wettbewerb treten ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen.

Die teilnehmenden Hochschulen kommen unter anderem aus Spanien, Großbritannien, den USA, Mexiko und China. Innerhalb Deutschlands steht die Hochschule für Technik Stuttgart im Wettbewerb mit drei weiteren Hochschulen.

IAHR DER ASTRONOMIE

Das Staunen über den Sternenhimmel hatte die Menschen zu allen Zeiten erfasst. Als der Philosoph Perikles gefragt wurde, warum es sich lohne, geboren zu werden antwortete er: "Um das Himmelsgewölbe betrachten zu können."

Die Freunde der Antike beschäftigen sich bei ihrem nächsten Treff im Forum 3 (Freitag, 19.30 Uhr) mit diesem Thema und beleuchten die Modelle der Antike, die z. T. bereits heliozentrisch orientiert waren.

FREIE STELLEN

Beim Berufsbildungstag der IHK am 19. Februar, 9 bis 15 Uhr, können die Jugendlichen sich über die freien Stellen in der Region informieren.

Es sind noch 1800 Ausbildungsstellen vakant. Weitere Infos zum 12. Berufsbildungstag gibt es unter www.stuttgart.ihk.de.

DENKEN LOHNT SICH

Das findet jedenfalls Kabarettist Vince Ebert, der morgen Abend (20 Uhr) mit seinem neuen Programm im Theaterhaus Stuttgart gastiert. Ob Treibhauseffekt,

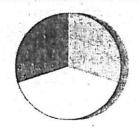
Mondphasen oder der Einfluss relativistischer Effekte in Fernbeziehungen – der gelernte Physiker gibt fundierte und überraschende Antworten. Wie etwa die Erkenntnis, dass eine Gleichung mit drei Unbekannten nicht lösbar ist, aber ein Treffen mit drei Unbekannten durchaus befriedigende Ergebnisse bringen kann. Kartentelefon 40 20 70.

APOKALYPSE

Es gibt neue Erkenntnisse zur Entstehung von Max Beckmanns Werk "Apokalypse". Grund genug für die Staatsgalerie Stuttgart, zu einem Vortrag ins Kunstgebäude einzuladen.

Heute, Donnerstag, 12. Februar, 19.30 Uhr, wird Historiker Andreas Hansert Einblicke in das Schaffen des Künstlers geben mit aktuellen Bezügen zum Werk "Apokalypse". Der Eintritt beträgt 4.50 Euro.

DIE WOCHEN-UMFRAGE



Verstoß gegen Datenschutz?

Bei 1600 Mitarbeiter der Stadt sind Konten ohne Wissen der Mitarbeiter "abgeglichen" worden. Der "Korruption" will man vorbeugen, sagt das Rechnungsprüfungsamt. OB Schuster hat ierst in der vergangenen Woche von den Vorwürfen erfahren. "Schweinerei" oder "Berechtigte Kontrolle"? Was sagen Sie? Ihre Stimme zählt unter www.stuttgarter-wochenblatt.de.

12.02.2009 Baden-Württemberg Anzeigenblatt wöchentlich

Gerlinger Wochenblatt

Gerlinger Wochenblatt

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Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden der HFT Stuttgart einen wichtigen neuen Baustein ihrer interdisziplinären und praxisnahen Ausbildung anzubieten. Das Kernteam für den Beitrag der HFT Stuttgart stammt aus dem Master-Studiengang Architektur, welches den Wettbewerb kontinuierlich über seine Laufzeit bis in den Sommer 2010 bearbeiten und begleiten wird. Es wird dabei unterstützt und betreut durch zahlreiche Professoren der Fakultät Architektur und Gestaltung. Weitere beteiligte Studiengänge sind Sustainable Energy Competence (SENCE), Bauphysik, Innenarchitektur und Konstruktiver Ingenieurbau.

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Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinführung innovativer solarer Energietechnologien soll gefördert.

Kontakt: Dipl.-Ing. Sebastian Fiedler, Hochschule für Technik – Stuttgart, Fakultät Architektur und Gestaltung, Schellingstrasse 24, 70174 Stuttgart Telefon: 0711/8926-2876

Email: sebastian.fiedler@hft-stuttgart.de Internet: www.sdeurope.de

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meistbeachteten und unabhängigen Architekturfachzeitschriften entwickelt ...

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19.02.2009 FH Stuttgart, Hochschule für Technik

> Solar Decathlon Europe 2010: Die ersten Entwürfe sind abgegeben

Die HFT Stuttgart ist eine von 20 Hochschulen weltweit, die beim Solar Decathlon Europe 2010 dabei ist. Bei diesem "Solaren Zehnkampf"- Wettbewerb treten ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Die teilnehmenden Hochschulen kommen unter anderem aus Spanien, Großbritannien, den USA, Mexiko und China. Innerhalb Deutschlands steht die HFT Stuttgart im Wettbewerb mit drei weiteren Hochschulen.

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http://www.hft-stuttgart.de

Bildung & Wissenschaft

Solar Decathlon

Studenten planen das solare Wohnen der Zukunft

Für den Solar Decathlon Europe 2010 entwerfen und bauen Studierende der Hochschule für Technik in Stuttgart derzeit ein Haus, das ausschließlich über Solarenergie betrieben wird. Sie sind eines von vier Hochschulteams aus Deutschland, die sich an dem Wettbewerb beteiligen. Dieser Tage haben sie ihre Entwürfe in Madrid abgegeben.

Von Stefanie Schlüter

STUTTGART. Die Idee für den Wettbewerb kommt aus den USA. Dort findet der Solar Decathlon alle zwei Jahre statt. Vor zwei Jahren waren auch Teams aus Europa dabei, von der TU Darmstadt – die den Wettbewerb gewonnen haben – und aus Spanien. Auch wenn die Spanier nicht gewonnen haben, fanden sie die Idee doch so gut, dass sie sich für einen solchen Wettbewerb in Europa stark machten.

Insgesamt 21 Hochschulteams aus Spanien, Deutschland, Großbritannien, den USA, Mexiko und Chi-

Hochschule für Technik

Hervorgegangen ist die Hochschule für Technik (HFT) in Stuttgart aus einer Winterschule, die 1832 für Bauhandwerker gegründet wurde. Diese sollten sich in den Wintermonaten hier fortbilden. An der HFT werden an drei Fakultäten insgesamt elf Bachelor und 13 Master-Studiengänge angeboten. Rund 100 Professorinnen und Professoren unterrichten rund 2500 Studierende, unterstützt von mehr als 170 Lehrbeauftragten. Der Schwerpunkt liegt auf einer praxisnahen Ausbildung in kleinen Gruppen.

na werden im Juni 2010 ihre Solarhäuser in Madrid vorstellen. Die Wettbewerbsbedingungen nicht einfach. Müssen die Studierenden doch in der Wettbewerbswoche beweisen, dass ihr Haus unterschiedlichen Belastungen gewachsen ist: Vom Wäsche waschen über Duschen, Kochen bis zum vermehrten Einsatz von unterschiedlichen elektrischen Geräten.

Studierende aus allen Bereichen der Hochschule beteiligt

An einem Abend werden sie Studenten der benachbarten Häuser zum Abendessen einladen. Dafür muss für zwölf Leute gekocht werden. "Das ist eine andere Situation, als wenn das Haus von einer Person bewohnt wird", sagt Jan Cremers, Professor für Gebäudetechnologie und Integrale Architektur an der Hochschule für Technik (HFT), der für die Projektleitung verantwortlich ist.

Das Kernteam für den Entwurf des Hauses an der HFT sind die Architekten im Masterstudiengang. Doch viele Teilaufgaben werden von Studenten in anderen Studiengängen erledigt: So leisten beispielsweise Studierende des Bachelor Bauphysik und des Bachelor Innenarchitektur ebenso ihren Beitrag zum Gelingen des Projekts wie Teilnehmer des Master-Studiengangs Konstruktiver Ingenieurbau. Das Energiekonzept wird außerdem von Studenten des Masters Sustainable Energie Competence auf Herz und Nieren geprüft. Projektmanager Sebastian Fiedler betont, dass es ein integriertes Projekt ist, an dem quasi die gesamte Hochschule beteiligt ist.

"Wir wollen nicht nur ein Haus aufbauen, dass energetisch gut funktioniert, sondern wir wollen auch gestalterisch ein schönes Haus aufstellen", macht Cremers den Anspruch der HFT beim Wettbewerb deutlich. Das Ziel: Die Architekten

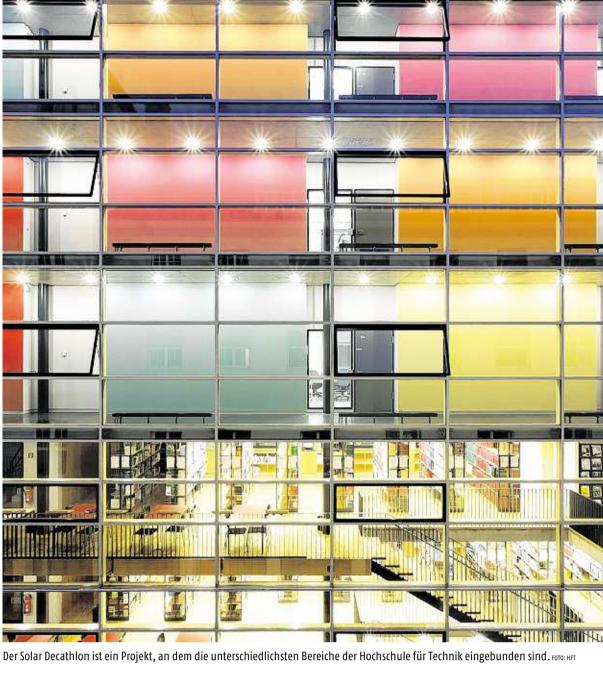
sollen aufzeigen, wie solares Wohnen künftig aussehen kann. Wobei sie moderne Solartechnik so einsetzen wollen, dass sie auch gestalterisch einen Gewinn darstellt und positiv zum Gesamtbild beiträgt.

Ihre Pläne wollen die Studenten noch nicht auf den Tisch legen - stehen sie doch im Wettbewerb mit anderen Hochschulen. Und die Anforderungen sind hoch. Planen und bauen die Studenten doch ein Haus, das für die Temperaturen in Madrid optimiert sein muss. Dafür haben sie bereits das Klima dort gründlich analysiert. Denn das Gebäude muss nicht allein während der Wettbewerbswoche in Madrid im Juni 2010 bestehen. Die Studierenden sollen auch plausible Simulationsergebnisse vorlegen, wie sich das Haus über das Jahr verhält.

Auf der Suche nach Förderern und Sponsoren

Klar ist für die Studenten von der Hochschule für Technik schon, dass sie thermisch bereits möglichst viel über die Gebäudehülle erreichen wollen, um die Temperaturschwankungen im Gebäude so gering wie möglich zu halten. Im Haus muss die Solartechnik dann sowohl zum Kühlen als auch bei Bedarf zum Heizen eingesetzt werden. Auch soll die Gebäudetechnik - vom Herd über Trockner und Waschmaschine bis zu PC und Fernseher - so wenig Energie wie möglich verbrauchen. Denn neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet.

Materialien und Gebäudetechnik zeigen bereits: Allein können Hochschule und Studenten das Projekt nicht stemmen. Derzeit werden deshalb intensiv Förderer und Sponsoren gesucht, die das Team mit Erfahrung, Sachleistungen und auch fi-



nanziell unterstützen. Denn immerhin müssen die Studenten im kommenden Jahr innerhalb von zwei Wochen ein Haus mit einer Wohnfläche von etwa 75 Quadratmetern in Madrid aufbauen.

Mit diesem Projekt will die Hochschule einmal mehr ihrem Anspruch gerecht werden: Architekten, die hier ihren Abschluss machen, sollen in den Büros vom ersten Tag an voll einsatzfähig sein, sagt Koordinator Sebastian Fiedler. Für ihn ist klar: Wer so ein Projekt durchgezogen hat, den schreckt ein Einfamilienhaus nach dem heutigen Stand der Technik nicht mehr.

MEHR ZUM THEMA

finden Sie auf den Seiten der Hochschule für Technik in Stuttgart:

www.hft-stuttgart.de



Studierende der Hochschule bei der Arbeit für den Solar Decathlon. FOTO: HFT

Sprachcomputer sollen auch Gefühle erkennen

STUTTGART. Wenn zwei Menschen miteinander sprechen, nehmen sie zweierlei wahr: Den Inhalt des Gesagten, aber auch Emotionen, die dadurch zum Ausdruck kommen, wie etwas gesagt wird. Diese sogenannten paralinguistischen Eigenschaften des Gesprochenen können von Systemen zur automatischen Spracherkennung wie beispielsweise in einer Telefonanlage bisher nicht erkannt werden. Wissenschaftler des Lehrstuhls für Systemtheorie und Signalverarbeitung der Uni Stuttgart suchen nach Wegen, damit Sprachcomputer auch Gemütsbewegungen verstehen können.

Noch ist unklar, wann die Technik im Alltag eingesetzt werden kann. Interessenten dafür gibt es allerdings bereits: Etwa Betreiber von Call-Centern oder auch Ärzte, die sich von dem neuartigen Sprachcomputer Hilfe bei der Diagnose erhoffen. Auch im Auto könnten über diese Technik Hinweise an Fahrerassistenzsysteme gegeben werden, ob sich der Fahrer gerade im Stress befindet. (sta)

Überblick über die Forschung am Lehrstuhl für Systemtheorie und Signalverarbeitung der Uni Stuttgart: www.lss.uni-stuttgart.de/

MEHR ZUM THEMA

ueberblick.html

Defizite bei Kindern mit einer zweiteiligen Eingangsschuluntersuchung frühzeitig erkennen Untersuchung flächendeckend eingeführt / Kritik: Methoden wurden nicht an jüngere Kinder angepasst

STUTTGART. Die Hirnforschung zögerung hin, wird nochmals eine beweist: Frühe Förderung ist für Kinder essentiell. In Baden-Würt-

temberg wurde – nach einem Ministerratsbeschluss von 2005 – die Eingangsschuluntersuchung (ESU) neu konzipiert. Das Ziel: Kinder mit Entwicklungsverzögerungen oder besonderem Förderbedarf recht-

zeitig zu erkennen und zu fördern.

Zwei Untersuchungen vor der Einschulung

Nach erfolgreichen Modellprojekten in zehn Stadt- und Landkreisen wie dem Alb-Donau-Kreis, Biberach oder Tübingen wird die neue ESU seit Januar 2009 flächendeckend eingeführt. Während einst angehende Erstklässler bloß einmal kurz vor der Einschulung zum Arzt mussten, gibt es nun zwei Untersuchungen. In der ersten werden die Kinder bereits 15 bis 24 Monate vor der Einschulung, also im vorletzten Kindergartenjahr, durch den Kinder- und Jugendärztlichen Dienst der Gesundheitsämter auf Auffälligkeiten untersucht, also Entwicklungsstand, Seh- und Hörvermögen, sprachliche Kompetenz, Motorik oder Körpergröße und Gewicht erfasst.

Weist das Screening auf eine Um Förderbedarf frühzeitig festzustellen, mögliche Sprachentwicklungsver- werden nun Vierjährige getestet. FOTO: DPA

Sprachstandsdiagnose durchgeführt. Ausgewertet werden zudem Fragebögen, die von den Eltern freiwillig, von Erzieherinnen obligatorisch ausgefüllt werden, sowie das Vorsorgeheft der ärztlichen Früherkennungsuntersuchungen.



Bei Auffälligkeiten sollen dann gezielt Fördermaßnahmen eingelei-

Im zweiten Schritt gibt es im letzten Kindergartenjahr vor der Einschulung eine weitere Untersuchung zur Schulfähigkeit. Sind die Ergebnisse unklar, erfolgt eine erneute Untersuchung durch den Kinder- und Jugendärztlichen Dienst der 38 Gesundheitsämter in Baden-Württemberg.

Acht davon haben, so heißt es im Landesgesundheitsamt im Regierungspräsidium Stuttgart, bereits im vergangenen Jahr mit der Einführung der neuen ESA begonnen, 22 Anfang des Jahres bereits Informationsabende für Eltern und Erzieherinnen durchgeführt. Gemäß den Angaben aus dem Sozialministerium werden medizinische Auffälligkeiten von der jeweiligen Krankenkasse bezahlt, eine eventuelle Sprachförderung falle in den Zuständigkeitsbereich des Kultusministeriums.

Tests sollen Schritt für Schritt an Jüngere angepasst werden

"Die neue ESU ist gut", so die Erfahrungen einer Kindergartenleiterin aus Stuttgart. "Das unterstützt uns und die Kinder." Ein Manko sei, dass zum Teil jene Tests, die

bisher mit knapp Sechsjährigen gemacht wurden, nun bei den Viereinhalbjährigen angewendet würden. "Die Methoden und Förderprogramme müssen an das Alter des Kindes angepasst werden." Aus dem Landesgesundheitsamt heißt es, dass jüngere Kinder leichtere Testaufgaben bekämen, man aber auf die Erfahrungen der Einführung reagieren werde und das Verfahren Schritt für Schritt an eine jüngere Altergruppe anpassen wolle. Einig sind sich indes alle, dass die neue Eingangsschuluntersuchung ein hervorragendes Instrument der Prävention sei und in ihrer umfassenden Ausgestaltung einzigartig in Deutschland.

In Bayern war etwa die einmalige Untersuchung kurz vor der Einschulung abgeschafft worden, es wurde allein auf die ärztliche Früherkennungsuntersuchung U9 gesetzt. Die wird indes, so zeigen Statistiken, am seltensten von den Eltern wahrgenommen. Vergangenes Jahr hat Bayern die ESU - in alter Form-wieder eingeführt. (mos)

MEHR ZUM THEMA

finden Sie auf den Seiten des Sozialministeriums Baden-Württemberg: www.sozialministerium-bw.de/de/ Schulgesundheitspflege/82058.html

Kurz notiert

Urteil: Studiengebühren sind verfassungsgemäß

MANNHEIM. Die Hochschulen im Land dürfen weiterhin Studiengebühren erheben. Das hat der Verwaltungsgerichtshof Baden-Württembergentschieden. Die Semesterbeiträge von 500 Euro seien verfassungsgemäß und sozialverträglich, urteilten die Richter. (lsw)

Schavan fordert einheitliche Zulassungsfristen an Unis

BERLIN/STUTTGART. Bildungsministerin Annette Schavan (CDU) will die Hochschulen dazu bewegen, mit einheitlichen Fristen das Zulassungschaos an den Hochschulen zum Wintersemester 2009 zu beheben. Die Studienplätze, die nach zwei Zulassungsrunden noch frei seien, sollten dann auf einer zentralen Internetseite gesammelt werden. (ddp)

Sachsen kritisiert das Abwerben von Lehrern

DRESDEN/STUTTGART. Sachsens Kultusminister Roland Wöller (CDU) hat die bundesweite Kampagne Baden-Württembergs zur Abwerbung von Junglehrern scharf kritisiert. In Baden-Württemberg wird dies anders gesehen: Das Land mache Lehrern aus anderen Ländern keine Lockangebote, sagte ein Sprecher des Kultusministeriums. (ddp)

Hochschule für Technik Stuttgart



Newsletter 03/10 - Team HFT Stuttgart

Wie meistern wir die Zukunft in bautechnischer Sicht und wie sehen Häuser in 20 Jahren aus? Fragen, die sich Wissenschaftler aus aller Welt aufgrund der gegebenen Umstände wie Ressourcenverbrauch und Klimaveränderung seit langem stellen. Es sind genau diese Fragen, auf die ein Studententeam der HFT Stuttgart beim internationalen Studentenwettbewerb Solar Decathlon Europe 2010 im Juni diesen Jahres Lösungen bieten möchte. Seit 2008 arbeiten wir nun an unserem Wettbewerbsbeitrag und sind derzeit mitten in der baulichen Umsetzung. Mit diesem Newsletter möchten wir Sie gerne über die aktuellen Ereignisse informieren.



Energieberaterforum in Feuchtwangen

Das Team wurde zum süddeutschen Energieberaterforum in Feuchtwangen am 29.01.10 eingeladen. Es ging dort um aktuelle Praxisfragen zur Technik, Wissenschaft, und Marktperspektiven des Energieeffizientes Bauens. Studenten aus dem SDE-Team Stuttgart haben dort einen Vortrag über das Projekt und den Wettbewerb gehalten und sind auf großes Interesse gestoßen. Durch die Diskussionen entstand ein lebhafter Austausch zwischen Fachingenieuren aus der Energiebranche und den Referenten.



Vortragsreihe an europäischen Hochschulen

Im Rahmen des Verbundes der deutschen SDE Teilnehmer haben sich die deutschen Teams zusammengeschlossen, um eine Vortragsreihe an europäischen Hochschulen zu initiieren. Unser Team stellte zusammen mit den drei anderen deutschen Teilnehmern den Wettbewerb und die jeweiligen Projekte an den renommierten Architekturfakultäten TU München und TU Delft vor.

Dies ist ein weiterer Schritt, das Bewusstsein und das Wissen um die Möglichkeiten und Chancen energieeffizienter und nachhaltiger Architektur zu steigern. Gleichzeitig birgt ein solches Zusammentreffen die Chance eines hochschulübergreifenden Austausches.



Messestände auf der Deubau in Essen und der Bautec in Berlin

Durch einen vom SDE-Team Stuttgart organisierten Messeauftritt auf Deutschlands größter Baumesse im Jahr 2010, der DeuBau in Essen, hat das Team vom 12. bis 16. Januar gemeinsam mit den anderen drei deutschen Wettbewerbsteilnehmern unser Projekt dem Fachpublikum präsentiert.

Auf der internationalen Fachmesse für Bauen und Gebäudetechnik Bautec (16. - 20. Februar 2010) war das Team zusammen mit den anderen am Solar Decathlon Europe 2010 teilnehmenden deutschen Hochschulen vertreten. Während dieser Woche informierten die Teams das interessierte Publikum über den Wettbewerb und die einzelnen Projekte und beantworteten Fragen zum energieeffizienten Wohnungsbau.



CEP - Clean Energy und Passivehouse Fair

Neben dem Forschungsinstitut zafh.net der Hochschule für Technik und anderen Forschungseinrichtungen im Bereich Solares Bauen in Baden-Württemberg, hat sich das SDE-Team Stuttgart auf der Messe CEP (25.-27.02 2010) präsentiert.

Bei dieser Gelegenheit konnten weitere Zielgruppen erreicht werden.



home+ - Richtfest am 20.04.2010

Derzeit werden die Holzmodule, die bereits Ende letzten Jahres als Rohbau fertiggestellt werden konnten, ausgerüstet und ausgebaut.

Ende März kommen die Module nach Stuttgart, wo sie auf dem Parkplatz Breitscheidstraße/Holzgartenstraße, hinter dem Bau 4 der HFT, aufgestellt werden. Ab Anfang Mai wird das Gebäude dann wieder zerlegt und für den Transport nach Madrid vorbereitet werden.

Am 20. April findet unser Richtfest statt. Das Team möchte Sie dazu herzlich einladen und freut sich auf Ihr Kommen.

sd europe



SDE 2010 - Fanreise nach Madrid

Endlich ist es soweit! Wir würden uns freuen, wenn Sie uns im Juni diesen Jahres in Madrid während der Wettbewerbszeit besuchen und uns bei diesem großen Ereignis begleiten würden.

Für weitere Informationen zur Fanreise kontaktieren Sie bitte unsere Fundraising Referentin:

Dipl.-Ing. Christiane Kloss christiane.kloss@hft-stuttgart.de

Ganz herzlich möchten wir uns auch bei unseren Partnern, Sponsoren und Unterstützern bedanken, ohne deren Hilfe und Einsatz wir dieses Projekt nicht realisieren können. Auf der nächsten Seite finden Sie eine Übersicht mit allen beteiligten Partnern und Sponsoren.

Ihr Solar Decathlon Team Stuttgart.

Solar Decathlon Team Stuttgart:

Prof. Dr. Jan Cremers
Prof. Dr. Heiner Hartmann
Sebastian Fiedler
Annette Kunz-Engesser
Christiane Kloss
Ulrich Handfest
Markus Binder
Antoine Dalibard
Siegfried Baumgartner
Albert Stöcker
Silvio Barta
Jürgen Aldinger
Ole Fach
Dominik Hahne

Faculty Advisor
Structural Engineer
Project Manager
Costs and Schedule
Fundraising
Fundraising
Bauphysik
Bauphysik
MSR/Electrical Engineer
Site Manager
Webdesign
Schreinerei Innenarch.
Site Manager Assistant
Site Manager Assistant

Daniel Walter Claudia Röttinger Sebastian Schmidt Sonya Untch Mark Fandrich Dalet Bodan Nansi Palla Nalan Okumus Thilo Sprenger Simon Büttgenbach Micha Schneider Michael Bauz Saskia Bulut Jens Rosenauer Simone Idler Christina Feil Elena Begaeva Maximilian Martin Michael Rösch Alen Lorenz

...und alle Aufbauhelfer

Construction Manager **Project Engineer** Student Team Leader Health & Safety **Public Relations Contact Instrumentation Contact** Cost Estimator Fire Watch Captain **PVT Contact Energieturm Contact** Messe Organisator Fassade Kühldecke Lichtsimulation Health & Safety Webprogrammier Nachhaltigkeit Innenraum Möbel

Film/Animation

Project Architect

Förderer des Teams der HFT Stuttgart - home⁺

Das Projekt Solar Decathlon Europe 2010 wird vom Bundesministerium für Wirtschaft und Technologie (BMWi) finanziell unterstützt und steht unter der Schirmherrschaft des Wirtschaftministers der Bundesrepublik Deutschland.

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Der HFT-Beitrag zum SDE2010 steht unter der Schirmherrschaft des Ministerpräsidenten und des Oberbürgermeisters der Landeshauptstadt Stuttgart.

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Knödler-Decker-Stiftung
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AStA/ Allgemeiner Studienausschuss
Architektenkammer Baden-Württemberg
Wacker Ingenieure
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Solar Decathlon Europe 2010

Erste Entwürfe

Die HFT Stuttgart ist eine von 20 Hochschulen weltweit, die beim Solar Decathlon Europe 2010 dabei ist. Bei diesem "Solaren Zehnkampf" – Wettbewerb treten ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Die teilnehmenden Hochschulen kommen unter anderem aus Spanien, Großbritannien, den USA, Mexiko und China. Innerhalb Deutschlands steht die HFT Stuttgart im Wettbewerb mit drei weiteren Hochschulen.

Ende Januar 2009 haben alle Hochschulteams die Plane und Konzepte ihrer Entwurfe in Madrid abgegeben. Damit geht es in die zweite Phase der Weiterentwicklung, Detailplanung und Bauvorbereitung.

An der HFT Stuttgart soll unter der Projektleitung von Professor Dr. Jan Cremers der Beweis angetreten werden, dass energieeffizientes Bauen mit einem hohen architektonischen Anspruch einhergehen kann. In interdisziplinären Teams wird ein leichtes Elementbausystem entwickelt und umgesetzt.

Zum Abschluss des Wettbewerbs werden die Hauser aller Teams in Madrid eine Woche lang einer breiten Offentlichkeit präsentiert und die Sieger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfahigkeit bewertet.

Hauptziel des Wettbewerbs ist es, bei Studierenden und in der Öffentlichkeit das Bewusstsein für und das Wissen um die Moglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinfuhrung innovativer solarer Energietechnologien soll gefördert werden

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Zukunftsprojekte

Wir sehen uns 2010 in Madrid!

Solar Decathlon

ie Hochschule für Technik Stuttgart ist beim Solar Decathlon Europe 2010 dabei! Bei diesem "Solaren Zehnkampf"-Wettbewerb treten 20 ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen.

VON PETRA DABELSTEIN

Zum Abschluss des Wettbewerbs werden die Häuser aller Teams eine Woche lang in Madrid der Öffentlichkeit präsentiert und die Sieger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet.

In den Jahren 2003, 2005 und 2007 wurde der Solar Decathlon vom amerikanischen Energieministerium (DOE) ausgelobt und in Washington D.C. ausgetragen. Nach dem vielbeachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA, wird der Wettbewerb nun zum ersten Mal auch in Europa ausgetragen. Auslober ist das spanische Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium. Die teilnehmenden Hochschulen kommen dieses Mal unter anderem aus Spanien, Großbritannien, den USA, Mexiko und China. Innerhalb Deutschlands steht die HFT Stuttgart im Wettbewerb mit drei weiteren Hochschulen. Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das



Das HFT-Team für den Solar Decathlon 2010.

Foto: privat

Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinführung innovativer solarer Energietechnologien soll gefördert werden. Unter der Projektleitung von Professor Dr. Jan Cremers soll der Beweis angetreten werden, dass energieeffizientes Bauen mit einem hohen architektonischen Anspruch einhergehen kann.

Der Wettbewerb Solar Decathlon Europe 2010 ist auch eine hervorragende Gelegenheit, den Studierenden der HFT Stuttgart einen wichtigen neuen Baustein ihrer interdisziplinären und praxisnahen Ausbildung anzubieten.

Das Kernteam für den Beitrag der HFT Stuttgart stammt aus dem Master-Studiengang Architektur, das den Wettbewerb kontinuierlich über seine Laufzeit bis in den Sommer 2010 bearbeiten und begleiten wird. Es wird dabei unterstützt und betreut durch zahlreiche Professoren der Fakultät Architektur und Gestaltung. Weitere beteiligte Studiengänge sind:

- Master Sustainable Energy Competence (SENCE) unter der Leitung von Prof. Dr. Ursula Eicker
- Bachelor Bauphysik unter der Leitung von Prof. Dr. Andreas Beck (thermische Bauphysik)

- Bachelor Innenarchitektur unter der Leitung von Prof. Diane Ziegler und Prof. Klaus-Peter Goebel
- Master Konstruktiver Ingenieurbau (KI) unter der Leitung von Prof. Dr. Heiner Hartmann und Prof. Dr. Pe-

Der Startschuss ist bereits gefallen! Das erste Semester des Master-Studiengangs Architektur hat im WS 2008/09 einen Entwurf erarbeitet. Ende Januar haben alle teilnehmenden Hochschulen ihr Konzepte in Madrid eingereicht. Damit ist die erste Phase abgeschlossen und es geht in die zweite Phase der Weiterentwicklung, Detailplanung und Bauvorbereitung. Darüber hinaus konzentriert man sich nun darauf, Förderer und Sponsoren zu gewinnen, die das Team der HFT Stuttgart mit Erfahrungswissen, Sachleistungen und finanziell unterstützen.

www.sdeurope.de

Partnerhochschulen der Hochschule für Technik Stuttgart

Name: University of Technology Krakow, Faculty of Architecture

Sitz: Krakow, Polen

Studierendenaustausch: Architektur, Stadtplanung

Partnerschaft seit: 2008

Gesamtzahl der Studierenden: 17.000

Profil

Die Polytechnica ist eine der bedeutensten Architektur-Universitäten Polens. Hier werden Architekten und Stadtplaner in Bachelor und Master ausgebildet, mit einem ausgewiesenen künstlerischen Schwerpunkt. Krakau ist eine der städtebaulich bemerkenswertesten Städte



Europas, hier können alle Baustile vom Mittelalter bis zur Moderne studiert werden. Krakau ist aber auch eine der am stärksten wachsenden Städte Polens, weshalb zunehmend auch Stadtplaner gesucht werden. Im Frühjahr 2007 nahm der Master Stadtplanung an einem gemeinsamen Workshop über Stadtentwicklung am Wasser in Krakau teil. Im Herbst 2008 besuchten Prof. Dr. Zuziak und Prof. Dr. Podhalanski mit einer Delegation die HFT, im Frühjahr 2009 ist der Gegenbesuch geplant. Neben Studenten- und Dozentenaustausch in Architektur und Stadtplanung sollen künftig auch gemeinsame Workshops und Wettbewerbe veranstaltet werden.

Lehren und lernen im Jahre 2020

Neuer Laptop- und Multimedia-Hörsaal

ie wird die Lehre an der HFT im Jahre 2020 aussehen? Außer der nicht besonders prophetischen Aussage, dass sie anders aussehen dürfte als heute, wird wohl niemand diese Frage im Detail beantworten können. Zwei Änderungen in der Lehre werden jedoch mit hoher Sicherheit eintreten. Zunächst werden Studierenden-Laptops keine Besonderheit, sondern eine Selbstverständlichkeit sein. Genauso werden Lehrinhalte überall und immer verfügbar sein, getreu dem Motto, dass wo der Studierende nicht zur HFT kommt, die HFT eben zum Studierenden kommen muss.

VON PROF. DR. PETER HEUSCH

Am Anfang stand jedoch die eher profane Frage nach der Einrichtung eines Hörsaals für die Vorlesungen der Vermessung und Geoinformatik. Nachdem der Raum 1/014 vor dem Sommersemester 2008 zum Rechnerraum für Veranstaltungen der Fakultäten B und C umgebaut worden war, mussten für die ehemals in diesem Raum stattfindenden Vorlesungen ein Ausweichraum gefunden werden. Von vornherein war klar, dass der im vormaligen Vermessungsgeräteraum 1/022 neu zu schaffende Hörsaal in dem Sinne multifunktional

sein sollte, dass er sowohl Veranstaltungen mit als auch ohne Rechner optimal unterstützt. Eine Ausrüstung mit festen Rechnerarbeitsplätzen erschien also nicht sinnvoll.

Angesichts zunehmender Laptop-Zahl bei den Studierenden der Fakultät C reifte die Überlegung, jeden Tisch mit einem Netzwerk- und einem Strom-Anschluss zu versehen, da auf absehbare Zeit WLANs nicht in der Lage sein würden, 40 Rechner simultan mit der nötigen Netzbandbreite zu versorgen.

Im Rahmen des Impulsprogramms des Landes Baden-Württemberg ergab sich zudem die Chance, eine Multimedia-Einrichtung, bestehend aus Kamera, Mikrofonen, zwei Beamern und entsprechender Aufzeichnungshardware einzubauen. Daneben gibt es noch ein Smartboard, d. h. einen Monitor, der mit speziellen Stiften beschrieben werden kann und somit die Tafel ersetzt. Natürlich werden auch Präsentationen mit PowerPoint, OpenOffice oder PDF unterstützt. Als Hilfestellung für die Studierenden gibt der zweite Beamer bei Benutzung des Smartboards, den "alten" Inhalt des Smartboards wieder, so dass, ähnlich wie bei normalen Tafelvorlesungen, nicht nur die aktuell beschriebene Tafel sichtbar ist. Somit können Vorlesungen aufgezeichnet und zeitversetzt oder live im Intranet zur Verfügung gestellt werden. Davon profitieren nicht nur Veranstaltungen, bei denen Vorträge Teil der Veranstaltung sind, wie zum Beispiel Präsentationstrainings oder Seminare. Interessant ist auch die Möglichkeit, Studierenden eine zeitversetzte Teilnahme an der Lehre zu erlauben, beispielsweise während Auslandssemestern oder bei berufsbegleitenden Studiengängen.

Der Zeitplan für den Umbau des Raumes in den vergangenen Sommersemesterferien war von vornherein recht knapp, zudem traten noch unvorhersehbare Probleme auf. Daher konnte der Raum erst Anfang November in Betrieb genommen werden. Um erste Erfahrungen mit der neuen Lehrform zu sammeln und die eingesetzte Software testen zu können, wurden ab diesem Zeitpunkt je eine Veranstaltung der Vermessung und Geoinformatik von Prof. Dr. Wolfgang Huep und der Informatik von Prof. Dr. Peter Heusch mit den Systemen echo360 und Lecturnity aufgezeichnet. Durch diesen Test konnten wertvolle Hinweise für einen künftigen produktiven Betrieb gesammelt werden. Dies betrifft nicht nur die Aufzeichnung der Vorlesungen, die von beiden Produkten recht gut unterstützt wurde, sondern viel stärker die Speicherung, Verwaltung und Wiedergabe der Inhalte, wo sich an einigen Stellen Probleme zeigten.

Im kommenden Semester wird auch Prof. Dr. Georg Hauer diese Möglichkeiten nutzen, um die Veranstaltung Controlling aufzuzeichnen. Es ist zu erwarten, dass in Zukunft weitere Kollegen diese Möglichkeiten nutzen werden. Interessierte dürfen sich gerne an einen der oben genannten Kollegen oder den Technischen Leiter des Rechenzentrums, Hans-Peter Heppel, wenden.

Mit Engagement, Verantwortungsbewusstsein und Teamgeist bauen Sie, auf dem Fundament eines Trainee-Programms, Ihre Zukunft in einer gesunden, mittelständischen Bauunternehmung, in der jeder noch jeden kennt.

Bauingenieure m/w (mit Diplom-, Bachelor- oder Masterabschluss) und Praktikanten



Bei der Wohnraumbeschaffung



Gottlob Rommel Bauunternehmung

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Wirtschaft

Neuer Markenauftritt

Mit einem komplett überarbeiteten Markenauftritt präsentierte sich der Energiedienstleister Techem im März der Öffentlichkeit. Im Sinne des neuen Slogans "Energie clever nutzen" wurden in den vergangenen Monaten sämtliche Kommunikationsmaterialien inhaltlich und optisch überarbeitet. Als wesentlicher Baustein der neuen Markenwelt ging Anfang März der ebenfalls vollständig neu gestaltete Internetauftritt www.techem.de online. Techem (bislang vor allem bekannt als Mess- und Abrechnungsdienstleister) ist in jüngster Zeit insbesondere mit Diensteistungen erfolgreich, die den Energieverbrauch in Gebäuden senken. Ein starkes Wachstumsfeld ist das so genannte "Energy Contracting". Betreiber von Gebäuden mit einem hohen Energieverbrauch wie Schwimmbäder, Krankenhäuser oder Rechenzentren übergeben den effizienten Betrieb ihrer Anlagen (z.B. Heizung, Kühlung oder Stromerzeugung) an einen professionellen Dienstleister wie Techem, um damit Energie und Kosten zu sparen. Hier erzielt Techem jährlich zweistellige Wachstumsraten. Darüber hinaus bietet das Unternehmen Systeme an, die mit geringem Kostenaufwand Energie sparen. So ist adapterm ein System, das über die Auswertung des individuellen Heizungsverbrauchs die Heizungsanlage optimal steuert. Jern der neuen Techem-Marke ist daher das Thema "Energie sparen in Gebäuden".

Solar Decathlon Europe 2010

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Die teilnehmenden Hochschulen kommen u.a. aus Spanien, Großbritannien, den USA, Mexiko und China. Innerhalb Deutschlands steht die HFT Stuttgart im Wettbewerb mit drei weiteren Hochschulen.

Ende Januar haben alle Hochschulteams die Pläne und KonDie im Dezember 2008 in Brüssel verabschiedete Neufassung der europäischen "Richtlinie zur Förderung der Nutzung von Energie aus erneuerbaren Quellen" (Erneuerbare-Energien-Richtlinie) setzt ehrgeizige Ziele:

 Die EU will bis 2020 20% ihres Endenergieverbrauchs aus erneuerbaren Energiequellen (EE) decken.

Die einzelnen Länder müssen ihren EE-Anteil am Gesamtenergieverbrauch bis 2020 verbindlich steigern – Deutschland beispielsweise auf 18 %

Die Richtlinie definiert Wärmepumpen erstmals als erneuerbare Energiequelle. Die erzeugte Wärme abzüglich des Antriebsstroms wird auf die jeweiligen Länderziele angerechnet.

Die EU rechnet Umweltnutzen von Wärmepumpen an

"Der Umweltnutzen der Wärmepumpe wird jetzt angemessen berücksichtigt", so Paul Waning, Vorstandsvorsitzender des Bundesverbands Wärmepumpe e. V. (BWP).

Einen weiteren Schwerpunkt

legt die Richtlinie auf qualifiziertes Fachpersonal. "Die fachmännische Planung und Regelung einer Wärmepumpe ist Voraussetzung für effiziente Anlagen und zufriedene Kunden. Daher setzen wir uns seit Jahren für

> die Qualifizierung von Wärmepumpen-Experten ein." Bis 2010 müs-

sen die Mitgliedsstaaten nun nationale Aktionspläne vorlegen, wie sie die Zielvorgaben aus Brüssel erfüllen wollen.

Die Neufassung der Erneuerbare-Energien-Richtlinie definiert Wärme aus Wasser, Erde und

zepte ihrer Entwürfe in Madrid abgegeben. Damit ist die erste Phase abgeschlossen und es geht in die zweite Phase der Weiterentwicklung, Detailplanung und Bauvorbereitung.

An der HFT Stuttgart soll unter der Projektleitung von Prof. Dr. Jan Cremers der Beweis angetreten werden, dass energieeffizientes Bauen mit einem hohen architektonischen Anspruch einhergehen kann. In interdisziplinären Teams wird ein leichtes Elementbausystem entwickelt und umgesetzt.

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Weitere beteiligte Studiengänge sind Sustainable Energy Competence (SENCE), Bauphysik, Innenarchitektur und Konstruktiver Ingenieurbau.

Momentan konzentrieren sich die Anstrengungen in der frühen Phase des Wettbewerbs besonders darauf, Förderer und Sponsoren zu gewinnen, die das Team der HFT Stuttgart mit Erfahrungswissen, Sachleistungen und auch finanziell unterstützen

Zum Abschluss des Wettbewerbs werden die Häuser aller Teams in Madrid eine Woche lang einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet.

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Noch "viel Luft nach oben"

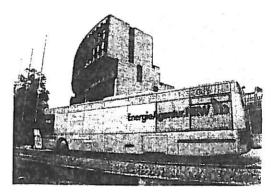
Die Papierindustrie hat ein eigenes Branchenenergiekonzept. Es wurde im Rahmen der Landes-Energieeffizienzoffensive "NRW spart Energie" mit Unterstützung des nordrhein-westfälischen Wirtschaftsministeriums erstellt und auf einer Veranstaltung der EnergieAgentur.NRW

Düsseldorf Ende 2008 der Öffentlichkeit vorgestellt. "Branchenenergiekonzepte basieren auf der Erkenntnis dass Unternehmen einer Branche in der Regel identische energetische Schwachstellen aufweisen

Energiekonzepte für eine ganze Branche eignen sich als Orientierungshilfe und Navigationsinstrument, um im Betrieb individuell die Schwachstellen aufzuspüren und zu beseitigen", so Prof. Dr. Norbert Hüttenhölscher, Geschäftsführer der EnergieAgentur.NRW. Die Einsparpotenziale in der Papierbranche betragen nach Erkenntnissen der EnergieAgentur.NRW im Durchschnitt zwischen 5 und 10 % der Energiekosten.

Das Branchenenergiekonzept Papier wurde von der Arbeitsgemeinschaft Papierindustrie (Institut für Energie- und Umwelttechnik e. V. IUTA, Duisburg, Lehrstuhl für technische Thermodynamik der RWTH Aachen, PTS Papiertechnische Stiftung, München, und EUtech Energie & Management GmbH, Aachen, in Kooperation mit dem Verband deutscher Papierfabriken, Bonn) erstellt.

Die Zellstoff- und Papierindustrie gehört zu den fünf größten industriellen Energieverbrauchern in Deutschland. In den vergangenen Jahren betrug der Anteil der Energiekosten (bezogen auf den Umsatz) rund 10 %. Wie für viele andere Branchen ist auch für die Papierindustrie der



Kostenfaktor Energie von erheblicher Bedeutung, wenn es darum geht, die Wettbewerbsfähigkeit zu erhalten. Die Papierindustrie hat deshalb bereits versucht, Möglichkeiten zur Verringerung des Energieeinsatzes umzusetzen.

Solar Decathlon Europe 2010

In den Jahren 2003, 2005 und 2007 wurde der Solar Decathlon vom amerikanischen Energieministerium (DOE) ausgelobt und in Washington D.C. ausgetragen. Nach dem vielbeachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA wird der Wettbewerb nun zum ersten Mal auch in Europa ausgetragen. Auslober ist das spanische Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium (DOE). Die Organisation übernimmt die Universidad Politécnica de Madrid (UPM).

Team HFT Stuttgart

Gebäude bedingen ein Drittel des weltweiten Gesamtenergieverbrauchs und damit auch ca. ein Drittel der weltweiten Treibhausgas-Emissionen, Der Bausektor produziert außerdem 25-40 % allen festen Abfalls weltweit und verbraucht damit insgesamt ungefähr die Hälfte aller Primärressourcen. Von daher ist gerade dieser Bereich gehalten, durch den größtmöglichen Einsatz von erneuerbaren Energien und einen umfassenden integralen Ansatz einen Beitrag zu Energieeinsparung und -effizienzsteigerung zu leisten.

Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010", der ein in den USA sehr erfolgreich etabliertes Modell nach Europa holt: Wie könnte Wohnungsbau in Zukunft aussehen, der das solare Bauen mit hohen gestalterischen Ansprüchen an die Architektur verbindet? Es geht dabei nicht nur um den Energieverbrauch, sondern um einen ausgewachsenen "Zehnkampf", das heißt, der strapazierte Begriff der Nachhaltigkeit wird als komplexes Themenfeld großer Breite ernst genom-

Die Hochschule für Technik Stuttgart wurde in einem aufwendigen Qualifizierungsverfahren als einer von 21 internationalen Teilnehmern ausgewählt. Wir vereinen für diesen Wettbewerb unsere gesamte umfassende Kompetenz auf diesem Gebiet, indem wir neben den Professorenkollegen und allen einschlägigen Studiengängen (Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence) auch unser Institut für Gebäudeenergieforschung (zafh.net) einbringen. Damit sehen wir uns bestens gerüstet, diese Aufgabe von der entwurflichen Konzeption über die technische Durcharbeitung bis hin zur Realisierung vor Ort in Madrid erfolgreich und auf hohem Niveau zu bewältigen Als Hochschule, die in langer Tradition der Baupraxis verbunden und verpflichtet ist, freuen wir uns besonders, dass der internationale Wettbewerb nicht als reine akademische Übung konzipiert ist. Wir wollen vielmehr in der Realisierung den Beweis der Praxistauglichkeit antreten und vertrauen darauf, dass die Veranstaltung als Bau-Ausstellung auf großes Interesse einer breiten internationalen Öffentlichkeit stoßen wird.

Neben der Hochschule für Technik Stuttgart nehmen drei weitere deutsche Hochschulen an diesem Wettbewerb teil, nämlich die Bergische Universität Wuppertal, die Fachhochschule Rosenheim und das Team LivingEquia rund um die Fachhochschule für Wirtschaft und Tech-

- Hochschule für Technik Stuttgart (HFT Stuttgart) www.sdeurope.de
- Bergische Universität Wuppertal
- www.sdeurope.uni-wuppertal.de - Fachhochschule Rosenheim
- www.solar-decathlon.fh-rosenheim.de
- Fachhochschule für Wirtschaft und Technik Berlin www.living-equia.com.

Die Herausforderung

Solar Decathlon Europe

Beim "Solaren Zehnkampf" treten 21 ausgewählte Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75 m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Dann werden die Häuser aller Teams eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept, stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

Ziele des Wettbewerbs

Das Hauntziel des Wettbewerbs ist es bei Studenten und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Darüber hinaus soll die Markteinführung innovativer solarer Energietechnologien gefördert und der Nachweis erbracht werden, dass energieeffizientes Bauen mit hohem Wohnkomfort und architektonischer Qualität verwirklicht werden kann.

Workshop und Messeauftritt in Madrid 27.-29.05.09

Vom 27.-29.05.09 treffen sich alle Teams der teilnehmenden Hochschulen für einen ersten gemeinsamen Workshop im Kongresszentrum der Messe in Madrid. Dabei werden die Entwürfe und Energiekonzepte vorgestellt und wichtige Fragen des weiteren Wettbewerbsablaufes mit den Organisatoren abgeklärt. Gleichzeitig bietet dieses Treffen natürlich auch eine hervorragende Gelegenheit zum Kennenlernen und für den internationalen Austausch von Erfahrungen und Ideen. Zeitgleich mit dem Workshop findet die internationale Immobilienmesse SIMA09 auf dem Messegelände in Madrid statt. Dort werden auf einem gemeinsamen Stand die Entwürfe und Konzepte aller Teams als Modelle im Maßstab 1:25, auf Postern und mit einem kurzen Filmbeitrag präsentiert.



Die 21 Wettbewerber

21 Teams renommierter Hochschulen aus Europa und der ganzen Welt stellen sich der Herausforderung und nehmen am Wettbewerb teil:

Hochschule für Technik Stuttgart (HFT Stuttgart)	Deutschland
Bergische Universität Wuppertal	Deutschland
Fachhochschule Rosenheim	Deutschland
Fachhochschule für Wirtschaft und Technik Berlin	Deutschland
Universidad Politécnica de Cataluna	Spanien
Universidad CEU Cardenal Herrera	Spanien
Universidad de Sevilla	Spanien
Universidad de Valladolid	Spanien
Universidad Politécnica de Valencia	Spanien
Instituto de Arquitectura Avanzada de Cataluna	Spanien
Cambridge University	Großbritannien
University of Nottingham	Großbritannien
Ecole Nationale Supérieure de Grenoble	Frankreich
Arts et Métiers Paris Tech (ENSAM)	Frankreich
Helsinki University of Technology	Finnland
University of Florida	USA
Virginia Polytechnic Institute State University	USA
Inst. Technol. y de Estudios Sup. de Monterrey	Mexiko
Consórcio Brasil	Brasilien
Tianjin University	China
Arial University Center of Samaria	Israel

Disziplinen und Gew Architektur	1. Architektur	130
	2. Konstruktion	80
Solar	3. Solarsysteme	130
	4. Elektrische Energiebilanz	130
Komfort	5. Komfortbedingungen	130
	6. Haushaltsgeräte	80
Sozial & Ökonomisch	7. Kommunikation & soziales Bewusstsein	80
	Industrialisierung und Marktfähigkeit	80
Strategie	9. Innovation	130
	10. Nachhaltigkeit	80
		1.000

nsteine
Auswahl der Teilnehmer
Abgabe Entwurfs- und Energiekonzept
Abgabe Architekturmodell und Multimediapräsentation
Workshop aller Teilnehmer und Messeauftritt in Madric
Abgabe Konstruktionspläne
Abgabe aktualisierte Konstruktionspläne
Abgabe Bauablaufplan
Wettbewerb in Madrid

Weitere Informationen zur SIMA09 finden Sie unter: www.simaexpo.com

Weitere Informationen zum SD Europe 2010 finden Sie unter: www.sdeurope.org

Autos mit Batterie sollen zukünftig auch als Stromspeicher dienen

Bis zum Jahr 2020 sollen nach dem Willen der Bundesregierung eine Million Elektroautos auf deutschen Straßen rollen. Bis dahin haben Forscher alle Hände voll zu tun, denn die umweltfreundlichen Motoren der Zukunft sind noch lange nicht marktfähig.

Von Jennifer Reich

KARLSRUHE/ULM. 500 Millionen Euro stellt die Bundesregierung im Rahmen des Konjunkturpakets II bis zum Jahr 2011 zur Förderung der Elektromobilität zur Verfügung. So erhält beispielsweise die Region Stuttgart als Modellregion für Elektromobilität 15 Millionen Euro (siehe Kasten). Elektrofahrzeuge sollen erprobt, der Markt dafür vorbereitet werden.

In der Forschung hat man im Geburtsland des Automobils in Sachen Elektromobilität schon einiges erreicht: Die ersten Smart-Flotten machen Testfahrten in London, Hybridfahrzeuge sind bereits auf dem Markt. Letztere verfügen neben einem Verbrennungsmotor über Elektromotor und Batterie. Diese lässt sich über eine Steckdose aufladen. Die Batterie unterstützt den Verbrennungsmotor und soll Bremsenergie zurückgewinnen. Vor allem im Stadtverkehr kann damit der Spritverbrauch gesenkt werden.

Auswirkungen der Elektromobilität auf das Stromnetz werden untersucht

Forscher am "Karlsruhe Institute of Technology" (KIT) untersuchen im Rahmen des Projekts "Flottenversuch Elektromobilität" die langfristigen Auswirkungen der Elektromobilität auf den Kraftwerkspark, die Übertragungsnetze und das Energieversorgungssystem in Deutschland und Europa. "Vor allem wollen wir untersuchen, inwieweit die Elektromobilität in den nächsten drei



Ein Mitarbeiter testet Hochleistungsbatterien am Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg. FORD: 13W

Jahrzehnten in Deutschland eine Möglichkeit zur Energiespeicherung darstellen könnte", so Dominik Möst vom Lehrstuhl für Energiewirtschaft am Institut für Industriebe triebslehre und industrielle Produktion am KIT. "Entwicklungen, wie die Vehicle-to-Grid-(V2G)-Technologie könnten die Übertragungsnet-ze entlasten und Produktionsspitzen abfangen." Bei der V2G-Tech-nologie werden Fahrzeuge, wenn sie nicht genutzt werden, ans Netz ge-hängt. Auf diese Weise wird nicht allein der Wagen aufgetankt, die Autos können zugleich als Speicher für das Stromnetz genutzt werden. Steht wenig Strom zur Verfügung, kann das Auto Strom ins Netz zurückspeisen. "Dabei gehen wir vor allem der Frage nach, in welchem Umfang Elektromobilität einen Beitrag zur besseren Integration von erneuerbaren Energien aus schwankenden Energiequellen wie Wind und Sonne

Stuttgart ist Modellregion für Elektromobilität

Die Region Stuttgart erhält rund 15 Millionen Euro aus dem Konjunkturpaket II der Bundesregierung. Das Geld soll in ein Projekt fließen, für das sich neben Daimler auch Zulieferer Bosch und Mahle sowie Universitäten und Forschungseinrichtungen zusammengeschlossen haben. Ziel des Netzwerks ist laut Umweltministerium, den Einsatz von Elek-

ins Energiesystem leisten kann", sagt Möst: Denn erneuerbare Energien wie Wind- und Sonnenkraft stehen nicht gleichmäßig zur Verfügung. Zu bestimmten Zeiten ist ein Überangebot an Strom im Netz.

"Diese Netzengpässe könnten bei unzureichendem Ausbau der Übertragungskapazitäten eine Barriere für die Nutzung von lokalen und zeitlich schwankenden Energiequellen sein", sagt Möst. Das gesteuerte Laden von Elektrofahrzeugen in Zeiten starker Stromeinspeisung aus Windkraftanlagen könnte das Übertragungsnetz entlasten und die Energie könnte dadurch sinnvoll genutzt werden. Auswirkungen auf das Energiesystem ergeben sich allerdings erst, wenn viele Elektroautos

hierfür eingesetzt würden. Eine Million Fahrzeuge fielen kaum ins Ge-

trofahrzeugen voranzutreiben. Zum

Beispiel soll der Einsatz von Elektrooder Hybridbussen getestet werden. Ne-

ben Stuttgart werden das Rhein-Main-Gebiet, die Regionen Berlin/Potsdam,

Bremen/Oldenburg, Hamburg, München, Rhein-Ruhr und Sachsen mit insgesamt

115 Millionen Euro unterstützt, Bewor-

ben hatten sich 130 Regionen.

wicht. Erste Forschungsergebnisse erwartet er bis Ende des Jahres. Doch noch gilt es ein weiteres Hindernis zu nehmen: Batterien von Elektroautos sind nach wie vor schwer und teuer. Die Reichweite der Batterie ist auf zirka 150 Kilometer beschränkt. Auch aus Sicherheitsgründen können die Batterien noch nicht eingesetzt werden. Forscher am Zentrum für Sonnenergie- und Wasserstoffforschung Baden-Württemberg (ZSW) in Ulm entwickeln neue Batteriematerialien, die derzeit eingesetzte Lithium-Ionen-Akkus verbessern sollen.

Ansprüche der Automobilindustrie müssen erfüllbar gemacht werden

Am häufigsten wird bei wiederaufladbaren Lithiumzellen bislang die
Kombination Lithiumkobaltoxid als
positive Elektrode und Grafit als negative Elektrode verwendet. Wie
auch bei Mobiltelefonen und Laptops. Diese Technologie kann aus
Kosten- und Sicherheitsgründen
bislang nicht für Autoantriebe eingesetzt werden. "Große Chancen für
Fahrzeuganwendungen räumen
Fachleute Kathodenmaterialien mit
Olivinstruktur, wie etwa Lithiumeisenphosphat oder Lithiummanganphosphat ein", sagt Werner Tillmetz, Vorstandsmitglied des ZSW.

"Sie besitzen eine ausgezeichnete thermische und chemische Stabilität, die Rohstoffe stehen in ausreichender Menge zur Verfügung." Die Anforderungen der Automobilindustrie erfüllen die neuen Materialien jedoch noch nicht: Stabilität und Sicherheit bei Temperaturen von minus 30 bis plus 80 Grad sowie hohe Zyklenzahlen bei großer Entladetiefe und eine Lebensdauer von mehr als zehn Jahren sind nötig.

MEHR ZUM THEMA
Weitere Infos zum Thema Elektromobilität finden Sie im Internet unter:
www.zsw-bw.de
www.kit.edu

Stimmen zum Thema



Harry Döring ZSW Ulm, Fachgebiet Elektrochemische Akkumulatoren

"Zukunft der Elektromobilität, unbedingt. Diese Form wird einen festen Platz mit wachsendem Anteil für die Sicherstellung einer hohen Mobilität haben, ob rein elektrisch oder in jeder anderen Form und in jedem anderen Grad der Hybridisierung. Probleme und Wünsche in Bezug auf limitierte Energiespeicherung: Energiedichte, Kosten, Sicherheit sind bekannt, werden aber sukzessive besser gelöst werden."



Jochen Wiedemann Leiter des Lehrstuhls Kraftfahrtswesen an der Universität Stuttgart

"Der Weg in die Elektromobilität wird lang sein und sich zunächst überwiegend auf Pkw beschränken. Bis zum Jahr 2020 wird bundesweit kaum mehr als ein einstelliger Prozentsatz von Elektrofahrzeugen zugelassen werden. Die Gründe dafür sind Kosten- und Akzeptanzprobleme sowie der Mangel an industriellen Prozessen für die Größserienfertigung."

Kurz notiert

Landesweite Kampagne gegen Mobbing an Schulen

STUTTGART. Das Kultusministerium hat gemeinsam mit der Techniker Krankenkasse dem Mobbing an Schulen den Kampf angesagt. Das Projekt "Mobbingfreie Schule–gemeinsam Klasse sein!" soll Drohungen und Schikanen Einhalt gebieten. Geplant sind Projektwochen an Schulen, Fortbildungen für Lehrer sowie Informationsveranstaltungen für Eltern. (Isw)

Positive Bilanz zu Kindergarten-Modellprojekt

STUTTGART. Drei Jahre lang haben Kinder in 79 Kindergärten experimentiert und gebastelt. Die Förder-Initiative "Naturwissenschaftlich-technische Modellprojekte in Kindergärten" der Stiftung Kinderland erzielte Erfolge: Motorische Fertigkeiten, kognitive Leistungen, Kreativität und Ausdauer wurden positiv beeinflusst. (jer)

Eucor feiert 20 Jahre Zusammenarbeit

FREIBURG/KARLSRUHE. Die Europäische Konföderation Oberrheinischer Universitäten (Eucor) feiert ihr 20-jähriges Bestehen. Zum trinationalen Universitätsverbund, der rund 100000 Studierende und 11000 Lehrende und Forscher umfasst, gehören auch die Universitäten Freiburg und Karlsruhe. Seit 1989 bietet Eucor Möglichkeiten für kooperative Lehre und Forschung, (jer)

Studierende präsentieren für den Solar Decathlon ein modular aufgebautes Gebäude, das sich an die Nutzung anpassen lässt

 $Entwurf wird in Madrid vorgestellt/Ministerpr\"{a}sident Oettinger \"{u}bernimmt Schirmherrschaft f\"{u}r Projekt der Hochschule f\"{u}r Technik$

STUTTGART/MADRID. Noch ein Jahr haben die Studierenden an der Hochschule für Technik (HFT) in Stuttgart Zeit, bis ihr Haus in Madrid aufgestellt wird. Die Hochschule für Technik ist eine von weltweit 20 Hochschulen, die am Wettbewerb Solar Decathlon 2010 in Madrid teilnimmt. Das Ziel: Die Studierenden entwerfen und bauen solares Wohnen der Zukunft. Dazu erstellen sie ein Haus, das ausschließlich über Solarenergie betrieben wird. Entwurf und Modell haben sie nun in Madrid auf der internationalen Immobilienmesse Sima vorgestellt.

Ab Herbst soll gebaut werden. Das Gebäude, das die Studierenden an der Hochschule für Technik entworfen haben und für das Ministerpräsident Günther Oettinger (CDU) die Schirmherrschaft übernommen hat, ist modular aufgebaut. Was nicht al-

Solar Decathlon 2010

Der Solar Decathlon ist ein Hochschulwettbewerb. Studententeams entwerfen und bauen dafür jeweils ein Haus, das ausschließlich über Solarenergie gespeist wird. Im Juni 2010 müssen die Häuser dann in Madrid ihre Praxistauglichkeit beweisen. Aus Baden-Württemberg ist die Hochschule für Technik in Stuttgart dabei.

www.sdeurope.org

lein Vorteile für den Transport nach Madrid mit sich bringt, sondern auch die Weiterentwicklung zu einem Bausystem ermöglicht. Es lässt sich modifizieren und erweitern, so dass mit diesen Modulen ebenso ein Wohngebäude für Singles wie auch für Familien entstehen kann.

Ein modular aufgebautes Gebäude mit Energieturm

Zwischen den einzelnen Modulen, etwa für Wohnen, Essen oder Schlafen, befinden sich schmale Bereiche. sogenannte Fugen, die der Belichtung und Belüftung dienen. Zentrales Element im Entwurf ist ein Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas beiträgt. Dabei orientieren sich die Studenten an Grundprinzipien traditioneller Vorbilder aus heißen Regionen, wie etwa den Windtürmen im arabi-schen Raum. "In der Kombination mit heute verfügbaren Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt", erläutert Projektleiter Jan Cremers, Pro-fessor für Gebäudetechnologie und Integrale Architektur an der HFT.

Die Kombination von traditionellen Grundprinzipien und modernen Materialien setzt sich auch an anderen Stellen im Haus fort. So sorgen etwa Phasenwechselmaterialien in dem Holzgebäude für Energiespeicherung oder Energieabgabe, ohne dass sich die Raumtemperatur verändert.

Um den Energiebedarf des Gebäudes und der Haushaltsgeräte zu decken, werden Dach und Fassaden mit einer Hülle aus Solarmodulen versehen, die zugleich auch als gestalterisches Element genutzt werden. Nach dem Wettbewerb soll das Gebäude auf dem Campus der Hochschule für die Lehre genutzt werden. Zuvor hoffen die Beteiligten jedoch auf breites öffentliches Interesse des Wettbewerbs als internationale Bauausstellung.

Erstes Treffen aller 20 Hochschulteams in Madrid

In Madrid haben sich nun zum ersten Mal alle Hochschulteams getroffen und ausgetauscht. Mit dabei sind weitere Teams aus Deutschland, Großbritannien, Frankreich, Spanien und Finnland, aber auch aus Israel, Brasilien, Mexiko, den USA und China. "Wir brauchen uns mit unserem Entwurf nicht zu verstecken", ist Cremers überzeugt. (schl)

MEHR ZUM THEMA
Die HFT beim Solar Decathlon 2010:
www.sdeurope.de



In Madrid wurden das Modell der Studierenden aus Stuttgart erstmals öffentlich gezeigt.



Stuttgart, 19. Juni 2009

Wohnungsbau der Zukunft mit HOME+

Internationaler Wettbewerb Solar Decathlon Europe 2010

Wie sieht der Wohnungsbau der Zukunft aus? Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010", der ein in den USA sehr erfolgreich etabliertes Modell nach Europa holt. Beim "Solaren Zehnkampf" tritt die HFT Stuttgart als eine von 20 ausgewählten Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen.



HOME+ heißt das Gebäude der HFT Stuttgart. Der Name steht für ein Wohnhaus und Zuhause, welches als Plusenergiehaus mehr Energie produziert, als es verbraucht. Zudem sollen die vielfältigen Nutzungsmöglichkeiten durch die Modularität des Bausystem ausgedrückt werden. (Bilder: HFT)

"Wir vereinen für diesen Wettbewerb unsere gesamte umfassende Kompetenz, indem wir das Knowhow der Studiengänge Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence sowie unses Instituts für Gebäudeenergieforschung (zafh.net) einbringen." Projektleiter Professor Dr. Jan Cremers sieht die HFT Stuttgart bestens gerüstet, diese Aufgabe von der Konzeption des Entwurfs über die technische Durcharbeitung bis hin zur Realisierung vor Ort in Madrid erfolgreich und auf hohem Niveau zu bewältigen. "Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden einen wichtigen interdisziplinären, zukunftsrelevanten und praxisnahen Baustein in ihrer Ausbildung anzubieten."

Das Entwurfs- und Energiekonzept der HFT Stuttgart stellt eine Kombination von traditionellen Grundprinzipien mit modernem Material und neuer Technologie dar. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch erreicht man eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs.

Die einzelnen Module werden mit etwas Abstand zueinander angeordnet. Die entstehenden Fugen dienen der Belichtung, der

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Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas beiträgt. Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus entsprechenden Regionen, wie der Windtürme im arabischen Raum und der in Spanien weitverbreiteten Patios. In Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt.

Um den zwar niedrigen, aber dennoch vorhandenen, Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert. Das Dach und die Fassaden werden mit einer Art zweiten Hülle mit Photovoltaik-Solarmodulen (PV) zur Stromerzeugung versehen. Erste Simulationen lassen erwarten, dass der Energiebedarf mit den Erträgen der PV-Flächen nicht nur gedeckt werden kann, sondern sogar noch zusätzlich Strom ins Netz eingespeist werden kann. Damit wird das Gebäude HOME+ der HFT Stuttgart zum Plusenergiehaus.

Der modulare Aufbau des Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen.

Der Zeitplan des Projektes sieht vor, im Herbst 2009 mit den ersten Bauteilen zu beginnen, für April 2010 ist die Fertigstellung des Gebäudes geplant. In einer Testphase werden Gebäudetechnik und Regelung optimiert, bevor im Juni 2010 die Demontage des Gebäudes und der Transport nach Madrid ansteht. Nach dem Wettbewerb wird das Gebäude am Hochschulstandort Stuttgart aufgestellt und soll dort als Veranstaltungs- und Forschungsgebäude dienen.

Zum Abschluss des Wettbewerbs, im Juni 2010, werden die Häuser aller Teams eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer



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Energiegewinnung in das Konzept stellen auch der Transport und die Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

Auslober ist das spanische Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium (DOE). Die beteiligten deutschen Hochschulen werden vom Bundesministerium für Wirtschaft und Technologie (BMWi) aufgrund eines Beschlusses des Deutschen Bundestages durch einen substantiellen Beitrag unterstützt.

Die Wettbewerbsteilnahme der HFT Stuttgart steht unter der Schirmherrschaft von Ministerpräsident Günther H. Oettinger. Neben dem BMWi konnte die HFT Stuttgart müllerblaustein (Müller Holzbau GmbH) als wichtigen Sponsor gewinnen. Weitere Förderer sind die Margarete Müller-Bull Stiftung, die Knödler Decker Stiftung, der Allgemeine Studierendenausschuss der HFT Stuttgart (AStA) und die Transsolar Energietechnik GmbH.

Weitere Informationen unter www.hft-stuttgart.de und www.sdeurope.de

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Hochschule für Technik Stuttgart

Tradition und Innovation – das charakterisiert die Hochschule für Technik Stuttgart. 1832 als Winterschule für Bauhandwerker gegründet, bietet die HFT Stuttgart heute ein breites Spektrum an akkreditierten Bachelor-Master-Studiengängen an. In drei Fakultäten stehen insgesamt 11 Bachelor- und 13 Master-Studiengänge zur Wahl. An der HFT Stuttgart wird praxisnah und in kleinen Gruppen ausgebildet. Rund 100 Professorinnen und Professoren unterrichten zirka 2500 Studierende, unterstützt von über 170 Lehrbeauftragten. Praktische Studienprojekte oder ein Auslandsstudium an einer der 75 Partnerhochschulen weltweit sind in die Studiengänge integriert. Der Campus der HFT Stuttgart liegt, zwischen Stadtgarten und Liederhalle, mitten in der Stadt Stuttgart, dem Wirtschaftszentrum Südwestdeutschlands.

Studienbereiche

Architektur und Gestaltung

Bauingenieurwesen

Bauphysik

Informatik

Mathematik

Vermessung

Wirtschaft

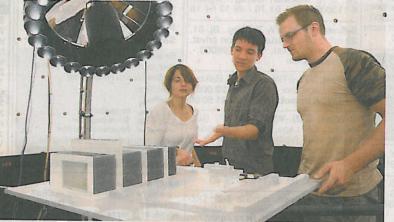
Wie wohnt man in der Zukunft?

Hochschule für Technik entwickelt Plus-Energiehaus Home+ für Solarwettbewerb

Wie sieht der Wohnungsbau der Zukunft aus? Häuser haben komplette Solarhüllen und Windtürme, verbrauchen weniger Energie, als sie über die Sonne erwirtschaften - man nennt das dann Plus-Energiehaus - und sind in der Gestaltung flexibel. Zum Solaren Wettkampf Decathlon beim Solar Europe 2010 tritt in Madrid ein Hochschulteam der HFT Stuttgart an.

Die Aufgabe: Bis Juni 2010 soll ein 75 Quadratmeter großes und ausschließlich mit solarer Energie versorgtes Wohnhaus entworfen und gebaut werden. "Wir vereinen für diesen Wettbewerb unsere gesamte umfassende Kompetenz, indem wir das Know-how der Studiengänge Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence sowie unseres Instituts für Gebäudeenergieforschung (zafh.net) einbringen." Projektleiter Professor Dr. Jan Cremers sieht die HFT Stuttgart bestens gerüstet, diese Aufgabe von der Konzeption des Entwurfs über die techni-

sche Durcharbeitung bis hin zur Realisierung auf hohem Niveau zu bewältigen. Das Entwurfs- und Energiekonzept der HFT Stuttgart stellt eine Kombination von traditionellen Grundprinzipien mit modernem Material und neuer Technologie dar. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch erreicht man eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs. Die einzelnen Module werden mit etwas Abstand zueinander angeordnet. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas beiträgt. Dabei bedient er sich der Grundprinzipien traditioneller Vor-



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bilder aus entsprechenden Regionen wie der Windtürme im arabischen Raum und der in Spanien weit verbreiteten Patios. In Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt.

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Der Zeitplan des Projektes sieht vor im Herbst

tes sieht vor. im Herbst 2009 mit den ersten Bauteilen zu beginnen, für April 2010 ist die Fertigstellung des Gebäudes geplant. In einer Testphase werden Gebäudetechnik und Regelung optimiert, bevor im Juni 2010 die Demontage des Gebäudes und der Transport nach Madrid anstehen. Nach dem Wettbewerb wird das Gebäude am Hochschulstandort Stuttgart aufgestellt und soll dort als Veranstaltungs- und Forschungsgebäude dienen. Betreff: greenbuilding-Newsletter | Ausgabe 7-8/2009 - August Von: "greenbuilding" <greenbuilding@news schiele-schoen.de>

Datum: Tue, 04 Aug 2009 17:47:33 +0200 An: petra dabelstein@hft-stuttgart.de

130

NewsLetter

Ausgabe 7-8/2009 - August

greenbuilding

Guten Tag!

Mit den nachfolgenden Kurzveröffentlichungen geben wir Ihnen einen Überblick über Artikel, die Sie in der Juli/August-Ausgabe von "greenbuilding" finden. Das vollständige Heft mit allen Artikeln und einer Vielzahl von neuen Produktinformationen und Systemvorstellungen erscheint als Printausgabe am 7. August.

Editorial: Tour de Trance

Urlaubszeit, endlich erholen, sich eine Auszeit gönnen, ausspannen, den Alltagsstress herunterfahren, raus, bloß weg von daheim, mal den Denkapparat auf Standby schalten. Jetzt in den Sommerferlen startet sie wieder, die Tour de Trance ... mehr

Magazin: In einem Tag um die Welt.

Bremerhafen ist um eine Attraktion reicher. Ende Juni hat das Klimahaus eröffnet, ein Jahr später und mit 107 Mio. Euro 37. Mio. teurer als geplant. Herausgekommen ist eine Architektur, die Aufsehen erregen, Wissen vermitteln, und nicht zuletzt auch Energie einsparen mochte. <u>mehr</u>...

Magazin: Green Building goes history - der Blick zurück bringt uns voran. Ressourcenschonend mit der Umwelt umzugehen, dies wussten und mussten unsere Vorfahren berücksichtigen, um zu überleben. Wäre doch auch sehr unklug, den Ast abzusägen, auf dem man sitzt. Es ist daher an der Zeit, sich zu erinnern, dass wir die Natur nicht technisch beherrschen konnen, sondern wieder in Einklang mit ihr leben und arbeiten müssen. Werfen wir einen kurzen Blick in die Geschichte und begeben wir uns einige Jahrhunderte zurück. mehr ...

Magazin: Ökostadt New York?

Sich New York als grüne Metropole vorzustellen, fällt derzeit noch ein bisschen schwer. Wenn es allerdings nach den Wunschen des New Yorker Burgermeisters Michael Bloomberg geht, wird diese Vision schon in wenigen Jahren Realitat sein. Der "Plan NYC 2030" soll's richten. Die 127 Projekte, die diese Liste umfasst, reichen vom Umbau des Times Square in eine Fußgängerzone bis hin zu einer Citymaut und autofreien Samstagen. New York ohne Autos? mehr

Anzeige

Solar Decathlon Europe 2010

Im Juni 2010 findet in Mailand erstmals der europaische Solar Decathlon nach dem Muster der gleichnamigen amerikanischen Variante statt. Aus Deutschland nehmen insgesamt vier Hochschulen an dem "Solaren Zehnkampf" teil, die auf die Erfahrungen des Solardecathlon-Teams der TU Darmstadt aufbauen konnen, das 2007 in Washington den ersten Platz abgeraumt hatte. mehr ...

Tourismus in Skandinavien

Wahrend in Deutschland nachhaltiger Tourismus trotz bemerkswerter Zuwachsraten noch ein Randphänomen darstellt, ist er in Skandinavien schon das Leitmodell. Dort haben sich seit Ende der Achtziger Jahre eine Vielzahl erfolgreicher Oko-Tourismuslabels entwickelt und Hotel-Konzerne wie Scandic setzen heute weltweit Zeichen, dass Nachhaltigkeit den "Sharholder-Value" nicht schmälert, sondern sogar vermehren kann. Lesen Sie weiter in der Printausgabe auf Seite 14

Nr 7-9 - 1 7 2009 Seite 5 uberregional Fachpublikation 4 x jahrlich

Intelligente Architektur

IntelligenteArchitektur

Autlage(vb) der genannten Quelle 16625

OG I SOLAR DEGATHLON EUROPE 2010

Beitrag HFT Stuttgart

Entwurfs- und Energiekonzept
Der Entwurf des Beitrags der HFT Stuttgart wurde im Wintersemester 2009/09
in einem mehrstufigen Verfahren aus Entwurfen der Studentien des Masterstudiengangs Architektur ausgewählt im Sommersemester 2009 wurde dieser
Entwurf dann von den Masterstudenten
der Architektur und Studenten weiterer
Studiengange an der HFT Stuttgart aus
gearbeitet und optimiert Insgesamt,
waren da 90 studenten aus den Masterstudiengangen Architektur Sustannable
Energy Competence (SENCE) und Konstruktwer ingeneurbau sowie aus den
Bachelorstudiengangen Bauphysik und
Innenarchitektur beteiligt. Umierstlutzt
wurden sie durch ihre Professoren und
aus Institut für Gebaudeenergeforschung
(zaff) nich) an der HFT Stuttgart.

Der Entwurf basiert auf gestaltierischen
und energeteischen Überlegungen. Ausgangspunkt ist ein kompaktes und sehr
gut gedammtes Volumen Im inneren dienen Phassenwechselmaterialien (PCM) der
Erhohung der thermischen Masse. Dach

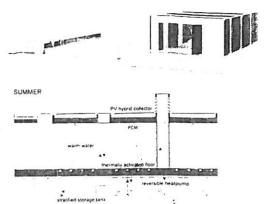
d Fassaden sind von einer Photovoltaik. Hulle umgeben, der damit gewonne ne Strom übersteigt den geringen Energiebedart, das Gebäude wird zum Plus-Engrone Haus.

Energie Haus

Das Vorumen wird in einzelne Module aufgeteilt, die mit etwas Abstand zuein

ander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der
Beluffung, der Vorwarmung im Winter
und der passiven Kuhlnung im Sommer
Eine besondere Rolle spreit dabei der Energieturm, der im Zusammenspiet von Wind und Verdunstungskuhlung zur
Erzeugung eines angenehmen Innenraumklimas in heißen und trockenen Reginnen zu denen auch Madrid zahlt, beitragt. Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus entsprechenden Regionen, wie der Windturme im arabischen Raum und der in Spanign weitverbreiteten Patios. In der Kombination mit neute verfügbaren neuen.
Matenatien und Technologien entsteht ein Element, das höhen Komfort bei niedngem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und raumliche Wahrnehmung des Gebaudes maßgeblich pragt.

Der modulare Aufbau des Gebäudes ermoglicht die Weiterentweckung zu einem Bausystem Durch die Addition der Module und Fügen können damit nachnätige, energieeffiziente und architektreisch nochwertige Wöhngebaude mit röhem Wohnwert für Singles. Pääre, Familien oder Wöhngemeinschaften entstehen Daruber hinaus kann das Gebäude insbesondere die Fügen, an die klimatischen Gegebenheiten des jeweiligen Standortes funktional angepasst werden



- warm water ... solar collector ... evacuated tube collector
- cooling
 cooling tower
 night-cooling

Beitrag Bergische Universität Wuppertal

Der Wettbewerbsbeitrag zum Solar Dec athlon Europe 2010 der Bergischen Uni versität Wuppertal wird von rund 30 Studierenden aus unterschiedlichen Fachberoichen (Architektur, Design, Wirtschaftswissenschaften) interdisziplinar hastibatet.

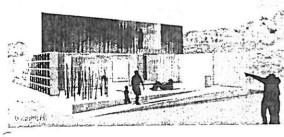
Als Grundgedanke des Gesamtkonzepts wurde die Entwicklung eines zukunftstahigen "Europaischen Hauses" formuliert. Dies bedeutet, dass das Gebaude nicht ausschließlich für den Weitbewerb und somit den Standorf Madrid konzipert wird, sondern gleichermaßen an anderen Standorfen Europas funktionie ren soll. Noben der Losung von architektionischen und einergetischen Fragestellungen werden innerhalb des ganzheitlichen Konzepts vor allem auch logistische und okonomische Aspekte berück sichtigt.

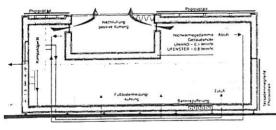
Die Leilidee des Projektes zielt auf ein funktional offenes, mit dem Außernaum verwöbenes Haus, das mit reduzierten gestalterischen Mitteln ein wandlungstahiges, atmospharisch spannungsvolles Raumkonzept formuliert. Hauptmerkmal des Gebaudes sind zwei solaraktive Wandschotten aus denen sich die Grundstruktur entwickelt. Sie definieren einen fließenden Raum zwischen innen und außen wobei der Wohnraum als Ireibespielbares Feld mit Leistber nutzungssenarien interpretiert wird. Über Glasschiebeilemente öffnet sich der Innenraum zu den beiden Außenterrassen Alszusatzlicher Außenraum dient ein Dachpalio, welcher gliechzielig Intimitat und Ausblick beitet.

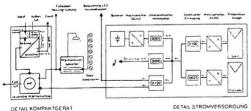
Autgrund des Verstandnisses als "Europaisches Haus" erlaubt das Gebaude auf

architektonischer und energetische Ebene eine Anpassung an die verschie-denen Klimazonen Europas. Mit geringtu gigen Anderungen innerhalb der Gebaudehulle sowie der Energiesysteme ist beispielsweise ein Standortwechsei des Hauses vom warmen Klima Madrids in das gemaßigte Klima Wuppertals oder auch in kaltere Klimazonen möglich. Das Energiekonzept folgt dem eines Netto-Nullenergie-Gebaudes. Voraussetzung dafur ist eine ausgeglichene Jahresener-gichilanz, d. h. es wird im Zeitraum eines Jahres mindestens genauso viel Energie produziert, wie verbraucht wird. Der Energiebedarf für Heizen und Kuhlen wird durch die Optimierung der hochwarme gedammten Gebaudehulle und einen konsequenten Sonnenschutz sehr gering gehalten. Die solare Stromversorgung wid hauntsachlich durch die in das Flachdach integrierte, netzgekoppelte Solarstromaniage sowie zusätzlich durch die mit Solarstrommodulen versehene Sudwand bereitgestellt. Solarthermische Energie wird über Vakuumrohrenkollekto-ren auf der Sudseite der nordlichen Wandschotte gewonnen. Als zentrales Element der aktiven Gebaudetechnik funktioniert ein Kompaktgerat mit inte grierter Kleinstwarmepumpe, das die Funktionen Heizen, Kuhlen und Trinkwas sererwarmung kombiniert. Der standort-unabhängige Energieverbrauch für Haus halt und Beleuchtung wird durch den Ein satz von ausschließlich effizienten Gera-ten und innovativer LED-Technik mini-

Insgesamt verstehl sich das Konzept als Beitrag zu energieeffizientern, zukunftslähigem Wohnen: auf minimalen Raum be größtmoglicher Nutzungsflexibilität und Wohnqualität









Hochschule für Technik Stuttgart

Solar Decathlon Europe 2010

Die Herausforderung - Das Team HFT Stuttgart

von Dipl.-Ing. Sebastian Fiedler und Prof. Dr.-Ing. Jan Cremers



Dipl.-Ing. Sebastian Fiedler Projektmanager SDE 2010 -Team HFT Stuttgart an der Hochschule für Technik Stuttgart.



Prof. Dr.-Ing. Jan Cremers
Projektleiter SDE 2010 - Team
HFT Stuttgart an der Hochschule für Technik Stuttgart.

Gebäude bedingen ein Drittel des weltweiten Gesamtenergieverbrauchs und damit auch ca. ein Drittel der weltweiten Treibhausgas-Emissionen. Der Bausektor produziert außerdem weltweit 25-40% allen festen Abfalls und verbraucht damit insgesamt ungefähr die Hälfte aller Primärressourcen. Von daher ist gerade dieser Bereich gehalten, durch den größtmöglichen Einsatz von erneuerbaren Energien und einen umfassenden integralen Ansatz einen Beitrag zu Energieeinsparung und -effizienzsteigerung zu leisten.

Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010", der ein in den USA sehr erfolgreich etabliertes Modell nach Europa holt.

Wie könnte der Wohnungsbau in Zukunft aussehen, der das solare Bauen mit hohen gestalterischen Ansprüchen an die Architektur verbindet? Es geht dabei nicht nur um den Energieverbrauch, sondern um einen ausgewachsenen "Zehnkampf", das heißt, der strapazierte Begriff der Nachhaltigkeit wird als komplexes Themenfeld großer Breite ernst genommen.

Die Hochschule für Technik Stuttgart wurde in einem aufwändigen Qualifizierungsverfahren als einer von 20 internationalen Teilnehmern ausgewählt.

Wir vereinen für diesen Wettbewerb unsere gesamte umfassende Kompetenz auf diesem Gebiet, indem wir neben den Professorenkollegen und allen einschlägigen Studiengängen (Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence) auch unser Institut für Gebäudeenergieforschung (zafh.net) einbringen. Damit sehen wir uns bestens gerüstet, diese Aufgabe von der Konzeption des Entwurfs über die technische Durcharbeitung bis hin zur Realisierung vor Ort in Madrid erfolgreich und auf hohem Niveau zu bewältigen.

Als Hochschule, die in langer Tradition der Baupraxis verbunden und verpflichtet ist, freuen wir uns besonders, dass der internationale Wettbewerb nicht als reine akademische Übung konzipiert ist. Wir wollen vielmehr in der Realisierung den Beweis der Praxistauglichkeit antreten und vertrauen darauf, dass die Veranstaltung als Bau-Ausstellung auf großes Interesse einer breiten internationalen Öffentlichkeit stoßen wird.

Natürlich sind wir für dieses ambitionierte Unternehmen auch auf der Suche nach geeigneten Partnern und Förderern, mit denen wir den Wettbewerb erfolgreich gestalten, realisieren und gewinnen können.



Ein erstes Präsentationsmodell und eine kurze Filmpräsentation waren Ende Mai auf der internationalen Immobilienmesse SIMA 2009 in Madrid zu sehen.

Der Wettbewerb

Beim "Solaren Zehnkampf" treten 20 ausgewählte Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Die Häuser aller Teams präsentieren sich eine Woche . lang in Madrid im "Solar Village" einer breiten Öffentlichkeit, bevor am Ende die Sieger gekürt werden.

Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

Das Hauptziel des Wettbewerbs ist es, bei Studenten und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Darüber hinaus soll Disziplinen und deren Gewichtung im Wettbewerb. die Markteinführung innovativer

solarer Energietechnologien gefördert und der Nachweis erbracht werden, dass energieeffizientes Bauen mit hohem Wohnkomfort und architektonischer Qualität verwirklicht werden kann.

In den Jahren 2002, 2005 und 2007 wurde der Solar Decathlon vom amerikanischen Energieministerium (DOE) ausgelobt und in Washington D.C. ausgetragen. Nach



SDEurope 2010 - Team HFT Stuttgart www.sdeurope.de

Hochschule für Technik Stuttgart www.hft-stuttgart.de

Zentrum für angewandte Forschung an Fachhochschulen - Nachhaltige Energietechnik www.zafh.net



Solar Decathlon 2007 auf der National Mall in Washington D.C. (USA), Gewinner dieses internationalen Wettbewerbs war damals die Technische Universität Darmstadt. (Foto: Kaye Evans-Lutterodt/Solar Decathlon)

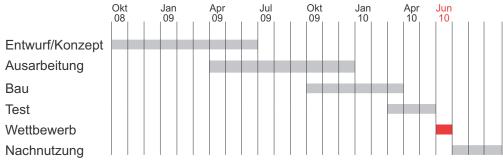
Architektur	1. Architektur	130
	2. Konstruktion	80
Solar	3. Solarsysteme	80
	4. Elektrische Energiebilanz	130
Komfort	5. Komfortbedingungen	130
	6. Haushaltsgeräte	80
Sozial & Ökonomisch	7. Kommunikation & soziales Bewusstsein	80
	8. Industrialisierung und Marktfähigkeit	80
Strategie	9. Innovation	80
	10. Nachhaltigkeit	130
		1.000

dem vielbeachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA wird der Wettbewerb nun zum ersten Mal auch in Europa stattfinden. Auslober ist das spanische Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium (DOE). Die Organisation übernimmt die Universidad Politécnica de Madrid (UPM).

Im Sommersemester 2009 wurden der Entwurf und die Konzeption unseres Beitrags weiter verfeinert. In der Ausarbeitungsphase wurden einzelne Teilbereiche genauer untersucht, optimiert und in der Werk- und Ausführungsplanung zusammengeführt. Im Herbst diesen Jahres soll dann mit der Vorbereitung des Bauplatzes und der Fertigung erster Bauteile begonnen werden. Die Bauphase soll auch für öffentlichkeitswirksame Veranstaltungen genutzt werden. Der Bau wird bis April 2010 in Stuttgart fertig ge-

www.infogrundundboden.de

Literaturrecherchen



Projektphasen über den 21 Monate dauernden Wettbewerb Solar Decathlon 2009.

stellt. In einer anschließenden Testphase werden wir die Gebäudetechnik und Regelung optimieren. Dann wird das Gebäude demontiert, nach Madrid verbracht und dort für die Wettbewerbswoche im Juni 2010 errichtet. Nach dem Wettbewerb wird das Gebäude am Hochschulstandort aufgestellt und soll dort als Veranstaltungs- und Forschungsgebäude dienen und einem Monitoring unterzogen werden.

Mit uns stellen sich 20 Teams renommierter Hochschulen aus Europa und der ganzen Welt der Herausforderung und nehmen am Wettbewerb teil. Neben drei weiteren deutschen Teams aus Wuppertal, Rosenheim und Berlin sind darunter auch Teams aus China, Brasilien, Mexiko, Israel und den USA.

Das Team HFT Stuttgart

Der Wettbewerb Solar Decathlon Europe 2010 ist eine hervorragende Gelegenheit, den Studierenden der HFT Stutt-

Das 2. Semester des Masters Architektur bearbeitet und koordiniert als Kernteam unter der Projektleitung von Prof. Dr. Jan Cremers bis in den Sommer 2010 kontinuierlich den Beitrag der HFT Stuttgart. Sie bilden das "Architekturbüro", in dem alle Informationen zusammenlaufen und die Beiträge der "Fachplaner" abgestimmt und in das Gesamtkonzept eingearbeitet werden. Die Entwurfsarbeiten werden im laufenden Semester durch die Professoren Harald Roser und Stefan Zimmermann betreut.

spruch

kann.

Als "Fachplaner" haben im Sommersemester 2009 Studenten weiterer Studiengänge der HFT Stuttgart Teilbereiche des Wettbewerbsbeitrags vertieft bearbeitet und Varianten untersucht. Folgende Studiengänge wurden dafür mit einbezogen:

- Master Sustainable Energy Competence (SENCE) unter der Leitung von Prof. Dr. Ursula Eicker.
- Master Konstruktiver Ingenieurbau (KI) unter der Leitung von Prof. Dr.-Ing. Heiner Hartmann und Prof. Dr.-Ing. Peter Steidle.
 - Bachelor Bauphysik unter der Leitung von Prof. Dr. Ursula Eicker und Prof. Dr. Andreas Beck.

gart einen wichtigen interdiszi-

plinären, zukunftsrelevanten und praxisnahen Baustein in ihrer

Ausbildung anzubieten. Für eine erfolgreiche Teilnahme werden

alle an der Hochschule vorhan-

denen Kompetenzen aus Lehre und Forschung gebündelt. So

wollen wir der interessierten Öf-

fentlichkeit vermitteln, dass energieeffizientes Bauen mit einem

hohen architektonischen An-

verwirklicht werden

 Bachelor Innenarchitektur (IA) unter der Leitung von Prof. Diane Ziegler und Prof. Klaus-Peter Goebel.

Weitere Unterstützung erfährt unser Team durch das Forschungszentrum zafh.net an der HFT Stuttgart. Im Zentrum für angewandte Forschung - Nachhaltige Energietechnik (zafh.net) wird seit 2002 die Gebäudeenergieforschung an der HFT Stuttgart gebündelt. Über 25 Mitarbeiter arbeiten in interdisziplinären Forschungsgruppen an der Entwicklung innovativer Energiekonzepte, Komponenten solarer Heizung und Kühlung und der betriebsbegleitenden Simulation von energietechnischen Anlagen und Gebäuden. Ein weiterer Schwerpunkt ist die Entwicklung und Umsetzung von Energiekonzepten und deren simulationsgestützte Optimierung auf kommunaler Ebene.

Hochschule für Technik Stuttgart	Deutschland
Bergische Universität Wuppertal	Deutschland
Hochschule Rosenheim	Deutschland
Hochschule für Technik und Wirtschaft Berlin	Deutschland
Universidad Politécnica de Cataluna	Spanien
Universidad CEU Cardenal Herrera	Spanien
Universidad de Sevilla	Spanien
Universidad de Valladolid	Spanien
Universidad Politécnica de Valencia	Spanien
Instituto de Arquitectura Avanzada de Cataluna	Spanien
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Arts et Métiers Paris Tech	Frankreich
Helsinki University of Technology	Finnland
University of Florida	USA
Virginia Polytechnic Institute State University	USA
Inst. Technol. y de Estudios Superior de Monterrey	Mexiko
Consórcio Brasil	Brasilien
Tianjin University	China
Arial University Center of Samaria	Israel

[&]quot;Solarer Zehnkampf" von 20 international besetzten Teams, 2009 ausgelobt vom spanischen Wohnungsbaumin.



Kernteam der HFT-Studentinnen und -studenten, die an der Umsetzung des Projektes Solar Decathlon 2010 beteiligt sind.

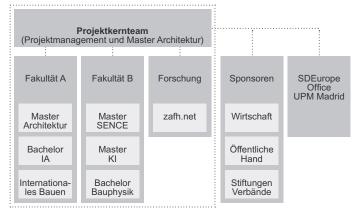
Neben nationalen Aktivitäten, unter anderem Vorhaben im Rahmen der Förderprogramme EnBau und EnSan des Bundesministeriums für Wirtschaft und Technologie (BMWi), werden auch europäische Forschungsvorhaben in den Bereichen energieeffizientes Bauen und kommunales Energiemanagement vom zafh.net durchgeführt und koordiniert. das Projekt **POLYCITY** So z.B. (http://www.policity.net), ein europäischer Forschungsverbund zum Thema nachhaltige Energiekonzepte für Kommunen mit 18 Partnern und Demonstrationsvorhaben im Gesamtumfang von 17 Millionen Euro. Seit 2007 fördert die Europäische Union auch das vom zafh.net koordinierte Graduiertenkolleg CITYNET (http://www.citynet.zafh.net), in welchem 10 Doktoranden an Hochschulen in Deutschland, England, Irland, Spanien, Italien, Polen und der Türkei an Themen der nachhaltigen Stadtentwicklung arbeiten.

Schon beim Solar Decathlon 2007 unterstützten das zafh.net und Studenten des Bachelor Bauphysik an der HFT Stuttgart das siegreiche Team Germany der TU Darmstadt bei der Durchführung der energetischen Gebäudesimulation und der Entwicklung eines innovativen Kühlkonzepts. Beim Solar Decathlon Europe 2010 tritt nun die HFT Stuttgart mit einem eigenen Team an.

Darüber werden unsere Arbeiten am SDE2010 schon von

mehreren Sponsoren unterstützt, die wir in dieser frühen Phase des Wettbewerbs gewinnen konnten:

- müllerblaustein (Müller Holzbau GmbH)
- Transsolar Energietechnik GmbH
- Knödler-Decker-Stiftung
- Margarethe-Müller-Buhl-Stiftung
- Allgemeiner Studierenden Ausschuss (AStA)



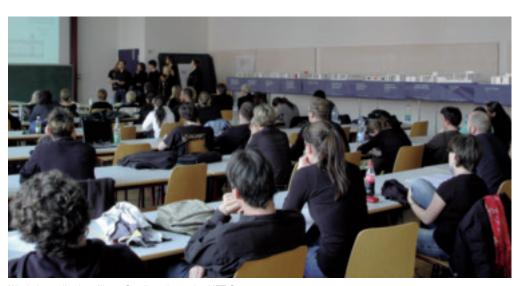
Organigramm Team HFT Stuttgart.



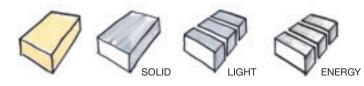
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Workshop aller beteiligter Studiengänge der HFT Stuttgart.



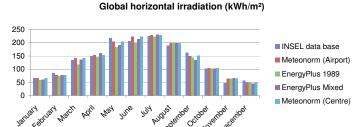
Entwurfs- und Energiekonzept

Der Entwurf basiert auf gestalterischen und energetischen Überlegungen. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch erreichen wir eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs.

Das Volumen wird in einzelne Module aufgeteilt, die mit etwas Abstand zueinander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas in heißen und trockenen Regionen, zu denen auch Madrid zählt, beiträgt.

Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus entsprechenden Regionen, wie der Windtürme im arabischen Raum und der in Spanien weitverbreiteten Patios (Als Wohnraum genutzter Innenhof. Anm.d.Red.). In der Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch er-

Mean ambient temperature (°C) 30 25 ■ INSEL data base 20 15 Meteonorm (Airport) ■ EnergyPlus 1989 ■ EnergyPlus Mixed Meteonorm (Centre) Mean relative humidity [%] ■ INSEL data base Meteonorm (Airport) ■ EnergyPlus 1989 ■ EnergyPlus Mixed Meteonorm (Centre) Octobe



Klimadaten von Madrid.

möglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt.

Die Kombination traditioneller Grundprinzipien und moderner Materialien und Technologien findet sich auch im Innenraum wieder. Dort erhöhen Phasenwechselmaterialien (PCM) die thermisch wirksame Masse der aus Holz gefertigten Module. Außerdem stellt ein Lüftungsgerät mit Wärmerückgewinnung die Minimierung der Lüftungswärmeverluste sicher.

Um den zwar niedrigen aber natürlich dennoch vorhandenen Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert. Das Dach und die Ost-, Süd- und Westfassaden werden wie mit einer zweiten Hülle mit Solarmodulen zur Stromerzeugung versehen. Erste Simulationen lassen erwarten, dass wir über ein Jahr betrachtet nicht nur den Energiebedarf unseres Gebäudes mit den Erträgen der PV-Flächen decken, sondern sogar noch zusätzlichen Strom ins Netz einspeisen können. Damit wird unser Gebäude zum Plusenergiehaus.

INTERGEO 2009 Karlsruhe

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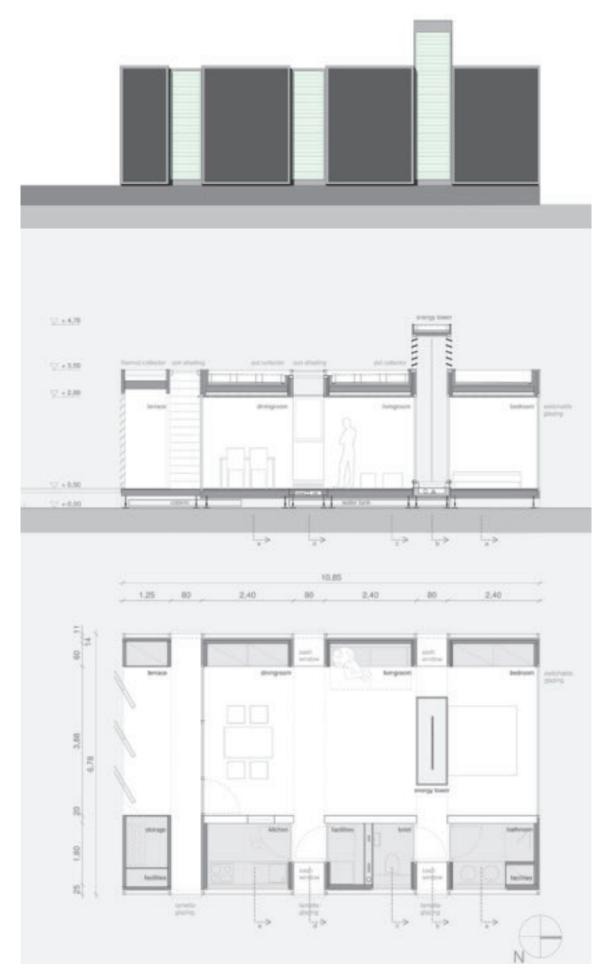
Kommen Sie - wir freuen uns!

An den Fassaden kommen dabei Dünnschichtzellen auf einer Glasscheibe zum Einsatz, die eine gewisse Transparenz erlauben. Dadurch kommt in der Außenansicht der modulare und mehrschichtige Charakter des Gebäudes zur Geltung. Auch im Innenraum geben die Module und quer dazu die Schichtung der Funktionsbereiche eine klare Zonierung vor.

Zusammen mit dem Energieturm werden damit eine hohe räumliche Flexibilität und spannende Raumbeziehungen hergestellt. Diese ist auch notwendig, denn im Laufe der Wettbewerbswoche im Juni 2010 in Madrid werden wir an zwei Abenden unsere direkten Nachbarn im "Solar Village" zu einem Dinner für 12 Personen einladen und bewirten.

Der modulare Aufbau unseres Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können damit nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen. Darüber hinaus kann das Gebäude, insbesondere die Fugen, an die klimatischen Gegebenheiten des jeweiligen Standortes funktional angepasst werden.

Zunächst, und nicht zuletzt mit Blick auf den engen Zeitplan, liegt unser Fokus auf der Optimierung, Ausarbeitung und Fertigung des Prototypen für den Wettbewerb. Ein erstes Präsentationsmodell und eine kurze Filmpräsentation wurden erstellt und waren Ende Mai auf der internationalen Immobilienmesse SIMA 2009 in Madrid zu sehen.

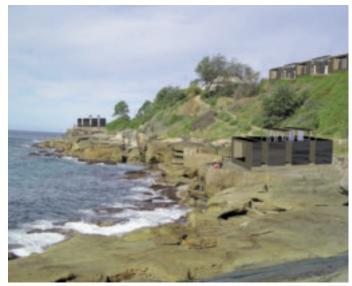


Ansicht Ost.

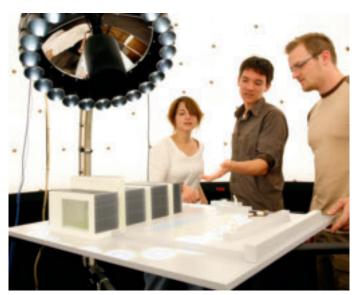
Längsschnitt.

Grundriss.





Flexibilität des Standorts - vom Flachdach auf einem Verwaltungsgebäude (hier: Königstraße Stuttgart) bis zum Felsenstrand in Spaniens Urlaubsregionen.



Arbeiten im künstlichen Himmel der HFT Stuttgart.



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Innenarchitektur

von Prof. Diane Ziegler

Das Projekt Solar Decathlon Europe 2010 ist ein hervorragendes Beispiel, wie unsere Studenten die Zusammenarbeit und Absprache mit verschiedenen am Bau tätigen Fachingenieuren kennenlernen und üben können.

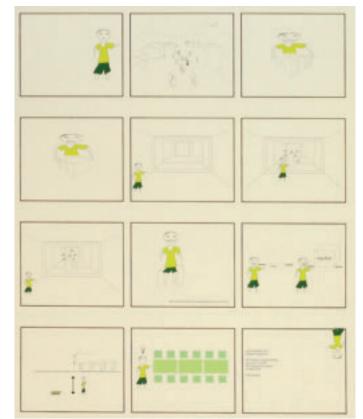
15 Studenten des 5. Semester Bachelor Innenarchitektur entwerfen die innenräumliche Gestaltung auf Grundlage des Gebäudeentwurfes der Architekten und entwickeln ein Konzept, wie das Haus während der Wettbewerbsjurierung bewohnt und 12 Personen bewirtet werden können.



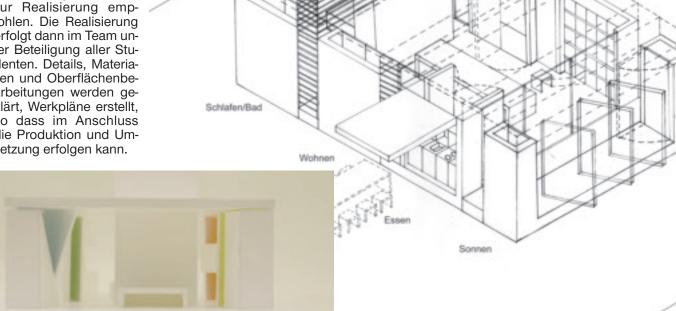
Zwischenpräsentation anhand von Modellen.

Da das ganze Projekt in einem engen Zeitraster erfolgt, wurde es in verschiedene Entwurfsschritte aufgeteilt. Die dabei erzielten Zwischenergebnisse werden in großer Runde unter Beteiligung aller Studiengänge präsentiert und diskutiert.

Die Studenten bearbeiten zu Beginn die Aufgabe als Einzelarbeit. Die beste Arbeit wird in einem Wettbewerbsverfahren ausgewählt und zur Realisierung empfohlen. Die Realisierung erfolgt dann im Team unter Beteiligung aller Studenten. Details, Materialien und Oberflächenbearbeitungen werden geklärt, Werkpläne erstellt, so dass im Anschluss die Produktion und Umsetzung erfolgen kann.

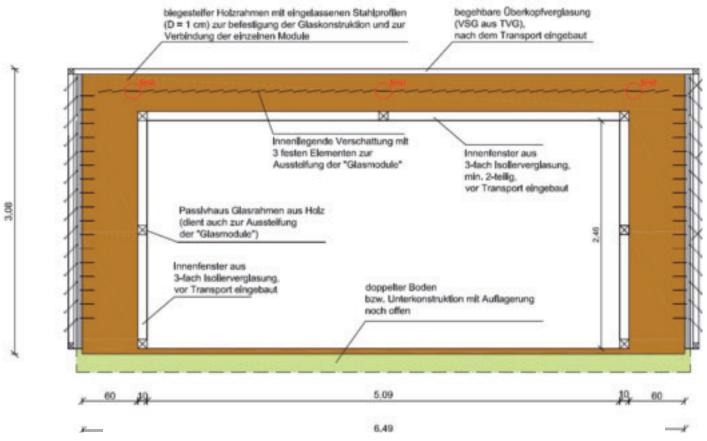


Erste Konzepte - Storyboard von Sinika Bäuerle.

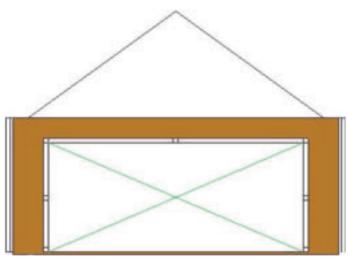


Erste Farbstudien, Zonierung von Raum- und Funktionseinheiten mit Farbe. Modell von Jessica Bitze.

Funktionen des Innenraumes, wie die Küche, sind durch das Aufklappen der Außenhaut auch vom Außenraum nutzbar. Isometrie von Linda Kreuz.







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Geoinformatik Softwarevertrieb Straßenplanung

Amtliche Lagepläne zum Baugesuch

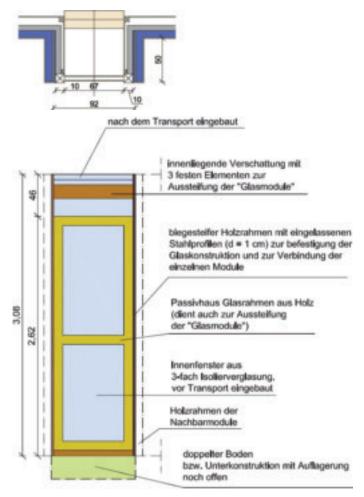
T³ - Tragkonzepte - Tragstrukturen - Tragelemente von Prof. Dr.-Ing. Heiner Hartmann

Zur Erzielung einer optimalen Tragstruktur wurden von Studierenden des Masters Konstruktiver Ingenieurbau (KI) für die einzelnen Module verschiedene Varianten und Konzepte verfolgt und bewertet. Die einzelnen Module, im Grundriss mit Abmessungen von ca. 2,40 x 6,80 m, werden über gläserne Fugen in der Breite von ca. 0,9 m aneinandergereiht. Entscheidende Kriterien für die Bewertung der einzelnen Konzepte sind:

- Elementierung für einfachen Transport und Montage
- · Geringes Gewicht für Montage vor Ort
- Einfaches Bearbeiten und Montieren auch für Nichtfachleute
- Steife Tragstruktur zur Sicherstellung von geringen Verformungen und zur Reduzierung der Gefahr gegen Glasbruch, auch im Transportzustand
- Verwendung von Baumaterialien mit geringem Primärenergieverbrauch
- Einfache Integration von Haus- und Energietechnik

Darüber hinaus sollte das Konzept einen möglichst hohen Innovationsanteil aufweisen, um auch hier bei der Bewertung Pluspunkte zu sammeln. Es ist deshalb nicht verwunderlich, dass der Baustoff Holz mit seinen neuesten strukturellen und technischen Möglichkeiten zum Einsatz kommen soll.

Bei einer dieser Varianten werden die begrenzenden Flächen der Module zu den Glasfugen hin als tragendes Element genutzt. Dadurch entsteht ein "Zweigelenkrah-



Horizontal- und Querschnitt der Fuge.

men", welcher sich auf den Boden punktuell abstützt. In Querrichtung sind verschiedene Nebentragsysteme, bis hin zu einer Plattenstruktur aus Brettsperrholz, möglich.

Die Abstützungen/Auflagerungen unten erhalten gleichzeitig eine Verlängerung nach oben, um damit im Montagezustand das Modul anheben zu können. Die Glasfuge könnte als eigenständiges (Glas-) Modul oder auch am Rahmen des normalen Moduls stabilisiert werden.



Besprechung Master Kl.

Solar Decathlon Europe 2010 Team HFT Stuttgart

Ansprechpartner an der Hochschule für Technik Stuttgart

Dipl.-Ing. Sebastian Fiedler

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Solar Decathlon Europe 2010

Der Sonne entgegen



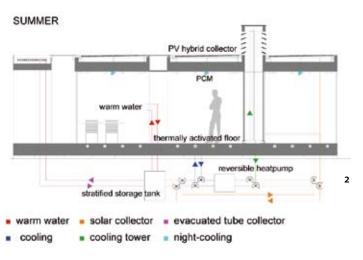
Im Juni 2010 findet in Madrid erstmals der europäische Solar Decathlon nach dem Muster der gleichnamigen amerikanischen Variante statt. Aus Deutschland nehmen insgesamt vier Hochschulen an dem "Solaren Zehnkampf" teil, die auf die Erfahrungen des Solardecathlon-Teams der TU Darmstadt aufbauen können, das 2007 in Washington den ersten Platz abgeräumt hatte.



Den ersten Solar Decathlon lobte das amerikanische Energieministerium (DOE) bereits im Jahr 2002 aus – auch damals waren die teilnehmenden Hochschulen aufgefordert, ihre ausschließlich mit solarer Energie versorgten Wohnhaus-Prototypen auf der National Hall mitten in Washington D.C. zu präsentieren und sich dem Wettbewerb zu stellen. Nach dem viel

beachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA wird der Wettbewerb nun erstmals in Europa ausgetragen. Damit man sich nicht ins Gehege kommt, findet der europäische Solar Decathlon immer im wechselseitigen Rhythmus mit seinem amerikanischen Pendant in den geraden Jahren statt. Für die erste Veranstaltung in Madrid haben sich insgesamt 20 Hochschulteams qualifizieren können, die meisten aus Europa und davon vier aus Deutschland. dazu gehören die Berliner Hochschule für Technik und Wirtschaft, die Hochschule Rosenheim, die Hochschule für Technik Stuttgart und die Bergische Universität Wuppertal.

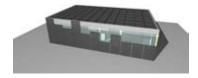
Jedes der vier deutschen Teams ist mit seinem Projekt im Zeitplan, derzeit wird intensiv an den Konstruktionsplänen getüftelt und gezeichnet. Im Mai 2009 hatten sich alle Wettbewerbsteilnehmer in Madrid zu einem gemeinsamen Workshop getroffen, der zugleich die letzte Gelegenheit geboten hatte, der Konkurrenz mal eben kurz über die Schulter zu schauen, um sicherzugehen, dass man selbst auf gutem Weg ist. Finzanzielle Unterstützung und Förderung erhalten die deutschen Teams nicht nur von ihren jeweiligen Sponsoren aus der Industrie, sondern aufgrund eines Beschlusses des Deutschen Bundestages auch vom Bundesministerium für Wirtschaft und Technologie.

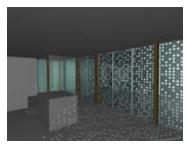


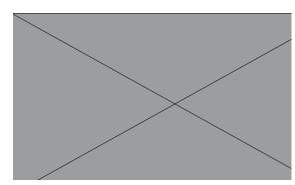
1,2 Auffälligstes Merkmal an dem Kubus des Teams der HFT Stuttgart ist der Energieturm, der nach dem Vorbild arabischer Windtürme für eine energiesparende Klimatisierung sorgen soll.

Die vier deutschen Hochschulteams verfolgen zwar alle das gleiche Ziel, nämlich am Ende ganz oben auf dem Siegertreppchen zu stehen, jedoch mit deutlich unterschiedlichen Konzepten und Ideen:

- An der HFT Stuttgart baut man auf ein sehr gut gedämmtes Volumen mit optimiertem A/V-Verhältnis (Bilder 1, 2).
 Eine zentrale Rolle spielt der auffällige Energieturm, der nach dem Vorbild der Windtürme im arabischen Raum den Wind zur Verdunstungskühlung nutzt, um den Innenraum bei geringestem Energieverbrauch zu klimatisieren. Auch finden sich in dem modular aufgebauten Kubus neben der klassischen Haustechnik Phasenwechselmaterialien (PCM). Zudem sind Dach, Ost-, Süd- und Westfassaden mit PV-Dünnschichtzellen belegt.
- Das Team Ikaros Bavaria von der Hochschule Rosenheim legt bei seinem modular aufgebauten Gebäudekonzept (Bilder 3, 4) großen Wert auf Nachhaltigkeit und hat deshalb eine Zertifizierung nach DGNB für das Pilotprojekt beantragt. Das technische Konzept baut auf hochwärmegedämmte Bauteile, eine geregelte Lüftung mit WRG und eine reversible Wärmepumpe. Auch hier ist die Hülle mit verschiedenen solaren Systemen für die Energiegewinnung ausgestattet.
- Die Studenten aus Wuppertal verfolgen das Ziel, für den Solar Decathlon ein zukunftsfähiges "europäisches Haus" (Bilder 5, 6) zu entwickeln, das nicht nur im heißen Madrid, sondern auch an anderen Standorten Europas mit ausgeglichener Energiebilanz funktioniert. Leitidee ist ein funktional offenes, mit dem Außenraum verwebtes Gebäude, dessen Grundstruktur sich aus zwei solar und energetisch relevanten Wandschotten entwickelt. Das Energiekonzept folgt den Prinzipien eines Null-Energiegebäudes. Zentrales Element der Gebäudetechnik ist ein Lüftungskompaktgerät mit integrierter Wärmepumpe.
- Das Team aus Berlin taufte sein Projekt "Living EQUIA" ("living ecologic and integration of ambience", Bilder 7, 8). Architektonisches Highlight sind zwei Lichtachsen, die sich nach den vier Himmelsrichtungen orientieren. Holz und Lehm gehören zu den wesentlichen Baumaterialien, die Fassaden und das Satteldach sind mit gebäudeintegrierten PV-Elementen bestückt.





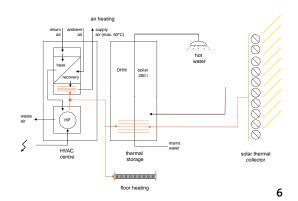


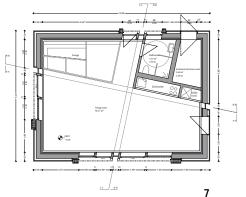
3 4



3,4 Bei dem Rosenheimer Konzept dienen zwei Wintergärten als Klimapuffer. Ungewöhnlich: der außenliegende Sicht- und Sonnenschutz.

- 5, 6 Das Team aus Wuppertal tüftelt an einem zukunftsfähigen "europäischen Haus", das im heißen Süden ebenso autark funktioniert wie im kühlen Skandinavien.
- 7,8 Einen ganz anderen Weg als die Konkurrenz bestreitet das Berliner Team mit "Living EQUIA": Weniger Transparenz zugunsten spannender Lichtachsen. Auffällig das Satteldach.







8

Liebesleben und **Auto-Emotionen**

Leser-Uni Der Bogen ist von der Tierwelt bis zur Automobiltechnik wieder einmal weit gespannt.

bwechslungsreich, aufregend und fantasievoll - so gestaltet sich das Liebesleben der Tiere. Mit seinem Vortrag "Sex im Tierreich: Liebespfeile und Hormonkriege im Zeichen der Fortpflanzung" wird der Tübinger Biologe Nico Michiels die Zuhörer der Leser-Uni in eine bunte Welt entführen, in der es um Liebesbeweise, aber auch um die Weitergabe der Gene und die Erhaltung der Art geht.



Leser-Uni

Die StZ lädt ihre Leser erneut zu zwei hochkarätigen Vorträgen ein.

Die Themen: Sex im Tierreich und das Auto der Zukunft

Im zweiten Vortrag berichtet der Autoexperte Willi Diez über die tiefgreifenden Veränderungen in dieser Branche - und über die Trends, in welche Richtung sich die Autotechnik entwickeln könnte.

Die Leser-Uni findet am Freitag, den 24. Juli, von 18 bis 20 Uhr an der Universität Hohenheim statt. Im Anschluss an die Vorträge sind die Leser herzlich eingeladen, bei einem Umtrunk mit den beiden Referenten und den Wissenschaftsredakteuren der StZ zu diskutieren.

Restkarten für die beiden Vorträge können noch am Donnerstag, den 16. Juli 2009, von 15 bis 17 Uhr unter der Telefonnummer 0711/72 20 99 72 bestellt werden wobei pro Anruf maximal zwei Karten erhältlich sind. Auf der schriftlichen Bestätigung findet sich dann auch die genaue Wegbeschreibung zum Hörsaal.

Mobile Dienste

Handyortung über WLAN

Ein Restaurant oder einen Geldautomaten in der Nähe orten – solche Dienste preisen Handyanbieter schon lange an. Doch erst seit Mobiltelefone mit GPS-Empfängern ausgestattet werden, können sich Kunden halbwegs bequem lokalisieren. Die Technik hat allerdings ein Manko: In Straßenschluchten schwächelt das Signal, in Gebäuden reißt die Verbindung ab. Darin sieht das Fraunhofer-Institut für Integrierte Schaltungen aus Erlangen eine Marktlücke und entwickelt zusammen mit IT2media, einer Tochter des Nürnberger Telefonbuchverlags Hans Müller, ein alternatives System, das es in der Praxis erprobt.

Das neue System orientiert sich an den WLAN-Funknetzen, von denen es in Städten immer mehr gibt. Jedes sendet eine eigene Kennung aus, das macht sie zu idealen Ortsmarken. Anhand der Stärke des Signals berechnet das Programm die Entfernung zum Sender, drei WLAN-Router reichen für die Ortung. "Wir erreichen in Gebäuden eine mittlere Genauigkeit von drei Metern", sagt Projektleiter Steffen Meyer. Damit konnten die Forscher schon eine Navigationshilfe für Messebesucher entwickeln. Auch im Freien soll das System genauer sein als GPS. Voraussetzung ist eine Datenbank, in der die Positionen und Feldstärken der Funknetze verzeichnet sind.

Für Nürnberg hat das Fraunhofer-Institut bereits eine Datenbank erstellt und ein Jahr lang getestet. Firmen können auf dieser Basis jetzt eigene ortsbezogene Anwendungen entwickeln, zum Beispiel einen Taxiruf, der die Position des Kunden an die Zentrale übermittelt. Als Nächstes will das Institut München und Berlin vermessen. Die Forscher treten gegen Konkurrenten wie den WLAN-Ortungsdienst Skyhook an, der auf dem iPhone läuft. Sie hoffen jedoch, ihr System als Standard zu etablieren. Der Anwendungsbereich beschränkt sich aber nicht auf Städte: So hat der Dienstleister SEP Logistik auf der Grundlage der Fraunhofer-Technik ein System entwickelt, das Gabelstapler im Lager ortet. dd

Kontakt

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Mit etwas Übung klappt auch das Tanken

Elektroautos Derzeit müssen sich 50 Pkw mit Elektromotor im Alltag bewähren. Die Testfahrer sind angetan. Von Lothar Lochmaier

ie Bedienung des elektrischen Minis ist denkbar einfach: Kurz den Startknopf drücken, Automatik einlegen - und los geht die Fahrt. Der kleine Unterschied zum Benzinmotor: Man hört vor allem beim Anfahren so gut wie kein Geräusch in der Fahrerkabine. Fast unmerklich setzt sich das Fahrzeug in Gang, und beim sportlichen Beschleunigen vibriert es so gut wie gar nicht.

Seit Juni fährt die Mikrobiologin Britta Kraushaar jeden Tag rund 70 Kilometer mit einem solchen Mini von Reinickendorf im Norden Berlins zu ihrer Arbeitsstelle nach Marienfelde im Süden der Stadt. Sie nimmt als eine von 50 Fahrern ein halbes Jahr an einem Praxistest für Elektroautos teil - und kann bisher nicht klagen. Aufpassen muss sie bei dem Versuch des Autoherstellers BMW und des Stromversorgers Vattenfall nur auf eines: "Wegen des leisen Motorgeräusches besteht die Gefahr, dass Fußgänger und Fahrradfahrer einen übersehen." Kraushaar lässt deshalb das Licht auch tagsüber angeschaltet.

Tanken kann die 33-jährige Testfahrerin entweder zu Hause, wo die Projektinitiatoren eigens eine Steckdose zum Nachladen installiert haben, oder an einer der öffentlichen Stromzapfsäulen. An den öffentlichen Stellen loggt sich der Nutzer wie beim Geldautomaten mit einer Chipkarte ein. Diese etwas umständliche Form der Registrierung hat Vattenfall eingeführt, damit Unbefugte das Gerät nicht zerstören. Erst nach dem Einloggen öffnet sich die Konsole mit der Steckdose zum Tanken.

Zum Nachladen an den öffentlichen Zapfstellen führt Kraushaar immer ein eigens dafür genormtes Ladekabel mit sich, das mit sicherheitsgeprüften Steckern ausgestattet ist. Strom zapfen kann man entweder mit einem Schukostecker für das Laden mit 16 Ampere oder mit einem CEE-Stecker für das Laden mit bis zu 32 Ampere. Da der Mini kein festes Ladekabel im Auto installiert hat, muss sich also der Fahrer die Mühe machen, das lange Kabel aus dem Auto zu ziehen und es mit der Ladesäule zu verbinden. Bei etwas Gewöhnung dauert das aber nicht mehr als zwei Minuten. Derzeit werden weltweit unterschiedliche Ladekonzepte erprobt.

50 ELEKTRO-MINIS IM TEST

Modellversuch Der Energieversorger Vattenfall Europe und die BMW Group haben im Juni einen Alltagsversuch mit 50 E-Minis und 50 öffentlich zugänglichen Stromladesäulen in Berlin gestartet. In zwei Testphasen von jeweils sechs Monaten haben insgesamt 100 ausgewählte Berliner die Möglichkeit, den Kleinwagen im täglichen Einsatz zu testen. Die erste frei zugängliche Stromladesäule wurde bereits Mitte Februar in Berlin-Treptow in Betrieb genommen. Vattenfall bietet den Testpersonen zudem ökologisch erzeugten Strom an, mit dem sie die Autos zu Hause aufladen können. Mehrere Universitäten begleiten den Versuch.



Wie gut diese E-Minis von BMW im Praxistest abschneiden, wird derzeit in Berlin von 50 Probefahrern ermittelt.

jektinitiatoren vollautomatische Batteriestationen vor. Shai Agassi hat zum Beispiel mit rund 200 Millionen US-Dollar Risikokapital das Projekt Betterplace gestartet, das in Israel Elektroautos flächendeckend einführen soll. Die Massenproduktion von Elektrofahrzeugen soll gemeinsam mit Renault Nissan schon bald beginnen.

Um die noch teure Batterietechnologie für den Endverbraucher mit Mehrkosten von mehreren tausend Euro nicht gänzlich unerschwinglich zu machen, haben sich die Macher von Betterplace etwas Besonderes ausgedacht: Der Kunde soll die Akkus nicht kaufen, sondern mieten. Während der Fahrt tauscht der Autonutzer bei Bedarf die leere

Batterie gegen eine neue aus oder lädt sie an einem der vollautomatischen Terminals auf. Damit derartige Pläne in den nächsten Jahren greifen, hofft Agassi auf politische Unterstützung mit Fördermaßnahmen, um Kaufanreize zu setzen.

Vor allem im städtischen Nahverkehr wäre das Elektroauto laut Experten eine sinnvolle Option. Rund 70 bis 80 Prozent der Autobesitzer bewegen sich schließlich während der Woche nur in einem Umkreis von 60 Kilometern. Für den Weg zur Arbeit ließe sich das Auto problemlos über Nacht auftanken. Um den Elektroautos zum Durchbruch zu verhelfen, ist jedoch zusätzlich eine ausgereifte, dezentrale Infrastruktur notwendig. Sinnvoll wäre es zum Beispiel, die Garagen am Wohnort mit Fotovol-

In Dänemark und Israel sehen die Protaikmodulen auf dem Dach auszustatten und auf dem Parkplatz des Arbeitgebers ökologisch erzeugten Strom

> bereitzustellen. Noch ist all dies Zukunftsvision: In Deutschland sind erste Projekte bisher noch nicht über die Testphase hinausgekommen. Zur Teilnahme an dem Versuch mit

dem E-Mini von BMW hat

sich Britta Kraushaar ent-

schieden, weil sie neugierig

war - und weil sie gerne Auto fährt. "In anderen Ländern gibt es bereits mehr Fahrzeuge mit alternativen Antrieben", sagt sie. Sie kann sich durchaus vorstellen, künftig ein Elektroauto als Erstfahrzeug zu fahren. Zu-

Britta Kraushaar (33), Mikrobiologin und Fahrerin

"Das Elektroauto

ist wie die Fahrt

mit der Straßen-

gefühl, leise, fast

wie zu schweben,

sehr entspannt."

bahn. Ein ganz

anderes Fahr-

mal der Opel, der jetzt zu Hause steht, etwas in die Jahre gekommen ist.

Die größten Hürden für Elektroautos im Massenmarkt sind derzeit die noch nicht ganz ausgereifte Batterietechnik und der hohe Preis. Auch bei der Reichweite und es so geräuschlos beim Komfort gibt es Abstriche: So bietet der Kofferraum im E-Mini von BMW zum Beispiel nur wenig Stauraum, weil dort der große Lithium-Ionen-Akku untergebracht ist. Daher eignet sich das Elek-

tromobil eher als Zweisitzer im Stadtgebiet, denn als Familienauto für die Überlandfahrt.

Trotzdem ist auch Demian Schaffert, studentischer Mitarbeiter an der Technischen Universität Berlin, von der neuen Technologie angetan. Er beschäftigt sich als angehender Ingenieur schon von Berufs wegen mit dem Fachgebiet der Kraftfahrzeuge. Technisch auszusetzen hat er kaum etwas. Nur an das Aufladen der Akkus müsse man sich erst noch gewöhnen. Aber das werde sich legen, glaube er, wie anfangs bei den Mobilfunktelefonen: "Heute weiß jeder,

Foto: BMW

Zeit einplanen muss." Allerdings rechnet der passionierte Rennfahrer Schaffert nicht mit dem schnellen Durchbruch der Elektrofahrzeuge. "Es wird wohl noch zehn Jahre dauern, bis die Technik soweit ist, dass sie von der breiten Masse zu einem erschwinglichen Preis ge-

dass er für das Aufladen des Handys etwas

nutzt werden kann." Er favorisiert ohnehin den sogenannten Plug-in-Hybrid, das heißt ein Auto mit Verbrennungsund Elektromotor, das man an der Steckdose aufladen kann. "Dann braucht man keinen Zweitwagen für größere Überlandfahrten und es lassen sich die Vorteile beider Technologien nutzen.", sagt

Schaffert. Trotz gewisser Einschränkungen: Auch Britta Kraushaar ist begeistert von der neuen Technik, und hofft, dass die deutschen Autohersteller aktiv werden, um Elektrofahrzeuge serientauglich

zu machen. Ihre Arbeitskollegen am Bundesinstitut für Risikobewertung sind längst neidisch geworden. Der E-Mini sei eben ein echter Hingucker.



"Das Fahren macht

richtig Spaß, weil ist, aber das Auto sportlich fährt." Demian Schaffert (27).

Student und Testfahrer

Ein Haus als Öko-Kraftwerk

Energietechnik Studenten stellen sich einem Ingenieur-Wettbewerb: Ihr Gebäude muss mehr Energie erzeugen als nötig. Von Asja Bernd

in Gebäude zu entwerfen und zu planen ist für angehende Architekten ✓ nichts Ungewöhnliches. Es während des Studiums auch zu bauen allerdings schon, denn üblicherweise entsteht lediglich ein Modell. Studenten der Stuttgarter Hochschule für Technik dürfen sich nun an einem richtigen Haus versuchen es ist ihr Beitrag zum Solar Decathlon, einem "Zehnkampf" der Solarhäuser. Es ist das erste Mal, dass der Wettbewerb in Europa stattfindet. Im Juni kommenden Jahres soll sich das Stuttgarter Energiesparhaus in Madrid durchsetzen. Jetzt haben die Studenten ein Modell ihres geplanten Hauses präsentiert.

Am Solar Decathlon nehmen 20 Teams teil, darunter vier deutsche. Wie der Name des Wettbewerbs schon andeutet, gilt es in zehn Kategorien zu punkten. Von der Architektur über den Komfort bis zur Nachhaltigkeit wird das Einfamilienhaus von einer Fachjury geprüft. Zeitweise haben rund 90 Studenten an dem interdisziplinären Projekt mitgearbeitet, koordiniert werden die verschiedenen Arbeitsgruppen von einem Kernteam von etwa 20 Personen. Die Studenten können schon auf Erfahrungen verweisen: Vor zwei Jahren haben sie das Sieger-Team der Universität Darmstadt beim Solar Decathlon in den USA unterstützt.

Das Modell zeigt ein quaderförmiges Gebäude mit schmalen, hohen Fenstern - und natürlich mit vielen Solarzellen an den Wänden und auf dem Dach. "Durch die Form ist die Oberfläche klein, das hilft, den Wärmeverlust zu minimieren", erklärt Nansi Palla, eine Studentin des Kernteams. Der Entwurf, home+ genannt, ist ein sogenanntes Plusenergiehaus, das mehr Energie erzeugt, als es verbraucht. Das Modell ist auf das Klima Spaniens ausgelegt. So

wird das Haus mittels eines Windturmes gekühlt: Heiße Luft wird oben angesaugt, im Turm angefeuchtet und ins Hausinnere geleitet. Das Wasser in der Luft verdunstet und benötigt dafür Energie, die es der Umgebung entzieht. So kühlt sich die Luft ab.

Neben Strom wird auf dem Dach auch kaltes und warmes Wasser erzeugt. Nachts kühlt sich das Wasser in Leitungen auf dem Dach stärker ab als die Umgebung, da das Dach seine Wärme abstrahlt. Tagsüber wird das Wasser dort von der Sonne erwärmt. "Zusätzlich zu diesen passiven Systemen kann man auch noch eine aktive Lüftung oder ein Wärmesystem einschalten", erläutert Palla. Aber das sei nur für unge-



Bis das Solarhaus gebaut ist, testen die Studenten das Modell unter einer künstlichen Sonne. Die dunklen Flächen sollen einmal mit Fotovoltaikfolien überzogen werden. Foto: HfT

wöhnlich hohe Temperaturen vorgesehen. Das Gebäude, das unter der Schirmherrschaft von Ministerpräsident Günther Oettinger entsteht, muss mehr als nur nachhaltig sein. "Wir müssen auch die Konkurrenz und die Jury einladen und bekochen", erklärt Projektleiter Jan Cremers.

Von Oktober an soll das Haus auf dem Campus aufgebaut und getestet werden. Anschließend wird es zerlegt und nach Madrid transportiert. "Nach dem Wettbewerb werden wir es an der Hochschule weiter erforschen", sagt Cremers. So werde man das Haus an das deutsche Klima anpassen. "Der Windturm wird dann zum Wärmen statt zum Kühlen verwendet, indem die ausströmende warme Luft die frisch hereinkommende aufwärmt."

Das Projekt ist Cremers zufolge vor allem für die Studenten eine Chance. "Manche schreiben ihre Masterarbeit über ein Thema des Hauses", sagt er. "Sonst ist eine Abschlussarbeit doch nur eine theoretische Trockenarbeit." Finanziert wird das Projekt vom Bundesministerium für Wirtschaft und Technik sowie Stiftungen und Förderern aus der Industrie. Zu den Kosten will sich Cremers nicht äußern.

Bei der Projektvorstellung lobte auch der Umwelttechnologe Matthias Schuler von der Universität Harvard das Haus. Er glaubt aber, dass man in Zukunft eher auf große Gebäude setzen wird. "2050 leben 75 Prozent der Menschen in Städten", sagte er. "Die Flächen sind bereits bebaut. Daher lautet die Zukunft des Bauens: Umbau."



1d bislang noch ohne Stelle. FOTO. DPA

lehrer als ebote

ereits überbuchte studierten ses Risiko müsse jelbst tragen, heißt es tusministeriums. inn widerspricht: ines Studiums 2003 h eingehend über : ingschancen inas habe es geheilienanfängerzahlen 1 'n Sonderschulen verpunkt Grundwas und beim Stut Hauptschule drasedarf. Und GEW-Le Doro Moritz eren Leute, die heute haben 2003 ihr in einer Zeit gro-

er Landesregierung

begonnen." Ihrer Meinung nach kann es nicht angehen, dass selbst Lehrer mit Einser-Examen heute keine Garantie mehr auf Einstellung haben.

Auch die Rektorenkonferenz der Pädagogischen Hochschulen dringt auf eine verlässlichere Vorhersage für den künftigen Lehrerbedarf in Baden-Württemberg. "Wir haben seit Jahrzehnten das Problem, dass Prognosen und reale Einstellungszahlen auseinanderklaffen", sagte der Landesvorsitzende der Rektorenkonferenz, Martin Fix. Er regte eine Arbeitsgruppe aus Vertretern der Pädagogischen Hochschulen, des Kultusministeriums und des Statistischen Landesamts an, um die Genauigkeit der Vorhersagen zu erhöhen.

Eine Hochschule im Wettbewerbsfieber

Studierende rüsten sich für den Solar Decathlon

STUTTGART. "In einem Jahr, so denke ich, stehen wir auf dem Siegertreppchen", sagt Andreas Löffler, Dekan der Fakultät Architektur. und Gestaltung an der Hochschule für Technik in Stuttgart. Denn aus diesem Grund nehme man schließlich an dem Zehnkampf teil. Die Rede ist allerdings nicht von einem · Sportwettkampf, sondern dem Solar Decathlon Europe 2010. Dazu wird von den Studierenden an der Hochschule ein Haus geplant und gebaut, das ausschließlich über Solarenergie versorgt wird und für das solare Bauen der Zukunft beispielgebend sein soll. In dieser Woche wurden die Pläne im Haus der Architekten vorgestellt, auch mit dem Ziel weitere Sponsoren zu finden.

Das Gebäude ist modular aufgebaut. Jedem Modul wird eine Funktion zugewiesen, etwa als Kochund Essensbereich, als Wohn- oder Schlafbereich. Selbst wenn das Gebäude, das die Hochschüler unter Leitung von Jan Cremers nun für den Wettkampf in Madrid entwerfen und bauen, einstöckig ist, haben sie mit ihrem modularen System bereits mehrgeschossige Häuser für Städte im Kopf.

Beim Energiekonzept wird neben der Solarenergie auch zur Kühlung und Belüftung des Hauses auf einen Windturm gesetzt, über den warme Luft durch Befeuchtung abgekühlt wird. Ein Prinzip, das die Studenten Micha Schneider und Simon Büttgenbach in einem Versuch vorführten. Phasenwechselmaterialien, die, je nach Bedarf, Wärme aufnehmen und abgeben können, sind ebenfalls Teil des Energiekonzepts.

Im Juni kommenden Jahres werden die Studierenden ihr Haus in Madrid aufbauen. Das Team aus Stuttgart – unter Schirmherrschaft von Ministerpräsident Günther Oettinger (CDU) – muss sich dort mit den Gebäuden von 19 weiteren Hochschulteams aus Europa, China, Israel und Brasilien messen. Und dann werden sie wissen, ob ihr Gebäude auch bei den Temperaturen in Madrid bestehen kann. (schl)



Studierende mit dem Modell für den Solar Decathlon. FOTO: HOCHSCHÜLE FÜR TECHNIK

Positive Zwischenbilanz zu Bildungshäusern

Kultusminister spricht von einem Zukunftsmodell

STUTTGART. Forscher des Transferzentrums für Neurowissenschaften und Lernen in Ulm haben erste Zwischenergebnisse zum "Bildungshaus 3 bis 10" vorgestellt. "In den zehn Monaten, die seit dem Start der wissenschaftlichen Begleitung vergangen sind konnten

mentieren deren Entwicklung.
"Ende des Jahres wird der Erhebungsdurchgang abgeschlossen
sein", schätzt Sambanis. Die Kosten für die vierjährige Begleitforschung in Höhe von rund 4,2 Millionen Euro trägt das Bundesministerium für Bildung und Forschung

Solar Decathlon 2010 erstmals in Europa

■ Im Juni kommenden Jahres findet der Architekturwettbewerb "Solar Decathlon" zum ersten Mal in Europa statt. Bei dem Wettbewerb entwerfen und bauen Teams von 20 weltweiten Hochschulen je ein rein solar beheiztes Haus, das sie in einem eigens dafür geschaffenen Solardorf präsentieren. Austragungsort ist Madrid.

Vier deutsche Hochschulen haben es bis in die Endrunde geschafft: die Hochschule für Technik (HFT) Stuttgart, die Fachhochschule Rosenheim, die Bergische Universität Wuppertal sowie ein Team der Hochschule für Technik und Wirtschaft Berlin und von anderen Hochschulen in Berlin. Die Teams planen gerade letzte Details ihrer Solarhäuser. Im Herbst beginnen sie mit dem Bau an ihren jeweiligen Hochschulen. Im Mai kommenden Jahres heißt es, das Werk nach Madrid zu transportieren, um es dort vier Wochen lang den Juroren und der Öffentlichkeit vorzustellen. Die Teams konkurrieren in zehn Kategorien, darunter auch Öffentlichkeitsarbeit und Beleuchtungskonzept.

Der Solar Decathlon fand 2002 zum ersten Mal in den USA statt. 2005, in der zweiten



HOME+ heißt das Gebäude, mit dem die HFT Stuttgart an dem ersten Solar Decathlon in Europa teilnimmt.

Der Name steht für ein Wohnhaus und Zuhause, das als Plusenergiehaus mehr Energie erzeugt, als es verbraucht.

Foto: HFT Stuttgart

Runde, etablierte der Veranstalter, das US-amerikanische Energieministerium, den Wettbewerb als zweijährliche Veranstaltung. Studierende aus Fachbereichen wie Architektur, Bauphysik und Innenarchitektur zeigen auf der National Mall in Washington D.C. ihre Vision vom Wohnungsbau der Zukunft. Im Mittelpunkt steht die autarke Energieversorgung der je 75 m² großen Wohnhäuser.

Die Universidad Politécnica de Madrid nahm 2005 und 2007 an dem Solar Decathlon teil. Sie konnte die spanische Regierung dafür gewinnen, den Wettbewerb nach Europa zu holen. 2007 unterzeichneten Abgeordnete des spanischen Wohnungsbauministeriums und des US-amerikanischen Energieministeriums ein entsprechendes Memorandum. Der Solar Decathlon soll künftig in allen Jahren mit ungeraden Jahreszahlen in den USA stattfinden, in den anderen Jahren in Europa.

Als ausführende Universität wird Madrid an dem Wettbewerb 2010 nicht teilnehmen. 2007 sorgte der Wettbewerb auch in Deutschland für Schlagzeilen. Zum ersten Mal setzte sich ein deutsches Team, das der Technischen Universität Darmstadt, gegen 19 Mitbewerber aus fünf Ländern durch. (ir)



Baustein ihrer interdisziplinären und praxisnahen Ausbildung anzubieten. Das Kernteam für den Beitrag der HFT Stuttgart stammt aus dem Master-Studiengang Architektur, welches den Wettbewerb kontinuierlich über seine Laufzeit bis in den Sommer 2010 bearbeiten und begleiten wird. Es wird dabei unterstützt und betreut durch zahlreiche Professoren der Fakultät Architektur und Gestaltung. Weitere beteiligte

Fakultät Architektur und Gestaltung. Weitere beteiligte Studiengänge sind Sustainable Energy Competence (SENCE), Bauphysik, Innenarchitektur und Konstruktiver Ingenieurbau. Momentan konzentrieren sich die Anstrengungen in der frühen

Momentan konzentrieren sich die Anstrengungen in der frühen Phase des Wettbewerbs besonders darauf, Förderer und Sponsoren zu gewinnen, die das Team der HFT Stuttgart mit Erfahrungswissen, Sachleistungen und auch finanziell unterstützen.

Zum Abschluss des Wettbewerbs werden die Häuser aller Teams in Madrid eine Woche lang einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet.

Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinführung innovativer solarer Energietechnologien soll gefördert.

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Wohnen von morgen schon heute - home+

Sebastian Fiedler und Jan Cremers, Hochschule für Technik Stuttgart

Angesichts der Tatsache, dass Gebäude ein Drittel des weltweiten Gesamtenergieverbrauchs und damit auch ca. ein Drittel der weltweiten Treibhausgas-Emissionen bedingen, muss gerade in diesem Bereich durch den größtmöglichen Einsatz von erneuerbaren Energien und einen umfassenden integralen Ansatz ein Beitrag zu Energieeinsparung und -effizienzsteigerung geleistet werden. Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010", der ein in den USA sehr erfolgreich etabliertes Modell nach Europa holt. Dabei werden Wohngebäude entwickelt, die hohen Wohnkomfort bieten, den dafür benötigten Energiebedarf ausschließlich durch die Nutzung solarer Energien decken und all das mit hohen gestalterischen und architektonischen Ansprüchen verbinden. Es geht also nicht nur um den Energieverbrauch, sondern um einen ausgewachsenen "Zehnkampf", das heißt, der strapazierte Begriff der Nachhaltigkeit wird als komplexes Themenfeld großer Breite ernst genommen.

Die Herausforderung Solar Decathlon Europe

Beim "Solaren Zehnkampf" treten 20 ausgewählte Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Die Häuser aller Teams präsentieren sich eine Woche lang in Madrid im "Solar Village" einer breiten Öffentlichkeit, bevor am Ende die Sieger gekürt werden. Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet. Eine erste Bewährungsprobe ist dabei die Finanzierung des Projektes durch Förderer und Sponsoren. Neben einem Startgeld von 100.000 Euro aus Madrid müssen alle teilnehmenden Teams die für die Entwicklung, den Bau und die Teilnahme am Wettbewerb benötigten Mittel selbst einwerben.

Das Hauptziel des Wettbewerbs ist es, bei Studierenden, aber auch in der breiten Öffentlichkeit das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Darüber hinaus soll die Markteinführung innovativer solarer Energietechnologien gefördert und der Nachweis erbracht werden, dass energieeffizientes Bauen mit hohem Wohnkomfort und architektonischer Qualität verwirklicht werden kann.

In den Jahren 2002, 2005 und 2007 wurde der Solar Decathlon vom amerikanischen Energieministerium (DOE) ausgelobt und in Washington D.C. ausgetragen. Nach dem viel beachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA wird der Wettbewerb nun zum ersten Mal auch in Europa stattfinden. Auslober ist das spanische Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium (DOE). Die Organisation übernimmt die Universidad Politécnica de Madrid (UPM).

Die HFT Stuttgart ist dabei

Ein Team aus Studenten, Mitarbeitern und Professoren der Hochschule für Technik Stuttgart (HFT Stuttgart) wurde als eines von 20 internationalen Hochschulteams ausgewählt an diesem Wettbewerb teilzunehmen. Für unseren Beitrag home+ vereinen wir die gesamte umfassende Kompetenz der HFT Stuttgart auf dem Gebiet des



Abb. 1: Das Projektteam home+



Prof. Dr.-Ing. J. Cremers



Dipl.-Ing. S. Fiedler

energieeffizienten und nachhaltigen Bauens. Neben Studenten und Professoren aller einschlägigen Studiengänge (Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence) ist auch unser Institut für Gebäudeenergieforschung bzw. das "Zentrum für Angewandte Forschung an Fachhochschulen - Nachhaltige Energietechnik (zafh.net)" mit eingebunden. Damit sehen wir uns bestens gerüstet, diese Aufgabe von der Konzeption des Entwurfs über die technische Durcharbeitung bis hin zur Realisierung vor Ort in Madrid erfolgreich und auf hohem Niveau zu bewältigen.

Als einziges Team aus Baden-Württemberg steht unser Projekt home⁺ unter der Schirmherrschaft von Ministerpräsident Günther H. Oettinger. Drei der neunzehn andern Hochschulteams kommen aus Deutschland: Das Team Living Equia aus Berlin

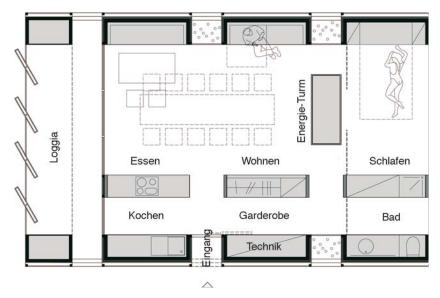


Abb. 2 Grundriss des aktuellen Entwurfsstandes home⁺

(Hochschule für Technik und Wirtschaft Berlin, Beuth Hochschule für Technik Berlin, Universität der Künste Berlin), das Team IKAROS (Hochschule Rosenheim) und das Team der Bergischen Universität Wuppertal. Alle vier deutschen Teams werden aufgrund eines Beschlusses des Deutschen Bundestages vom Bundesministerium für Wirtschaft und Technologie gefördert. Weitere Teams kommen aus Spanien, Frankreich, Großbritannien, Finnland, China, Brasilien, Mexiko, Israel und den USA.

home+ - Entwurfs- und Energiekonzept

Der Entwurf basiert auf gestalterischen und energetischen Überlegungen. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch erreichen wir eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs. Das Volumen wird in einzelne Module aufgeteilt, die mit etwas Abstand zueinander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas in heißen und trockenen Regionen, zu denen auch Madrid zählt, beiträgt.

Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus entsprechenden Regionen, wie der Windtürme im arabischen Raum und der in Spanien weit verbreiteten Patios (Innenhöfe). In der Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt. Die Kombination traditioneller Grundprinzipien und moderner Materialien und Technologien findet sich auch im Innenraum wieder. Dort erhöhen Phasenwechselmaterialien (PCM) die thermisch wirksame Masse der aus Holz gefertigten Module. Außerdem stellt ein Lüftungsgerät mit Wärgiebedarf unseres Gebäudes mit den Erträgen der Kollektoren decken, sondern sogar noch zusätzlichen Strom ins Netz einspeisen können. Damit wird unser Gebäude zum Plusenergiehaus. An den Fassaden kommen dabei Dünnschichtzellen auf einer Glasscheibe zum Einsatz, die eine gewisse Transparenz erlauben.

Dadurch kommt in der Außenansicht der modulare und mehrschichtige Charakter des Gebäudes zur Geltung. Auch im Innenraum geben die Module und quer dazu die Schichtung der Funktionsbereiche eine klare Zonierung vor. Zusammen mit dem Energieturm werden damit eine hohe räumliche Flexibilität und spannende Raumbeziehungen hergestellt. Diese ist auch notwendig, denn im Laufe der Wettbewerbswoche im Juni 2010 in Madrid werden wir an zwei Abenden unsere direkten Nachbarn im "Solar Village" zu einem Dinner für 12 Personen einladen und bewirten.

Der modulare Aufbau unseres Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können damit nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen. Darüber hinaus kann das Gebäude, insbesondere die Fugen, an die klimatischen



Abb. 3: Modell aktueller Entwurfsstand home+

merückgewinnung die Minimierung der Lüftungswärmeverluste sicher.

Um den zwar niedrigen aber natürlich dennoch vorhandenen Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert. Das Dach und die Ost-, Süd- und Westfassaden werden mit einer zweiten Hülle mit fotovoltaischen und thermischen Solarkollektoren versehen. Erste Simulationen lassen erwarten, dass wir über ein Jahr betrachtet nicht nur den Ener-

Gegebenheiten des jeweiligen Standortes funktional angepasst werden.

Wo stehen wir, wie geht es weiter?

Am 13. Juli präsentierten wir unser Projekt home⁺ vor Vertretern aus Wirtschaft, Politik und Presse im Haus der Architekten in Stuttgart. Dabei wurde sowohl die wichtigsten Grundlagen des Energiekonzeptes mit einem Versuch zur Verdunstungskühlung an-



Abb. 4: Prof. Dr. Cremers und Prof. Schuler bei der Präsentation unseres Projektes home⁺

schaulich erklärt wie auch im Impulsvortrag von Matthias Schuler (Transsolar Energietechnik) der große Rahmen

aufgespannt.

Bis Herbst diesen Jahres werden einzelne Teilbereiche des Projektes genauer untersucht, optimiert und in der Werk- und Ausführungsplanung bearbeitet. Dann soll mit der Vorbereitung des Bauplatzes und der Fertigung erster Bauteile begonnen werden. Die Bauphase wird auch für öffentlichkeitswirksame Veranstaltungen genutzt werden, der Bau soll bis April 2010 in Stuttgart fertig gestellt sein. In einer anschließenden Testphase werden wir die Gebäudetechnik und Regelung optimieren. Ende Mai 2010 wird das Ge-

bäude demontiert, nach Madrid verbracht und dort für die Wettbewerbswoche im Juni 2010 errichtet. Nach dem Wettbewerb wird das Gebäude am Hochschulstandort aufgestellt und soll dort als Veranstaltungs- und Forschungsgebäude dienen und einem Monitoring unterzogen werden.

Als Hochschule, die in langer Tradition der Baupraxis verbunden und verpflichtet ist, freuen wir uns besonders, dass der internationale Wettbewerb nicht als reine akademische Übung konzipiert ist. Wir wollen vielmehr in der Realisierung den Beweis der Praxistauglichkeit antreten und vertrauen darauf, dass die Veranstaltung als Bau-Ausstellung auf großes Interesse einer

breiten internationalen Öffentlichkeit stoßen wird.

Prof. Dr.-Ing. Jan Cremers ist Architekt und unterrichtet Gebäudetechnologie und Integrale Architektur an der Hochschule für Technik Stuttgart (HFT).

Dipl.-Ing. Sebastian Fiedler ist Geschäftsführer des Zentrums für angewandte Forschung an Fachhochschulen - Nachhaltige Energietechnik (zafh. net) an der HFT Stuttgart.

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Team HFT Stuttgart (home+) www.sdeurope.de

Hochschule belohnt herausragende Forschungsleistungen. Verleihung des Research Excellence Award Pforzheim 2009

(IAF Pforzheim) Qualität und Innovationskraft der Forschung an der Hochschule Pforzheim standen bei der sechsten Verleihung des Research Excellence Award Pforzheim in den Kategorien "Professor/-in, "Mitarbeiter/-in" und "Student/-in" wieder im Fokus des Interesses.

Den mit 3.500 EUR dotierten Research Excellence Award in der Kategorie "Professor/-in" teilen sich in diesem Jahr die Professorinnen Heike Bühler, Professorin für Public Relations/ Öffentlichkeitsarbeit, und Kirsten Wüst, Professorin für Wirtschaftsmathematik und Statistik.

Frau Prof. Heike Bühler hat den Preis in Anerkennung ihrer Forschungsaktivitäten im Bereich Public Relations erhalten. In ihrer jüngsten Forschungsarbeit ging Bühler zusammen mit der Leiterin der globalen Kommunikation der Firma Bosch, Professor Uta-Micaela Dürig,



VI.n.r.: Lisa Luppold; Absolventin der Hochschule Pforzheim, Prof. Dr. Martin Erhardt, Rektor der Hochschule Pforzheim, Heike Bühler, Professorin für Public Relations/Öffentlichkeitsarbeit, Christian Haubach, wissenschaftliche Mitarbeiter am Institut für Angewandte Forschung, Dr. Kirsten Wüst, Professorin für Wirtschaftsmathematik und Statistik und Prof. Dr. Mario Schmidt, wissenschaftlicher Direktor des IAF

der Frage nach, welchen Stellenwert Geschichte und Tradition des Unternehmens in der Unternehmenskommunikation haben. Ergebnis dieses neuen Forschungsansatzes ist das "Handbuch der Heritage Communication", das 2008 erschien und großes Interesse in der Fachwelt hervorrief.

Mit Frau Prof. Dr. Kirsten Wüst wird in diesem Jahr eine Professorin geehrt, die sich insbesondere durch interdisziplinäre Forschungsprojekte einen Namen gemacht hat. Wissenschaftlich anspruchsvoll aber keineswegs "trocken" publizierte Wüst - oft im Verbund mit Kollegen über die Anwendung mathematischer Methoden im Bereich der Betriebswirtschaft. In ihren Veröffentlichungen - beispielsweise "Nicht drängeln! - Simulation von Reißverschlüssen bei Fahrbahnverengungen" oder "Diät? – Mache ich morgen! - Zeitinkonsistenz in ökonomischen Entscheidungen" – bezieht sich Wüst oft auf bekannte Phänomene.

WOHNUNGSBAU DER ZUKUNFT MIT HOME +

INTERNATIONALER WETTBEWERB SOLAR DECATHLON EUROPE 2010



Wie sieht der Wohnungsbau der Zukunft aus? Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010". Beim "Solaren Zehnkampf" tritt die HFT Stuttgart als eine von 20 ausgewählten Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen.

"Wir vereinen für diesen Wettbewerb unsere gesamte umfassende Kompetenz, indem wir das Knowhow der Studiengänge Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence sowie unser Instituts für Gebäudeenergieforschung (zafh.net) einbringen." Projektleiter Professor Dr. Jan Cremers sieht die HFT Stuttgart bestens gerüstet, diese Aufgabe von der Konzep-

tion des Entwurfs über die technische Durcharbeitung bis hin zur Realisierung vor Ort in Madrid erfolgreich und auf hohem Niveau zu bewältigen. "Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden einen wichtigen interdisziplinären, zukunftsrelevanten und praxisnahen Baustein in ihrer Ausbildung anzubieten." Das Entwurfs- und Energiekonzept der HFT Stuttgart stellt eine Kombination von tradi-

tionellen Grundprinzipien mit modernem Material und neuer Technologie dar.

DAS HAUS UND SEIN ENERGIEKONZEPT

"Unter den vorangegangenen Einzelentwürfen der mitwirkenden Studenten, hat sich das Gebäude herauskristallisiert, welches am meisten Potential für den Wettbewerb bietet," so Nansi Palla, die als eine von 15 engagierten Studenten und Studentinnen des "Kern-Teams" mit dabei ist.

Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis HOME+ heißt das Gebäude der HFT Stuttgart. Der Name steht für ein Wohnhaus und Zuhause, welches als Plusenergiehaus mehr Energie produziert, als es verbraucht. Zudem sollen die vielfältigen Nutzungsmöglichkeiten durch die Modularität des Bausystem ausgedrückt werden.





zum umschlossenen Raum aufweist. Dadurch erreicht man eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs. Die einzelnen Module werden mit etwas Abstand zueinander angeordnet. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer.

Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas beiträgt. In Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element,

das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt. Um den zwar niedrigen, aber dennoch vorhandenen Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert.

Das Dach und die Fassaden werden mit einer Art zweiten Hülle mit Photovoltaik-Solarmodulen (PV) zur Stromerzeugung versehen. Nach ersten Simulationen wäre eine zusätzliche Energieeinspeisung in das öffentliche Stromnetz möglich. Damit wird das Gebäude HOME+ der HFT Stuttgart zum Plusenergiehaus.

DIE KONSTRUKTION

Der modulare Aufbau des Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen.

Unsere Modul-Bauweise ermöglich es, das Raumkonzept in unterschiedliche Bereiche zu teilen. So findet man neben dem Eingangsbereich auch einen Kochbereich, Aufenthaltsbereich und einen Schlafbereich. Jedes dieser Module ist auf eine Lastwagenladefläche begrenzt, was uns »



wiederum eine enorme Zeitersparnis beim Aufbau in Madrid einräumen wird. Die Module werden nahezu vollständig vormontiert Deutschland im Juni 2010 in Richtung Madrid verlassen," so Sebastian Schmidt, einer der Verantwortlichen Studenten für die Konstruktion.

ZEITPLAN UND UMSETZUNG

Innerhalb von 8 Tagen muss es den beteiligten Studierenden möglich sein, den gesamten Wettbewerbsbeitrag aufzubauen und der Jury betriebsbereit zu übergeben. Straffe Randbedingungen und damit gestalterischen Zwängen unterliegt das Projekt unter anderem durch die Höhenbegren-

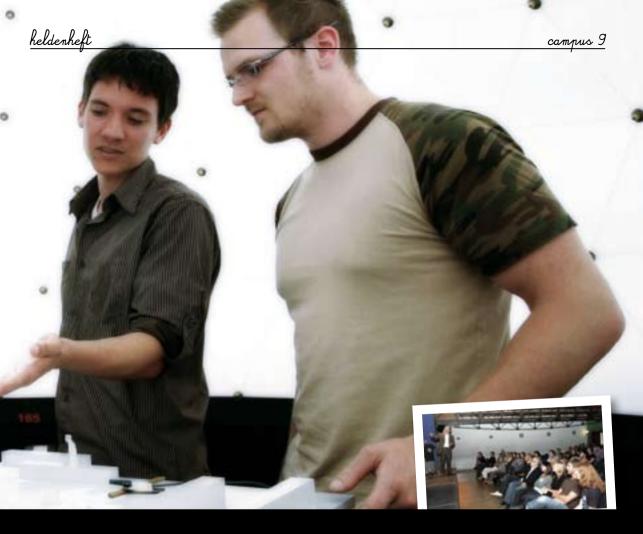
zung und eines maximalen Footprints von 75m². Dennoch wurde ein wettbewerbsfähiger Entwurf geschaffen. Startschuss für die Erstellung der ersten Bauteile war im Herbst. In einer Testphase werden danach Gebäudetechnik und Regelung optimiert, bevor im Juni 2010 die Demontage des Gebäudes und der Transport nach Madrid ansteht.

Zum Abschluss des Wettbewerbs, im Juni 2010, werden die Häuser aller Teams eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Nach dem Wettbewerb soll HOME+ am Hochschulstandort Stuttgart als Veranstaltungs- und Forschungsgebäude dienen.

WETTBEWERBSKRITERIEN

Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept, stellen auch der Transport und die Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt.

Darüber hinaus werden architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet. Auslober ist das spanische Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium (DOE). Eine nette Teilaufgabe des Wettbewerbs stellt auch die kulinarische Versorgung in einem Kochduell



dar. So wird eine 12-köpfige Mannschaft im laufenden Wettbewerb bekocht und sich im Gebäude aufhalten. Verschiedene Szenarien werden so simuliert. Wie auch hier werden während dem Wettbewerb in Madrid ständig Messungen des Innenraumklimas durchgeführt, welche eine Grundlage für die Wertung im Wettbewerb bilden.

WER MACHT ES MÖGLICH?

Die Wettbewerbsteilnahme der HFT Stuttgart steht unter der Schirmherrschaft des Bundeswirtschaftsministeriums, des baden-württembergischen Ministerpräsidenten und des Oberbürgermeisters der Landeshauptstadt Stuttgart. Als Sponsoren konnten bisher müllerblaustein (Müller Holzbau GmbH), Transsolar Energietechnik GmbH, die Margarete Müller-Bull Stiftung und die Knödler Decker Stiftung gewonnen werden. Insgesamt nehmen vier Hochschulen aus Deutschland am Wettbewerb teil. Diese werden vom Bundesministerium für Wirtschaft und Technologie (BMWi) aufgrund eines Beschlusses des Deutschen Bundestages durch einen substantiellen Beitrag unterstützt.

Ohne Sponsoren wäre, besonders in wirtschaftlich schweren Zeiten, eine Realisierung des Projektes mit einem Gesamtaufwand in der Größenordnung von 1 Million Euro nicht denkbar.

Auch ohne ein zusätzliches Engagement der Studenten von mittlerweile nahezu 3 Tagen pro Woche wäre dieses Projekt wohl kaum möglich. Besonders das Bachelor-Master-System und die Dauer des Projektes von 2 Jahren macht eine Integration im Lehrplan schwierig. Bis zur Abgabe in Madrid werden wohl noch viele gemeinsame Stunden vergehen.

Das Heldenheft Team wünsch gutes Gelingen und eine erfolgreiche Teilnahme am Wettbewerb.

Weitere Informationen unter www.hft-stuttgart.de und www.sdeurope.de.

home+ - unser Beitrag zum Solar Decathlon Europe 2010

Im letzten Sommersemester wurde durch fünf verschiedene Studiengänge der HFT an einem ambitionierten Thema gemeinsam gearbeitet, der Entwicklung eines solaren "Plusenergie"-Wohnhauses für den SDE mit ca. 70 m² Wohnfläche. Die Semesterarbeit der rund 90 teilnehmenden Studierenden wurde am 25. Juni der interessierten Hochschulöffentlichkeit vorgestellt.

Gebäude bedingen ein Drittel des weltweiten Gesamtenergieverbrauchs und damit auch ca. ein Drittel der weltweiten Treibhausgas-Emissionen. Der Bausektor produziert außerdem weltweit 25 bis 40% allen festen Abfalls und verbraucht damit insgesamt ungefähr die Hälfte aller Primärressourcen. Von daher ist gerade dieser Bereich gehalten, durch den größtmöglichen Einsatz von erneuerbaren Energien und einen umfassenden integralen Ansatz einen Beitrag zu Energieeinsparung und -effizienzsteigerung zu leisten.

VON PROF. DR. JAN CREMERS

Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010", der ein in den USA sehr erfolgreich etabliertes Modell nach Europa holt. Wie könnte der Wohnungsbau in Zukunft aussehen, der das solare Bauen mit hohen gestalterischen Ansprüchen an die Architektur verbindet? Es geht dabei nicht nur um den Energieverbrauch, sondern um einen ausgewachsenen "Zehnkampf", das heißt, der strapazierte Begriff der Nachhaltigkeit wird als komplexes Themenfeld großer Breite ernst ge-

Die HFT wurde in einem aufwändigen Qualifizierungsverfahren als einer von 20 internationalen Teilnehmern ausgewählt. Wir vereinen für diesen Wettbewerb die umfassende Kompetenz unserer Hochschule, indem wir neben den Professorenkollegen und Studierenden aller einschlägigen Studiengänge (Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence) auch unser Institut für Gebäudeenergieforschung (zafh. net) einbringen. Damit sehen wir uns bestens gerüstet, die Aufgabe von der Konzeption des Entwurfs über die technische Durcharbeitung bis hin zur Realisierung vor Ort in Madrid erfolgreich und auf hohem Niveau zu Wettbewerb nicht als reine akademische Übung konzipiert ist. Wir wollen vielmehr in der Realisierung den Beweis der Praxistauglichkeit antreten

staltung als Bau-Ausstellung auf großes Interesse einer breiten internationalen Öffentlichkeit stoßen wird.

Die Häuser aller Teams präsentieren sich im Juni 2010 eine Woche lang als "Solar Village" im Zentrum von Madrid, in direkter Nachbarschaft zu Schloss und Kathedrale, einer breiten Öffentlichkeit, bevor am Ende die Sieger gekürt werden. Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet. Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Darüber hinaus soll die Markteinführung innovativer solarer Energietechnologien gefördert und der Nachweis erbracht werden, dass energieeffizientes Bauen mit hohem Wohnkomfort und architektonischer Qualität verwirklicht werden

Das Team HFT Stuttgart

Der Wettbewerb Solar Decathlon Europe 2010 ist eine hervorragende Gelegenheit, den Studierenden der HFT Stuttgart einen wichtigen interdisziplinären, zukunftsrelevanten und praxisnahen Baustein in ihrer Ausbildung anzubieten. Studierende aus dem Master Architektur bearbeiten und koordinieren als Kernteam den Beitrag der HFT Stuttgart. Sie bilden das "Architekturbüro", in dem alle Informationen zusammenlaufen und die Beiträge der "Fachplaner" aus den weiteren beteiligten Studiengängen abgestimmt und in das Gesamtkonzept eingearbeitet werden. Weitere Unterstützung erfährt unbewältigen. Als Hochschule, die in ser Team durch das HFT-Forschungs-

Parallel zur inhaltlichen Bearbeitung engagieren wir uns intensiv im Bereich Fundraising, denn obwohl uns die Hochschule nach Kräften unterstützt, sind sowohl externes Know-how wie auch erhebliche Mittel für eine erfolgreiche Wettbewerbsteilnahme erforderlich. Wir freuen uns daher sehr, dass wir inzwischen die Firma Müller Holzbau als Premiumsponsor gewinnen konnten, dass wir aufgrund eines Beschlusses des Deutschen Bundestages maßgeblich durch das Bundesministerium für Wirtschaft und Technologie (BMWi) gefördert werden und dass Ministerpräsident Günther H. Oettinger für unseren Hochschulbeitrag die Schirmherrschaft übernommen hat.

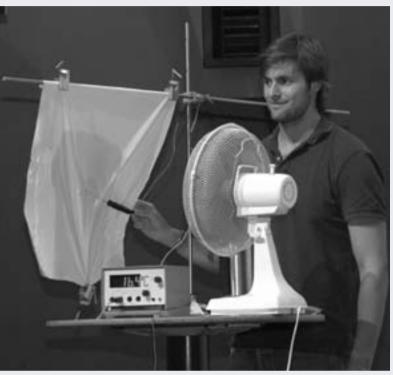
Das Entwurfs- und Energiekonzept

Der Entwurf, der inzwischen den Namen "home+" erhalten hat, basiert auf gestalterischen und energetischen Überlegungen. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch erreichen wir eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs. Das Volumen wird in einzelne Module aufgeteilt, die mit etwas Abstand zueinander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der "Energieturm", der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas in heißen und trockenen Regionen beiträgt. Dabei bedient er sich der Grundprinzipien traditioneller lokaler Vorbilder, wie der Windtürme im arabischen Raum und der in Spanien weitverbreiteten Patios. In der Kombination mit heute verfügbaren neuen Materialien und Technologien ensteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht

Die Kombination traditioneller Grundprinzipien und moderner Materialien und Technologien findet sich auch im Innenraum wieder. Dort erhöhen Phasenwechselmaterialien (PCM) die thermisch wirksame Masse der aus Holz gefertigten Module. Außerdem stellt ein Lüftungsgerät mit Wärmerückgewinnung die Minimierung der Lüftungswärmeverluste sicher. Um den zwar niedrigen aber natürlich dennoch vorhandenen Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert: Das Dach und die Ost-, Südund Westfassaden werden wie mit einer



notwendig, denn im Laufe der Wettbewerbswoche im Juni 2010 in Madrid werden wir an zwei Abenden unsere direkten Nachbarn im "Solar Village" zu einem Dinner für zwölf Personen einladen und bewirten.



Studenten der Bauphysik demonstrieren sehr anschaulich das Klimakonzept unseres Entwurfs, hier das Prinzip der adiabaten Kühlung (Verdunstungskälte): Das Thermometer zeigt einen Temperaturunterschied zur Raumlufttemperatur von rund fünf Kelvin. Foto: Team HFT

zweiten Hülle mit Photovoltaik-Modulen zur Stromerzeugung versehen. Erste Simulationen lassen erwarten, dass wir über ein Jahr betrachtet nicht nur den Energiebedarf unseres Gebäudes mit den Erträgen der PV-Flächen decken, sondern sogar noch zusätzlichen Strom ins Netz einspeisen können. Damit wird unser Gebäude zum "Plusenergiehaus". An den Fassaden kommen dabei Dünnschichtzellen auf Glas zum Einsatz, die eine gewisse Transparenz erlauben. Dadurch kommt in der Außenansicht der modulare und mehrschichtige Charakter des Gebäudes zur Geltung. Auch im Innenraum geben die Module und quer dazu die Schichtung der Funktionsbereiche eine klare Zonierung vor. Zusammen mit dem Energieturm werden eine hohe räumliche Flexibiliund gleichzeitig die gestalterische und tät und spannende Raumbeziehungen nationalen Immobilienmesse SIMA langer Tradition der Baupraxis ver- zentrum zafh.net, das schon beim Solar räumliche Wahrnehmung des Gebäudes hergestellt. Diese Flexibilität ist auch 2009 in Madrid zu sehen.

Der modulare Aufbau unseres Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können damit nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen. Darüber hinaus kann das Gebäude, insbesondere die Fugen, an die klimatischen Gegebenheiten des jeweiligen Standortes funktional angepasst werden.

Mit Blick auf den engen Zeitplan liegt unser Fokus auf der Optimierung, Ausarbeitung und Fertigung des Prototypen für den Wettbewerb. Ein erstes Präsentationsmodell und eine kurze Filmpräsentation wurden erstellt und waren bereits Ende Mai auf der inter-



Solar Decathlon Europe 2010

home* Gestaltung Innenraum

Bachelor-Studiengang Innenarchitektur

as Projekt Solar Decathlon Europe 2010 ist ein hervorragendes Beispiel, wie unsere Studierenden die Zusammenarbeit und Absprache mit verschiedenen am Bau tätigen Fachingenieuren kennenlernen und üben können.

VON PROF. DIANE ZIEGLER

15 Studierende des fünften Semester Bachelor Innenarchitektur entwerfen die innenräumliche Gestaltung auf Grundlage des Gebäudeentwurfes der Architekten und entwickeln ein Konzept, wie das Haus während der Wettbewerbsjurierung bewohnt und zwölf Personen bewirtet werden können. Da das ganze Projekt in einem engen Zeitraster erfolgt, wurde es in verschiedene Entwurfsschritte aufgeteilt. Die dabei erzielten Zwischenergebnisse werden in großer Runde unter Beteiligung aller Studiengänge präsentiert und disku-

Die Studierenden bearbeiten zu Beginn die Aufgabe als Einzelarbeit. Die beste Arbeit wird in einem Wettbewerbsverfahren ausgewählt und zur Realisierung empfohlen.

Die Realisierung erfolgt dann im Team unter Beteiligung aller Studierenden. Details, Materialien und Oberflächenbearbeitungen werden geklärt, Werkpläne erstellt, so dass im Anschluss die Produktion und Umsetzung erfolgen kann.

Erste Konzepte (Storyboard: Sinika Bäuerle)

FÖRDERER

Wir danken besonders den Förderern des Projekts an der HFT Stuttgart:

- Bundesministerium für Wirtschaft und Technologie (BMWi)
- Müller Holzbau GmbH/ müllerblaustein
- **TRANSSOLAR**
- Energietechnik GmbH
- Margarete Müller-Bull Stiftung Knödler Decker Stiftung

Wir danken auch besonders der engagierten Unterstützung durch das

Der HFT-Beitrag zum SDE 2010 steht unter der Schirmherrschaft von Ministerpräsident Günther H. Oettin-

HFT-BETEILIGTE:

Im SS 09 waren von der HFT Stuttgart folgende Studiengänge, Einrichtungen und Personen beteiligt:

Master Architektur

Prof. Bleicher, Prof. Dr. Cremers, Prof. Löffler, Prof. Roser, Prof. Zimmermann

Bachelor Innenarchitektur Prof. Ziegler, Prof. Goebel, Prof. Holder

Master

Konstruktiver Ingenieurbau Prof. Dr. Hartmann, Prof. Dr. Steidle **Bachelor Bauphysik** Prof. Dr. Eicker, Prof. Dr. Beck

Master SENCE/zafh.net

Prof. Dr. Eicker

Fundraising

Christiane Kloss, Ulrich Handfest Unterstützung des Teams im SS 09 außerdem durch Beate Collmer, Petra Dabelstein, Albert Stöcker,

Gesamtprojektmanagement und

Markus Bachmann (Modellfotogra-

-leitung: Sebastian Fiedler, Prof. Dr. Cremers

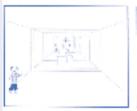






















Tragkonzepte -Tragstrukturen -**Tragelemente**

Master-Studiengang Konstruktiver Ingenieurbau

ur Erzielung einer optimalen Tragstruktur wurden von Studierenden des Masters Konstruktiver Ingenieurbau (KI) für die einzelnen Module verschiedene Varianten und Konzepte verfolgt und bewertet.

> VON PROF. DR.-ING. HEINER HARTMANN

Die einzelnen Module, im Grundriss mit Abmessungen von rund 2,40 x 6,80 m, werden über gläserne Fugen in der Breite von rund 0,9 m aneinandergereiht. Entscheidende Kriterien für die Bewertung der einzelnen Konzepte

- Elementierung für einfachen Transport und Montage
- Geringes Gewicht für Montage vor
- · Einfaches Bearbeiten und Montieren auch für Nichtfachleute
- · Steife Tragstruktur zur Sicherstellung von geringen Verformungen und zur Reduzierung der Gefahr gegen Glasbruch, auch im Transportzustand

- · Verwendung von Baumaterialien mit geringem Primärenergieverbrauch
- Einfache Integration von Haus- und Energietechnik

Darüber hinaus sollte das Konzept einen möglichst hohen Innovationsanteil aufweisen, um auch hier bei der Bewertung Pluspunkte zu sammeln. Es ist deshalb nicht verwunderlich, dass der Baustoff Holz mit seinen neuesten strukturellen und technischen Möglichkeiten zum Einsatz kommen soll. Bei einer dieser Varianten werden die begrenzenden Flächen der Module zu den Glasfugen hin als tragendes Element genutzt. Dadurch entsteht ein "Zweigelenkrahmen", welcher sich auf den Boden punktuell abstützt. In Querrichtung sind verschiedene Nebentragsysteme, bis hin zu einer Plattenstruktur aus Brettsperrholz, möglich.

Die Abstützungen/Auflagerungen unten erhalten gleichzeitig eine Verlängerung nach oben, um damit im Montagezustand das Modul anheben zu können. Die Glasfuge könnte als eigenständiges (Glas-) Modul oder auch am Rahmen des normalen Moduls stabilisiert werden.

begehbere Überkopfverglasung (VSG aus TVG). innenliegende Verschattung mit hiprofilen (d = 1 cm) zur befestigung der Glaskonstruktion und zur Verbindung der einzelnen Module Passivhous Glasrahmen aus Holiz (dient auch zur Ausstellung der "Glasmodule") 8 innenfenster aus. 3-fach Isolienverglasung Holzrahmen der bzw. Unterkonstruktion mit Auflegerung

Horizontal- und Querschnitt einer Fuge.

Grafik: Team HFT



Besprechung Master KI.

Foto: Team HFT

TEILNEHMER SDE

Die 20 internationalen Teilnehmer des SDE 2010:

... aus Deutschland

Hochschule für Technik Stuttgart Bergische Universität Wuppertal Hochschule Rosenheim Hochschule für Technik und Wirtschaft Berlin

... aus Spanien

Universidad Politécnica de Cataluna Universidad CEU Cardenal Herrera Universidad de Sevilla Universidad de Valladolid Universidad Politécnica de Valencia Instituto de Arquitectura Avanzada de Cataluna

... aus Großbritannien University of Nottingham

... aus Frankreich

Ecole Nationale Supérieure de Grenoble

Arts et Métiers Paris Tech

... aus Finnland

Helsinki University of Technology

... aus den USA

University of Florida

Virginia Polytechnic Institute State University

... aus Mexico

Inst. Technol. y de Estudios Superior de Monterrey

... aus Brasilien

Consórcio Brasil (6 Universitäten)

... aus China

Tianjin University

... aus Israel

Arial University Center of Samaria

DISZIPLINEN

Die Disziplinen des Solaren Zehnkampfs:

Architektur

1. Architektur 130 2. Konstruktion

Solar

3. Solarsysteme 4. Elektrische Energiebilanz 130

Komfort

5. Komfortbedingungen 6. Haushaltsgeräte

Sozial & Ökonomisch

7. Kommunikation & soziales Bewusstsein 8. Industrialisierung und Marktfähigkeit

Strategie

9. Innovation 10. Nachhaltigkeit 130

1000

12 I SOLAR DECATHLON EUROPE 2010

Solar Decathlon Europe 2010 Beitrag HTW Berlin Die Kühlkonzepte

Beim "Solaren Zehnkampf" treten 21 ausgewählte Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75 m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Dann werden die Häuser aller Teams eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt.

Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept, stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

xia berichtet an dieser Stelle fortlaufend über die Entwicklung des Solar Decath-Ion Europe, bis die Sieger gekürt werden. Nach der allgemeinen Vorstellung des Wettbewerbs in xia 67 und der Vorstellung der deutschen Teilnehmer und ihrer Projekte in xia 68, in dieser Ausgabe ein näheres Eingehen auf die unterschiedlichen Kühlkonzepte der Deutschen Beiträae

Weitere Informationen zum SD Europe 2010 finden Sie unter: www.sdeurope.org

Bei der Entwicklung der living EQUIA-Kühlstrategie stand das Vermeiden von Kühllasten an erster Stelle. So hat das living EQUIA-Haus keine durchgehende Glasfassade, sondern einzelne, relativ kompakte Fensterflächen, welche sich zudem durch flexible PV-Lamellen vollständig verschatten lassen. Die Lichtachsen, die Dach und Wände in Ost-West und Nord-Süd-Richtung teilen, lassen hierbei stets genug Tageslicht in den Innenraum. Hinzu kommt eine Lüftungsanlage der Firma Enervent, die dank einem Sorptionsrotor nicht nur eine Wärme-, sondern auch Feuchterückgewinnung ermöglicht.

Die dann noch vorhandenen Kühllasten werden größtenteils durch thermische Speicher abgepuffert. Dies geschieht zum einen direkt über die an Wänden und Decke angebrachten Lehmbauplatten der Firma Lebast mit integrierten Latentspeichermaterialien (PCM). Zum anderen wird Wasser aus einem isolierten Wassertank unter der Nordterrasse durch in den Lehmbauplatten verlaufende Rohre gepumpt. Mit diesem Wasser wird auch die Zuluft auf einem angenehmen Temperaturniveau gehalten. Dank der Speicher kann die passive Kühlung in den Nachtstunden erfolgen. Neben einer Erhöhung der Luftwechselrate (Nachtlüftung) wird das Wasser aus dem Wassertank durch die Abstrahlfläche auf dem Norddach gepumpt. Dort kühlt es sich durch den vom ZAE Bayern untersuchten Strahlungsaustausch mit der Atmosphäre ab, meist sogar auf unter Umgebungstemperatur. (living EQUIA verwendet ein geschlossenes System, bestehend aus Metallplatten mit rückseitig angeklebten Kapillarrohrmat-

ten.) So steht das Wasser im Tank zur

Kühlung am nächsten Tag bereit.

Erst wenn das Wasser im Tank zu warm geworden ist, um den Raum direkt zu kühlen, kommt die Wasser-Wasser-Wärmepumpe ins Spiel. Diese schaltet sich zwischen Wassertank und die wassergeführten Lehmbauplatten und stellt somit die Kühlung des living EQUIA-Hauses sicher. Dank der Verwendung des relativ kühlen Wassertanks als Wärmesenke kann die Wärmepumpe mit sehr guten Wirkungsgraden und damit minimalem Stromverbrauch arbeiten.

Ein besonderer Fokus wird bei living EQUIA auch auf den Feuchtehaushalt gelegt. Schließlich wird in konventionellen Kühlsystemen unnötig Energie verschwendet, um die Zuluft im Sommer durch Taupunktunterschreitung zu entfeuchten. Bei living EQUIA wird durch das Sorptionsrad der Lüftungsanlage ein Großteil der Feuchte von der Zuluft direkt an die Abluft übertragen und kommt so gar nicht erst ins Haus. Die restliche überschüssige Feuchte wird von den Lehmbauplatten aufgenommen und erst bei Bedarf wieder abgegeben. Und sollte die Speicherkapazität des Lehms einmal nicht ausreichen, wird über ein Aufheizen der Abluft das Sorptionsrad getrocknet und damit die Zuluft entfeuchtet. Da das Aufheizen der Abluft über das Solarsystem geschieht, erfolgt auch die Entfeuchtung mit maximaler Energieeffizienz.

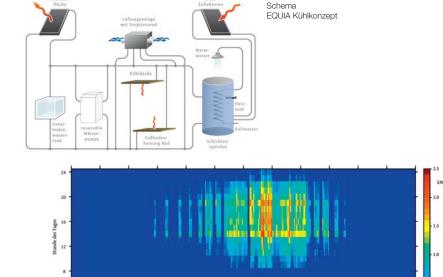
Beitrag Hochschule Rosenheim

Die Leitidee des Rosenheimer Entwurfes für die südlichen Breiten (Madrid) sind in erster Linie eine gute Isolierung, ein Maximum an Luftdichtheit und ein effizienter Sonnenschutz, um zu hohe Kühllasten zu vermeiden.

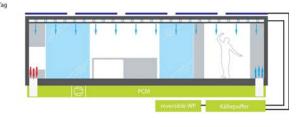
Des Weiteren beruht das Kühlkonzept des Gebäudes auf aktiven sowie passiven/hybriden Systemen.

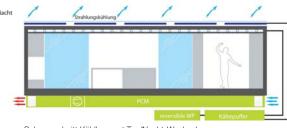
Grundlage des passiven Kühlungssys- tems ist die Strahlungskühlung über die Dachfläche. Dabei wird in den kühlen klaren Nachtstunden ein kontinuierlicher Wasserfilm über die geneigte Dachebene geleitet. Durch Strahlungsaustausch mit dem klaren Nachthimmel, konvektiver Wärmeabgabe an die Umgebungsluft und Verdunstung wird das Wasser abgekühlt und anschließend in einem gedämmten Speicher gesammelt. Als zweite passive Maßnahme ist die Nutzung eines luftdurchströmten PCM-Puffers vorgesehen. Dieser Speicher nimmt am Tag durch Umluftbetrieb die Wärme der Raumluft auf und gibt diese im Außenluftbetrieb in der Nacht wieder an die kühlere Umgebungsluft ab. Die ventilierte Nachtlüftung wird durch außenlufttemperaturgesteuerte Klappen geregelt, damit wird der Entladungsprozess des PCM Speichers nur bei möglichen Außenlufttemperaturen gestartet und spart somit unnötige Hilfsenergien

Die reversible Luft/Wasserwärmepumpe ist der aktive Teil des Kühlkonzeptes. Mit der produzierten Kühlleistung wird die wasserdurchströmte Kühldecke im Wohnraum betrieben. Die Vorkonditionierung des Kältespeichers durch die Strahlungskühlung erfordert den Einsatz der Wärmepumpe nur bei möglichen Spitzenlasten.



Stündliche Darstellung der Kühllasten, um das living EQUIA-Haus in Madrid auf 24 °C zu halten. Der jährliche Kühlenergiebedarf beträgt rund 1600 kWh.





Schemaschnitt Kühlkonzept Tag/Nacht-Wechsel des Rosenheimer Entwurfs

Beitrag HFT Stuttgart

Um auch bei hohen Außentemperaturen in Madrid angenehme Innenraumbedingungen zu schaffen, bedient sich home+sowohl passiver wie auch aktiver Komponenten.

Die großflächig verglaste Südfassade wird durch das Terrassenmodul verschattet, ohne dass der Ausblick eingeschränkt wird. Die horizontalen Glasflächen der Fugen werden durch einen feststehenden Sonnenschutz, die vertikalen Glasflächen der Fugen durch einen beweglichen Sonnenschutz vor zu hohem Strahlungseintrag geschützt. Im Innenraum nehmen PCM (Phase Change Materials) in der Deckenkonstruktion tagsüber die Wärme auf. Nachts werden sie mit kühlem Wasser, das durch Rohre an der raumabgewandten Seite der PCM geführt wird, wieder entladen. Das dafür benötigte Wasser wird durch die Abstrahlung gegen den kalten Nachthimmel gekühlt. Dazu wird es nachts in Rohren an der Rückseite der auf dem Dach montierten Photovoltaik-Module entlanggeführt. Die Oberfläche der PV-Module steht im Strahlungsaustausch mit dem Nachthimmel und kühlt stark ab. Es ist dasselbe Phänomen, das auch zur Reifbildung auf den Windschutzscheiben von Autos führt. Die abgekühlten PV-Module entziehen wiederum dem Wasser die Wärme, die dieses aus den PCM aufgenommen hat. Durch die nächtliche Abstrahlung wird wesentlich mehr Kühlenergie generiert, als zur Aushärtung der PCM erforderlich ist. Der Überschuss wird in einen Pufferspeicher eingespeist. Dieser dient tagsüber als Rückkühlspeicher für den Betrieb einer reversiblen Wasser-Wasser-Wärmepumpe. Diese wird allerdings nur in extrem heißen und feuchten Zeiten zur Kühlung eingesetzt, um die im Wettbewerb eng gesetzten Komfortbedingungen einzuhalten. Die Lufttemperatur im Innenraum muss zwischen 23 und 25 °C, die relative Luftfeuchte zwischen 40 und 55% gehalten werden.

Das Klima in Madrid ist in Zeiten mit hoher Außentemperatur allerdings meist sehr trocken. Dies nutzt der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas beiträgt. Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus heißen und trockenen Regionen, wie der Windtürme im arabischen Raum und der in Spanien weitverbreiteten Patios. In der Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt.

Der über das Gebäude hinausragende Teil des Energieturms ist so ausgerichtet, dass warme und trockene Außenluft aus der im Sommer am Standort in Madrid vorherrschenden Windrichtung eingefangen wird. Im Inneren des Turms hängen befeuchtete Gewebe, an denen die Luft entlangstreicht und über Verdunstung gekühlt wird. Die abgekühlte Luft fällt nach unten und wird am Fußpunkt des Turmes in das Gebäudeinnere geführt, wo sie sich nach dem Quellluftprinzip verteilt. Seitlich neben dem Energieturm befinden sich zwei Solarkamine, die über hochliegende Öffnungen in der Turm-Fuge verbrauchte Luft aus dem Gebäude abziehen. Energieturm und Solarkamine stellen also eine gute Durchströmung des Gebäudes mit gekühlter Luft sicher, und das ohne den Einsatz mechanischer Energie.

Universität Wuppertal Das Team der Bergischen Univer

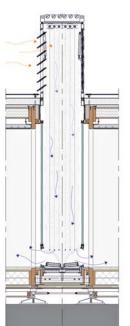
Beitrag Bergische

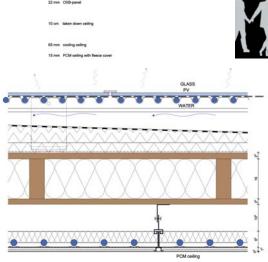
Das Team der Bergischen Universität Wuppertal verfolgt mit seinem Beitrag zum Solar Decathlon Europe 2010 die Konzeptidee eines "Europäischen Hauses". Sowohl im sommerwarmen Klima von Madrid als auch am späteren Nutzungsort in Wuppertal sollen hohe Komfortansprüche ebenso erreicht werden wie eine ausgeglichene Jahresenergiebilanz (Netto-Nullenergiehaus). Während in Madrid der Kühlbedarf dominiert, wird es bei der Nachnutzung in Wuppertal der Heizwärmebedarf sein. Ausgangsbasis für beide Fälle ist die Passivhausbauweise mit hochwertigem Wärmeschutz und aktiver Lüftung. Hohe Energieeffizienz bei der Beleuchtung und sämtlichen Elektrogeräten minimieren den jährlichen Strombedarf ebenso wie die damit verbundenen Wärmelasten.

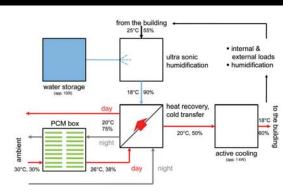
Auffälliges Merkmal zur Reduktion der äußeren Wärmelasten ist das geplante Vorhangsystem. Es dient als konsequenter Sonnenschutz und gleichzeitig als wichtiges architektonisches Element im Kontext der Gestaltung der Gebäudehülle. Die dazu vorgesehenen Behänge besitzen ein hohes Strahlungsreflexionsvermögen und eine sehr geringe, richtungsselektive Lichttransmission. Die durchgeführten Simulationsrechnungen haben gezeigt, dass für die im Wettbewerb in Madrid angestrebten Innenraumtemperaturen von maximal 25 °C eine Kühlung unverzichtbar ist. Die gewählte Lösung basiert zunächst auf der Kühlung der Zuluft durch indirekte adiabate Kühlung über Befeuchtung der Fortluft. Hierbei kommt eine Sonderentwicklung für den Wettbewerb zum Einsatz (Klingenburg). Aufgrund des geringen Wasserbedarfs erfolgt keine eigene Wasseraufbereitung. Die kühle Fortluft



entzieht über den Wärmetauscher der Wärmerückgewinnung Wärme aus der Zuluft. Außentemperaturspitzen werden durch Latentspeichermaterial im Luftkanal gedämpft (Dörken). Ein Lüftungskompaktgerät mit reversibler Wärmepumpe als zentrales Element der Gebäudetechnik ermöglicht die hydraulische Umschaltung von Heiz- auf Kühlbetrieb (Viessmann). Die maximal 1 kW Kälteleistung stehen für die weitere Abkühlung der Zuluft auf minimal 18 °C sowie in Verbindung mit der hydraulischen Anbindung der Fußbodenheizung als Kühlfläche zur Verfügung. Das dargestellte Schema verdeutlicht einen typischen Betriebsfall.







Indirect adiabatic supply air cooling including PCM to reduce the outdoor temperature peaks

Thema wechseln

BAUNETZ WISSEN SOLAR

FACHWISSEN

2 x Solar Decathlon

Neu!

OBJEKTE

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Verbände Wettbewerbe/Preise

Gebäudeintegrierte Solartechnik ausgezeichnet Innovationspreis Architektur und Bauwesen verliehen Intersolar Award 2009 vergeben

Solar Decathlon Europe 2010 - Living Equia

Solar Decathlon 2009 entschieden

Batimat Awards 2009 verliehen

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Solar Decathlon Europe 2010

Solar Decathlon in Washington

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Solar Decathlon Europe 2010



Der solare Zehnkampf kommt nach Madrid

Das spanische Wohnungsbauministerium und das amerikanische Energieministerium bringen den Solar Decathlon Europe gemeinsam 2010 nach Madrid. Die Teilnehmer des europäischen Wettbewerbs sollen auf die Frage nach dem Wohnungsbau der Zukunft eine adäquate Antwort geben.

Mit dem Wettbewerb soll das Bewusstsein der Öffentlichkeit für energieeffizientes Bauen geweckt bzw. gestärkt werden. Bis Juni 2010 haben die zwanzig Hochschulen aus der ganzen Welt Zeit, ein 75 m² großes Wohnhaus zu entwerfen und zu bauen, welches ausschließlich mit solarer Energie versorgt wird. Unter den Teilnehmern befinden sich auch vier deutsche Hochschulen:

- · Bergische Universität Wuppertal
- Living Equia –Team Berlin (FHTW Berlin, TFH Berlin, UdK Berlin, FH Potsdam)
- HFT Stuttgart
- · Hochschule Rosenheim

Das Projekt hat nicht nur hohe Anforderungen an Energieeffizienz und Einbindung solarer Energiegewinnung, eine große Herausforderung wird es sein, das Gebäude nach Madrid zu transportieren und dort aufzustellen. In die Bewertung gehen ebenso die architektonischen Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte sowie die Marktfähigkeit ein.

Im Juni 2010 werden dann die Häuser der zwanzig Teams eine Woche lang in Madrid der Öffentlichkeit präsentiert und die Sieger gekürt. Die deutschen Hochschulen erhalten infolge eines Beschlusses des Deutschen Bundestages vom Bundesministerium für Wirtschaft und Technologie (BMWi) einen substanziellen Beitrag zur Unterstützung.



Zum Thema 2 x Solar Decathlon Plus-Energie-Haus des BMVBS

Solar Decathlon in Washington Sonnige Zeiten - Solar Decathlon

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1 von 1 07.12.2009 10:45 Aktuelle News

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News Archiv

Aktuelle News

zurück zur Übersicht

vorheriger Artikel nächster Artikel Artikel 584 von 1875



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Mehr zum Thema Bauen auf der

Handwerker machen Energie-Check Neues Solaraktivhaus sichert Stromund Wärmeversorgung nur durch Sonnenenergie

Energieeffizientes Sanieren

13. Internationale Passivhaustagung 2009 in Frankfurt

Energielabel soll energieeffiziente Gebäude sichtbar machen



Inhalt drucken



Inhalt versenden

:: Wer baut das beste solar betriebene Wohnhaus?

+ 30.11.2008 + Beim Solar Decathlon Europe 2010 treten ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen.

Die Hochschule für Technik Stuttgart ist beim Solar Decathlon Europe 2010 dabei! Bei diesem "Solaren Zehnkampf"- Wettbewerb treten 15 bis 20 ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Zum Abschluss des Wettbewerbs werden die Häuser aller Teams in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt.

Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet. Der Solar Decathlon Europe wird zum ersten Mal in Europa ausgetragen. Auslober des europäischen Wettbewerbs ist das spanische Wohnungsministerium in Zusammenarbeit mit dem amerikanischen Energieministerium.

Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinführung innovativer solarer Energietechnologien soll gefördert und der Beweis angetreten werden, dass energieeffizientes Bauen auch mit einer Steigerung des Komforts, sowie der Gestaltungs- und Lebensqualität, einhergehen

"Die HFT Stuttgart nimmt diese Herausforderung gerne an" erklärt Professor Andreas Löffler, Dekan der Fakultät Architektur und Gestaltung an der HFT Stuttgart. "Wir freuen uns auf diese komplexe Aufgabe und werden dafür die Kompetenzen der gesamten Hochschule im Bereich des energieeffizienten Bauens bündeln." Studierende, Mitarbeiter und Professoren der Fakultät Architektur und Gestaltung und der Fakultät Bauingenieurwesen, Bauphysik und Wirtschaft sowie dem Forschungszentrum (Gebäudeenergieforschung) sind an dem Projekt beteiligt.

In interdisziplinären Teams wird ein leichtes Elementbausystem entwickelt und umgesetzt. Das ausschließlich solarbetriebene Gebäude muss einfach zu transportieren sein und soll mit seiner schlanken und transparenten Anmutung der vorherrschenden Wahrnehmung energieeffizienter Gebäude als "klobige Thermoskanne" entschieden

Der Startschuss ist bereits gefallen. Seit Anfang Oktober arbeiten Studierende des Masterstudiengangs Architektur am konzeptionellen Entwurf des Hauses, der bis Ende dieses Jahres abgeschlossen sein wird. Innovative Materialien und die intelligente Abstimmung von Gebäude, Anlagentechnik und Nutzung sind die Grundlagen für eine ansprechende Gestaltung, einen geringen Energieverbrauch und hohen Wohnkomfort.

Eine Projekt-Homepage wird in den nächsten Tagen gestartet, um aktuell über den Fortschritt des Projektes zu informieren. Darüber hinaus konzentrieren sich die Anstrengungen in der frühen Phase des Wettbewerbs darauf, Förderer und Sponsoren zu gewinnen, die das Team der HFT Stuttgart mit Erfahrungswissen, Sachleistungen und auch finanziell unterstützen.

Quelle:

Fachhochschule Stuttgart, Hochschule für Technik 2008

Schriftgröße wählen







Suche



FROHE OSTERN



Die berechtigte Sorge um die Welt ist die Voraussetzung für eine begründete Hoffnung in der Welt, Ihre Bigi und Franz Alt.

Die Tagesshow: Wie man in 15 Minuten die Welt unbegreiflich macht



Welt ohne Kriege



Haben Sie Fragen zu Photovoltaik?



Größte Solarkampagne Deutschlands



Medienpartner



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Aktuelle Nachrichten



Sonnenseite.com

NEWSLETTER 12/09 - TEAM HFT STUTTGART

Wie meistern wir die Zukunft in bautechnischer Sicht und wie sehen Häuser in 20 Jahren aus? Fragen, die sich aufgrund der gegebenen Umstände wie Ressourcenverbrauch und Klimaveränderung seit langem Wissenschaftler aus aller Welt stellen. Es sind genau diese Fragen, auf die ein Studententeam der HFT Stuttgart beim internationalen Studentenwettbewerb Solar Decahtlon im Juni 2010 Lösungen bieten möchte. Im vergangenen Jahr wurden alle Voraussetzungen geschaffen, um einen hervorragenden Wettbewerbsbeitrag beim Solar Decathlon Europe 2010 abzuliefern und wir möchten Sie gerne auf diesem Wege über die aktuellen Ereignisse informieren.



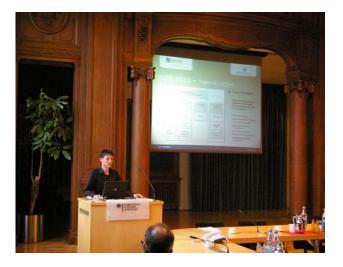
Projektpräsentation bei der Deutschen Bank

Auf Einladung der Deutschen Bank Stuttgart präsentierten Studenten des Team Stuttgart am 25. November ihren Beitrag zum Solar Decathlon Europe 2010. Ziel der Veranstaltung war es, die Anwesenden über zukünftiges energieeffizientes Bauen und zukunftsorientierte Energiequellen und -strategien zu informieren. Das Interesse der Zuhörer war sehr groß und es wurde angeregt über Wohnkomfort und energieeffiziente Technologien diskutiert. Bei einem anschließenden Imbiss konnten die Teammitglieder näher auf spezielle Fragen der Anwesenden eingehen. Das Team bedankt sich bei der Deutschen Bank für die Einladung zu dieser Veranstaltung.



Baubeginn in Blaustein bei Ulm

Wir liegen mit unserem Wettbewerbsbeitrag sehr gut im Zeitplan. Derzeit wird noch intensiv an den letzten Feinheiten der Konstruktionspläne getüffelt und gezeichnet. Damit haben wir alle Ziele für dieses Jahr erreicht und die Vorfertigung der Holzkonstruktion konnte noch vor den Weihnachtsfeiertagen in den Produktionshallen unseres Partners, der Firma Müller Holzbau, beginnen.



Projektpräsentation beim Bundesministerium für Wirtschaft und Technologie

Am 4. November 2009 stellten wir gemeinsam mit den drei anderen deutschen Teilnehmer aus Wuppertal, Berlin, Rosenheim unser Wohnhauskonzept beim Bundesministerium für Wirtschaft und Technologie vor. Das BMWi ist Schirmherr und finanzieller Unterstützer der vier deutschen Beiträge beim internationalen Wettbewerb Solar Decathlon Europe.

Mit der langfristig angelegten Förderung der Energieforschung leistet das BMWi einen wichtigen Beitrag auf dem Gebiet der Energieeffizienztechnologien in Deutschland.



home+ - Richtfest am 16.03.2010

Im Februar nächsten Jahres sind alle Voraussetzungen geschaffen, um mit der Bauphase in Stuttgart zu beginnen und das Wettbewerbshaus auf dem Parkplatz der HFT Stuttgart zu errichten. Zur Fertigstellung des Rohbaus werden wir am 16.03.2010 ein Richtfest veranstalten. Diese Veranstaltung dient dazu die zahlreichen Unterstützer, Partner und Interessierte über den Projektfortschritt zu informieren und an den Zwischenergebnissen teilhaben zu lassen.



Dokumentarfilm mit teamWERK

Ein Kamerateam der Filmproduktion teamWERK begleitet uns während der gesamten Wettbewerbsphase des Solar Decahtlons 2010. Aus dem gesammelten Filmmaterial wird nach dem Wettbewerb ein Dokumentationsfilm entstehen. Aktuelle Filmbeiträge zu verscheidenen Veranstaltungen finden Sie auch auf unserer Website www.sdeuerope.de





Messeauftritte Anfang 2010

Neben dem Richtfest am 16.03.2010 werden wir im kommenden Jahr auch auf verschiedenen Messen vertreten sein. Vom 12.-16. Januar werden wir einen Messestand auf der Deubau in Essen in Halle 6 haben und vom 16.-20. Februar werden wir mit einem Messestand auf der Bautec Berlin in Halle 18 Stand 102 vertreten sein. Wir freuen uns auf Ihren Besuch an unseren Ständen.

Ganz herzlich möchten wir uns auch bei unseren Partnern, Sponsoren und Unterstützern bedanken, ohne deren Hilfe und Einsatz wir dieses Projekt nicht realisieren können. Auf der nächsten Seite finden Sie eine Übersicht mit allen beteiligten Partnern und Sponsoren.

Wir würden uns freuen, wenn wir Sie bald auf einer unserer Veranstaltungen begrüßen dürfen und wünschen Ihnen erholsame Weihnachtsfeiertage und ein gutes Neues Jahr 2010. Ihr

Solar Decathlon Team Stuttgart:

Prof. Jan Cremers
Prof. Heiner Hartmann
Sebastian Fiedler
Annette Kunz-Engesser
Christiane Kloss
Ulrich Handfest
Markus Binder
Antoine Dalibard
Siegfried Baumgartner

Albert Stöcker

Daniel Walter
Claudia Röttinger
Sebastian Schmidt
Sonya Untch
Mark Fandrich
Dalet Bodan
Nansi Palla
Nalan Okumus
Thilo Sprenger
Simon Büttgenbach
Michael Schneider
Saskia Bulut
Michael Bauz

Faculty Advisor Structural Engineer Project Manager Costs and Schedule

Fundraising Fundraising Bauphysik Bauphysik

MSR/Electrical Engineer

Site Manager

Project Architect Construction Manager Project Engineer Student Team Leader Health & Safety

Public Relations Contact Instrumentation Contact

Cost Estimator
Fire Watch Captain
PVT-Spezialist
Energieturm-Experte

15.12.2009 UH/CK

Jens Rosenauer

Förderer des Teams der HFT Stuttgart - home+

Das Projekt Solar Decathlon Europe 2010 wird vom Bundesministerium für Wirtschaft und Technologie (BMWi) finanziell unterstützt und steht unter der Schirmherrschaft des Wirtschaftministers der Bundesrepublik Deutschland.

Gefördert durch:



aufgrund eines Beschlusses des Deutschen Bundestages

Sponsoren











































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Der HFT-Beitrag zum SDE2010 steht unter der Schirmherrschaft von Ministerpräsident Günther H. Oettinger.

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europaticker: Energieoptimierte und architektonisch anspruchvolle Wohnhäuser



Die deutschen Teilnehmer beim Solar-Decathlon sind unsere Botschafter für das Gebäude der Zukunft

Das Bundesministerium für Wirtschaft und Technologie ist Schirmherr der vier deutschen Beiträge beim internationalen Wettbewerb "Solar Decathlon Europe", der 2010 in Madrid stattfindet. am 04.12. haben angehende Architekten und Ingenieure aus Wuppertal, Stuttgart, Berlin und Rosenheim ihre ambitionierten Entwürfe von energieoptimierten und architektonisch anspruchvollen Wohnhäusern im BMWi ausgestellt und gemeinsam mit ihren Professoren die innovativen Wettbewerbskonzepte präsentiert. So konnten 60 Experten aus Wissenschaft und Politik einen Einblick in das "Nullenergie-Gebäude der Zukunft" bekommen.

Die Bergische Universität Wuppertal stellte ihr "Haus für Europa" vor. Außergewöhnliche Architektur gepaart mit intelligenten Energielösungen ermöglicht Nutzungs- und Standortflexibilität und verleiht dem Projekt europäischen Charakter. "Wohnen von morgen schon heute!" ist die Devise der Hochschule für Technik aus Stuttgart. Der Entwurf verbindet Grundprinzipien traditioneller Bauweisen mit heute verfügbaren neuen Materialien und Technologien. Die Hochschule für Technik und Wirtschaft aus Berlin zeigte mit ihrem Vorschlag "Living equia - living ecologic quality and integrated ambience", wie ein ökologisches Leben im Einklang mit der Natur möglich ist, ohne an Lebensqualität einzubüßen. Mit dem Konzept "Team IKAROS" demonstrierte die Hochschule für angewandte Wissenschaft aus Rosenheim, dass modulare Bauweise und ein flexibler und offener Grundriss sich an die Bedürfnisse der Bewohner anpassen lässt.

Bereits im Jahr 2007 nahm ein Team der Technischen Universität Darmstadt mit maßgeblicher Unterstützung des BMWi am Solar Decathlon 2007 in Washington teil und gewann. Dass der Erfolg in diesem Jahr wiederholt werden konnte, belegt das hohe Niveau deutscher Energieeffizienztechnologien im internationalen Vergleich.

Der Parlamentarische Staatssekretär beim Bundesministerium für Wirtschaft und Technologie, Peter Hintze, dazu: "Deutschland nimmt auf dem Gebiet der Energieeffizienztechnologien international eine Vorreiterrolle ein. Mit der langfristig angelegten Förderung der Energieforschung leistet das BMWi einen wichtigen Beitrag. Mit insgesamt 1,6 Mio. Euro unterstützen wir die deutschen Hochschulen bei ihrer Teilnahme am "Solar Decathlon Europe 2010". Sie sind unsere Botschafter für das "Gebäude der Zukunft" und werden unsere Spitzenposition beim solaren Zehnkampf verteidigen. Mit unseren Exportinitiativen Energieeffizienz und Erneuerbare Energien unterstützen wir zusätzlich mittelständische Unternehmen bei der weltweiten Vermarktung ihrer energieeffizienten Produkte."

(BMWi)

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Hintze: "Die deutschen Teilnehmer beim Solar-Decathlon sind unsere Botschafter für das Gebäude der Zukunft"

Kategorie: Energie und Umwelt Erschienen am : 07.12.2009 - 18:01h Gelesen: 14 X

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Siemens antwortet

auf wichtige Fragen der Gegenwart und Zukunft. www.siemens.com/answers

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"Deutschland nimmt auf dem Gebiet der Energieeffizienztechnologien international eine Vorreiterrolle ein. Mit der langfristig angelegten Förderung der Energieforschung leistet das BMWi einen wichtigen Beitrag. Mit insgesamt 1,6 Mio. Euro unterstützen wir die deutschen Hochschulen bei ihrer Teilnahme am "Solar Decathlon Europe 2010". Sie sind unsere Botschafter für das "Gebäude der Zukunft" und werden unsere Spitzenposition beim solaren Zehnkampf verteidigen. Mit unseren Exportinitiativen Energieeffizienz und Erneuerbare Energien unterstützen wir zusätzlich mittelständische Unternehmen bei der weltweiten Vermarktung ihrer energieeffizienten Produkte."

Pressestelle des BMWi

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08.12.2009 12:13



intelligent glass solutions 45

The Solar Decathlon Europe is an international competition for universities from all over the world to design and build a self-sufficient home, grid-connected, using solar energy as the only energy source and equipped with technologies that permit maximum energy efficiency. At the hightest architectural design level.

An interdisciplinary team of architects, interior designers, structural engineers and building physicians at the Hochschule für Technik Stuttgart accepted the challenge and is working on the design of the building since October 2008. The basic idea of our design is to use traditional means of dealing with the climate in hot and arid zones and to combine them with new technologies. Thermal mass, sun shading and evaporative cooling will help to achieve a comfortable indoor climate with passive means. The key element of our passive cooling concept is a new building component that we call "energy tower", which is also an important feature of the interior design. In addition night cooling via sky radiation and evaporation is used to discharge Phase-Change-Material (PCM) embedded in the house's ceilings. Active cooling is supplied by a reversible heat pump powered by photovoltaics.

The Solar Decathlon Europe is a great chance for students and schools of architecture to gain experience, to exchange ideas and to promote the concerns of energy-efficient and sustainable building. This article aims to introduce the competition and to present the design and energy concept of our project 'home+'.

The competition

In the Solar Decathlon Europe, 20 different universities from all over the world compete to design and build a home powered only by solar energy. Then the house of each team will be presented to the public in Madrid this year and the winner will be chosen.

In the years 2003, 2005 and 2007 the Solar Decathlon competition was organised by the US Department of Energy (DOE) and carried out in Washington D.C. After the very respected victories of the TU Darmstadt at Solar Decathlon 2007 and 2009 in the USA, the competition will be carried out now for the first time also in Europe, organized by the Spanish Ministry of Housing in cooperation with the US Department of Energy (DOE).

Objectives of the competition

The main objectives of the competition are:

- 1. To generate knowledge on the industrialisation and sustainability of the homes, increasing suitable scientific benefits, as well as, the dissemination of the knowledge.
- 2. To make both students and the general public aware of the environmental and sustainability issues, especially of the responsible use of energy and natural resources, promoting the use of the renewable energies.
- 3. To maximise the publicity of the event by taking advantage of the competition's characteristics and potential to achieve the maximum media coverage and public information.

OUR DESIGN CONCEPT

The design is based on architectural and energetic considerations. The starting point is a compact and highly insulated volume, with a small surface to volume ratio. The volume is segmented into four modules, which are positioned with interspaces between them. These gaps are used for lighting, ventilation, pre-heating in winter and passive cooling in summer. One of these gaps is higher than the others, containing the "energy tower". Based on traditional principles of climate control, the energy tower is a key element for the energy concept as well as for the outer appearance of the building and the interior space. The modules and the gaps are bound together by the building envelope, which is covered in large areas with photovoltaic elements.

	424
Architecture	120
Engineering and Construction	80
Solar Systems	80
Electrical Energy Balance	120
Comfort Conditions	120
Appliances	120
Communications and Social Award	eness 80
Industrialization and Market Viab	ility 80
Innovation	80
Sustainability	120





Zoning

The interior shows a clear zoning. In north-south direction the terrace, the living area and the dining area are marked by the gaps, but can be used as one big space also. This is especially important for the two dinners we have to invite our neighbours in the solar village to in June 2010. The more private working and sleeping area is separated by the volume of the energy tower. In east-west direction each area is accompanied by a serving zone (kitchen, entrance and facilities, bath).

Modularity

The modular design of the building does not only facilitate the transport to and the assembly in Madrid, but also allows thinking about a modular building system for different requirements. Using the same basic modules it is possible to create living and working space for singles, couples, families or apartment-sharing communities in detached and semi-detached as well as in multi-family houses.

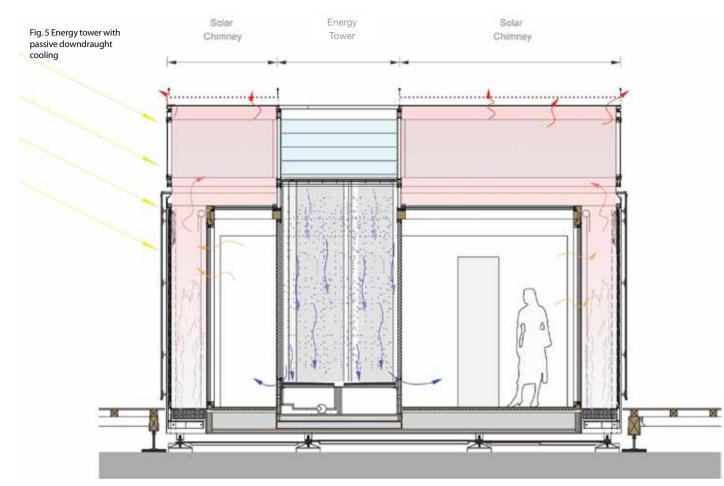
ENERGY CONCEPT

The basic idea of our design is to use traditional means of dealing with the climate in hot and arid zones and to combine them with new technologies. Thermal mass, sun shading and evaporative cooling will help to achieve a comfortable indoor climate with passive



Fig. 4 Floor Plan (North on top)

intelligent glass solutions intelligent glass solutions 47

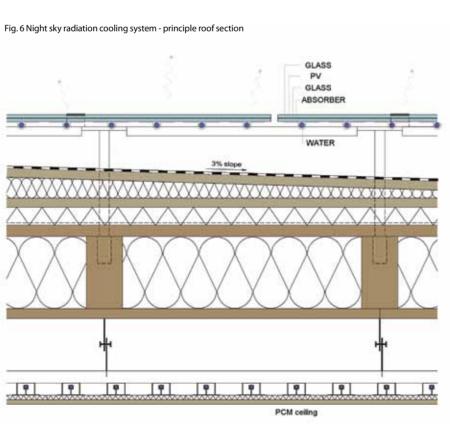


means. The key element of our passive cooling concept is a new building component that we call "energy tower", which is also an important feature of the interior design. In addition night cooling via sky radiation and evaporation is used to discharge Phase-Change-Material (PCM). Active cooling is supplied by a reversible heat pump powered by photovoltaics.

Since the competition occurs in June in a Southern Europe country, the most challenging part is to satisfy the comfort level in cooling mode, which will be the focus of this study.

Innovative PV Modules

With regard to a unique design we have different façade and roof PV modules. The roof should provide a maximum of electricity output. Roof and façades are visually connected using differently coloured cells in a unique 'pixel design'. The cell colours are gold and bronze on the roof edge and façade while the roof is covered with monocrystalline black cells. The overall installed power will be in the range of 12.5 kWp.





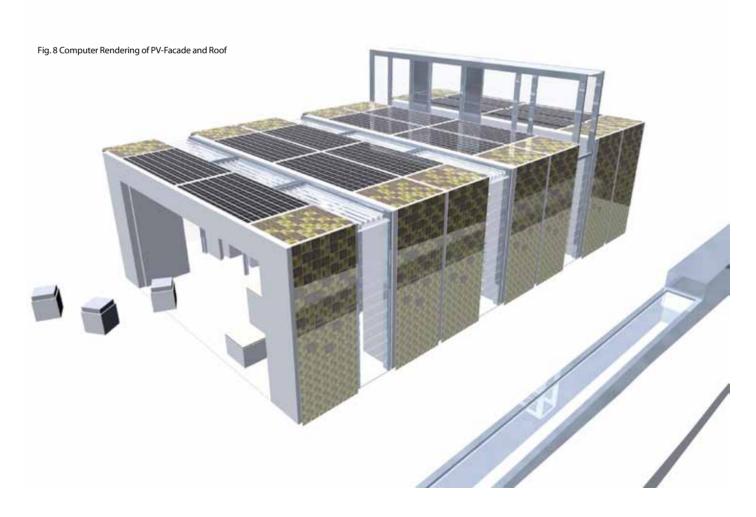
Passive cooling systems

The energy tower supplies passively part of the ventilation and cooling needs by evaporative cooling when the ambient conditions are not extreme (not too hot, not too humid). Free cooling operates in moderate climate conditions and/or at night by letting the air flow through the openings in the gaps.

Low energy night cooling systems

During the day, the PCM ceiling uses the latent heat of the PCM to store the heat and maintain the room temperature around the melting temperature (21-23°C). During the night, the PCM ceiling is actively regenerated using cold water from the night radiative cooling system on the roof. The cold water is stored in a cold storage and used during the day to activate the radiant floor.

The conventional ventilation system (active) is equipped with a heat recovery system between the return air and the supply air for winter and summer. Additionally an indirect evaporative



51



cooling device enhances the cooling capacity through ventilation in summer.

Back-up cooling system

When the passive or the low energy cooling systems can not cover the demand, the reversible heat pump removes heat from the radiant activated floor to cool down the house. The choice of an electrical solution for the backup is due mainly to the lack of thermally driven chillers in the range of small power and the lack of space available for the equipments (solar collectors, heat rejection devices,...). Therefore, the façades and the roof will be covered with PV modules in order to provide the electricity needs of the house and inject the rest into the grid. A classic solar thermal system will provide the domestic hot water needs of the building.

Control strategy

Once we know all the components able to meet part of the cooling demand of the

house, one needs to define the order of use of these elements in order to meet the required cooling demand. The passive technologies will be used with the highest priority and then the technologies that require low parasitical energy will have the priority. Table 2 shows the priority given for each subsystem in the control strategy.

Table 2 Control strategy of the energy concept

Priority	Subsystems
1	PCM ceiling
2	Energy tower (natural evapor. cooling)
3	Free cooling
4	Night cooling / activated floor
5	Indirect evaporative cooling
6	Reversible heat pump

About the authors:

Dr Jan Cremers is architect and professor for building technology and sustainable architecture at Hochschule für Technik Stuttgart. As project director of 'home+' he is responsible for Stuttgart's contribution to the Solar Decathlon Europe 2010.

Dipl.-Ing. Sebastian Fiedler, also architect, is managing director of zafh.net, the research centre for renewable energy technology at Hochschule für Technik Stuttgart and project manager of 'home+'.

Contact:

Prof. Dr.-Ing. Jan Cremers, HFT Stuttgart jan.cremers@hft-stuttgart.de www.sdeurope.de



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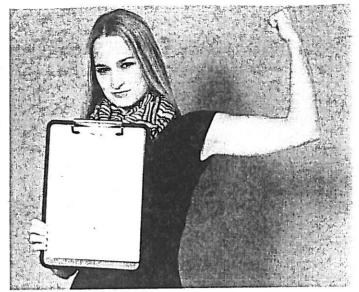
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Kommunikation & Coaching



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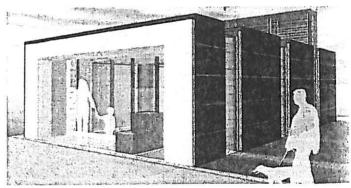
Von Mental- über Persönlichkeitstraining bis hin zu Rhetorik bietet das Frauenkolleg ein umfangreiches Programm – nicht nur für Frauen. Das Frauenkolleg steht dafür, zu einer positiven gesellschaftlichen Entwicklung beizutragen und die Menschen bei ihrer persönlichen Entwicklung zu unterstützen. Wer neue Wege gehen und seine Angst überwinden will, der ist im Seminar "Den Sprung wagen – über den Dingen schweben" genau richtig. Nach einem Mentaltraining geht es hoch auf 4.000 Meter und dann mit einem Tandem-Sprung ins Ungewisse. [Kleine Falterstr. 26, S-Degerloch, Tel. 0711/78 70 44, www.frauenkolleg.de]

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Die Loquenz Unternehmensberatung. Die Loquenz Unternehmensberatung hat sich neben Coaching auf betriebliches Gesundheitsmanagement, Change-Begleitung und zukunftsorientierte Führung spezialisiert. Es werden Coachings für Teams und Führungskräfte wie zum Beispiel zu den Themen Potenzialcoaching, Crashcoaching, Teamcoaching und Coaching vor speziellen Anlässen wie einem Messeauftritt geboten. [MaxLang-Str. 56, Leinfelden- Echterdingen, Tel. 0711/758 577 870, www.loquenz.de]

— Südwestdeutsche Akademie für Marketing und Kommunikation Hier erlangen Studierende in vier Semestern fundiertes Fachwissen für die Analyse, Planung und Realisierung von Kommunikationsprozessen. Das ganztägige Studium ist in acht Fachgruppen unterteilt, die zum Beispiel die Absatzwirtschaft, Werbewirtschaft oder die Unternehmensführung beinhalten. Das Studium wird mit der Bezeichnung Marketing- und Kommunikationswirt abgeschlossen. (Königstr. 1B, S-Mitte, Tel. 0711/29 17 14, www.swd-akademie.de)



Wie könnte Wohnungsbau in Zukunft aussehen? Wie verbindet man solare Bauten mit gestalterischen Ansprüchen? Fragen mit denen sich Studenten der Hochschule für Technik Stuttgart (Schellingstr. 24, S-Mitte, www.hft-stuttgart.de) das Semester über beschäftigen. Aktuell arbeiten sie studiengangsübergreifend an einem Wohnhaus, das nicht nur den Strombedarf des Gebäudes deckt, sondern sogar noch zusätzlichen Strom ins Netz speist. Mit "home+" nehmen sie auch am internationalen Wettbewerb Solar Decathlon Europe 2010 teil. Ihre Meinung zum Projekt ist gefragt: Unter www.stuttgart-architekturschule.de/sdebefragung haben die Studenten einen Fragebogen zusammengestellt.

Studierende der Hochschule für Technik planen und bauen Solarhaus der Zukunft

Endspurt für den Solar Decathlon: Einzelne Module werden bereits gebaut, im März beginnt die Montage

STUTTGART. Die Studierenden an der Hochschule für Technik sind inzwischen über das Planungsstadium hinaus. Nun haben sie mit dem Bau des Hauses für den Solar Decathlon Europa 2010 begonnen. Seit über einem Jahr planen und entwerfen die Studierenden in Stuttgart ein Haus, das ausschließlich über Solarenergie betrieben wird. Die Leistungsfähigkeit ihres Gebäudes müssen sie im Juni dieses Jahres beim Wettbewerb mit 20 weiteren Hochschulteams aus aller Welt in Madrid unter Beweis stellen.

Der Holzbau entsteht derzeit in Blaustein bei Ulm. Witterungsgeschützt worden die Holzmodule in einer Halle montiert. Jedes dieser Module, aus denen am Ende ein zusammenhängender Raum entstehen wird, ist 2,4 auf sieben Meter groß. Die Größe kommt nicht von ungefähr, erzählt Projektleiter Jan Cremers: Sie wurden für den Lkw-Transport nach Spanien optimiert und haben Lkw-Breite.

Im März soll das Gebäude in Stuttgart montiert werden

Im März sollen die Bauteile auf dem Gelände der Hochschule für Technik in Stuttgart zusammengebaut werden. "Die Montage wird bereits ein Probelauf für Madrid", sagt Proiektmanager Sebas-

schützt werden die Holzmodule in drid", sagt Projektmanager Sebas-

Die Holzarbeiten für das Solarhaus haben bereits begonnen. Die Studierenden begutachten nun den Baufortschritt. Foto: Hochschule für Technik

tian Fiedler. Denn im Juni haben die Studierenden bloß zehn Tage Zeit für den Aufbau. Dann muss die Technik getestet werden. Viel Zeit bleibt den Studierenden dafür nicht, denn Anfang Mai müssen sie ihr Haus schon wieder auseinander bauen, damit alle Teile rechtzeitig für den Wettbewerb in Madrid ankommen.

Für die Studierenden hat nun die heiße Phase des Wettbewerbs begonnen. In der kommenden Woche müssen sie in Madrid noch ein rund 300-seitiges Papier mit Entwurfsbeschreibungen, Materiallisten, Energiekonzept, Marktfähigkeitskonzept, Sicherheitsstudien und vielem mehr vorlegen.

Für den Aufbau des Gebäudes im März an der Hochschule ist unter anderem eine Baugenehmigung erforderlich. Für das Bauschild liegt diese bereits vor. Auch nach weiteren Sponsoren wird noch gesucht.

Daneben müssen noch viele Detailentscheidungen für den Bau getroffen werden, etwa über die Farbgebung und Anordnung der Photovoltaikzellen. Die Studierenden haben sich für gefärbte Zellen mit kristalliner Struktur entschieden. Doch diese gibt es von bronzefarben über blau bis grünlich. Mit den gefärbten Zellen wollen sie ihrem rund 70 Quadratmeter großen Haus einen eigenen Ausdruck verleihen.

Auch an der Mess-, Steuer- und Regeltechnik wird noch eifrig gearbeitet. "Die Konzeption ist schon relativ weit", sagt Cremers. Das Projekt ist ein Kraftakt für die Hochschule, doch es steht zugleich für die praxisnahe Ausbildung, mit der die Hochschule für Technik immer wieder wirbt.

Energieturm als zentrales Element des Gebäudes

Zentrales Element des Hauses ist

ein Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Raumklimas beitragen soll. Dabei haben sich die Studierenden an Grundprinzipien aus heißen Regionen, wie etwa den Windtürmen im arabischen Raum, orientiert. Denn das Haus muss für das Klima im Sommer in Madrid optimiert werden.

Um den Energiebedarf des Gebäudes und der Haushaltsgeräte zu decken, werden Dach und Fassaden mit einer Hülle aus Solarmodulen versehen, die zugleich auch als gestalterisches Element genutzt werden sollen. Nach dem Wettbewerb soll das Gebäude, das die Studenten entworfen haben, auf dem Campus der Hochschule für Technik für die Lehre genutzt werden. (schl)

MEHR ZUM THEMA

Informationen über den Solar Decathlon und den Wettbewerbsbeitrag der Hochschule für Technik finden Sie unter: www.sdeurope.de

Hochschule für Technik Stuttgart

Newsletter der Fakultät Architektur und Gestaltung: 2010 N° 2

Neuer Studiengang: Bachelor KlimaEngineering

- Klima und Architektur
- Energieoptimiertes Bauen
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- Innovative Gebäudetechnik

Der Studiengang schließt die Lücke der steigenden energetischen und konstruktiven Anforderungen in der Architektur. Dazu werden komplexe architektonische, bauliche, energetische und thermodynamische Zusammenhänge und deren Anwendung unter gestalterischen und konstruktiven Aspekten vermittelt.

Studienbeginn

zum Sommersemester

Regelstudienzeit
7 Semester, Vorpraktikum notwendig

Abachlusa

Bachelor of Engineering (B.Eng.)

In Kürze: weitere Informationen/ Bewerbungsverfahren



Ausstellung Innenarchitektur: Messestand bei Fa. Fleiner

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Nachdem der Messestand vom 19.-24.01.2010 auf der Internationalen Möbelmesse in Köln für Aufsehen gesorgt hat haben nun alle die nicht in Köln waren die Möglichkeit zu sehen wie sich der Studiengang Innenarchitektur dort präsentiert hat. Kommen Sie und schauen Sie was man mit 100.000 PET-Deckeln so machen kann.

Studierende des 4. Semesters entwarfen unter der Leitung von Prof. Karsten Weigel den Messestand, bauten ihn danach mit den Meistern in den Werkstätten des Studiengangs Innenarchitektur.

Studierende des 6. Semesters stellen, die ebenfalls mit Prof. Karsten Weigel entwickelten, Stuhlentwürfe und Produkte aus gelasertem und gekantetem Stahlblech aus. Teile des Messestandes sind noch bis 07.05.2010 im Schaufenster der Fa. Fleiner, Rotebühlplatz 23 in Stuttgart zu sehen.



Hochschule für Technik Stuttgart

Newsletter der Fakultät Architektur und Gestaltung: 2010 N° 2

Solar Decathlon Europe 2010

Endlich ist es soweit: home+ Richtfest!

Wir, das Team home+ der Hochschule für Technik Stuttgart, möchten Sie herzlich zu unserem Richtfest einladen, um mit Ihnen gemeinsam dieses große Ereignis zu feiern.

- Dienstag, 20.04.2010, 16.30 Uhr
- Hochschule für Technik, Schellingstr. 24, 70174 Stuttgart

Wir freuen uns auf Ihr Kommen,

Prof. Rainer Franke Rektor

Prof. Jan Cremers Projektleiter SDE

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www.sdeurope.de



... ist es nur der Mondschein, der durch Tannendunkel bricht? (Heine)

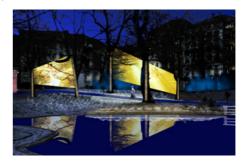
IMIAD: Lichtskizzen in der Obermainanlage

Der Park der Obermainanlage wird durch eine Lichtinszenierung in einzelne Raumfragmente zerlegt. Durch die Selektion entstehen nächtliche Stillleben, die den Raum prägen. Projizierte Elemente erzeugen eine zusätzliche ephemere Ebene. Szenische Bilder entwickeln sich im fließenden Wechsel aus der Dunkelheit.

Ein Gemeinschaftsprojekt von Studenten der FH Coburg—Innenarchitektur, betreut von Prof. Uwe Belzner, und der HFT Stuttgart—IMIAD betreut von Andrew Holmes und Stephanie Schuster.

 $\label{lem:project} \textbf{Das Projekt wird von iGuzzini und LDE Belzner Holmes unterstützt}.$

- Obermainanlage (Nähe Literaturhaus)
- Obermainanlage (Wallanlage)
- 11.4. 16.4.2010
- Mit Einbruch der Dunkelheit
- U-Station "Zoo", Tram "Hospital zum Heiligen Geist", Bus 30, 36 "Schöne Aussicht"



Home+-Energiehaus beim "Solar Decathlon" in Madrid vertreten



Solar Decathlon Europe heißt der europäische Wettbewerb für energieeffizientes Bauen, für den sich insgesamt 20 Teams aus der ganzen Welt angemeldet haben, um sich in Kürze in Madrid zu messen. Unter den vier deutschen Teams ist auch die Hochschule für Technik (HFT) in Stuttgart.

Die Grundlage für das Energiespar-Haus, das Studierende der HFT bauen, ist ein konstruktiver Mix aus verschiedenen Energiesystemen in einem modular aufgebauten Gebäude. Eine sogenannte feuchtadiabatische Kühlung sorgt während der Sommermonate für kühle Luft in dem 75 m² großen Wohnhaus. Das geschieht in einem Kühlturm rein mechanisch (durch die abfallende kühle Luft, die zuvor an feuchten Tüchern vorbeistreift). Eine thermische Solaranlage (96 Prozent des Warmwasserbedarfs werden darüber gedeckt) und eine reversible Wärmepumpe (als zusätzlicher Sicherheitspuffer) versorgen das

Haus mit Wärme, beziehungsweise – für diesen Standort wichtig – mit Kühlenergie. Mit einer Photovoltaik-Anlage wird Strom produziert.

Das ausgeklügelte Energiekonzept ist in die Module des HOME +, eingebettet. Die vier demontierbaren Teile, die wie Wohncontainer wirken, sind massiv aus Schichtsperrholz gefertigt und durch eine Vakuumdämmung hoch gedämmt. Das Haus ist speziell für die mediterranen Wettbewerbsbedingungen ausgelegt. "Am Standort Madrid produzieren wir doppelt so viel Energie, wie wir verbrauchen", rechnet Projektleiter Jan Cremers von der HFT vor. Und selbst in Stuttgart - unter sehr viel schlechteren klimatischen Bedingungen - würde das Haus noch mehr Energie produzieren als es verbraucht. "Es ist deshalb auch Vieles möglich", sagt Cremers und spricht auf die Möglichkeit, eine Serienproduktion zu starten. "Die Baukosten

liegen jetzt noch sehr hoch, bei rund einer halben Million Euro, da es sich um einen Prototyp handelt." Durch diverse Veränderungen ließen sich diese Kosten jedoch bei einer Weiterentwicklung sehr deutlich reduzieren, ist sich Cremers sicher.

Dass das Haus oder das Konzept des Hauses in Produktion geht und zukunftsfähig ist, daran haben die Konstrukteure von der HFT keinen Zweifel. Möglichkeiten zur Verwendung und Orte zur Aufstellung gibt es für sie en masse. Die vielen Flachdächer in Stuttgart oder in anderen Städten bieten sich dafür zum Beispiel an. Aber auch Orte, die nicht an eine zentrale Energieversorgung angeschlossen sind, könnten sich als Standort eignen.

In den nächsten drei Wochen wird das energieautarke Haus unweit des Campus' der HFT fertig gestellt und Tests unterzogen. Dann geht es mitsamt der studentischen Mannschaft nach Madrid. Dort muss es von den Studierenden in zehn Tagen wieder aufgebaut werden und unterliegt dann den realen Bedingungen vor Ort. Welche Platzierung für die HFT drin ist, entscheidet eine unabhängige Jury.

Das fakultätsübergreifende Projekt hat Studierende verschiedener Fakultäten zusammengeführt. Dazu kommt die enorme Praxisorientierung. Seit Januar haben im Schnitt zehn Studierende die Module bei der Müller Holzbau GmbH in Blaustein vormontiert und praktische Erfahrungen gesammelt. Beim zünftigen Richtfest wünschte Firmeninhaber Reinhold Müller dem Team viel Glück. Gewonnen hätten die Studierenden bereits jetzt, denn das Projekt sei ein Schritt in die energieautarke Bauzukunft, sagte Müller.

Spende an Dominik Brunner-Stiftung

Die Baustoffring-Partnerunternehmen spendeten der neu gegründete Dominik Brunner-Stiftung einen Betrag von rund 5000 Euro. Die symbolische Scheckübergabe fand in den Geschäftsräumen der Erlus AG statt.

Bekanntlich wurde Dominik Brunner (zuletzt im Vorstand der Erlus AG) im September 2009 am Münchner S-Bahnhof Solln Opfer eines Gewaltverbrechens, nachdem er sich schützend vor vier bedrohte Kinder stellt.

Die Baustoffring-Partner teilen das Anliegen der Stiftung, "dass die Gesellschaft sich nicht durch Brutalität und Gewalt entmutigen lassen soll. Sie soll vielmehr ein Zeichen setzen, dass in unserer Gesellschaft nicht Gleichgültigkeit, sondern

Menschlichkeit, Nächstenliebe, Bürgersinn und Zivilcourage als zentrale Werte gestärkt werden".

Der Baustoffring ist eine Kooperation selbstständiger mittelständischer Baustoff-Fachhändler in Deutschland. Zur Kooperation gehören 74 Partnerbetriebe mit 73 Filialen in ganz Deutschland.

www.dominik-brunner-stiftung.de



V

"Gut bedacht"-Architekturpreis verliehen



Foto: Atelier Schwemmer

Auf der Messe Dach und Holz in Köln hat der Dachbaustoff-Hersteller Braas den Architekturpreis "Gut bedacht 2009" verliehen. Der Preis wurde gemeinsam mit dem Bund Deutscher Baumeister ausgeschrieben. Der Ausschreibung zufolge war es das Ziel, die Verbindung des geneigten Daches mit anspruchsvoller Architektur umzusetzen. Dabei zählten unter anderem die architektonischen Gestalt, die Konstruktion, die Materialität und die Nachhaltigkeit zu den Kriterien für die Jury. Die Grundvoraussetzungen für die Teilnahme war die Dachdeckung. Hier mussten Dachziegel der Marke Braas verwendet werden.

Die drei Erstplatzierten wurden im angemessenen Rahmen, im Schokoladenmuseum des Kölner Rheinauhafens, gewürdigt. Der erste Preis ging an Architekt Paulus Eckerle aus Titting. Er hat in Augsburg eine ehemalige Maschinenhalle, in der einst Dampfmaschinen standen, für ein Medienunternehmen saniert und umgebaut (Bild unten). Das Gesamtkonzept mit dem reduzierten Umgang der vorhandenen Bausubstanz überzeugte die Jury.

Der zweite Preis, ein urbanes Wohncluster in Reutlingen, wurde dem Architekturbüro Brucker aus Stuttgart zugesprochen. Das Büro plante eine Siedlung, die – laut Jury – mit ihrem flexiblen Modulsystem eine qualitätvolle und nachhaltige Alternative zu herkömmlichen Baugebieten bietet und damit die Umsetzung verschiedenster Lebensentwürfe möglich macht.

Einen Sonderpreis verlieh die Jury an das Atelier Schwemmer. In einen leerstehenden Stadel, Teil einer Hofanlage im niederbayerischen Landkreis Rottal-Inn, wurde ein Wohnhaus integriert. "Der Stadel stellt ein gelungenes Beispiel einer Gebäudeumnutzung dar, die vor allem durch ihre architektonische Zurückhaltung auffällt", begründete die Jury ihre Entscheidung. Der Architekt habe Respekt vor den vorgefundenen Materialien gezeigt und diese sogar wieder verwendet. Die seit 1985 bestehende Dachdeckung mit Frankfurter Pfanne von Braas war ohne jeglichen Schaden und voll funktionsfähig. Sie wurde daher dem Baustoff-Recycling zugeführt und deckt heute wieder das neue Dach.



Foto: mk publishing

Änderung der DIN gefordert

Seit etwa 15 Jahren wird Konstruktionsvollholz (KVH) ohne vorbeugenden chemischen Holzschutz in Innen- und nicht direkt bewitterten Außenbereichen von Holzbauwerken eingesetzt. Bis jetzt wurde bei keinem dieser Holzbauwerke oder Holzbauteilen Insektenbefall festgestellt. Auch bei technisch getrocknetem Nadelholz in Form von Brettschichtholz und Balkenschichtholz (zum Beispiel Duobalken oder Triobalken) ist bis heute in Deutschland kein einziger Insektenbefall dokumentiert.

Eine Untersuchung an über 100 Gebäuden untermauert diese Erfahrungen. Untersucht wurden technisch getrocknete Nadelhölzer im Innenraumbereich (zum Beispiel sichtbare Holzbalken oder Sparren), außerdem Hölzer in nicht direkt bewitterten, durch Überdachung vor Niederschlägen geschützten Außenbereichen, wie etwa Sparrenteile im Traufenbereich oder Carports. Obwohl sich in der Nähe einiger untersuchter Häuser ältere Gebäude mit ausgewiesenem Hausbockbefall befanden, konnte bei keinem der untersuchten Objekte Anzeichen eines Insektenbefalls festgestellt werden.



Tobias Wiegand, Geschäftsführer der Überwachungsgemeinschaft Konstruktionsvollholz e.V., kommt deshalb zu dem Schluss, dass die DIN-Norm überzogen ist. "Die Wahrscheinlichkeit eines Befalls von KVH in den Nutzungsklassen 1 (Innenraumbereich) und der Nutzungsklasse 2 (nicht direkt bewitterter Außenbereich) ist vernachlässigbar klein", so Wiegand. Dieser Erkenntnisstand, so Wiegand weiter, sollte zu einer Korrektur im Rahmen der DIN 68800 (Holzschutz) führen, so dass in einer künftigen Fassung technisch getrocknetes Holz bei der Verwendung in allen Anwendungsbereichen der Nutzungsklassen 1 und 2 keinen vorbeugenden chemischen Holzschutz mehr benötige.

Weitere Informationen unter www.kvh.eu.

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Neue Schriftenreihe Schiefer

Seit über 15 Jahren veröffentlicht der Schiefer-Dachverband Deutschland e.V. regelmäßigen Abständen eine Schriftenreihe, die vor allem Sachverständigen, Schieferdeckern, Denkmalschützern, Planern und Architekten als fachspezifische Informationshilfe dient. Nun ist Band 10 der Schriftenreihe unter dem Titel "Wissenschaftliche und empirische Hilfen zu Qualitätsfragen von Schiefer" erschienen. Besonders interessant dürfte die erstmalige Aufarbeitung der im Mai 2008 in Kraft getretenen neuen Produktnorm für Dachschiefer (DIN EN 12326) stoßen. Dabei wird vom Autor Henning Rohowski die komplizierte Thematik leicht verständlich dargestellt. Der Beitrag stellt den Stand der Normung dar und geht auf Stärken und Schwächen der neuen Norm ein. Die Beiträge von Dieter Jung und Reza Khorasani von der Universität Hamburg beschäftigen sich mit der Dachschieferqualität. Der zehnte Band bietet zahlreiche neue Forschungsergebnisse und Informationen rund um die Themenbereiche Dendriten, Qualitätsbeurteilung von Dachschiefern sowie der Einfluss von Karbonatgehalt und Gefügemerkmale auf die Witterungsbeständigkeit von Dachschiefern.



Band 10 ist beziehbar über www.schieferfachverband.de oder bei Kliomedia GmbH, 54296 Trier, Tel.: 0651/46398-40, www. kliomedia.de.

Strom vom Fußball-Dach

Das Dach des Weserstadions, Heimat des SV Werder Bremen, erzeugt seit geraumer Zeit Strom aus Photovoltaik (PV)-Zellen. Bei der Sanierung wurden bereits im vergangenen Jahr rund 1500 m² der Dachkonstruktion mit Makrolon, dem Polycarbonat des Herstellers Bayer Material Science, gefertigt. In kürze soll der zweite Bauabschnitt starten, bei dem noch mal 770 m² der transparenten PV-Module zum Einsatz kommen (Hersteller ist die Sunovation GmbH in Elsenfeld). Die zwischen zwei Platten aus Makrolon schwimmend eingebetteten Siliziumzellen sparen pro m² rund 100 Watt Strom ein. Darüber hinaus vereinen die Module Funktion, Kreativität

und Design. Das zumindest bestätigte die Jury der Initiative "pro-K" im Industrieverband Halbzeuge und Konsumprodukte aus Kunststoff e.V. mit der Auszeichnung "Produkt des Jahres 2009".

In Bremen werden die Solarmodule nicht einfach auf das Dach montiert, sondern vollständig in die Dachfläche integriert. Da der Abstand der Zellen und der Einsatz teiltransparenter Solarzellen variabel ist, kann eine gute Lichtdurchlässigkeit erreicht werden (wichtig für das Rasenwachstum). Eine spezielle Verbindertechnik zur Kontaktierung der Solarzellen untereinander gewährleistet eine lange Lebensdauer der Module – selbst für gebogene Formen.



Internationaler Architekturpreis



Der erste Preis ging an das Hansjörg Göritz Architekturstudio für das neue Landesforum und -parlament im liechtensteinischen Vaduz

Die Wienerberger AG verlieh in Wien zum vierten Mal den mit 21 000 Euro dotierten "Brick Award". Neben innovativer Architektur, dem Material Ziegel (für Dach, Wände, Fassade oder als Pflasterung) waren Funktionalität und Ökologie für die Jury ausschlaggebende Kriterien.

Der erste Preis ging an das Hansjörg Göritz Architekturstudio für das neue Landesforum und -parlament im liechtensteinischen Vaduz. Das Dokumentationszentrum für Menschenrechte in Neu Delhi von Anagram Architetcs erhielt den zweiten Preis. Dritter wurde Nikolaus Bienefeld für ein Einfamilienhaus in der Eifel.

Das Thema nachhaltiges Bauen spielte bei der Vergabe der Platzierungen eine große Rolle. "Bei diesem Thema zeigt sich, dass Nachhaltigkeit nicht nur durch eine Technologisierung der Architektur, sondern durch die zum Einsatz kommenden Materialien, intelligente Baukonzepte und Formen sowie die Bezugnahme auf geografische und klimatische Gegebenheiten erreicht wird", sagte Heimo Scheuch, Vorstandsvorsitzender der Wienerberger AG. "Diese Faktoren wirken sich positiv auf die energetische Gesamtbilanz eines Gebäudes aus und nicht nur auf dessen Energiebedarf", so Scheuch weiter. Wienerberger selbst möchte mit dem Konzept für den Bau eines energieeffizienten Ziegelhaus dem Thema Nachhaltigkeit begegnen.



Der dritte Platz, ein Jagdhaus in der Eifel des Architekten Nikolaus Bienefeld, besticht, laut Jury, durch seine Einfachheit und seine ökologische Bauweise

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Mit Holz und Lehm im Großtstadt-Dschungel bauen

Ein siebenstöckiges Passivhaus steht seit kurzer Zeit mitten in Berlin – dieses (noch) ungewöhnliche Bauvorhaben wurde kürzlich mit Hilfe von großformatigen Holztafelwänden und Kork-Lehm-Dämmung realisiert. Hergestellt und montiert wurden die Bauelemente aus Naturmaterialien des Potsdamer Fertighaus-Herstellers Haacke-Haus. Das Gebäude braucht dank der hochwertigen Holz-Fertigbauteile gerade einmal 15 Kilowattstunden pro Quadratmeter im Jahr an Heizwärme – ein energetischer Wert, der bei hohen Stadtgebäuden selten erreicht wird.

Das Bauprojekt im Berliner Bezirk Prenzlauer Berg zeigt, wie es gehen kann. Dort haben sich umweltbewusste Bauherren mit dem Ziel zusammengetan, ein energiesparsames Wohnhaus mit sieben Geschossen und Geschäftsräumen im Erdgeschoss zu bauen. Die beauftragten Architektinnen entschieden sich für ein Hybridhaus – eine Verbindung aus Betonbau für Decken und Tragestruktur und Holzbau-Elementen bei Fassade und Innenwänden.

Das Beton-Skelett, das die Traufhöhe von 22 m erreicht, wurde mit im Werk vorgefertigten Holztafeln mit dreilagiger Wärmedämmung bestückt. Die Wandelemente sind aufgrund der guten Dämmwirkung des Holzes nur 43,5 cm dick. Die Innenseite wurde mit speziellen Lehm-Kork-Platten ausgekleidet, die trotz nur 6 cm Stärke die Dämmung des Gebäudes perfektionieren und auf Passivhaus-Standard bringen. Der mehrschichtige, diffusionsoffene Wandaufbau sorgt – gemeinsam mit 2 cm Lehm-Innenputz – für ein angenehmes Raumklima im Haus.

Noch ist der "grüne Siebengeschosser" in Berlin eine Ausnahme, aber ähnliche Projekte stehen schon vor der Tür. Gestartet werden sie von Architekten und Bauherren, die anscheinend das Besondere wollen: Leben mit Holz, Kork und Lehm mitten in der Metropole – dies werde für eine umweltbewusste Klientel immer attraktiver. "Viele verstehen sich als eine Art "Klima-Avantgarde" und wollen etwas für den Klimaschutz tun. Das schafft Holz besonders gut, weil für die Dauer der Nutzung CO² gebunden wird", sagt Dirk-Uwe Klaas, Hauptgeschäftsführer des Bundesverbandes Deutscher Fertigbau (BDF).

www.fertighauswelt.de





Dachdeckerhandwerk mit blauem Auge davongekommen

Der Zentralverband des Deutschen Dachdeckerhandwerks (ZVDH) meldet, dass die Dachdecker vom Krisenjahr 2009 wirtschaftlich nicht verschont geblieben seien, doch es bleibt dennoch Grund zur Hoffnung: "Wir sind mit einem blauen Auge davongekommen", so Ulrich Marx, Hauptgeschäftsführer des Verbandes. Der Verband rechnet mit einem Umsatzrückgang von etwa zwei Prozent für das Geschäftsjahr 2009. Eine Umsatzsteigerung werde für das Jahr 2010 nicht er-

wartet. Insgesamt beurteilten gut 80 Prozent der Dachdeckerbetriebe ihre Ertragslage im vergangenen Jahr als ausreichend, allerdings gebe es deutliche regionale Unterschiede.

Für das Jahr 2010 geben sich die Dachdecker des Verbandes verhalten optimistisch. Nach einem der härtesten und längsten Winter der letzten Jahre gelte es, das zwischenzeitlich angewachsene Auftragspolster abzuarbeiten. Insgesamt lägen die Auftragsreichweiten aber deutlich höher

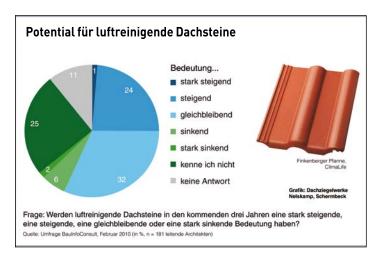
als im vergangenen Jahr. Während im Jahr 2009 Aufträge durchschnittlich für 2,3 Monate vorhanden waren, seien es heute schon 3,2 Monate. Auch das Konjunkturpaket II habe den Dachdeckern letztes Jahr Aufträge beschert. Immerhin 41 Prozent der Dachdeckerbetriebe konnten bereits Aufträge aus dem Konjunkturpaket II generieren. "Das Maßnahmenpaket kann für uns als Erfolg bezeichnet werden", so das Resümee des Hauptgeschäftsführers.

Luftreinigende Dachsteine den meisten Planern bekannt

Eine Umfrage von BauInfoConsult im Frühjahr 2010 im Auftrag der Dachziegelwerke Nelskamp unter Architekten ergab, dass knapp die Hälfte aller Bauherren bei der Wahl ihrer Baustoffe nach umweltfreundlichen Produkten fragt. Die Planer gehen mehrheitlich davon aus, dass unter den umweltfreundlichen Produkten zum Beispiel luftreinigende Dachbausteine eine "gleich bleibende bis stark steigende Bedeutung" haben werden.

Der Hersteller Nelskamp hat seit knapp drei Jahren luftreinigende Dachsteine im Angebot, diemiteinerspeziellen Beschichtung Luftschadstoffe neutralisieren. Nach Angaben des Herstellers sind bereits mehrere 100 000 m² auf Deutschlands Dächern verlegt.

Allerdings kenne, laut Studie, auch etwa ein Drittel der Planer die Dachsteine noch nicht. Der Markt für diese Produkte sei aber groß, stellte ein Sprecher von Nelskamp fest.



Die nächste Flut kommt von oben: Besser entwässern mit Sita Produkten.



Gully ist nicht gleich Gully. Das stellen Sita Gullys millionenfach unter Beweis. Mit hoher Abflussleistung, ausgeklügelter Funktion, bester Material- und Fertigungsqualität – sowie allen Garantien. Sie suchen die optimale Entwässerungslösung? Unser Beratungs- und Berechnungsservice-Team findet sie. Perfekte Logistik und engagierter Service inklusive!















Liebe Leserinnen, liebe Leser,



nach dem langen Winter wuselt es wieder auf den Baustellen im Land und das ist gut so. Eingeläutet hat die Geschäftigkeit die Leitmesse Dach und Holz Ende Februar in Köln. Über 42 000 Fachbesucher konnten sich an vier Tagen bei 471 Ausstellern über die aktuellen Trends informieren. Neben neuen Produkten waren vor allem Sanieren und Umbauen beliebte Themen bei Fachgesprächen

In dieser Ausgabe der dach + holzbau wollen wir aber nicht nur in die Zukunft blicken, sondern schauen auch zurück. Getreu dem Motto: Nur wer die Vergangenheit versteht, kann in der Zukunft bestehen, beschäftigt sich der Artikel "Historische Dachtragwerke" auf Seite 33 mit der Sanierung ebensolcher Holzbaukonstruktionen.

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Das Thema energetische Bauweise ist nicht nur ein Trend, sondern inzwischen fest im Denken verankert

zwischen Herstellern und Handwerkern. Und nicht nur die hohe (und vom Veranstalter unerwartete) Besucherzahl lässt einen positiven Trend für die Branche erwarten. Über 90 Prozent der Fachbesucher gaben dem Messeangebot die Noten gut bis sehr gut. Damit lässt sich positiv in die Zukunft schauen!

Dass die Themen energetische Sanierung bei Bauten im Bestand und optimierte energetische Bauweise bei Neubauten nicht nur Trends, sondern inzwischen bei allen in der Branche Beschäftigten fest im Denken verankert sind, hat sich nicht nur auf der Messe gezeigt. Unlängst wurde bei einem besonders zukunftsorientierten Haus in Stuttgart (auf dem Bild oben) Richtfest gefeiert. Derzeit wird das Haus (das in Modulbauweise erstellt wurde und dessen Kernelemente aus Holz gefertigt sind) aufgebaut, getestet und dann auf die Reise nach Madrid geschickt. Auf einem Parkplatz vor der Universität arbeiten angehende Architekten auf einen internationalen Wettbewerb hin, der die energetische Zukunftsfähigkeit von Häusern im Blickpunkt hat. Mehr über diesen Wettbewerb, den Solar-Decathlon Europe, finden Sie auf den kommenden Seiten.

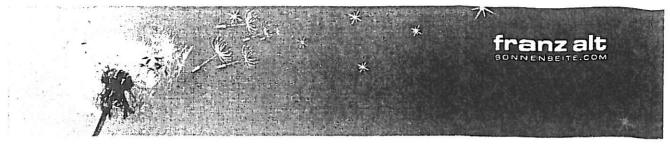
Der Holzbau will immer höher hinaus. In der Rubrik "Baustelle des Monats" auf Seite 50 wird am Beispiel eines Ärztezentrums in Gießen gezeigt, dass Mehrgeschossigkeit in Holzrahmenbauweise nicht nur möglich, sondern dank Vorfertigung auch sehr ökonomisch ist und darüber hinaus den Brandschutzanforderungen genügt.

Auf besonderes Interesse in der Redaktion stieß ein Beitrag über einen jungen Zimmermann, der sich in Namibia selbständig gemacht hat. Wir freuen uns, dass wir auf der letzten Seite dieser Ausgabe über solche Erfolgsgeschichten berichten können. Haben auch Sie eine Geschichte auf Lager, die in unsere Rubrik "Zünftig" passen könnte? Wir freuen uns über Ihre Anregung oder über Ihren Bericht!

Viel Erfolg bei der Arbeit und frohes Schaffen wünscht Ihnen

Ludgo &





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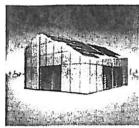
TV-Tipps

Buch-Tipps

Tipps

News Archa

Aktuelle News



Der Arbeitstitel des Hauses: "living ecologic quality and integration of ambience" und er soll die Intention unterstrechen, ein Haus zu entwerfen, in dem die Bewohner im Einklang mit der Natur werden leben konnen, ohne dabei an Lebensqualität einzubußen. © living-equia com

Weltere Informationen

Video: "living ecologic quality and integration of ambience" Die audiovisuelle Prasentation umfasst einen 5-minutigen Kurzfilm und die Abgabe der Architekturmodelle im Maßstab 1-25.

Mehr zum Thema Bauen auf der

Das schwimmende Klimahaus EU-Pariament beschließt: Ab 2019 nur noch "Null-Energie-Gebaude" China baut den "grünsten" Wolkenkratzer

Aktueller Tagungsband zum energieeffizienten und solaren Bauen Bauwesen verbraucht in Deutschland die meisten Ressourcen

Inhalt drucken

Inhalt versenden

zuruck zur Übersicht

vorheriger Artikel nächster Artikel Artikel 22 von 2280

:: Solarhaus-Forschungsprojekt "living EQUIA"

+ 17.07.2009 + Die konzeptionelle Ausarbeitung zum Bau eines energieeffizienten und technisch innovativen Solarhauses im Rahmen des internationalen Wettbewerbes "Solar Decathlon Europe" ist nahezu abgeschlossen und geht nun in die Phase der Umsetzung.

Anfang Juli trafen sich die Mitglieder des Berliner Studententeams "living EQUIA" in der Universität der Kunste in Berlin, um der Offentlichkeit, den Professoren und Sponsoren die aktuellen Fortschritte und Arbeitsergebnisse des interdisziplinären Forschungsprojektes zu präsentieren, so living EQUIA.

Auch aus diesem Grund seien im Mai 2009 12 Mitglieder des living EQUIA-Teams nach Madrid zum Austragungsort des Wettbewerbes gereist. In einem dreitägigen Workshop wurden das Miniatur-Hausmodell den spanischen Juroren vorgestellt, offene organisatorische Fragen besprochen und das Wettbewerbsgelande "Villa Solar" besichtigt, auf dem im Juni 2010 die Häuser aller Teilnehmer aufgebaut werden.

Darüber hinaus haben sich die vier deutschen Teilnehmer des Wettbewerbes – die Hochschule für Technik und Wirtschaft Berlin, die Hochschule für Angewandte Wissenschaften Rosenheim, die Hochschule für Technik in Stuttgart und die Bergische Universität Wuppertal auf eine Zusammenarbeit bei der Öffentlichkeitsarbeit geeinigt. Zukünftig wurden überregionale und fachspezifische Artikel und Publikationen gemeinsam veröffentlicht und auch bei Auftritten auf Fach- und Publikumsmessen wird zusammengearbeitet.

Zum Abschluss des Treffens in der Universität der Künste in Berlin wurde der Kurzfilm zum Projekt erstmals in deutscher Sprache aufgeführt. Den Film zum Solarhaus-Projekt konnen Sie her sehen

Quelle: LIVING EQUIA 2009

zuruck zur Übersicht

vorheriger Artikel nächster Artikel Artikel 22 von 2280

zum Seitenanfang 🕇

Schriftgröße wählen



Suche

. The Park 🛶

Video: Eine unbequeme Rechnung



Humane Marktwirtschaft als Ausweg aus der Krise



Weltweiter Marsch für Frieden + Gewaltfreiheit



Zur Lage der Welt 2009



Haben Sie Fragen zu Photovoltaik?



Medienpartner



Tipp



Aktuelle Nachrichten



Sonnenseite Newsletter

Jeden Sonntag gibt es einen kostenlosen NEWSletter mit solaren, okologischen und politischen aktuellen Meldungen





PRESSEMITTEILUNG

Stuttgart, März 2010

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Petra Dabelstein

Wettbewerbshaus home⁺ kommt nach Stuttgart Internationaler Wettbewerb Solar Decathlon Europe 2010

Wie sieht der Wohnungsbau der Zukunft aus? Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010". Bei diesem "Solaren Zehnkampf" tritt ein interdisziplinäres Team der HFT Stuttgart als eines von 20 ausgewählten Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Das Wettbewerbsgebäude der HFT Stuttgart heißt home⁺. Der Name steht für ein Wohnhaus, welches als Plusenergiehaus mehr Energie produziert, als es verbraucht.

Transport von Ulm nach Stuttgart am Montag, den 29. März 2010



Bei der Firma müllerblaustein in Ulm wurden die einzelnen Module für das Wettbwerbshaus home⁺ erstellt. Professoren, Mitarbeiter und Studierende der HFT Stuttgart sind dort seit Dezember 2009 im Dauerseinsatz. "Wir vereinen für diesen Wettbewerb unsere gesamte umfassende Kompetenz, indem wir das Knowhow der Studiengänge Archi-

tektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence sowie unseres Instituts für Gebäudeenergieforschung (zafh. net) einbringen." Projektleiter Professor Dr. Jan Cremers sieht die HFT Stuttgart bestens gerüstet, diese Aufgabe von der Konzeption des Entwurfs über die technische Durcharbeitung bis hin zur Realisierung vor Ort in Madrid erfolgreich und auf hohem Niveau zu bewältigen. "Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden einen wichtigen interdisziplinären, zukunftsrelevanten und praxisnahen Baustein in ihrer Ausbildung anzubieten."

Am Montag, den 29. März werden die Gebäude-Module von Ulm nach Stuttgart transportiert. In direkter Reichweite der Hochschule (Parkplatzbereich an der Breitscheidstraße) werden die Module montiert und das Haus fertiggestellt.

Richtfest in Stuttgart am Dienstag, den 20. April 2010

In einer Testphase werden Gebäudetechnik und Regelung optimiert, dann steht die Demontage des Gebäudes und der Transport nach Madrid an. Bevor das Wettbewerbshaus home⁺ auf Reisen geht und rechtzeitig zum Wettbwerbsbeginn in Madrid unterhalb des Königspalastes als Teil der "Villa Solar" wieder aufgebaut wird, ist in Stuttgart ein großes Richtfest geplant. Das Grußwort wird Staatssekretär Dr. Dietrich Birk sprechen, zahlreiche Förderer und Unterstützer des Projektes werden erwartet.



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Abschluss und Prämierung in Madrid im Juni 2010

Zum Abschluss des Wettbewerbs, von 18. bis 27. Juni 2010, werden die Häuser aller Teams eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept stellen auch der Transport und die Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

Entwurfs- und Energiekonzept der HFT Stuttgart: Plusenergiehaus mit Energieturm in modularer Bauweise



Das Gebäudekonzept home+ stellt eine Kombination von traditionellen Grundprinzipien mit modernem Material und neuer Technologie dar. Ausgangspunkt ist ein sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch erreicht man eine Minimierung der Transmissionswärme-

verluste und damit auch des Energiebedarfs.

Die einzelnen Module werden mit etwas Abstand zueinander angeordnet. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas beiträgt. Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus entsprechenden Regionen, wie der Windtürme im arabischen Raum und der in Spanien weitverbreiteten Patios. In Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt.

Um den zwar niedrigen, aber dennoch vorhandenen, Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert. Das Dach und die Fassaden werden mit einer Art zweiten Hülle mit Photovoltaik-Solarmodulen (PV) zur Stromerzeugung versehen. Erste Simulationen zeigen, dass der Energiebedarf nicht nur gedeckt werden kann, sondern sogar noch zusätzlich Strom ins Netz eingespeist werden kann. Damit wird das Gebäude home⁺ der HFT Stuttgart zum Plusenergiehaus.



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Der modulare Aufbau des Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen.

Förderer und Schirmherrschaft

Das Projekt Solar Decathlon Europe 2010 wird vom Bundesministerium für Wirtschaft und Technologie (BMWi) finanziell unterstützt. Die Wettbewerbsteilnahme der HFT Stuttgart steht unter der Schirmherrschaft des Ministerpräsidenten Baden-Württembergs und des Oberbürgermeisters der Stadt Stuttgart. Wichtigste Sponsoren sind müllerblaustein (Müller Holzbau GmbH), eines der führenden Ingenieurholzbau-Unternehmen in Deutschland und der renommierte Fassadenbauer MBM Konstruktionen GmbH. Insgesamt konnten bisher über 30 weitere Förderer und Unterstützer gewonnen werden.

Weitere Informationen

www.hft-stuttgart.de www.sdeurope.de

Hochschule für Technik Stuttgart

Tradition und Innovation – das charakterisiert die Hochschule für Technik Stuttgart. 1832 als Winterschule für Bauhandwerker gegründet, bietet die HFT Stuttgart heute ein breites Spektrum an akkreditierten Bachelor-Master-Studiengängen an. In drei Fakultäten stehen insgesamt 11 Bachelor- und 13 Master-Studiengänge zur Wahl. An der HFT Stuttgart wird praxisnah und in kleinen Gruppen ausgebildet. Rund 100 Professorinnen und Professoren unterrichten zirka 3000 Studierende, unterstützt von über 170 Lehrbeauftragten. Praktische Studienprojekte oder ein Auslandsstudium an einer der über 70 Partnerhochschulen weltweit sind in die Studiengänge integriert. Der Campus der HFT Stuttgart liegt, zwischen Stadtgarten und Liederhalle, mitten in der Stadt Stuttgart, dem Wirtschaftszentrum Südwestdeutschlands.

Studienbereiche

Architektur und Gestaltung

Bauingenieurwesen

Bauphysik

Informatik

Mathematik

Vermessung

Wirtschaft



Solar Decathlon Europe

Eggenstein-Leopoldshafen, 3.03.2010. Architekturentwürfe aus der Studienzeit bleiben im Normalfall Theorie. Der "Solar Decathlon Europe" eröffnet vier deutschen Studententeams die Möglichkeit, ihren Entwurf eines energetisch selbstversorgenden Wohnhauses an den Ansprüchen der Wirklichkeit zu messen und mit anderen ehrgeizigen Protoypen in Wettstreit zu treten. Zur Zeit ist die Fertigung der transportfähigen Gebäude in vollem Gange.



Der Wettbewerb

Der europäische Solar Decathlon nach dem Vorbild der gleichnamigen amerikanischen Variante findet im Juni in Madrid erstmals statt. Er verfolgt das Ziel, nicht nur die Studierenden, sondern auch die allgemeine Öffentlichkeit für den verantwortungsvollen Umgang mit Energie und naturlichen Ressourcen zu sensibilisieren. Die Gebäude sollen zeigen, wie gute Solararchitektur, Energieeffizienz und Wohnkomfort Hand in Hand gehen.

Seit Anfang 2009 entwickeln ausgewählte, fachübergreifend zusammengesetzte Studententeams dafür gemeinsam mit ihren Professoren und Sponsoren und Partnern aus der Industrie jeweils ein 75 m² großes, ausschließlich solar betriebenes

Wohngebäude. Die Herausforderung besteht darin, dass dies nicht nur auf dem Papier stattfindet. Die Entwürfe werden 1:1 umgesetzt und müssen sich während einer Woche im Betrieb beweisen.

Den Sieger kürt eine interdisziplinär besetzte Fachjury aus der Gesamtwertung über zehn Einzeldisziplinen (Decathlon). Fast die Hälfte der Punktzahl ist in den Bereichen Architektur, Elektrische Energiebilanz, Komfortbedingungen und Innovation zu holen. Die andere Hälfte kann man gleichrangig in den Disziplinen Konstruktion, Solarenergie, Ausstattung / Geräte, kommunikativer und sozialer Anspruch, Industrialisiertes Bauen / Marktfähigkeit und Nachhaltigkeit erreichen.

Unterstützung erhalten die deutschen Teams nicht nur von ihren jeweiligen Industriepartnern, auch das Bundesministerium für Wirtschaft und Technologie fördert die vier Projekte im Rahmen der Forschungsinitiative EnOB - Forschung für Energieoptimiertes Bauen.

Terminplan

Während an der Fachhochschule für Technik und Wirtschaft Berlin letzte Woche Richtfest gefeiert wurde, zelebrierte die Bergische Universität Wuppertal gestern den symbolischen Akt der Grundsteinlegung. An der Hochschule für Technik Stuttgart sind die Holzmodule fertiggebaut und das Richtfest ist für April avisiert. Die Hochschule Rosenheim beginnt man gerade mit dem Innenausbau und plant das Richtfest Anfang Mai. Nach dem Testbetrieb an der heimischen Hochschule werden die Gebäude wieder demontiert und auf die Reise nach Madrid verschickt, um sich dort ab dem 18. Juni im Wettbewerb zu messen und sich einer breiten Öffentlichkeit zu präsentieren.

Hintergrund

2002 rief das US-amerikanische Energieministerium den Solar Decathlon ins Leben. In Deutschland bekannt machten ihn die Siege der Universität Darmstadt 2007 und 2009. Der europäische Ableger feiert in diesem Jahr in Madrid Premiere und soll auch in Zukunft alternierend zu dem amerikanischen Wettbewerb stattfinden. Für die erste Veranstaltung haben sich insgesamt 20 Hochschulteams qualifizieren können - aus Spanien, China, Israel, Frankreich, USA, Mexiko, England, Finnland und Brasilien.

Quelle: Bine Informationsdienst



Anzeige





Engagiert und motiviert – das interdisziplinäre Team des Solar Decathlon 2010.

»Wir haben mit dem Bau von homet begonnen!«

Von der Planung zur Realisierung – Zum Stand unseres Beitrags zum Solar Decathlon Europe 2010.

von Prof. Dr.-Ing. Jan Cremers

Am 10. Dezember 2009 war Baubeginn für unser Haus für den »Solar Decathlon Europe 2010«. Wie bereits in den letzten Ausgaben des Stallgeflüsters berichtet, beteiligt sich die HFT Stuttgart mit einem engagierten interdisziplinären Team von Studierenden an diesem äußerst anspruchsvollen internationalen Studierendenwettbewerb. Seit Oktober 2008 haben wir ein Wohngebäude mit einer Grundfläche von ca. 75 m² in einem komplexen Planungsprozess konzeptionell entwickelt, optimiert und inzwischen weitgehend technisch durchgearbeitet. Dabei wollen wir mit unserem Beitrag natürlich eine möglichst gute Platzierung im Wettbewerb erreichen, das heißt, wir müssen die zehn Disziplinen des »Decathlon« stets im Blick behalten. Ein wesentliches Teilziel ist, dass das Gebäude für den Wettbewerbsstandort Madrid über das Jahr gesehen eine positive Netto-Energiebilanz aufweist.

Da dieser Entwurf nicht nur in der Theorie bewältigt werden muss, sondern eins zu eins baulich umzusetzen ist, galt es von Anfang an Partner zu suchen, mit denen dies gelingen kann. Hierbei waren wir bisher bereits durchaus erfolgreich (siehe Kasten unten). Aber dieser Prozess ist damit keineswegs abgeschlossen, sondern wir suchen auch weiterhin Partner und Sponsoren. Wer hierzu Ideen, Vorschläge oder Kontakte hat, kann sich hier gerne einbringen und uns an dieser wichtigen Stelle unterstützen – wir würden uns sehr freuen!

Derzeit befindet sich das Haus in der Fertigung bei unserem Holzbaupartner MÜLLERBLAUSTEIN in der Nähe von Ulm. Dort können wir die einzelnen Komponenten witterungsgeschützt in der Montagehalle fertigstellen. Die weitgehend vorgefertigten Module werden von dort dann voraussichtlich im März zu uns an die Hochschule kommen, wo das Gebäude dann im Verlauf der Monate März und April

fertiggestellt werden muss, bevor es wieder zerlegt und auf die Reise nach Madrid geschickt wird. Dort wird sich unser Haus home⁺ als Teil der »Villa Solar« in direkter Blickbeziehung zu Palast und Kathedrale vom 18. bis 27. Juni dem Wettbewerb mit 20 Teilnehmern aus neun Nationen stellen.

Als Bauplatz bei uns auf dem Hochschulgelände ist ein Teil des Parkplatzes an der Breitscheidstraße vorgesehen (siehe Lageplan). Der bei uns stattfindende Aufbau des Hauses wird gleichzeitig die Generalprobe für den Aufbau in Madrid unter Wettbewerbsbedingungen sein, für den wir im Juni nur rund neun Tage Zeit haben werden. Diese äußerst knappe Aufbauphase stellt eine der großen Herausforderungen des Decathlon dar. Das Richtfest wird am 20. April 2010 stattfinden.

Auch die Verbreitung der Wettbewerbsidee und -inhalte selbst ist eine der Disziplinen des Zehnkampfes. Von daher sind wir auch im Bereich der Außendarstellung sehr aktiv und präsentieren uns mit home⁺ bei vielen Gelegenheiten durch zahlreiche Fachbeiträge, Präsentationen und Ausstellungen. Dazu zählten in den letzten Monaten u. a.:

- Sustainable Energy Technologies 2009, Aachen
- Solar Summits 2009, Freiburg
- Europäisches Symposium »90 Jahre Bauhaus«, Bad Langensalza
- Kongress Bauhaus.SOLAR Technologie-Design-Umwelt, Erfurt
- Projektpräsentation beim Bundesministerium für Wirtschaft und Technologie, Berlin
- 8. Lange Nacht der Museen, Böblingen/Sindelfingen

- Präsentation bei der Deutschen Bank Stuttgart, am 25.11.2009
- Bauphysikertreffen an der HFT am 27.11.2009
- auf der Messe »DeuBau« in Essen (12.-16. Januar, Halle 6, Stand 405)
- »Bautec« in Berlin (16.-20. Februar)
- »CEP« in Stuttgart (25.-27. Februar)

Außerden werden wir unser Projekt in den nächsten Wochen an verschiedenen Hochschulen vorstellen, unter anderem an der Universität Stuttgart, an der TU Delft und der TU München.

Aus Professorensicht bietet das Projekt neben den Innovationsaspekten für die Forschung in vielerlei Hinsicht auch sehr großes Potenzial für die Lehre: Die beteiligten Studierenden lernen an einem großen, praktischen Projekt reales, interdisziplinäres und integrales Planen. Außerdem erweitern sich die kommunikativen Fähigkeiten erheblich, die Studierenden lernen, sich mit Spezialisten auszutauschen und abzustimmen. Sie üben regelmäßig, sich sehr professionell nach außen zu präsentieren, auch außerhalb ihrer Muttersprache. Sie knüpfen wertvolle Kontakte in die Welt der Wirtschaft und der Forschung und stehen im engen Austausch mit anderen Decathleten in Deutschland und den weiteren Teilnehmerländern. Auf all diesen Ebenen sind bereits heute die Früchte dieser Erfahrungen sehr deutlich sichtbar.

Weitere Informationen finden sich auf unserer Website unter: »www.sdeurope.de«. Neben aktuellen Neuigkeiten, Bildern und kleinen Filmen finden sich dort auch diverse weitere Links zum Solar Decathlon Wettbewerb allgemein.

Partner der HFT für das Projekt home+

»Platin«-Sponsor«

- Fa. müllerblaustein BauWerkPartner (Müller Holzbau GmbH), Blaustein bei Ulm

»Gold«- Sponsoren«

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- Fa. Sunways AG, Konstanz
- Fa. Ertl Glas AG Abt. Photovoltaik ertex-solar, Mauer (A)
- Fa. va-Q-tec AG, Würzburg
- Fa. Transsolar Energietechnik GmbH, Stuttgart

»Silber«-Sponsoren«

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- Fa. Raible + Partner, Reutlingen
- Fa. augusta-solar GmbH, AugsburgFa. Baumgartner GmbH, Kippenheim
- Fa. PE International,
- Leinfelden-Echterdingen
 Fa. Sika Deutschland Gmb
- Fa. Sika Deutschland GmbH, Stuttgart
- Fa. Steico AG, Feldkirchen
- Fa. Häussermann GmbH & Co.KG, Sulzbach/Murr

- Fa. Beckhoff Automation GmbH, Verl
- Fa. Glasbau Hahn, Stockstadt/Main
- Fa. Schwämmle GmbH & Co.KG, Aspach
- Fa. Nemetschek Allplan GmbH, München

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- Messe Essen (Bautec)
- Messe Berlin (Deubau)
- Architektenkammer Baden-Württemberg
- AStA der HFT Stuttgart
- Freunde der Hochschule für Technik Stuttgart e.V.
- Margarete Müller-Bull Stiftung, Stuttgart
- Knödler-Decker-Stiftung, Stuttgart

Schirmherrschaft

Der HFT-Beitrag zum SDE 2010 steht unter der Schirmherrschaft des Ministerpräsidenten von Baden-Württemberg. Das Projekt Solar Decathlon Europe 2010 wird vom Bundesministerium für Wirtschaft und Technologie (BMWi) finanziell unterstützt und steht unter der Schirmherrschaft des Wirtschaftministers der Bundesrepublik Deutschland.

Ansprechpartner für Fundraising: Christiane Kloss (christiane.kloss@hft-stuttgart.de), Tel. +49 (0) 711 8926 2886 oder Jan Cremers (jan.cremers@hft-stuttgart.de).

Hochschule für Technik

Lageplan Bauplatz an der HFT

Mitmachen!

Wir suchen interessierte Studierende, die beim beim Bau in Stuttgart (und dann ggf. auch in Madrid!) mit dabei sein wollen, z. B. für Installationen im Bereich der technischen Gebäudeausrüstung sowie den Innenausbau. Auch für viele andere Aufgaben können wir noch Unterstützung gebrauchen, z. B. in den Bereichen Marketing und Visualisierung. Wer Interesse hat, sich mit seinen Fähigkeiten einzubringen, ist herzlich eingeladen, mit uns Kontakt aufzunehmen: Sebastian Fiedler (sebastian.fiedler@hft-stuttgart.de), Tel. +49 (0) 711 8926 2876 oder Jan Cremers (jan. cremers@hft-stuttgart.de)



Rohbau in Holzbauweise: Die Module unseres Hauses in der Werkhalle in Blaustein.

Schöner wohnen im Kraftwerk

Studenten der Hochschule für Technik bauen Haus mit positiver Energiebilanz

Angesichts hoher Nebenkosten können Hausbesitzer und Mieter nur davon träumen, dass ihre Immobilie mehr Energie erzeugt als verbraucht. Studenten der Hochschule für Technik haben jetzt so ein Wunderhaus entworfen. Im Juni wollen sie damit bei einem internationalen Wettbewerb in Madrid siegen.

VON KLAUS EICHMÜLLER

STUTTGART. Viele Jahre lang war der Studiengang Architektur der Hochschule für Technik in Container ausgelagert, die in der Breitscheidstraße nicht gerade als Schmuckstücke anzusehen waren. Kaum sind die roten Metallschachteln verschwunden, tauchen einen Steinwurf entfernt schon wieder voluminöse Kästen auf. Auf den Parkplatz zwischen Breitscheidstraße und Landesvermessungsamt sind am Montagnachmittag an einem großen Kran vier mit weißer Plane verhüllte Bauteile eingeschwebt, die in den xommenden Tagen zu einem Gebäude mit 74 Quadratmeter Fläche zusammengefügt werden. Das Haus mit Holzterrasse trägt len Namen "home+". Das Pluszeichen steht ür eine positive Energiebilanz.

Projektkosten von mehr als einer Million Euro müssen über Sponsoren aufgetrieben werden

20 ausgewählte Hochschulteams aus aller Velt messen sich vom 18. bis 27. Juni in Malrid beim Solar Decathlon Europe 2010. Bei liesem Solarzehnkampf, an dem auch Stulenten aus Darmstadt, Berlin und Roseneim teilnehmen, wird ein Haus mit möglichst positiver Energiebilanz gesucht. "Wir vollen den Wettbewerb natürlich gewinen", sagt Architektur-Professor Jan bremers, der das Studentenprojekt an der Iochschule für Technik (HfT) leitet. "Das zird aber nicht leicht."

Schon die erste Hürde war schwer zu nehnen. Alle teilnehmenden Gruppen müssen ie Kosten für das Projekt, den Bau des Hau-



Ein Teil des Solarhauses der Hochschule schwebt vom wolkenlosen Himmel Foto: Kraufmann

ses und den Transport des Hauses nach Madrid mit Hilfe von Sponsoren selbst finanzieren. "Die Kosten liegen deutlich über einer Million Euro", deutet Cremers an. Genaue Zahlen will er nicht nennen; auch bei der Frage nach dem Betrag, der noch fehlt, hüllt er sich in Schweigen. Hauptsponsor ist die Holzbaufirma Müller aus Blaustein, die nach den studentischen Entwürfen die vier Module für das Fertighaus gebaut hat.

Daniel Walter, der 25-jährige Masterstudent im Fach Architektur, ist so etwas wie der Koordinator des studentischen Projekts. Bis zu 150 Studenten waren in den vergangenen 18 Monaten an den Vorarbeiten beteiligt, 15 gehörten zum harten Kern. "Es war eine große, aber auch eine schöne Herausforderung", sagt Daniel Walter. Er lobt besonders die strengen Wettbewerbsvorgaben. "Je enger die Rahmenbedingungen sind, umso kreativer muss man sein."

Feuchte Tücher im Windturm sollen die Raumtemperatur angenehm und kostenlos kühlen

Für das Solarhaus der HfT haben die Studiengänge Architektur, Bauphysik, Innenarchitektur, Kontruktiver Ingenieurbau und Erneuerbare Energien zusammengearbeitet. Selbst die Möblierung des Musterhauses für Madrid kommt aus eigener Werkstatt.

Die Stuttgarter Studenten wollen in Madrid mit einem Mix aus ausgeklügelter Technik, bestehend aus Solarzellen und Vakuumröhrenkollektoren, punkten. Gleichzeitig greifen sie aber auch auf die uralte Techniken der Windtürme zurück, die im arabischen Raum und in Spanien Tradition haben. Im Turm werden Tücher in den Wind gehängt und ständig mit Wasser benetzt. Durch Verdunstung kühlt die Lufttemperatur um bis zu fünf Grad ab. In der Sommerhitze der spanischen Hauptstadt könnte das die strengen Juroren überzeugen.

Außerdem haben die HfT-Studenten noch einen Trumpf in der Hinterhand. Jedes teilnehmende Team muss die Jury in der eigene Küche bekochen. "Wir machen etwas Schwäbisches", sagt Daniel Walter, "viel-

leicht Maultaschen."

STZ 30.3.2010

Hightechhaus hat Energie im Überschuss

Plusenergiegebäude Seit gestern legen Stuttgarter Studenten Hand an ihren Beitrag für zukunftsträchtiges Bauen. Von Jan Georg Plavec

Ein arabischer

als natürliche

Klimaanlage

Windturm wirkt

s ist eben etwas anderes, ob man über Zeichnungen und Modellen brütet oder vor einem Kran, der tonnenschwere Hausmodule vom Lastwagen hebt. Stolz funkelte in den Augen der angehenden Architekten, Bauphysiker, Ingenieure und Energiefachleute der Hochschule für Technik (HfT), als sie gestern die meterhohen Bauteile für ihr Hightechhaus bestaunten.

Auf dem Parkplatz vor der HfT entsteht

in den nächsten Wochen ein Plusenergiehaus. Die Hochschule nimmt damit am Studentenwettbewerb "Solar Decathlon Europe" für energieeffizientes Bauen teil. Insgesamt 21 Teams aus Europa,

Nord- und Südamerika sowie China präsentieren im Juni in Madrid Häuser, die nicht nur wenig Energie verbrauchen, sondern

sogar einen Überschuss erzeugen.

Bis Mai steht das Plusenergiehaus aber auf dem Parkplatz in der Breitscheidstraße: Richtfest ist am 20. April. Der aus vier Modulen bestehende Holzrahmen ist vakuumgedämmt, Fotovoltaik und Vakuumröhrenkollektoren erzeugen Strom und Wärme. Besonders stolz sind die Studenten aber auf ihre Idee, eine Art arabischen Windturm aufs Dach zu setzen. Er wirkt wie eine natürliche Klimaanlage; die angesaugte Luft kühlt beim Verdunsten von zugeführtem Wasser um bis zu fünf Grad ab. "Er ist perfekt für das heiße Klima in Madrid", erklärt Jan Cremers. Der Professor betreut das Kernteam von rund zwanzig Studenten, die seit anderthalb Jahren ganz

engagiert an ihrem neuartigen Plusenergiehaus tüfteln.

Für diese Gruppe beginnt nun der spannende Teil der Arbeit. Wird alles so funktionieren, wie die Studenten es sich am Reißbrett ausgedacht haben? Wie kommt das Modell an? Hier können die Stuttgarter in Madrid einen substanziellen Beitrag leisten. Ermittelt wird nämlich nicht nur das messbare Energieplus, sondern auch gefühlter Wohnkomfort und Funktionsfähig-

keit der Inneneinrichtung.

Die Stuttgarter wollen neben an der HfT gefertigten Möbeln auch mit einer Dinnerparty für die Jury punkten; selbstverständlich werden dabei schwäbische Köst-

lichkeiten kredenzt.

Das Modellhaus ist zwar noch nicht marktreif; es gibt aber angesichts immer weiter verbesserter Dämm- oder Solartechnologien und seines flexiblen, modularen Aufbaus die Richtung vor. Als eine von vier deutschen Hochschulen im Wettbewerb will sich Stuttgart mit dem kompakten Plusenergiehaus weiter profilieren.

Das Forschungszentrum für nachhaltige Energietechnik ist eingebunden, Kontakte zur Wirtschaft springen bei dem ehrgeizigen Projekt ebenfalls heraus. Die Hochschule selbst kostet das Hightechhaus außer viel Herzblut von Studenten, Professoren und Mitarbeitern kaum etwas: Ein Großteil der Kosten und Arbeiten, so betonen Studenten und Hochschule, werde durch Sponsoren getragen oder in der Hochschule selbst erledigt.

12 I SOLAR DECATHLON EUROPE 2010

Solar Decathlon Europe 2010 Beitrag HTW Berlin **Building Performance**

Beim "Solaren Zehnkampf" treten 21 ausgewählte Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75 m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Dann werden die Häuser aller Teams eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt.

Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

xia berichtet an dieser Stelle fortlaufend über die Entwicklung des Solar Decath-Ion Europe, bis die Sieger gekürt werden. Nach der allgemeinen Vorstellung des Wettbewerbs in xia 67, der Vorstellung der deutschen Teilnehmer und ihrer Projekte in xia 68 und dem näheren Eingehen auf die unterschiedlichen Kühlkonzepte der deutschen Beiträge in xia 69 folgt in dieser Ausgabe die Erläuterung des Umgangs mit Energie.

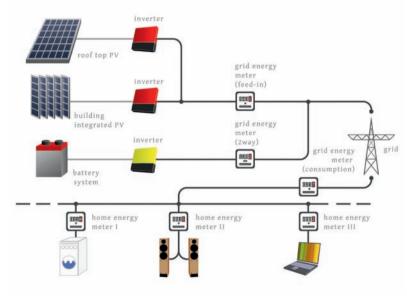
Weitere Informationen zum SD Europe 2010 finden Sie unter: www.sdeurope.org

Die positive Energiebilanz des living EQUIA Hauses ergibt sich aus der konsequenten Umsetzung zweier grundlegender Prinzipien: Minimierung des Energieverbrauchs und Maximierung der Eneraieerzeuauna.

Im Sinne der Energieeinsparung beruht das Konzept von living EQUIA vornehmlich auf der Nutzung passiver Effekte, um Heiz- und Kühllasten so gering wie möglich zu halten. So ist die thermische Hülle des Gebäudes gemäß dem Passivhausstandards ausgeführt. Lehmwände mit integrierten Phasenwechselmaterialien (PCM: phase changing materials) sorgen ohne Energiezufuhr für ein angenehmes Raumklima

Alle aktiven Komponenten zur Beeinflussung des Raumklimas und der Energiebereitstellung, wie beispielsweise die maßgeschneiderte Wärmepumpe, sind zu einem Gesamtsystem kombiniert. So ist zu jeder Zeit ein optimaler Energiefluss einstellbar. Die in der Temperatur und Feuchte der Abluft enthaltene Energie wird mittels eines Sorptionsrades zurückgewonnen und dem Energiekreislauf im Haus wieder zur Verfügung gestellt. Da auch bei der Auswahl der elektrischen

Sankey-Diagramm Energieströme





Komponenten des living EQUIAHauses auf größtmögliche Energieeffizienz geachtet wurde, beträgt der jährliche Energieverbrauch nur etwa 3800 kWh. Dem gegenüber steht die Seite der Energieerzeugung. Hocheffiziente monokristalline Photovoltaik-Module liefern mit 6600kWh in Madrid etwa 70% mehr Strom als benötigt wird. Selbst in Regionen mit geringerer Sonneneinstrahlung kann die 4,6 kWp starke PV-Anlage genug Energie erzeugen, um aus dem Passivhaus ein Plusenergiehaus zu machen. Ein klarer Vorteil ist hierbei die optimale Ausrichtung der PV-Module nach Süden bei 29° Neigung, wodurch die Sonneneinstrahlung maximiert wird. Zur energetischen Unterstützung trägt der photovoltaische Sonnenschutz in der Süd- und Westfassade bei, dessen Lamellen mit etwa 1kWp Leistung ausgestattet sind. Zur thermischen Energiegewinnung sind acht Quadratmeter Flachkollektoren in die Südfassade integriert. Somit produziert das living EQUIA Haus je nach Standort etwa um die Hälfte mehr Energie, als seine Bewohner ver-

Diese Energie könnte zukünftig zum Beispiel für ein elektrisch betriebenes Fahrzeug verwendet werden.

Beitrag Hochschule Rosenheim

Team IKAROS Bavaria: Das zur Entwicklung des Plus-Energiehauses verwendete Konzept der Hochschule Rosenheim basiert auf drei grundlegenden Faktoren:

- Nutzung (Vorgabe der Behaglichkeitskriterien)
- Building Performance (Gebäudehülle, TGA, Ausrichtung, A/V)
- Klimaregion (Standort des Gebäudes). Die durch den Wettkampf gegebenen Rahmenbedingungen sind die Nutzung des Hauses als Wohnraum sowie die Klimaregion Madrid als Standort. Das Bindeglied zwischen der Behaglichkeit und den klimatischen Bedingungen ist die Building Performance, welche in passive und aktive Bereiche unterteilt ist. Die Reduzierung des Energiebedarfs ist im Sommer (Kühlperiode) wie auch im Winter (Heizperiode) Ziel der passiven Maßnahmen.

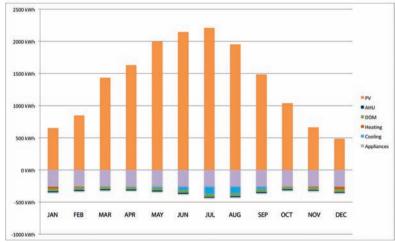
In der Heizperiode wird dies durch hoch wärmedämmende, luftdichte Bauteile der Gebäudehülle erreicht. Die Glasfassade weist beispielsweise einen U-Wert von 0,5 W/m²K auf, die opaken Wandaufbauten einen Wert von < 0,1 W/m²K. Des Weiteren können optimale solare Gewinne durch die verglaste Südfassade erzielt werden

In der Kühlperiode dient neben der guten Wärmedämmung und dem geringen g-Wert (< 0,3) der Verglasung auch der außenliegende Sonnenschutz für eine maximale Reduzierung der solaren Lasten. Der für südliche Klimaregionen optimierte und selbst entwickelte Sonnenschutz kombiniert Funktionalität mit einer idealen Tageslichtversorgung. Durch die Möglichkeit der flexiblen Positionierung von unten wird eine Oberlichtsituation geschaffen, die einerseits den größten Teil der Solarstrahlung abschirmt, andererseits jedoch durch die diffuse Reflexion der Abschlussleiste eine behagliche Tageslichtverteilung im Raum gewährleistet. Somit kann eine Minimierung der Strahlungslasten für den Kühlfall realisiert werden, ohne Einschränkungen der Behaglichkeit. Durch flexible Öffnungen im Eingangs- bzw. Wintergartenbereich lässt sich eine bestmögliche Nachtlüftung realisieren. Dadurch wird das Gebäude in den späten Nachtstunden ausgekühlt und bietet somit einen Puffer für die im Laufe des Tages entstehenden Wärmelasten.

Die aktiven/hybriden Maßnahmen umfassen die technische Gebäudeausrüstung. Beheizt und Gekühlt wird das Gebäude durch das Prinzip der Strahlungskühlung und einem PCM-Speicher (Phase change material) (siehe Beitrag xia 69). Diese Systeme werden durch eine Kompressionswärmepumpe unterstützt, als Übergabesystem wird eine Kühl-/Heizdecke verwendet. Die geregelte Lüftung mit Wärmerückgewinnung und optionaler Feuchterückgewinnung gewährleistet eine optimale Balance der Raumtemperatur und der relativen Luftfeuchtigkeit. Durch den Einsatz von 40 Monokristallinen Photovoltaik-Modulen kann eine Leistung von ca. 12 kWp erreicht werden. Dies ermöglicht einen spezifischen Jahresertrag der Photovoltaikanlage von ca. 16.500 kWh Strom.

Dem Jahresertrag gegenübergestellt ist der Jahresstromverbrauch mit 4200 kWh, der sich aus dem Bedarf von Hausgeräten, Heizen/Kühlen, TWW, Lüf-

ENERGY - BALANCE



tung und Gebäudeautomation zusammensetzt. Diese Werte sind überdurchschnittlich hoch, da sie aus den Wettbewerbsbedingungen abgeleitet sind und nicht einem typischen 2-Personen-Haushalt entsprechen.

Durch die effiziente und innovative Kombination aus Reduzierung des Energiebedarfs, Optimierung der technischen Gebäudeausrüstung und maximaler Energiegewinnung kann ein Überschuss von ca. 12.000 kWh erzielt werden. Dies entspricht einem 4-Fachen des gesamten Jahresverbrauches.

Die Grafik zeigt die Jahresenergiebilanz, in der die monatlichen Stromerzeugnisse den Verbrauchen gegenübergestellt sind.

Beitrag HFT Stuttgart

Bedingt durch die Vorgaben des Wettbewerbs liegt der Stromverbrauch der Häuser deutlich über dem einer normalen Wohnung dieser Größe. Während des Wettbewerbs muss nahezu täglich Wäsche gewaschen und getrocknet, Geschirr gespült und der Ofen aufgeheizt werden. Tagsüber müssen zu einem großen Teil der Zeit sämtliche Multimedia-. Geräte laufen und abends für zwei Stunden sämtliche installierten Leuchtmittel mit voller Leistung leuchten. Auch ist durch die begrenzte Wohnfläche der Häuser der spezifische Stromverbrauch, also der Stromverbrauch pro Quadratmeter Wohnfläche, besonders hoch. Die Ermittlung des jährlichen Strombedarfs erfolgt nach den Vorgaben des Wettbewerbs durch die Simulation eines

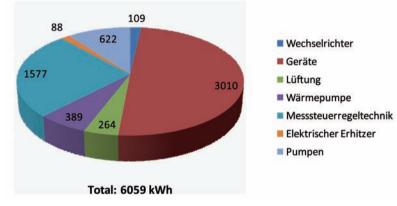
Durchschnittswertes für die Wettbewerbswoche und dessen Hochrechnung auf ein ganzes Jahr. Für das Haus der HFT Stuttgart, home+, ergibt sich dadurch ein jährlicher Stromverbrauch von etwa 6.000 kWh. In diesem Wert sind der Verbrauch der Hausgeräte, Multimedia und Licht, sowie sämtliche Hilfsenergien, einschließlich der Verluste der Inverter und der Verbrauch der Gebäudeautomation eingerechnet.

In der Jahresbilanz für den Standort Madrid wird der Strombedarf durch einen nahezu doppelt so großen Stromertrag von ca. 11.500 kWh ausgeglichen, bzw. die Strommenge des jährlichen Strombedarfs noch einmal zusätzlich ins Netz eingespeist. Den Ertrag liefern farbige polykristallinen PV-Zellen an der Ost- und Westfassade sowie schwarze monokristallinen Zellen auf dem Dach. Der Zellwirkungsgrad an den Fassaden liegt bei etwa 13 %, der auf dem Dach bei etwa 17 %. Die installierte Gesamtleistung liegt bei etwa 12 kWp (6 kWp an den Fassaden, 6 kWp auf dem Dach).

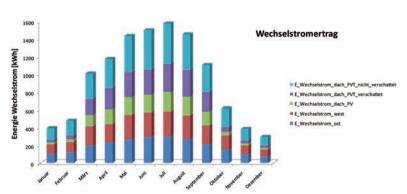


Rendering PV-Fassade home+

Jährlicher Stromverbrauch in Madrid (kWh)



Jährlicher Strombedarf

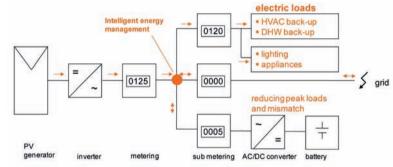


Stromertrag der einzelnen PV-Flächen

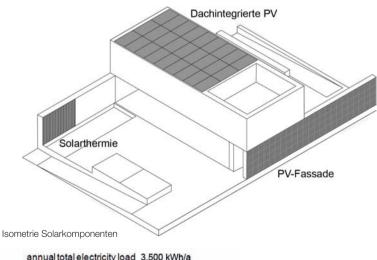
Beitrag Bergische Universität Wuppertal

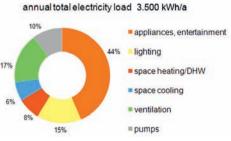
Über die Deckung des eigenen Energiebedarfs hinaus erreicht das Team Wuppertal mit seinem Entwurf des "Europäischen Hauses" als Plusenergiehaus standortabhängig einen mehr oder weniger deutlichen Überschuss an Solarstrom, der in das Netz eingespeist wird. Während des Wettbewerbs stellen spezielle Anforderungen, wie Innenraumtemperaturen von maximal 25° C im spanischen Sommer, erhöhte Laufzeiten der Haushaltsgeräte sowie einer hohen technischen Ausstattung auf kleinem Raum eine besondere Herausforderung zur Realisierung einer ausgeglichenen Strombilanz dar. Umgesetzt wird dies einerseits durch eine Minimierung des Haushaltsstrombedarfs durch den Einsatz von best-practice Geräten und LED-Technik, andererseits durch energetische Optimierung und die Integration von solaraktiven Flächen innerhalb der Gebäudehülle. Während 27 Standardgroßmodule mit monokristallinen Zellen auf einer Fläche von 40 m² für fast 70% des jährlichen Stromertrags in Madrid sorgen, ist das auffällige architektonische Merkmal des Gebäudes die "Solarwand".

Auf einer Fläche von 30 m² erzeugen speziell designte PV-Module mit unterschiedlichen Zellentvoen und transparentem Rückseitenlaminat als Vorhangfassade ein individuelles Bild. Beide Generatoren nutzen Module des deutschen Herstellers SolarWorld. Als Besonderheit besitzt das Gebäude einen kleinen Batteriesatz (48 V) mit 6 kWh Speicherkapazität, der über einen separaten Wechselrichter eingebunden wird. Das Energiemanagement ist so ausgelegt, dass ein möglichst hoher Anteil des Stromverbrauchs aus eigenem Solarstrom gedeckt wird. Während dies ohne Batteriepufferung rechnerisch in der Jahressumme nur zur Hälfte gelingt, steigert der Batteriesatz diesen Anteil auf über 95%. Vorteilhaft ist insbesondere die nächtliche Stromversorgung aus der Batterie. Unter optimalen Bedingungen kann das Gebäude während der 10-tägigen Wettbewerbsphase - theoretisch - ohne Netzstrombezug auskommen und einen deutlichen Überschuss einspeisen. Dieser Ansatz soll nicht nur in Gebieten mit hoher Solarstrahlung funktionieren, sondern auch mit geringfügigen Anpassungen am finalen Standort Wuppertal, Hier kann der Eigenstromverbrauch bis zu 85 % innerhalb eines Jahres durch Solarstrom gedeckt werden.



Schema Energieversorgung





Stromverbrauch

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Google-Anzeigen

Pressemitteilungen online

...richtig positionieren! Erfolgreiche Texte fürs Web:

HAUS | HOLZ | ENERGIE vom 16.-18. April in Stuttgart

Veröffentlicht Montag, 12. April 2010

150 Aussteller und viele Sonderschauen sprechen private Hausbesitzer, Bauherren und Modernisierer an

150 Aussteller präsentieren auf der HAUS | HOLZ | ENERGIE (16.-18. April) in Stuttgart (fast) alles, was Bauherren und Immobilienbesitzer, die umbauen oder modernisieren wollen, brauchen. Foto: HAUS | HOLZ | ENERGIE / Fabry

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Bodenbeläge, Dämmmaterial, Fenster, Holzhäuser, Kamine, Küchen, Solaranlagen, Treppen und Türen: Die Liste dessen, was 150 Aussteller auf der HAUS | HOLZ | ENERGIE vom 16. bis zum 18. April auf der Stuttgarter Messe bieten, ließe sich lange fortsetzen. Außerdem gibt es Sonderschauen und -stände zu Energie-Themen und "Wohnen im Alter". Eine Ausstellung mit künstlerischen Arbeiten Konstanzer Studenten hinterfragt Wohn-Gewohnheiten. "Mein Traumhaus" heißt ein Gewinnspiel, das zum Mitmachen anregt. Ein Highlight im Vortragsprogramm: Projekt-Architekt Daniel Walter stellt das Solar-Haus vor, mit dem sich die Hochschule für Technik Stuttgart am "Solar Decathlon Europe 2010" beteiligt.

150 Aussteller präsentieren auf der HAUS | HOLZ | ENERGIE vom 16. bis zum 18. April in Halle 8 der Stuttgarter Messe auf über 7.500 Quadratmetern fast alles, was Menschen mit Bau-, Umbau- oder Modernisierungsplänen suchen. Von Alarmanlagen bis zu Wärmepumpen oder Wintergärten reicht die Angebotspalette. Besondere Schwerpunkte setzt die Messe auf die Themen "Energie" und "Holz", das nicht nur als Bau-, sondern auch als Heizmaterial Furore macht. Sonderschauen und -stände, wie die Energie-Info-Stände des Wirtschaftsministeriums Baden-Württemberg und des GIH Landesverbands Baden Württemberg der Gebäudeenergieberater, Ingenieure und Handwerker, sowie ein kostenfreies Vortragsprogramm an allen drei Messetagen ergänzen das Angebot.

Sonderthema: Wohnen im Alter

Erstmals thematisiert die Messe 2010 ausdrücklich den zunehmend diskutierten Aspekt des Wohnens im Alter. Dazu gibt es eine vom Handwerks- und Dienstleistungsnetzwerk L.O.B. Leben ohne Barrieren konzipierte Sonderschau und vier Vorträge am Freitag, 16. April, dem ersten Messetag.

"Un-gewohnt": Studierende hinterfragen gängige Innenraumgestaltung

"Un-gewohnt": so heißt eine Ausstellung in der Studentinnen und Studenten von Professor Myriam Gautschi von der Hochschule für Technik, Wirtschaft und Gestaltung in Konstanz, die gängige Sehund Wohn-Gewohnheiten hinterfragen. Das gemeinsame Motto der Arbeiten, die auf der HAUS | HOLZ | ENERGIE zu sehen sind und sich mit Innenraumgestaltung befassen, lautet "Alles Vorhang!". In ihrem Vortrag am Sonntag, 18. April, macht sich die Professorin – passend dazu - "Gedanken zu scheinbar Unverrückbarem".

Stuttgarter Solar-Haus für internationalen Wettbewerb

Solar Decathlon Europe 2010: Dahinter verbringt sich ein Zehnkampf zwischen ausschließlich mit solarer Energie versorgten 75-Quadratmeter-Häusern, die 20 ausgesuchte Hochschulen aus aller Welt eigens für diesen Wettbewerb entwickeln und im Juni in Madrid präsentieren. Die Hochschule für Technik Stuttgart wird dabei sein. Auf der HAUS | HOLZ | ENERGIE präsentiert Projekt-Architekt Daniel Walter in einem Vortrag am Samstag, 15. April, um 16.30 Uhr, das Stuttgarter Decathlon-Haus.

Gewinnspiel "Mein Traumhaus"

Das Gewinnspiel "Mein Traumhaus" lädt die Besucherinnen und Besucher der Messe zum Mitmachen ein. Eine Fotoausstellung zeigt Häuser, unter denen die Gäste ihre drei Favoriten wählen und attraktive Preise gewinnen können.

Eine Eintrittskarte für sechs Frühjahrsmessen

Weitere Informationen zur Messe, den Ausstellern sowie dem Vortragsprogramm finden Interessierte auf der Homepage des Veranstalters, der Peter Sauber Agentur Messen und Kongresse GmbH, Stuttgart, unter: www.messe-sauber.de. Das Messeticket (Erwachsene: 12,00 Euro) berechtigt auch zum Besuch der parallel stattfindenden Messen Garten, Slow Food, I-Mobility, Fair Handeln und der Internationale Mineralien- und Fossilienbörse.

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2 von 2 13.04.2010 11:41

Hochschule sucht Standort für das Wettbewerbshaus des Solar Decathlon

Favorisiert wird ein Platz auf dem Dach des Neubaus, auch Stadtgarten denkbar

STUTTGART, Für die Studierenden an der Hochschule für Technik (HFT) in Stuttgart wird es nun ernst. Sie bauen derzeit ein von ihnen selbst entworfenes, mit Solarenergie betriebenes Haus auf dem Hochschulgelände auf. Dies ist bereits der Probelauf für den Wettbewerb Solar Decathlon im Juni in Madrid, an dem die Hochschule sich beteiligt. Die HFT wurde unter mehr als 100 Bewerbern als einer der 20 Teilnehmer für den Hochschulwettbewerb ausgewählt. Am kommenden Dienstag wird das Richtfest gefeiert.

"Wir sind noch halbwegs im Zeitplan", sagt Projektleiter Jan Cremers, Professor an der Fakultät für Architektur und Gestaltung. Spätestens Anfang Mai muss alles stehen, damit noch zwei Wochen Zeit bleiben, um die Technik im Haus zu testen. Denn Mitte Mai wird dann schon wieder abgebaut und das Haus mit Lastwagen und Tiefladern zum Wettbewerb nach Madrid verfrachtet.

Und während die Studierenden noch die Haushaltsgeräte testen, Fenster und Türen einbauen, Solarmodule installieren und die gesamte Technik testen, die sie an einigen Stellen gemeinsam mit Mittelständlern neu entwickelt haben, treibt die Verantwortlichen an der HFT bereits ein anderes Thema um:



Bis zum Richtfest in der kommenden Woche muss das Haus stehen: Von den Studierenden ist beim Zusammenbau der Module Maßarbeit gefordert. Foto: HFT

Wo soll das Haus nach dem Wettbewerb dauerhaft stehen? Die Hochschule möchte es auch künftig für Lehre und Forschung nutzen. Mehrere Ministerien haben ebenfalls bereits ihr Interesse an Fortbildungen in dem Gebäude angekündigt. Doch dazu sollte das Solarhaus

auch möglichst dicht am Hochschulgelände stehen und vor Vandalismus geschützt sein. "Spätestens nach der Baumesse im Januar in München benötigen wir einen endgültigen Standort", sagt Cremers. Dort werden alle Häuser der vier Teams aus Deutschland zu sehen sein. Die HFT ist die einzige Hochschule aus dem Land, die sich an dem Wettbewerb beteiligt hat.

tekten an der HFT ein Standort hoch oben: auf dem Dach des geplanten Neubaus der Fakultät für Architektur. Der Platz wäre für Forschung und Lehre gut geeignet. Eine Alternative, so Cremers, könnte auch noch der Stadtgarten sein. Dann könnte das Gebäude möglicherweise sogar gemeinsam mit den Architekten an der benachbarten Universität Stuttgart genutzt werden. (schl)

Favorisiert wird von den Archi-

MEHR ZUM THEMA

Das Projekt der Hochschule für Technik beim Solar Decathlon Europe 2010: www.sdeurope.de 22 STUTTGART STUTTGARTER ZEITUNG Nr. 91 | Mittwoch, 21. April 2010

Polizeibericht

Sillenbuch

Fußgängerin angefahren

Eine 73 Jahre alte Fußgängerin ist am Montag gegen 17 Uhr bei einem Verkehrsunfall in der Spaichinger Straße schwer verletzt worden. Ein Notarzt und Rettungssanitäter kümmerten sich um die Verletzte und brachten sie in ein Krankenhaus. Eine 51 Jahre alte Fahrerin eines schwarzen BMW fuhr die Mendelssohnstraße entlang in Richtung Spaichinger Straße. Als sie nach links in die Spaichinger Straße abbiegen wollte, trat plötzlich von rechts die 73-Jährige auf die Straße. Die 51-Jährige konnte nicht mehr bremsen und erfasste die Fußgängerin, die nach dem Aufprall schwer verletzt auf der Straße liegen blieb. Die Polizei bittet Zeugen des Unfalls, sich unter der Rufnummer 89 90-52 00 zu melden.

Feuerbach Kind von Auto erfasst

Schwere Verletzungen hat ein vierjähriges Mädchen am Montag bei einem Verkehrsunfall an der Wiener Straße erlitten. Die Vierjährige befand sich gegen 18.15 Uhr auf dem Gehweg der Wiener Straße. Als sie für einen Augenblick unbeaufsichtigt war, rannte sie hinter einem Eckgebäude hervor und über die Fahrbahn der Wiener Straße, ohne auf den Verkehr zu achten. Eine 59 Jahre alte VW-Fahrerin, die in Richtung Wilhelm-Geiger-Platz fuhr, erfasste das Kind trotz sofortigen Bremsens seitlich mit der Fahrzeugfront. Das Mädchen stürzte zu Boden, stand jedoch wieder auf und rannte auf den Gehweg zurück. Zeugen alarmierten die Rettungskräfte, die das Kind mit Verdacht auf eine Schädelfraktur in ein Krankenhaus brachten.

S-Ost Zwei Fahrverbote drohen

Die Polizei hat am Montag Geschwindigkeitsmessungen an der Pischekstraße durchgeführt. Zwischen 18.30 und 21 Uhr überschritten zehn der gemessenen Fahrzeuge die zulässige Höchstgeschwindigkeit von 50 Kilometer pro Stunde um 21 Kilometer pro Stunde und mehr. Sie müssen mit Geldbußen und Punkten in Flensburg rechnen. Zwei der Fahrer waren mehr als 30 Kilometer pro Stunde zu schnell unterwegs. Beiden droht ein Fahrverbot. jgr

Tipps und Termine

S-Mitte Konzept für Elektrofahrzeuge

In der Hochschule für Technik, Schellingstraße 24, stellt am Donnerstag, 22. April, 16.30 Uhr, Rolf Schumann ein Konzept für den Betrieb von Elektrofahrzeugen vor. Der Vortrag wird im Rahmen des Informatiktages und des Kontakttages Wirtschaft angeboten.

Bad Cannstatt Mit Orthopädie gegen Rheuma

Wie kann die Orthopädie bei Rheuma helfen? Um diese Frage geht es bei einer Patientenfortbildung der Klinik für Orthopädie und Unfallchirurgie am Krankenhaus Bad Cannstatt. Die Veranstaltung findet am Donnerstag, 22. April, 17.15 Uhr, im Multimediaforum des Krankenhauses (Prießnitzweg 24) statt.

S-Mitte Information über die Schufa

"Schufa, wer oder was ist das?" lautet der Titel einer Infoveranstaltung am Donnerstag, 22. April, um 16 Uhr im Treffpunkt Rotebühlplatz. Eine Anmeldung ist möglich über ein Online-Formular unter www.schufa.de (weiterklicken zu Unternehmen, Veranstalter).

S-Mitte

Brautmode nach dem Krieg

Wie sich Frauen trotz Rohstoffknappheit in der Nachkriegszeit zu Brautkleidern verhalfen, zeigt der Vortrag "Ein Traum aus Fallschirmseide" am Donnerstag, 22. April, im Landesmuseum. Der Kurzvortrag innerhalb der Reihe "Kunstpause" beginnt um 12.30 Uhr im Ständesaal. Der Eintritt kostet 3 Euro.

Vaihingen

Astronaut an der Uni

Über seinen ersten Außenbordeinsatz an der Internationalen Raumstation ISS berichtet der Astronaut Hans Schlegel am Donnerstag, 22. April, um 16 Uhr auf dem Campus Vaihingen der Universität, Pfaffenwaldring 47, im Hörsaal 47.01. Bei dem Einsatz ist im Jahr 2008 das Wissenschaftslabor Columbus an die ISS angekoppelt worden. Dieses ist mit Forschungseinrichtungen ausgerüstet, die auch Experimente im Weltall ermöglichen.

Bad Cannstatt Bilder zeigen Emotionen

Malereien der Künstlerin Ute Schramm zeigt die Ausstellung "Betrachtungsreise für Auge und Fantasie" vom kommenden Freitag, 23. April, an im Anna-Haag-Mehrgenerationenhaus in der Martha-Schmidtmann-Straße 16 in Bad Cannstatt. Bis zum 15. Juni sind die Bilder täglich von 8 bis 20 Uhr zu sehen. bg/ktm



Der Rohbau steht; Das technische Herzstück des "Home plus"-Hauses ist der gläserne Aufsatz mit den Belüftungslamellen. Foto: Zweygarth

Solarhaus geht in den Zehnkampf

Richtfest Architekturstudenten der Technikhochschule haben ein Energiesparhaus der Extraklasse ausgetüftelt. Von Inge Jacobs

s ist klein, aber pfiffig: Gestern ist an der Hochschule im Technical fest für ein experimentelles Solarder Hochschule für Technik Richtenergiehaus gefeiert worden. Damit will die Hochschule im Juni beim internationalen Wettbewerb Solar Decathlon Europe 2010 in Madrid teilnehmen und tritt dort gegen 19 ausgewählte Hochschulteams aus der ganzen Welt an.

Saskia Bulut ist eine der acht Masterstudenten im Fach Architektur, die als Kernteam das Projekt ausgetüftelt und mit Hilfe von Fachleuten umgesetzt haben: "Wir produzieren damit so viel Strom, dass wir damit einen Haushalt komplett versorgen könnten." Genaugenommen erbringe das Haus sogar das Dreifache der Energie, die es brauche - "natürlich bezogen auf die Madrider Klimaverhältnisse".

Beim Richtfest konnte man das technische Herzstück des Tüftlerhauses namens "Home plus" besichtigen: den Energieturm. Mittels kiemenartigen Glaslamellen lasse sich die Belüftung sehr fein dosieren, erklärte der Projektleiter und Architekturprofessor Jan Cremers. "In dem Turm werden oben nasse Tücher aufgehängt." Die Idee sei, möglichst wenig Primärenergie einzusetzen und möglichst viele natürliche Effekte zu nutzen. "Das Projekt ist ein ge $waltiger\,Kraftakt\text{``}, sagt\,Cremers.\,Doch\,Sas-$

kia Bulut ist davon überzeugt, dass sich die Anstrengung auszahlt, nicht nur beim Wettbewerb, sondern auch ganz persönlich. "Wir ziehen viel Profit daraus, Sachen, die man plant, auch bauen zu können und Firmenkontakte aufzubauen -

unser Studiengang hatte Glück", meint die Masterstudentin.

Auch Rektor Rainer Franke sieht das Projekt als nutzbringend an. "Das ist eine neue Dimension des Praxisbezugs." Und ein besonderes Merkmal zeichne seine Hochschule bei dem Projekt aus: "Wir haben alle Kompetenzen gebündelt." Er hoffe nur, dass im Juni, wenn das Haus wieder in seine Einzelteile zerlegt und nach Madrid transportiert werde, "nicht irgendeine Flugasche dazwischenkommt".

Lob gab es auch von Staatssekretär Dietrich Birk. Die Studierenden zeigten mit dem Projekt, "was heute machbar ist und morgen schon Standard sein könnte - sie arbeiten auf dem Gebiet der Gebäudetechnik an der Gestaltung von Zukunftstechnologien". Solche Innovationskraft könne das Land brauchen. "An dieser Technik muss weiter geforscht werden", sagte Birk. Besonders gut gefalle ihm der ganzheitliche

Ansatz. Denn in dem Zehnkampf sind nicht nur Architektur, Konstruktion, Solarsysteme und Energiebilanz gefragt, sondern auch Faktoren wie Komfort, Kommunikation, Marktfähigkeit, Innovation und Nachhaltigkeit. Und noch in anderer Hinsicht

werde sich das Projekt positiv auswirken, ist Andreas Löffler. Dekan der Architekturfakultät, überzeugt: "Die Erfahrungen damit werden sich auch in der Lehre und in

der Drittmittelakquise niederschlagen." Es gibt allerdings noch ein kleines Problem: Niemand weiß, wo das Haus nach seiner Rückkehr aus Madrid aufgebaut werden kann. "Wir haben noch keinen Bauplatz", sagt Cremers. "Auch eine gemeinsame Nutzung mit der Uni Stuttgart wäre aus unserer Sicht denkbar – bei Interesse."

Die Pfandleiher haben von der Krise profitiert

Kredite Für Wertgegenstände gibt es problemlos und schnell Bargeld. Von Frederike Poggel

ur Bares ist Wahres, zumindest für Rosita L. (Name geändert), die Stammkundin im Pfandleihhaus Germann in der Innenstadt ist. Alten Hochzeitsschmuck und Erbstücke bringt sie regelmäßig hierher, um sich für ein paar Monate wieder Luft zu verschaffen: für Besuche der kranken Mutter oder andere unvorhersehbare Ereignisse, für die ihr das zur Verfügung stehende Geld einfach nicht ausreicht. Trotz eines halbwegs sicheren Jobs. 13,50 Euro bekommt sie für das Gramm Gold, ein Prozent Zinsen zahlt sie im Monat, plus 2,5 Prozent Gebühr.

Wie Rosita L. machen es immer mehr Menschen: 2009 haben die deutschen Pfandleihhäuser so viel Geld verliehen wie noch nie zuvor. Darlehen im Wert von 530 Millionen Euro wurden bundesweit vergeben, das sind 3,5 Prozent mehr als im Vorjahr, wie der Zentralverband des Deutschen Pfandkreditge-

werbes mit Sitz in "Wirhaben Stuttgart mitteilt.

Die hiesigen Pfandleihanstalten bestäti- mehr Umsatz gen dies: "Wir haben gemacht." im vergangenen Jahr Umsatzsteigerung von 40 Prozent

Daniela Germann-Schedl, Pfandhaus

40 Prozent

verzeichnet", sagt Daniela Germann-Schedl vom gleichnamigen Pfandleihhaus. Auch die städtische Pfandleihe teilt mit, dass mehr Uhren und Schmuck beliehen wurden als im Vorjahr. Als Grund vermutet der Zentralverband, dass durch Kurzarbeit oder Arbeitslosigkeit mehr Menschen in Geldnot gerieten. Eine weitere Rolle spielt der momentan hohe Goldpreis.

"Egal was ich herbringe, ich löse meine Sachen immer wieder aus", sagt Rosita L. "Aber ich lebe lieber ohne Schmuck als mit einem Kredit." So argumentieren viele Kunden und sehen Vorteile gegenüber einem Bankdarlehen: Ohne Schufa-Eintrag, ohne Prüfung der Bonität und ohne die Verpflichtung, die Wertsachen auszulösen, können Mittellose an Geld kommen.

Das Geschäft mit den Bankdarlehen sei davon allerdings nicht betroffen, sagt Manfred Rube, der Pressesprecher der BW-Bank. Zwar meldet die Deutsche Bundesbank für Baden-Württemberg etwas mehr als 65 000 kurzfristige Kredite mit einer Laufzeit bis zu einem Jahr, die Ende 2009 offen waren. Das sind mehr als 1000 weniger als Ende 2008. "Aber die Klientel der Pfandleihhäuser ist eine ganz andere als die Leute, die einen Kredit beantragen", sagt BW-Bank-Sprecher Rube. "Das hat beides nichts miteinander zu tun."

Was Wann Wo

Masterstudenten

als Vordenker: das

Gebäudekonzept

Maßstäbe setzen.

könnte neue

HILFE IM NOTFALL

POLIZEI FEUERWEHR 112 **RETTUNGSDIENST** 112 **NOTRUF-FAX** 112 KRANKENTRANSPORT 0711/19 222

Notfall- und Bereitschaftsdienst (für nicht Gehfähige, deren Hausarzt unerreichbar ist): Mo-Fr 19-7 Uhr, Telefon 2 62 80 12. Notfallpraxis der Stuttgarter Ärzteschaft, im Marienhospital, Böheimstraße 37, Heslach (für Gehfähige): Mo-Fr 19-7 Uhr. Psychiatrische Notfallpraxis. Furthachkrankenhaus, Furtbachstraße 6: Mo-Fr 19-7 Uhr Augenärztlicher Notdienst: durchgehend

Telefon 19 222. Informationen zur Bereitschaft von Medi-Fachärzten (für Patienten, deren Arzt nicht erreichbar ist): Mi, Fr 13-19 Uhr,

Tierarzt: durchgehend Telefon 7 65 74 77. **Telefonseelsorge:** 0800 / 11 10 - 111 (evang.), 0800/1110-222 (kath.). Kontakt - und Informationszentrum für Suchtkranke, Nikolausstraße 2, Telefon 26 74 25: Mo-Fr 18-21 Uhr,

Telefon 0 18 05 / 30 80 90.

Sa, So 10-12 Uhr.

Mobbing-Hotline: Telefon 0180/ 26 62 24 64. Mo-Fr 8-22 Uhr. Krisen- und Notfalldienst: Telefon 0180 / 5 11 04 44, Mo-Fr 9-24 Uhr, Sa, So 12-24 Uhr.

Anonyme Alkoholiker: Telefon 1 92 95. Kinder- und Jugendtelefon: 0800/1110-333.

Babyklappe am Weraheim, Oberer Hoppenlauweg 2-4: Telefon 16 26 30. Frauenhaus: Telefon 54 20 21. Städtisches Frauenhaus: Telefon 4 14 24 30

Anwaltlicher Notdienst für Strafsachen: Telefon 2 36 93 06, täglich 18 - 8 Uhr. Heißer Draht zur Stadtverwaltung: Telefon 216 - 2323 (Mo-Do 9-11 Uhr). Elektro-Notdienst: Telefon 56 68 52.

Pannendienst: ADAC Telefon 01 80 / 2 22 22 22; AvD Telefon 7 97 90 68; ACE Telefon 01 80 / 2 34 35 36

APOTHEKEN

theke am Hauptbahnhof, Klett-Passage 31, Tel. 29 55 86 und Johannes, Rotebühlstr. 44, Tel. 61 87 23. Bad Cannstatt, Neckarvororte und Fellbach: am Bahnhof. Cannstatt, Bahnhofstr, 11, Tel, 9 55 96 50. Degerloch, Filderbezirke und Vaihingen: Österfeld, Vaihingen, Österfeldstr. 7, Tel. 7 35 21 05. Feuerbach, Stuttgarter Norden, Gerlingen, Korntal und Zuffenhausen: Zentral, Korntal, Johannes-Daur-Str. 3, Tel. 83 32 09 und am Kelterplatz, Zuffenhausen, Ludwigsburger Str. 100, Tel. 72 20 88 10. Dienstbereit von 8.30 bis 8.30 Uhr.

Stuttgart Innenstadt und Botnang: U-Apo-

PERSÖNLICHES

Altersjubilare, die keine Veröffentlichung wünschen, bitten wir, unter folgender Nummer anzurufen: 216 - 65 92. Ehejubilare, die eine Veröffentlichung wünschen: 216 - 67 50. Geburtstage: 101 Jahre: Charlotte Hoffmann, Münster. 97 Jahre: Elisabeth Michalczyk, Möhringen. 96 Jahre: Marianne Sauer, West. 95 Jahre: Eleonore Plathe, Vaihingen, 94 Jahre: Wilma Mayer, Feuerbach. 92 Jahre: Klara Deininger, Hedelfingen; Frieda Dunz, Münster. 91 Jahre: Eugen Schlosser, Botnang. 90 Jahre: Barbara Fröhlich, West; Gottlob Vöhringer, Bad Cannstatt; Hilda Wohlfromm, Ost. 85 Jahre: Gertrud Kessel, Feuerbach; Anna Rück, Mühlhausen.

VERANSTALTUNGEN

KULTUR ET CETERA Cannstatter Wasen, 72. Stuttgarter Frühlingsfest, 12 Uhr Deutscher Kinderschutzbund Ortsverband Stuttgart, Christophstraße 8: Infoabend zur Gruppenarbeit mit Kindern in Scheidungssituationen, Anmeldung unter Tel. 24 44 24, 16 Uhr.

Haus der Caritas, Filderbahnplatz 23: Der Garten im Frühling, 15 Uhr. Charlottenklinik für Augenheilkunde, Falkertstraße 50: Möglichkeiten der refraktiven Chirurgie, Anmeldung unter Tel. 66 92-100, 19 Uhr

Haus der Kath. Kirche, Königstraße 7: Wissenswertes über Fußpflege, vor allem bei Diabetikern, 16 Uhr. Hospitalhof, Büchsenstraße 33: Gesund-

heit: Ordnungsgesetze des Lebens, 18 Uhr. Marienhospital, Böheimstraße 37: Gebärmutter- und Myomentfernung mithilfe der Schlüssellochchirurgie, 18.30 Uhr. Rathaus, Marktplatz 1: Homosexuellenverfolgung in der NS-Zeit, 19 Uhr. Robert-Bosch-Krankenhaus, Auerbach-

straße 110: Künstlicher Gelenkersatz, Informationsabend mit Fachärzten, 18 Uhr. Staatliches Museum für Naturkunde, Nordbahnhofstraße: Riffe in der Erdgeschichte, 18 Uhr.

Steuerberaterhaus, Hegelstraße 33: Steu-

ern und Recht im Gespräch, 19 Uhr. Treffpunkt Rotebühlplatz, Rotebühlplatz 28: Gesundheit beginnt im Kopf: Warum Menschen gesund bleiben, 20 Uhr. Mediencenter Wohnzimmer, 17.30 Uhr. Reisen mit Multipler Sklerose, 19 Uhr. Universität Stuttgart, Pfaffenwaldring 47: Elektromobilität: Revolution oder Evolution?. 18.30 Uhr.

straße 44: Musik, Spiel und Bewegung was braucht das Kind?, 20 Uhr. Pflegezentrum Bethanien, Onstmettinger Weg 35: Offenes Singen, 15.30 Uhr. **Stadtmedienzentrum,** Rotenbergstr. 111: Ferne Hoffnung Kaukasus - Deutsche Spu-

Waldorfschule Uhlandshöhe, Haußmann-

KINDERSPASS

Eliszis Jahrmarktstheater, Höhenpark Killesberg: Jahrmarkt wie zu Großmutters Zeiten, 14 Uhr.

ren in Aserbaidschan, 19.30 Uhr.

Grundschule Burgholzhof, James-F.-Byrnes-Straße 3: Spielmobil (6-12 J.), 14 Uhr.

Junges Ensemble Stuttgart, Eberhardstraße 61a: Pizza (ab 7 J.), 11 Uhr. KifU Kindertreff, Brückenstraße 45 A: Breakdance (6-12 J.), 15.30 Uhr. Wir bauen eine Seifenkiste (6-12 J.), 15 Uhr.

Kinder- und Jugendhaus Birkach, Grüningerstr. 18: Hip-Hop Tanztreff. Internetcafé und Spiele (ab 12 J.), 18 Uhr. Schlagzeug und Trommeln (6-12 J.), 16.30 Uhr. Softfußballturnier (6-12 J.), 14.30 Uhr.

Kinder- und Jugendhaus Ostend, Ostendstraße 75: Die Schöne und das Biest (9 - 10

Kinder- und Jugendhaus Vaihingen, Walter-Heller-Straße 29: Individueller Stifehalter (6-12 J.), 15 Uhr. Kinderhaus Büsnau, Adolf-Engster-Weg

4: Azur und Asmar (ab 8 J.), 15 Uhr. Kinderhaus Feuerbach, Mühlstraße 2: Garten bepflanzen (6-12 J.), 12 Uhr. Kindertreff Botnang, Griegstraße 18: Bastelwerkstatt: Launenbarometer, 15 Uhr. Kindertreff Münster, Moselstraße 25: Kinderkochclub: Pizza (6-12 J.), 14 Uhr. Kommunales Kontakt Theater, Kissinger Straße 66 A: Teichnixe Josefa und das Seeungeheuer (ab 5 J.), 10.30 und 16 Uhr. Spielhaus, Untere Schlossgartenanlage: Kreativwerkstatt und Holzwerkstatt

(6-13 J.), 13 Uhr. Spielplatz Alter Friedhof Untertürkheim, Spielmobil Mobifant (6-12 J.), 14 Uhr. Staatliches Museum für Naturkunde, Rosenstein 1: Im hohen Gras, eine Stunde im Museum (ab 5 J.), 15 Uhr

Stadtteilbücherei Degerloch, Löffelstraße 5: Jim Knopf und die wilde 13 (4-10 J.); Anmeldung unter Tel. 216 - 44 27, 15 Uhr. Stadtteilbücherei Feuerbach, Sankt-Pöltener-Straße 29: Der faule Kater Josef, Bilderbuchschau (6-8 J.), Anmeldung unter Tel. 216 - 52 46, 10.30 Uhr. Leseohren aufgeklappt (4-7 J.), 16 Uhr.

Stadtteilbücherei Möhringen, Filderbahnstraße 29: Dr. Brumm geht baden, Bilderbuchschau (ab 4 J.), 15 Uhr.

Theater am Faden, Hasenstraße 32: Die weiße Jaranga, Märchen, 10.15 Uhr. Theater in der Badewanne, Stresemannstraße 39: Wo die wilden Kerle wohnen (ab 5 J.), 20 Uhr.

Treffpunkt Rotebühlplatz, Rotebühlplatz 28: Duftende Papierblumen, Kinderwerkstatt (ab 3 J.), Anmeldung unter Tel. 187 38 81, 15 Uhr, Dunkelgemunkel, Kinderwerkstatt (ab 5 J.). Anmeldung unter Tel. 187 38 81, 15 Uhr.

Gottesdienstzeiten: Telefon 284 55 47.

VERSCHIEDENES

Planetarium, Mittlerer Schlossgarten: Vorführungen: Mi 10, 15 und 20 Uhr. Schwäbische Sternwarte Uhlandshöhe: Führung am Teleskop: 20 Uhr. Fernsehturm: täglich von 9 bis 22.30 Uhr. Turmforum Stuttgart 21 im Bahnhofsturm: Dauerausstellung zu Stuttgart 21 und Aussichtsplattform 10 bis 18 Uhr. Flughafen: Besucherterrasse mit Albatros-Flugmuseum: täglich von 8 bis 18 Uhr. Wilhelma, Neckartalstraße: Tierhäuser täglich bis 18.15 Uhr, Pflanzenhäuser täglich bis 18 Uhr, Kasse 8.15 bis 17.30 Uhr. Neckarschifffahrt: Telefon 54 99 70 60. Stadtführungen: Anmeldung und Informationen über weitere Stadtrundfahrten beim i-Punkt, Königstraße 1a, Telefon 22 28 - 0. Fax 22 28 - 253, www.stuttgart-tourist.de. Alle Angaben stammen von den Veranstaltern. Die Stuttgarter Zeitung übernimmt keine Gewähr, dass die Veranstaltungen stattfinden und dass Karten erhältlich sind.

UMWELTMOBIL

Büsnau, Büsnauer Platz: 12.30 bis 14 Uhr. Birkach, Grüninger Straße: 14.45 bis 16.15 Uhr.

Hedelfingen, Rohrackerstraße, Nähe Nr. 161: 17.30 bis 19 Uhr.

SPERRMÜLL

Wertstoffhöfe sind in der Einödstraße 50 in Hedelfingen, in den Entenäckern 1 in Plieningen, in der Burgholzstraße 31/1 in Münster und in der Hemminger Straße 125 in Weilimdorf (gegenüber Grüner Heiner).

Leonberger Kreiszeitung

Auflage(vb) der genannten Quelle: 16875

Leonberg Haus mit Solarenergie

Der Energiekreis lädt am Freitag, 23. April zu einer Besichtigung des Plus-Energie-Hauses der Hochschule für Technik in Stuttgart ein, das am Solar-Decathlon-Wettbewerb in Madrid teilnehmen wird. Treffpunkt ist der Bahnhof Leonberg um 15 Uhr. Eine Anmeldung ist unter den Telefonnummern 0 71 52 / 4 56 33 oder 01 62 / 8 94 02 92 möglich. arno

SOLAR DECATHLON EUROPE 2010

TEIL 1: ARCHITEKTONISCHE ENTWÜRFE



Bild 1: Vision der Villa Solar, Ausstellungsort des Solar Decathlon Europe 2010 in Madird

Vier deutsche Teams aus Berlin, Rosenheim, Stuttgart und Wuppertal haben es in das Finale des Solar Decathlon Europe (SDE 2010) geschafft. Im Juni dieses Jahres werden sie sich in Madrid mit ihren 74m² großen Prototyphäusern mit Hochschulteams aus der ganzen Welt in dem als Zehnkampf ausgetragenen Wettbewerb messen.

Der Solar Decathlon Europe 2010 (SDE 2010) ist ein Ableger des amerikanischen Wettbewerbs Solar Decathlon, der 2002 zum ersten Mal vom US-Ministerium für Energie ausgelobt wurde. Die letzten beiden Wettbewerbe in den USA in den Jahren 2007 und 2009 konnte die Technische Universität Darmstadt als einziger deutscher Teilnehmer für sich entscheiden. Der diesjährige Wettbewerb findet nun zum ersten Mal in Europa statt. Die Schirmherrschaft übernahm das spanische Ministerium für Wohnungsbau, ausgerichtet wird der SDE von der Technischen Universität Madrid (UPM).

Die Anforderungen an die Studierenden könnten anspruchsvoller nicht sein: Sie müssen in weniger als zwei Jahren nicht nur ein Plusenergiehaus planen und bauen, das seinen gesamten Energiebe-

darf alleine durch solare Energie deckt, sondern auch darauf achten, in allen zehn Wettbewerbskategorien zu punkten (siehe Übersichtstabelle am Ende des Artikels). Erschwerend kommt hinzu, dass die Häuser – vorgefertigt am jeweiligen Hochschulstandort – zum Finale nach Madrid transportiert und dort in einer nur zehntägigen Aufbauphase errichtet werden müssen. Obendrein müssen sich die Teilnehmer überwiegend selbst finanzieren, indem sie Sponsoren für ihre Projekte gewinnen.

Den deutschen Teams gelang es, das

Bundesministerium für Wirtschaft und Technologie (BMWi) als Förderer zu gewinnen. Im Rahmen der Forschungsinitiative EnOB "Energieoptimiertes Bauen" erhält jedes Team eine substantielle Unterstützung und steht zusätzlich unter der Schirmherrschaft des Wirtschaftsministers Rainer Brüderle.

Aus zahlreichen internationalen Bewerbern von renommierten Hochschulen wurden insgesamt 20 Teams zum solaren Zehnkampf zugelassen. Darunter vertreten sind sechs spanische, zwei französische und zwei US- amerikanische Teilnehmer sowie studentische Teams aus Mexiko, China, Finnland und Großbritannien.

Die vier deutschen Finalisten stellen sich im Folgenden vor.

HTW Berlin

Das Team

Das Berliner Team hat eine Vision und diese zu ihrem Leitsatz und Namen gemacht – living EQUIA – living ecological quality and integration of ambience: Die Vision ein Haus zu entwerfen, in dem die Bewohner im Einklang mit der Natur leben können ohne dabei an Lebensqualität einbüßen zu müssen. Das ausschließlich studentisch organisierte Team arbeitet interdisziplinär und hochschulübergreifend. So gehören neben Studenten der Hochschule für Technik



Bild 2: Rendering des living EQUIA Entwurfes, Ansicht aus Süden

und Wirtschaft Berlin (HTW) auch angehende Architekten und Energietechniker der Beuth Hochschule Berlin (BHT) und der Universität der Künste (UdK) zum Kernteam.

Der architektonische Entwurf

Eindrucksvolle funktionale und gestalterische Aspekte prägen den Hausentwurf von living EQUIA.

Farbgebung

Die Fassade des Hauses wird mit abgeflammten Holzplatten versehen. Diese dienen als natürlicher Witterungsschutz und ermöglichen die perfekte Integrierung der dunklen PV-Module in das Gesamtbild des Gebäudes. Die Fassadenverschalung aus dem heimischen Rohstoffen Holz benötigt nach dem Abflammen keinerlei weitere Behandlungen mehr und ist somit nicht nur besonders nachhaltig, sondern langfristig gesehen eine Kostenersparnis.

Lichtachsen

Da das living EQUIA Haus ein mobiles Gebäude und nie an einen Ort gebunden ist, war die architektonische Verortung eine gewisse Herausforderung. Zwei Lichtachsen in Nord-Süd- und Ost-West als Kreuz angeordnet, bilden ein Zentrum im Haus. Sie beziehen sich auf die Himmelsrichtungen und geben dem Haus somit an jedem Ort dieser Welt den Bezug zu seiner unmittelbaren Umwelt. Durch die Lichtachsen kann tagsüber der Sonnenverlauf, ähnlich einer Sonnenuhr, im Haus nachempfunden werden. Sobald es dunkel wird, dringt das Licht aus dem Innenraum nach außen und kann als Symbolik dafür gesehen werden, dass die Energie, die das Haus während des Tages aufgenommen hat, nachts wieder an die Umwelt abgegeben wird. So wird auch konstruktiv der Bau aufgebrochen und seine modulare Charakteristik gezeigt, die eine Spannung in das gewohnte Bild von Einfamilienhäusern bringen soll.



Bild 3: 3D Visualisierung des Rosenheimer Solarhauses

Schräg verlaufende Traufen

Die optisch ansprechende, dynamische Architektur entsteht aus der Verdrehung des Grundrisses gegen die Lichtachsen. Die Verdrehung ergab sich aus dem Spiel mit dem vorgegebenen Grundstück für den Wettbewerb von 20 x 25m mit Nord-Süd-Ausrichtung. Für weitere Bauten oder Siedlungen sollte sich diese Verdrehung frei gedacht werden und eine Vielzahl verschiedener Formen hervorbringen.

Satteldach

In Sachen Form sowie A/V-(Oberfläche zu Volumen) Verhältnis hält sich der Prototyp von living EQUIA an die bewährten Prinzipien solaren Bauens. Dabei steht die optimale Integration der technischen Oberflächen im Vordergrund und führte dazu, dass sich das Team für den traditionellen deutschen Hausbaustil mit Satteldach entschieden hat. Sie nutzen somit die ökonomischen Vorteile bei der Ausrichtung der gebäudeintegrierten Photovoltaikanlage und der für das Abgeben der Wärme zuständigen Abstrahlfläche auf der Nordhälfte des Daches.

FH Rosenheim

Das Team

Wohnlichkeit, Behaglichkeit und die Funktionalität des solarbetriebenen Wohngebäudes sind die wichtigsten Faktoren für das Rosenheimer Team. Aus den Studiengängen Innenarchitektur, Innenausbau, Holzbau/Ausbau, Holz-Wirtschafts-Ingenieurwesen, technik, Elektrotechnik und Informatik haben sich Studierende zusammen gefunden, die nun ein Team mit beinahe vierzig Köpfen bilden. Wissenschaftliche Unterstützung erhalten die Studierenden durch die Fraunhofer Allianz Bau, dem Rosenheimer Fensterinstitut und dem ZAE Bayern. Als "Holzstadt" hat sich Rosenheim einen Namen gemacht. So ist es nicht verwunderlich, dass durch die enge Verbindung zum Holzbau eine neuartige Rahmenkonstruktion zum Einsatz kommen wird.

Der architektonische Entwurf Architektur

Die Architektur des Rosenheimer Solarhauses ist eine Schnittstelle von modernem Design, ökologisch nachhaltigen Standards und Energieeffizienz. Der Entwurf vereinigt diese Faktoren und schafft einen Lebensraum, der nicht nur den Bedürfnissen des Menschen gerecht wird, sondern einen neuen luxuriösen Lebensstil darstellt.

"Flexibles Wohnen" ist die Grundidee! In Form von modularen Baukörpern und einem Innenraum, dessen Nutzung durch flexible Möbel verändert werden kann.



Bild 4: Visualisierung des Innenraumes, hier für Feierlichkeiten bis zu 8 Personen



Bild 5: Mit Lichtwellenleiter simuliertes Model

Dadurch entstehen eine enorme Gestaltungsfreiheit sowie eine hohe Flächeneffizienz. Blickfang des Hauses ist die speziell entwickelte Zick-Zack-Fassade, die dem Gebäude seinen unverkennbaren Charakter verleiht.

Innenraum

In jedem der vier Gebäudemodule findet sich eine eigene Nutzbarkeit, beziehungsweise ein eigenes Möbel. Der Raum wird durch ein ganzheitliches, schlichtes Design zusammengefügt. Das Mobiliar besticht durch seine Flexibilität, Innovation und seine Benutzerfreundlichkeit. Die weißen Fronten beruhigen den durch die hohe Funktionalität geprägten Raum. Farbig gehaltene Einschnitte und Aussparungen setzen Highlights und betonen außerdem die Nutzung des Bereiches. Beim Möbelbau wurde auf nachhaltige Leichtbauplatten zurückgegriffen. Dadurch kommt es zu einer enormen Ersparnis an Gewicht, was besonders wichtig für Beweglichkeit der Möbel und für den Transport ist.

Licht

Die Raumaufteilung ist für eine ideale Tageslichtnutzung ausgerichtet. Die Anordnung der verschiedenen Nutzungsbereiche entspricht dem natürlichen Sonnenverlauf über einen Tag.

Mit der aufgehenden Morgensonne im Osten wird der Bewohner sanft geweckt. Mit zunehmender Höhe zieht sich die direkte Sonneneinstrahlung durch den Dachüberstand im Eingangsbereich aus dem Schlaf- und Arbeitsbereich zurück. Tagsüber kann der Benutzer durch den aus dem Boden nach oben fahrbaren Sonnenschutz den Eintrag des Sonnenlichtes variabel steuern. Bei nicht ganz geschlossenem Sonnenschutz hält dieser den Bewohner vor Blicken geschützt, lässt aber genügend Tageslicht in den Raum. In den Abendstunden kommen neuartige warm-weiß leuchtende LEDs zum Einsatz, diese in ihrer Gesamtenergie betrachtet nicht mehr als zweimal 75 Watt

Glühbirnen ausmachen. Somit wird das Haus zu einem wirklichen Energiesparer. Außerdem findet ein Lichtwechselspiel von innen nach außen statt, welches das Rosenheimer Solarhaus zu einem echten Hingucker macht.

HFT Stuttgart

Das Team

Am Beitrag der HFT Stuttgart wirken Studenten aus den Masterstudiengängen Architektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence (SENCE), sowie den Bachelorstudiengängen Bauphysik, Infrastrukturmanagement und Innenarchitektur mit. Das zafh.net, das Zentrum für Gebäudeenergieforschung der HFT Stuttgart, unterstützt das Studententeam, die Organisation und Leitung des Projektes liegt bei der Fakultät für Architektur. Als interdisziplinär angelegtes Projekt vereint der SDEurope alle Kompetenzen der HFT Stuttgart in diesem Bereich und bietet den Studenten einen wertvollen Baustein in ihrer praxisnahen Ausbildung.

Der architektonische Entwurf

home+ – Der Entwurf basiert auf gestalterischen und energetischen Überlegungen. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen. Im Inneren dienen Phasenwechselmaterialien (PCM) der Erhöhung der thermischen Masse. Das Volumen wird in einzelne Module aufgeteilt, die mit etwas Abstand zueinander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer.

Energieturm

Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas in heißen und trockenen Regionen, zu denen auch Madrid zählt, beiträgt. Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus entsprechenden Regionen, wie der Windtürme im arabischen Raum und der in Spanien weitverbreiteten Patios. In der Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt.

Energiehülle

Dach und Fassaden sind von einer Photovoltaik-Hülle umgeben. Der damit gewonnene Strom übersteigt den geringen Energiebedarf, das Gebäude wird zum Plus-Energie-Haus. Gleichzeitig prägt diese Hülle das äußere Erscheinungsbild entscheidend. An der Fassade kommen farbige polykristalline PV-Zellen zum Einsatz, auf dem Dach schwarze monokristalline PV-Zellen. Die PV-Flächen auf dem Dach werden nachts auch zur Abkühlung eines Rückkühlspeichers genutzt. Dazu wird Wasser durch Rohrschlangen an der Rückseite der PV-Module gepumpt. Dieses Wasser wird durch die Abstrahlung der PV-Module gegen den Nachthimmel abgekühlt und dient sowohl der direkten Kühlung des Gebäudeinneren über Rohrschlangen in Decke und Boden und der Rückkühlung der reversiblen Wärmepumpe im Kühlbetrieb.

Modularität

Der modulare Aufbau von home+ ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können damit nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen. Darüber hinaus kann das Gebäude, insbesondere die Fugen, an die klimatischen Gegebenheiten des jeweiligen Standortes funktional angepasst werden.



Bild 6: Rendering des Entwurfes home+ der HFT Stuttgart

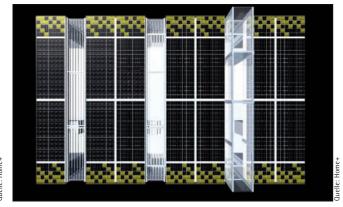


Bild 7: Vogelperspektive des home+ der HFT Stuttgart

Bergische Universität Wuppertal Das Team

Der Wettbewerbsbeitrag der Bergischen Universität Wuppertal wird von Studierenden unterschiedlicher Fachbereiche interdisziplinär bearbeitet. Das Team aus den Bereichen Architektur, Bauingenieurwesen, Design und Wirtschaftswissenschaften arbeitet eng zusammen, um das Projekt gemeinsam zu entwickeln und umzusetzen.

Als Grundidee des Gesamtkonzepts wurde die Entwicklung eines zukunftsfähigen "Europäischen Hauses" formuliert. Dies bedeutet, dass das Gebäude nicht ausschließlich für den Wettbewerb und somit den sommerwarmen Standort Madrid konzipiert wird. Gleichermaßen soll das Gebäude auch an anderen Standorten Europas, wie vor allem dem späteren Nutzungsstandort Wuppertal, hohe Komfortansprüche sowie eine ausgeglichene Jahresenergiebilanz (Netto-Nullenergie) erreichen.

Die Architektur

Der Kerngedanke des architektonischen Entwurfes zielt auf ein atmosphärisch spannungsvolles, wandelbares und somit zukunftsfähiges Raumkonzept.

Hierbei wird mittels zweier solaraktiver Wandscheiben ein von Ost nach West fließender, funktional offener Raum definiert, der als frei bespielbares Feld begriffen wird. Der so entstehende Raum kann mittels Schiebeelemente vollständig geöffnet werden, die Grenzen zwischen Wohn- und Außenraum lösen sich auf.

Den oberen Abschluss bildet ein auf den Wänden aufliegendes Tragwerk, welches den Raum auf einer Länge von über rund 12 Metern überspannt und zugleich einen, in der Höhe differenzierten Innenraum sowie einen Dachpatio formuliert.

An der Nordwand des Innenraums befindet sich ein multifunktionales, begehbares Wohnmöbel, dem gegenüber die Küchenwerkstatt mit ihrem flexiblen Tresen. Sämtliche wichtige Wohnfunktionen werden in diesen beiden durch Klappen,

Drehen oder Herausziehen wandelbaren Elementen gebündelt. Einzelne dieser Elemente sind mobil und können somit den gesamten Raum bespielen.

Gleicherweise wie die Ansprüche der architektonischen Gestaltung sehr hoch gesteckt sind, ist eine hochwertige Umsetzung aller Bauteile Voraussetzung für den Erfolg des Projektes. Ausgangsbasis dafür ist die durchgängige Passivhausbauweise mit hochwertigem Wärmeschutz im Bereich der Gebäudehülle sowie die bestmögliche Integration von Flächen zur aktiven Solarenergienutzung. Eine Besonderheit des Hauses ist hier die "Solarwand": speziell designte PV-Module mit unterschiedlichen Zellentypen und transparentem Rückseitenlaminat erzeugen als Vorhangfassade ein individuelles Bild. Ein weiteres auffälliges Merkmal ist beispielsweise auch das geplante Vorhangsystem. Dieses dient nicht nur als konsequenter Sonnenschutz zur Reduktion der äußeren Wärmelasten sondern gleichzeitig als wichtiges architektonisches Element im Kontext der Gestaltung.



ZUM AUTOR:

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Die 10 Disziplinen

Ziel des Wettbewerbes ist der Bau eines energieeffizienten und technisch innovativen Plusenergiehauses mit einem Maximum an Wohnkomfort. Über den architektonischen und technischen Anspruch hinaus sind die Erstellung von Businessplänen und Marktanalysen sowie die öffentliche Darstellung entscheidend.

Ein Konzeptentwurf über die nachhaltige Nutzung des Hauses sowie Innovationen haben ebenfalls einen wesentlichen Einfluss auf das Endergebnis. Das spanische Wettbewerbskomitee legt insgesamt folgende 10 Kriterien für die Gesamtbewertung zu Grunde:

	Maximal mögliche Punkte			
Architektur	120			
Konstruktion und				
Verarbeitung	80			
Solare Systeme	80			
Elektrische				
Energiebilanz	120			
Wohnqualität	120			
Haustechnik	120			
Kommunikation und				
Information	80			
Marktaussichten	80			
Innovation	80			
Nachhaltigkeit	120			
	1000 (maximale Gesamt-			
punktzahl)				

Informationen zu dem Wettbewerb und den deutschen Teams finden Sie unter:

- www.sdeurope.org/
- solar-decathlon.fh-rosenheim.de,
- www.sdeurope.de/,
- www.sdeurope.uni-wuppertal.de,
- www.living-equia.com/de/

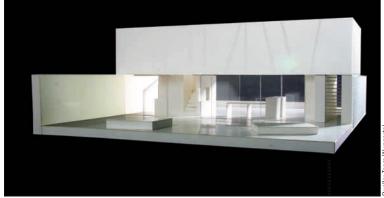


Bild 8: Entwurf des Team Wuppertal

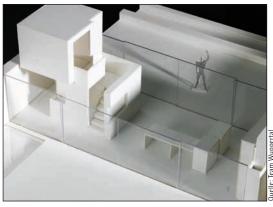


Bild 9: Blick in den Innenraum und Zugang zur 2. Etage

SOLAR DECATHLON EUROPE 2010

TEIL 2: PHOTOVOLTAIK

er Solar Decathlon Europe ist ein internationaler Architektur und Innovationswettbewerb, bei dem 20 Studententeams aus aller Welt innerhalb von zwei Jahren einen Prototyp eines Solarhauses entwerfen und bauen, das sich im Juni 2010 zum finalen Contest in Madrid in zehn verschiedenen Wettbewerbskategorien vor einer ausgewählten Fachjury behaupten muss. Bewertet werden Nachhaltigkeit, Innovation, Marktaussichten, Kommunikation, Haustechnik, Wohnqualität, Architektur, Konstruktion sowie zwei Disziplinen, die sich mit der solaren Energiegewinnung beschäftigen - "Solare Systeme" und "Elektrische Energiebilanz".

In der Disziplin "Solare Systeme" gilt es zu beweisen, wie effizient Photovoltaik- und Solarthermie-Anlagen sind. Die Fachjury wird deren Konzeption, Ausführung und Funktionalität ebenso prüfen wie die Zugänglichkeit für Wartungen und Reparaturen. Außerdem achten die Juroren darauf, ob das Haus genügend elektrische und thermische Energie produziert, um sich selbst zu versorgen: Von den Teams durchgeführte Jahressimulationen unter madrilenischen Bedingungen müssen darüber einen Nachweis erbringen.

Im Contest "Elektrische Energiebilanz" werden in der Wettbewerbswoche die erzeugten und verbrauchten Energiemengen vor Ort messtechnisch erfasst. Anhand dieser Messwerte werden in drei verschiedenen Teilwettbewerben Punkte verteilt:

- Das Erreichen der geforderten positiven Bilanz am Ende der Woche,
- der Grad der Energieautarkie und
- die Gleichzeitigkeit von Erzeugung und Verbrauch.

Die meisten Punkte entfallen dabei auf die erste Teildisziplin, bei der vorausgesetzt wird, dass jedes Team vom 18. bis 27. Juni 2010 zwischen 20 und 40 kWh mehr Strom generieren kann als es in diesem Zeitraum verbraucht. Effiziente PV-Anlagen sind demnach genauso wertvoll wie sparsame Verbraucher.

Im Folgenden stellen die vier deutschen Wettbewerbsteilnehmer aus Berlin, Rosenheim, Stuttgart und Wuppertal ihre Erzeugerkonzepte vor. Darin erklären die Teams, welche Anlagen verwendet wurden, welche Nennleistung installiert ist und wie sie die PV-Anlagen in ihre Häuser integriert haben.

HTW Berlin

Das Team Berlin produziert seinen Strom mit zwei Photovoltaik-Anlagen – eine ist als Aufdach-PV-Anlage ausgeführt, die zweite in den Sonnenschutz

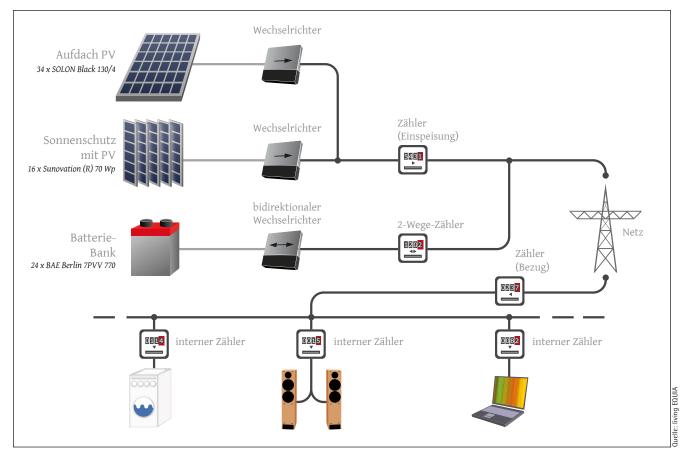


Bild 1: Das PV-Schema von living EQUIA



Bild 2: Westansicht des Berliner Solarhauses mit offenen Verschattungselemeten mit integrierter PV

vor Süd- und Westfassade integriert. Den Großteil der Jahreserzeugung wird die auf der Südseite des Satteldaches installierte PV-Anlage liefern, die vom Berliner Modulhersteller Solon SE gesponsert wird. Die Südausrichtung und der Neigungswinkel von 28,7° ermöglichen größtmögliche Ertragsausbeute, insbesondere in mediterranen Breitengraden. Die 4,6 kWp starke Anlage besteht aus 34 monokristallinen Modulen aus der Design Line von Solon, die rahmenlos und ganz aus schwarzen Komponenten gefertigt sind. Zudem geben sie durch ihre quadratische Grundform der Fassade eine Rasterung, die in Verbindung mit der einheitlich dunklen Farbgebung ein homogenes Erscheinungsbild der Gebäudehülle gewährleistet.

Neben der dachintegrierten Anlage verfügt das Berliner Solarhaus zusätzlich über Verschattungselemente mit integrierter PV vor den Fenstertüren im Süden und Westen des Hauses. Sonnenschutz und photovoltaische Energiegewinnung ergänzen sich gut in Zeiten hoher Einstrahlung. Daher wurde ein eigener, an den Entwurf angepasster Sonnenschutz in Zusammenarbeit mit der Firma Colt entwickelt, der als Faltladensystem ausgeführt ist. Die motorbetriebenen Lamellen können einstrahlungs- sowie nutzergesteuert auf- und zugefahren werden. Aus ästhetischen Gründen sowie aufgrund des geringen Gewichts kommen maßgeschneiderte Kunststoffsolarmodule der Sunovation GmbH zum Einsatz. 20 monokristalline Q-Cells-Zellen pro Modul sind zwischen zwei Plexiglas®-Scheiben eingelassen und liefern ca. 70 Wp (Gesamtanlage: 1,1 kWp).

Alles in allem können während eines Jahres in Madrid mehr als 8.000 kWh Strom erzeugt werden, mehr als doppelt so viel, wie von einem 2-Personen Haushalt benötigt würde. In Berlin wird mit einem Jahresertrag von 5.300 kWh ge-

rechnet. Um den Autarkiegrad des Hauses zu erhöhen, wird das Berliner Team recyclebare Blei-Gel Batterien mit 770 Ah bei 48 V installieren, die von den Batteriewerken BAE Berlin gesponsert werden. Durch den Einsatz solcher Batteriesysteme wird das Stromnetz entlastet. Hinsichtlich der verbesserten Eigenverbrauchsregelung im EEG soll deren Wirtschaftlichkeit untersucht werden.

FH Rosenheim

Das Team der Hochschule Rosenheim verwendet eine der Leistungsstärksten Anlangen von SunPower. Von außen unsichtbar sind diese mit einem geringen Neigungswinkel von etwa 3° auf dem Dach installiert. Dabei wurde der leicht verminderte Ertrag aus gestalterischen Aspekten bewusst in Kauf genommen. Trotz der fast waagrechten Ausrichtung, ist diese Neigung ausreichend, um einerseits den Ablauf des Regenwassers zu gewährleisten und andererseits die Funktion der Strahlungskühlung zu nutzen. Durch eine aufgeständerte Installationsweise und den Abstand zur Dachfläche, findet zudem eine natürliche Hinterlüftung statt.

Das ausgewählte Modul der Firma Sunpower besteht aus 96 monokristallinen Zellen von denen 40 Module zum Einsatz kommen. Nach Herstellerangaben werden 193 Wattpeak/m² erreicht. Dies entspricht der doppelten Leistung von Dünnschichtsolarzellen, bei denen übliche Werte von 90 Wp/m² erzielt werden. Durch die Auswahl der Serie 315 ergeben sich auch bei Teilauslastung, durch geringe Sonneneinstrahlung sehr

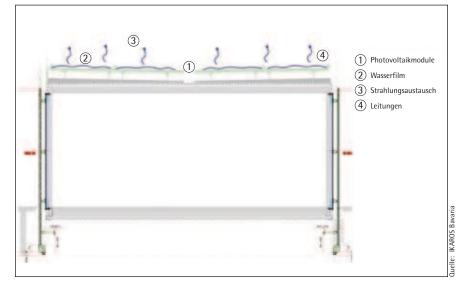


Bild 3: Schnitt durch das Rosenheimer Solarhaus



Bild 4: Seitenansicht des Rosenheimer Solarhaus

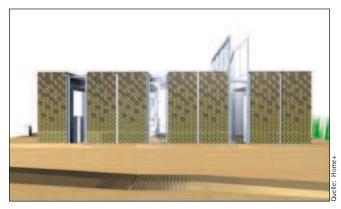


Bild 5: Seitenansicht des Home+ mit gold- und bronzefarbenen PV-Zellen an der Fassade

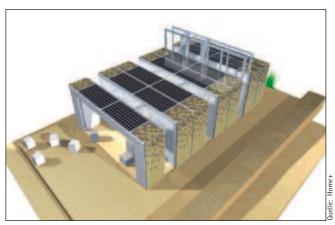


Bild 6: Dauchaufsicht des Home+ der HFT Stuttgart

gute Energiegewinne. Besonders wichtig ist dies für das Einsatzgebiet Deutschland. Der Systemnutzungsgrad liegt bei 14,9% und nach Berechnungen liegt der Jahresertag für den Standort Madrid bei 16500 kWh. Das entspricht etwa dem vierfachen Energieeintrag gegenüber dem Verbrauch. Ein weiteres Augenmerk liegt dabei in der Einsparung an CO₂-Emissionen mit jährlich 14.600 kg/a. Die Anlage ist insgesamt auf einen Netzgekoppelten Betrieb ausgerichtet. In Madrid wird ein hoher Energiebedarf für die Klimatisierung benötigt. Mithilfe von Strahlungskühlung und Verschattung der Südfassade werden die Verbräuche so weit wie möglich minimiert.

HFT Stuttgart

Die Energiehülle des Stuttgarter Hauses home+ liefert nicht nur Strom, sondern verleiht dem Gebäude auch ein charakteristisches Erscheinungsbild. Großformatige PV-Module bilden eine zweite Haut, die sich mit einem kleinen Abstand um die vier Raummodule legt. In diesen rahmenlosen Glas-Glas-Modulen sind kristalline PV-Zellen mit einer Größe von 156 x 156 mm und einem Abstand von etwa 5-6 mm verlegt. Durch den Abstand der Zellen und die dahinter durchscheinende helle Oberfläche der Raummodule, sowie durch eine minimierte Unterkonstruktion erhält die Energiehülle einen leichten und filigranen Charakter.

Gesteigert wird dies noch durch die Verwendung von gold- und bronzefarbenen polykristallinen PV-Zellen an den Fassaden und in Teilbereichen des Daches. So werden im unteren Bereich der Fassaden ausschließlich goldfarbene Zellen verwendet, die sich dann in Richtung des oberen Fassadenbereiches mehr und mehr mit bronzefarbenen Zellen mischen. Diese Aufpixelung zieht sich über die Dachkante hinweg fort und bildet einen weichen Übergang zu den im mittleren Dachbereich liegenden PV-Modulen mit schwarzen monokristallinen Zellen.

Der Zellwirkungsgrad der gold- und bronzefarbenen polykristallinen Zellen liegt jeweils bei etwa 13%. Dies ermöglicht es auch sie ohne Verluste in ein und demselben Modul zu verbauen. Der Zellwirkungsgrad der schwarzen monokristallinen Zellen auf dem Dach liegt bei etwa 17%. Die installierte Gesamtleistung liegt bei etwa 12 kWp (6 kWp an den Fassaden Ost und West, 6 kWp auf dem Dach), der zu erwartende jährliche Stromertrag für den Standort Madrid bei 11.500 kWh. Die Zellen, sowie die Wechselrichter werden von der Firma Sunways zur Verfügung gestellt.

Die Glas-Glas-Module werden von der Firma Ertex Solar hergestellt und gesponsert. Mit einer Breite von etwa 1,20 m und einer Höhe von etwa 3,0 m haben die PV-Module an den Fassaden dabei die größten Abmessungen. Neben der Größe stellt bei diesen Modulen auch die Verlegung der verschiedenfarbigen Zellen nach einem vorgegebenen Muster eine technische Herausforderung dar. Für die äußeren Glasscheiben der PV-Module an den Fassaden werden außerdem entspiegelte Gläser von der Firma Centrosolar beigestellt, die verhindern, dass das Schillern der polykristallinen Zellen durch Spiegelungen auf den Gläsern überdeckt wird.

Die PV-Module mit monokristallienen Zellen auf dem Dach werden auf ihrer Rückseite mit Leitblechen und Rohrschlangen versehen. Durch diese wird nachts Wasser geleitet, das sich über die Abstrahlung der Moduloberflächen gegen den Nachthimmel abkühlt und für die Kühlung des Gebäudes verwendet werden kann. Diese Doppelnutzung der PV-Flächen ist gerade für heiße Regionen mit hohem solaren Energieeintrag, also auch gleichzeitig hohem Kühlbedarf, ein vielversprechendes Konzept, dass am Haus der HFT Stuttgart getestet werden soll.

Bergische Universität Wuppertal

Das Team der Bergischen Universität Wuppertal erreicht mit seinem Konzept des "Europäischen Hauses" als Plusenergiehaus über die Deckung des eigenen Strombedarfs hinaus standortabhängig einen mehr oder weniger deutlichen Überschuss an Solarstrom, der ins öffentliche Netz eingespeist wird. Da es sich bedingt durch das Wettbewerbsreglement um ein "Nur-Strom-Haus" handelt, kann der Nachweis einer Jahresplusenergiebilanz mit einfachen Mitteln erfolgen.

Eine besondere Herausforderung zur Realisierung der ausgeglichenen Strombilanz während der Wettbewerbsphase stellen spezielle Anforderungen dar, wie beispielsweise erhöhte Laufzeiten der Haushaltsgeräte, die hohe technische Ausstattung auf kleinstem Raum sowie Innenraumtemperaturen von maximal



Bild 7: Solarwand mit verschiedenfarbigen Solarzellen für eine individuelle Fassandengestaltung

Tabelle 1: Installierte Leistung und Jahresertag in Madrid der deutschen Teilnehmer am SDE2010					
	Berlin	Rosenheim	Stuttgart	Wuppertal	
Installierte Leistung [kWp]	5,7	12,6	12,0	10,1	
Batterien	770 Ah bei 48 V	Keine Batterien	Keine Batterien	150 Ah bei 48 V	
Jahresertag in Madrid [kWh]	8.000	16.500	11.500	12.500	

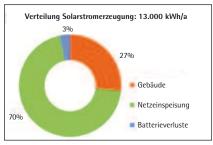


Bild 8: Verteilung des am Gebäude erzeugten Solarstroms für den Standort Madrid

25° im spanischen Sommer. Umgesetzt wird dies einerseits durch eine Minimierung des Haushaltsstrombedarfs durch den Einsatz von best-practice Geräten und innovativer LED-Technik, andererseits durch energetische Optimierungen und die Integration von solaraktiven Flächen innerhalb der Gebäudehülle.

Die eigene Stromerzeugung erfolgt hauptsächlich über 27 Standardgroßmodule. Diese werden auf einer Fläche von 40 m² in das Flachdach mit 3° bzw. 6° Neigung integriert und sorgen für knapp 70% des jährlichen Stromertrags in Madrid. Dahingegen stellt die "Solarwand" das auffälligste architektonische Merkmal des Gebäudes dar. Auf einer Fläche

von knapp 30 m² verdeutlichen speziell designte PV-Module als Vorhangfassade das Leitbild des Gebäudes. Durch die Kombination unterschiedlicher Zellentypen – blaue polykristalline und schwarze monokristalline Zellen – mit transparentem Rückseitenlaminat kann ein individuelles Bild erzeugt werden.

Insgesamt wird mit beiden Flächen eine Leistung von über 10 kWp bereitgestellt. Sowohl die Module der Aufdachanlage wie auch die Entwicklung und Sonderanfertigung der Fassadenmodule stammen von der SolarWorld AG.

Die Netzintegration der PV-Anlagen erfolgt über Wechselrichter des Herstellers SMA. Als Besonderheit besitzt das Gebäude einen kleinen Batteriesatz für Tag/Nachtpufferung, der über einen separaten Wechselrichter eingebunden wird. Das Energiemanagement ist so ausgelegt, dass ein möglichst hoher Anteil des Stromverbrauchs aus eigenem Solarstrom gedeckt wird. Während dies ohne Batteriepufferung rechnerisch in der Jahressumme im Klima Madrids nur zur Hälfte gelingt, steigert der Batteriesatz diesen Anteil auf über 95%. Vorteilhaft ist insbesondere die nächtliche Stromversorgung aus der Batterie. Während der 10 tägigen Wettbewerbsphase wird das Gebäude unter optimalen Bedingungen ganz ohne Netzstrombezug auskommen und einen deutlichen Überschuss einspeisen.

Dieser Ansatz soll nicht nur in Gebieten mit hoher Solarstrahlung funktionieren, sondern auch mit geringfügigen Anpassungen am finalen Standort Wuppertal. Hier kann der Stromverbrauch bis zu über 85% innerhalb eines Jahres durch Solarstrom gedeckt werden.

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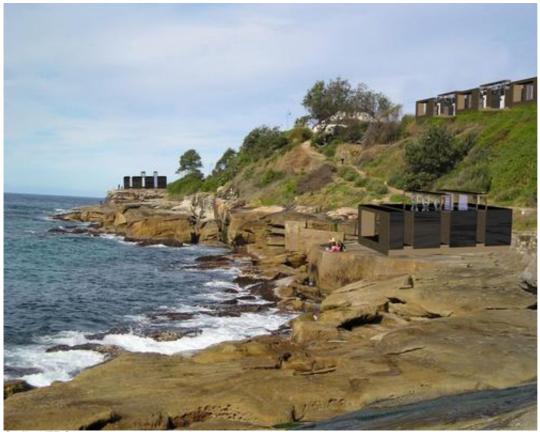




PROJEKTE

Plusenergie aus Stuttgart [12.01.2010]

Im Juni 2010 wird in Madrid beim ersten Solar Decathlon Europas das beste ausschließlich mit solarer Energie betriebene Wohnhaus gekürt. Schon seit Oktober 2008 arbeitet das Team der Hochschule für Technik (HTF) Stuttgart an seinen Wettbewerbsbeitrag.

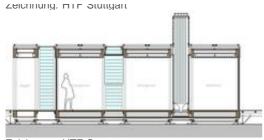


Grafik: HTF Stuttgart

Die Stuttgarter haben ihren Schwerpunkt auf der Integration von solaren Energietechnologien gelegt. Momentan arbeiten mehr als 25 Studenten unter Projektleitung von Professor Dr. Jan Cremers in interdisziplinären Forschungsgruppen an dem Solarhaus. Unter Begleitung des Zentrums für angewandte Forschung – Nachhaltige Energietechnik (zafh.net) entwickeln sie innovative Energiekonzepte, Komponenten für solare Heizung und Kühlung sowie eine betriebsbegleitende Simulation der energietechnischen Anlagen und Gebäude. Die ersten Prototypen einzelner Komponenten liegen schon vor. Auch tüftelt das Team bereits an einer Strategie für den Wettbewerbsablauf des Solar Decathlons in Madrid. Da die Bauphase näher rückt, steht als nächstes an, die einzelnen Bauteile zu fertigen und der Bauplatz an der HFT Stuttgart vorzubereiten.

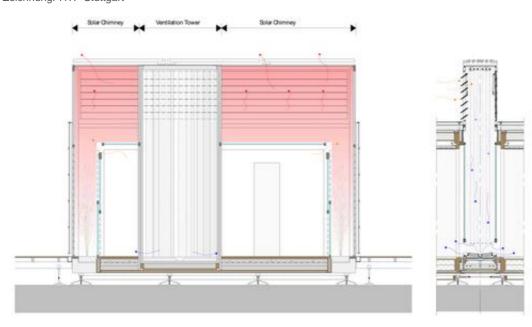


Das Gebäude, um das sich an der HFT Stuttgart momentan alles dreht, besteht aus einem quaderförmigen Baukörper aus modularen Scheiben, die mit "Zwischenfugen" aufgereiht werden. Die Fugen dienen – neben Belichtung und Belüftung – der Vorwärmung im Winter sowie der passiven Kühlung im Sommer. Im Verhältnis zum umschlossenen Raum weist das kompakte Volumen eine geringe Hüllfläche auf, zudem ist es gut gedämmt, so dass die Transmissionswärmeverluste – und damit auch der Energiebedarf – minimal sind. Eines der Kernelemente des für einen Ein- bis Zweipersonenhaushalt ausgelegten Gebäudes ist der "Energieturm", eine Anleihe an die Windtürme im arabischen Raum. In einer Fuge zwischen geschlossenen Modulen liegend, unterteilt er den Innenraum in zwei Bereiche: den großen Wohnbereich, der



sich über zwei Module erstreckt und den privaten Schlafbereich, der im nördlichen Gebäudeteil angeordnet ist. In einem Zusammenspiel aus Wind und Verdunstungskühlung ermöglicht der "Energieturm" ein angenehmes Innenraumklima, auch in heißen und trockenen Regionen.

Zeichnung: HTF Stuttgart



Zeichnung: HTF Stuttgart

Im Innenraum baut das Team der HFT auf eine Kombination aus traditionellen Grundprinzipien und modernen Materialien und Technologien: Phasenwechselmaterialien (PCM) erhöhen die thermisch wirksame Masse der Module aus Holz. Zudem sorgt ein Lüftungsgerät mit Wärmerückgewinnung für eine Minimierung der Lüftungswärmeverluste. Dabei ist es den Studenten aber wichtig, die passiven Möglichkeiten im Entwurf so weit wie möglich auszuschöpfen und die vorgesehenen aktiven Systeme lediglich bei Temperaturspitzen im Winter und im Sommer einzusetzen.



Westfassaden mit Solarmodulen umhüllt. An den Fassaden sind dabei Photovoltaikpaneele vorgesehen, die eine gewisse Transparenz zulassen und somit den modularen und mehrschichtigen Charakter des Gebäudes unterstreichen. Von den Studenten durchgeführte Simulationen haben gezeigt, dass das Stuttgarter Solarhaus ein Plusenergiehaus ist: Die Erträge der Photovoltaik-Flächen übersteigen den Strombedarf des Wohnhauses Die überschüssige Energie kann in das öffentliche Stromnetz eingespeist werden.

Um den anfallenden Energiebedarf zu decken, sind das Dach sowie die Ost- und

Grafik: HTF Stuttgart

Der modulare Aufbau des Gebäudes ist nicht nur für den Transport nach Madrid praktisch, auch ermöglicht er die Entwicklung eines Bausystems: Durch eine Addition von geschlossenen Modulen und transparenten "Fugen" können die Wohngebäude den Bedürfnissen von Singles, Paare, Familien und Wohngemeinschaften angepasst werden. Verschiedene Varianten der Reihung ermöglichen Bauformen, die von freistehende Einzelhäusern und Doppelhaushälften bis hin zu Wohnappartements reichen. Darüber hinaus lässt sich das Gebäude an die klimatischen Gegebenheiten des jeweiligen Standortes funktional anpassen.



Das Kernteam, das den Wettbewerbsbeitrag der HFT Stuttgart bis zum Sommer 2010 kontinuierlich bearbeitet, stammt aus dem Master-Studiengang Architektur. Zahlreiche Professoren der Fakultät Architektur und Gestaltung unterstützen und betreuen es. Weitere beteiligte Studiengänge sind Sustainable Energy Competence (SENCE), Bauphysik, Innenarchitektur und Konstruktiver Ingenieurbau. Projektleiter Professor Dr. Jan Cremers sieht in dem Wettbewerb "eine hervorragende Gelegenheit, den Studierenden einen wichtigen interdisziplinären, zukunftsrelevanten und praxisnahen Baustein in ihrer Ausbildung anzubieten." Nicht nur steigere die Teilnahme am



Foto: HTF Stuttgart

Wettbewerb das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien, auch werde der Beweis erbracht, dass energieeffizientes Bauen mit einem hohen architektonischen Anspruch einhergehen könne.

Insgesamt nehmen 20 Hochschulen an dem Solar Decathlon Europe 2010 in Madrid teil. Im Juni 2010 werden sie ihre Beiträge in einem "Solar Village" präsentieren. Wertungskriterien der internationalen Jury sind neben Konzept, Energiebilanz und Innovationsgehalt auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit.

Noch drei weitere deutsche Hochschulen haben sich für die Teilnahme am Solar Decathlon Europe 2010 qualifiziert:

- Bergische Universität Wuppertal
- Living Equia -Team Berlin (FHTW Berlin, TFH Berlin, UdK Berlin, FH Potsdam)
- Hochschule Rosenheim

zur Website des Solar Decathlon Europe Teams der HTF Stuttgart

zur Website des Zentrums für angewandte Forschung an Fachhochschulen – Nachhaltige Energietechnik

Link-URL: http://www.detail.de/artikel solar-decathlon-madrid 25136 De.htm

Mit Holz die Zukunft bauen

Energieeffizienz I Vier deutsche Hochschulteams beteiligen sich am internationalen Architektur- und Innovationswettbewerb "Solar Decathlon Europe 2010". Die Studierenden aus Berlin, Rosenheim, Stuttgart und Wuppertal planen und bauen jeweils ein Haus, das seinen gesamten Energiebedarf ausschließlich aus Sonnenengie bezieht und dennoch keinerlei Einbußen in Wohnkomfort und Wohlfühlklima bieten soll. Matthias Schwärzle

er Solar Decathlon Europe ist ein vom spanischen Bauministerium ausgelobter, erstmals in Europa stattfindender solarer Zehnkampf, der seinen Teilnehmern viel abverlangt: Insgesamt 19 Teams aus der ganzen Welt ringen in den Einzeldisziplinen Architektur, Konstruktion und Verarbeitung, Solare Systeme, Elektrische Energiebi-

lanz, Wohnqualität, Haustechnik, Kommunikation und Information sowie Marktfähigkeit, Innovation und Nachhaltigkeit um den Titel. Nach zweijähriger Planungs- und Bauzeit werden alle Teams mit ihren Häusern zum finalen Wettbewerb nach Madrid reisen und sich vom 18. bis 27. Juni 2010 einer breiten Öffentlichkeit präsentieren. Zusätz-

lich werden die Häuser vor Ort unterschiedlichen Tests unterzogen und von einer Fachjury bewertet. Es liegt nahe, dass solche Projekte nicht ohne die Unterstützung starker Partner aus der Industrie möglich wären. Eine Auswahl der Partner wird in den jeweiligen Texten genannt.

living EQUIA - Berlin

Dem Berliner Team war von Planungsbeginn an wichtig, dass sich ihr Haus nach der Sonne ausrichtet und auf diese Weise einen direkten Bezug zu seiner unmittelbaren Umwelt und der Natur nimmt. Daher fiel auch die Wahl auf den heimischen Rohstoff Holz leicht, als Baumaterial nicht nur für den Rohbau, sondern auch für die Fassade.

Christoph Hey, Arlett Ruhtz

Den Gewichts- und Bearbeitungsvorteil, den Holz als Werkstoff bietet, machten sich die Berliner Studenten unter anderem für die modulare Konstruktion zunutze. Denn sowohl die Wand- als auch die Deckenmodule bestehen aus massiven Schichtholzplatten. Für die passgenaue Fertigung entwarfen die angehenden Architekten ein 3D-Modell, aus dem Einzelteilzeichnungen erstellt wurden. So war es möglich, die scheibenförmigen Fichtenholzelemente mittels CNC-Fräse industriell und millimetergenau vorfertigen zu lassen.

Das gesamte Haus wurde in jeweils acht Boden- und Dach- sowie 15 Wandmodule aufgeteilt, die die Studenten bei ihrem Partner, dem Fertighaushersteller Haacke Haus, im Potsdamer Werk selbst montierten. Die 15 Wandmodule bestehen aus dreilagigen Schichtholzplatten, deren mittlere Lage als Funierschichtholz ausgeführt wird, um die Luftdichtigkeit zu gewährleisten. Auf den Modulen befindet sich 240 mm dicker, aus natürlichen Rohstoffen hergestellter ökologischer Holzfaserdämmstoff (Homatherm),

der zwischen Steg-Trägern (Finnforest) aufgebracht und anschließend mit Unterdeckplatten abgeschlossen wird. Darauf wird eine Doppelllattung aus Kantholz geschraubt, die die vorgehängte Fassade trägt.

Die acht Deckenmodule wurden dagegen aus fünflagigen Massivholzplatten vorgefertigt und mit einer Volldämmung versehen. Die aufgebrachte, 200 mm dicke, trittfeste ökologische Holzfaserdämmung wird mit 35 mm Unterdeckplatten geschützt, die ebenfalls aus Holzfaser bestehen, und von einer bis in die Massivholzplatte verschraubten Konterlattung genalten. Punkthalter tragen das Ständersystem für die Fassade und die technischen Dachaufbauten. Die wasserführende Schicht befindet sich ebenso wie die Entwässerung und die Fallrohre versteckt hinter der Fassade.

Als Träger der Wandelemente und somit als Lastenverteiler fungieren die aus acht Massivholzrahmen bestehenden und ebenfalls mit Holzfaserdämmung isolierten Bodenmodule. Sie ruhen auf 16 von den Studenten selbst hergestellten Betonpunktfundamenten mit einer Höhe von jeweils 18 cm. Durch die Holzbauweise und die Verwendung von massiven Schichtholzplatten sowie Unterdeckplatten aus Holzfaserstoffen versucht das Berliner Team, die für die Dichtheit nötigen Folien auf ein Minimum zu reduzieren.

Fassade sorgt für Brandschutz

Eine Besonderheit des Berliner Entwurfs ist die vorgehängte Fassade aus 1 × 1 m großen abgeflammten Lärchenholzplatten, die in Zusammenarbeit mit der Hochschule für nachhaltige Entwicklung Eberswalde realisiert wird. Durch die 3 mm tiefe Verkohlung bietet die Fassade einen natürlichen und nachhaltigen Witterungsschutz und verfügt zusätzlich über die nötigen positiven Brandschutzeigenschaften. Die dunkle Hülle prägt das Haus und ergänzt sich darüber hinaus hervorragend mit den in sie eingelassenen Solarthermie-Kollektoren und der Aufdach-Photovoltaik-Anlage. Das sich so ergebende homogene Erscheinungsbild wird durch die

durchgängigen Lichtachsen aufgelockert.

Die Lichtachsen definieren den gesamten Entwurf des Berliner Solarhauses. Sie haben zum einen einen ästhetischen Charakter, der die Kommunikation des Hauses mit seiner unmittelbaren Umwelt beschreibt und sich ebenfalls in der Innenraumaufteilung widerspiegelt. Zum anderen bilden sie den First des um rund 29 Grad geneigten Dachs, um eine optimale Ausrichtung der Photovoltaikanlage zur Sonne gewährleisten zu können. So wird an den Traufen ein schräger Anschnitt erzeugt, wodurch das Haus eine ganz eigene Dynamik erhält.

Die außergewöhnliche Form des Berliner Solarhauses brachte auch hohe Anforderungen an die Statik mit sich. Die größte Herausforderung war dabei die Realisierung der Lichtachsen, die mittels zweier Dreigelenkrahmen, die eine Lichtachse in Nord-Süd-Richtung bilden, gelöst wur-

de. Diese Konstruktion erlaubte das Spannen der Dachmodule zwischen den Giebeln und den Dreigelenkträgern in der Mitte des Hauses. Durch das sich selbst tragende sta-

Als Tragercen Wandelemente und somit als Lastenverteiler fungieren die aus acht Massivhalt rahmen bestehunden und ebenfalls mit Holzfaserdämmung isolierten Bodenmodure.



tische System kann im Innenraum auf fixe Elemente verzichtet werden. Dies ermöglichte es, einen völlig freien Innenraum zu erschaffen, der durch eine flexible Wohnraumgestaltung eine zeitgenössische Raumsituation bietet und den Bewohnern eine individuelle Darstellung ihres eigenen Wohnkonzeptes erlaubt.

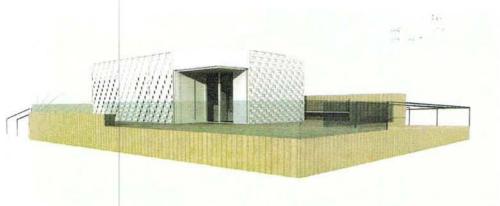
IKAROS Bavaria - Rosenheim

Das Plus Energie Haus der Hochschule Rosenheim ist als modularer Holzskelettbau für zwei Personen konzipiert und wird nach der BayBO 2008 der GK1 zugeordnet. Insgesamt besteht das Gebäude aus vier Raummodulen $(6,50 \text{ m} \times 3,00 \text{ m} \times 3,20 \text{ m})$. Gitte Hennig, Andreas Rudolph, Marcus Wehner

Rund 40 Rosenheimer Studierende aller Fakultäten planen, konstruieren und bauen ihr Plus Energie Haus selbst. Dazu gehört neben den statischen Berechnungen, den Konstruktionszeichnungen, den notwendigen bauphysikalischen Nachweisen auch die Gebäudetechnikplanung. Das Besondere am Rosenheimer Plus Energie Haus



ler: Team Ikaros Bavaria



Seine abschließende Verwendung findet das Plus Energie Haus "IKAROS Bavaria" als Appartementhaus in der "Nullenergiestadt" in Bad Aibling.

ist, dass auch die Umsetzung der Planung, beginnend beim Rohbau über den Innenausbau bis hin zur Inbetriebnahme, durch die Studierenden realisiert wird. Die Module wurden im Februar 2010 in den regionalen Holzbaufirmen Grossmann Bau GmbH & Co. KG und Huber & Sohn GmbH & Co. KG gefertigt.

Das Haupttragwerk besteht aus Rahmentragern in Querrichtung des Gebaudes, die an den Eckanschlüssen biegesteif mit jeweils zwei Schlitzblechen verklebt sind. Zur Übertragung der Eckmomente vom Deckenbalken in den Pfosten werden die Kräfte über sich ausbildende Kunststoffdübel in der zweischnittigen Verbindung übertragen. Dabei handelt es sich um eine neue, innovative "Holz-Stahl-Klebeverbindung" (HSK), die mit einem 2K-Polyurethan-Klebstoff hergestellt wird. Diese Technik der Holzverbindung wird gerade durch den Erfinder Prof. Dr. Leander Bathon bauaufsichtlich eingeführt und steht dem Rosenheimer Team exklusiv zur Verfügung. Nach erfolgter Zulassung kann dieses System nach DIN 1052 nachgewiesen werden. Mit einer Funierschichtholzplatte (Finnforest Merk), die auf dem BSH-GL28h-Haupttragwerk schraubpressverleimt ist, konnten sehr schlanke, tragsichere und platzsparende Decken- und Bodenkonstruktionen ausgeführt werden: Die biegesteife Eckverbindung dient zur optimierten Holzauslastung und reduziert in Verbindung mit dem halben Plattenbalken die Feldmomente des Hauptträgers. Während eine klassische Stabdübelverbindung, durch die notwendigen Mindestabstände, den Holzquerschnitt definiert, ist bei der HSK-Verbindung die reine Belastungssituation maßgebend. Jedes einzelne der vier

Module besteht aus zwei Rahmenträgern, die den seitlichen Abschluss des Elements definieren. Zwischen diesen Rahmen werden Querhölzer eingebaut, die das Dach und den Boden bilden. Somit entsteht ein Raumtragwerk, das die Module ausbildet. Durch die Verwendung spezieller Verbinder (Knapp Walco V80) konnen die Horizontalund Vertikalkräfte an den Modulstoßen übertragen werden. Erst im Verbung der Module wird die Standsicherneit des Hauses gewährleistet. Die Windaussteifung in Langsund Querrichtung erfolgt über eine minimale Anzahl von Wandscheiben. Aufgrund des sehr geringen Platzbedarfs von 75 m² Bruttogeschossfläche ist es mit einem platzspa-

2

Studentenprojekte, Prototypen, experimentelle Baustoffe - was bringt das dem Zimmerer für seinen beruflichen Alltag? Wir haben bei den betreuenden Holzbauern der hier vorgestellten Studentenprojekte nachgefragt: Die Antworten lesen Sie in unserer Rubrik "Markt" auf Seite 54.

renden Vakuum-Isolation-Panel (VIP/QASA) (Variotec) wärmebrückenfrei ummantelt. Die einzelnen Wand-, Dach- und Bodenaufbauten unterscheiden sich geringfügig voneinander und werden nachfolgend näher erläutert.

Mehrmaliger Auf- und Aufbau der Konstruktion

Bei der Gebäudewand handelt es sich um eine 156 mm dicke Holzständerkonstruktion. Eine 80 mm dicke Flachsdämmung in den Zwischenfaumen, kombiniert mit einer vorgesetzten 46 mm dicken Vakuum-Dämmung (VIP) erreicht einen U-Wert von < 0.1 W/(m²K). Der hier gezeigte Wandaufbau ist auf das Klima in Madrid optimiert. das heißt, die Dampfbremse liegt auf der Außenseite und wird von der VIP-Dämmung gebliaet. Zur Ausstelfung dient eine 15-mm-DHF-Platte (Egger Formline). Um die selbst entwickeite Zacken-Fassade anschließen zu konnen, werden Adapterprofile auf die PU-Randstreifen der VIP geschraubt. Die Außenseite der VIP ist mit einer HPL-exterior-Platte (High Pressure Laminat) beschichtet, das durch Abkleben der Stöße eine wasserführende und winddichte Ebene zugleich darstellt. Innenseitig ist eine 15-mm-Gipsfaserplatte angebracht.

Da eine mit dem Rahmenwerk starr verbundene Furnierschichtholzplatte statisch mit angesetzt werden kann, ist es möglich, den Dachaufbau sehr gering zu halten. Auch hier sorgt die außen angebrachte VIP-Dammung für einen sehr guten U-Wert von < 0,1 W/(m2K) und bildet gleichzeitig die Wasserdampfdiffusionwiderstandsebene. Durch eine bereits werksseitig aufgebrachte PUR-Schicht (Polyurethan) auf der VIP-Dämmung kann ohne Probleme eine FPO-Bahn (flexible Polyolefine) als wasserführende Schicht aufgeschweißt werden. Als Dachdeckung wird ein Solardach realisiert. Innenseitig sorgt eine Kühldecke (Incotec) auch im Sommer für ein angenehmes Klima. Sie ist auf eine 10-mm-Gipsfaserplatte (GKF-Platte) mit integrierten Kohlenstofffasern (Saint-Gobain Rigips) aufgesetzt. Diese GKF-Platte bildet auch den Untergrund für die individuelle Farboestaltung.

Seine abschließende Verwendung findet das Plus Energie Haus als Appartementhaus in der "Nullenergiestadt" in Bad Aibling. Bis es allerdings so weit ist, wird das Gebäude insgesamt sechsmal auf- und fünfmal abgebaut. Das heißt, es bestehen höchste Anforderungen an die Fertigungsgenauigkeit und Standfestigkeit aller Materialien.

www.BAUENMITHOLZ.de

Zu den vorgestellten Projekten gibt es im Internet auf verschiedenen Seiten zahlreiches weiteres Material – zum Beispiel Videos. Nutzen Sie die entsprechenden Links, die wir für Sie auf www.bauenmitholz.de, Rubrik "Holzbauten" > Wohnbau, zusammengestellt haben.

home+-Stuttgart

Das modular aufgebaute Gebäude home⁺ der HFT Stuttgart mit einer überbauten Fläche von 74 m² muss entsprechend den Wettbewerbsvorgaben den besonderen Anforderungen zukunftsweisender Gebäude mit energieoptimierter Gebäudehülle und deren technischer Umsetzung genügen. Heiner Hartmann und Michael Bauz

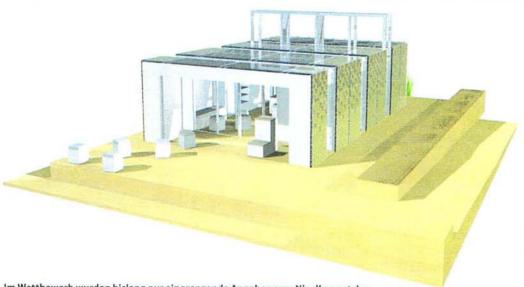
Das Gebäude besteht zunächst aus drei über Fugen verbundenen Modulen mit gleichen äußeren Abmessungen sowie einem vierten, etwas schmaleren vorgesetzten Terrassen-Modul, das auch der Verschattung des dahinter liegenden Wohnbereichs dient. Zusammen mit den drei dazwischen angeordneten Fugen von je etwa 1 m Breite entsteht ein Gebäude mit äußeren Abmessungen von etwa 10.9 x 6.8 m im Grundriss und einer Gebäudehöhe von etwa 3,5 m.

Drei Holzmodule mit Außenabmessungen von $6.51 \times 2.20 \times 2.88$ m werden in Querrichtung des Gebäudes durch je zwei Rahmen aus Furnierschichtholz (FSH, Stärke 75 mm) ausgeführt. Die oberen und unteren Rahmenriegel müssen dabei die Lasten aus dem Dach und aus dem Boden zu den Auflagern hin abtragen - die beiden seitlichen Rahmenstiele steifen in Ouerrichtung aus. Die biegesteife Eckverbindung wird über eingeleimte Gewindestangen mit Vorspannung erreicht. Die jeweils außen verbleibenden senkrechten Rahmen-

stiele weisen dabei noch eine statische Höhe von rund 65 cm auf. Die beiden Modulrückwände werden aus Furnierschichtholzplatten mit gesperrter Faserrichtung hergestellt.

Die Vorspannung an den biegesteifen Ecken umgeht eine aufwendige Keilzinkenverbindung und ermöglicht eine flächige

Das Gebiluja kon handrat sun drei über Fuge Begebünderen di filosomit gleicher dußeren Abmersungen some Timber justens twas schmaleren vorges staten Terrosobil delle der Verschattung des dahlnigt liegenden Wohnbereichs dient.



Im Wettbewerb wurden bislang nur eingrenzende Angaben zum Nivellement der zugeordneten Grundstücksflächen angegeben. Demnach müssen für das Grundstück von des Berliner Hauses "home" maximale Höhenentwicklungen bis 45 cm angenommen werden.

Eckausbildung. Der im unteren und oberen Bereich auf eine Länge von 50 cm in die vertikalen Elemente eingeleimte Gewindestab M 16 aus Edelstahl wird mit den aus Edelstahl bestehenden Fuß- und Kopfplatten (200 × 75 × 20 mm) verbunden und vorgespannt. Durch die Vorspannung wird sowohl die Einspannung der Riegel in die

Stiele erreicht als auch eine Überdrückung der ohne Vorspannung aufklaffenden Fuge zwischen Rahmenriegel und Rahmenstiel. Durch die Vorspannung wird zudem eine günstigere Spannungsverteilung in der Fuge zwischen vertikalem und horizontalem Rahmenteil erreicht. Weiterhin dienen die vier Gewindestäbe an den Ecken des

Bilder: Team home

Moduls oben als Aufhängepunkte beim Transport und gleichzeitig unten als Auflagerpunkte für die Lastabtragung zum Fundament bzw. den Stahlfüßen. Die einzelnen Rahmenteile werden an der Innenkante der Ecke in der Fuge zusätzlich mit Hartholzdübeln 20 × 200 mm lagegesichert.

Die beiden Rahmenteile werden im Bodenbereich mit Doppelstegträgern h = 240 mm und im Dachbereich mit Querträgern aus Konstruktionsvollholz KVH 160 × 100 mm verbunden. Zur zusätzlichen Queraussteifung werden im Boden- sowie Dachbereich noch OSB-Platten mit den Querträgern verschraubt und bilden damit zusammen mit den Furnierschichtholzplatten der Querwände die tragende Gebäudehülle.

Verankerungen an beliebiger Stelle möglich

Die Grundkonstruktion von home* aus Furnierschichtholz bietet einen flächigen Verankerungsgrund für alle weiteren Installa-

tionen. Dies ist besonders im Hinblick auf die Fassadengestaltung und die Verankerung der PV-Module besonders vorteilhaft, weil die Modulteilung der PV-Elemente sowie die Bekleidung der Grundkonstruktion mit Vakuum-Panelen eine völlig andere Teilung und Achsenorientierung aufweisen. Gegenüber einen Tafelbaus oder einer Rippenkonstruktion mit Beplankung können Verankerungen für Fassade und PV-Unterkonstruktion an beliebiger Stelle in der Grundkonstruktion verankert werden. ohne dass auf die Struktur der Grundkonstruktion weiter Rücksicht genommen werden muss. Somit konnten auch noch in der Ausbauphase Veränderungen an den Verankerungspunkten und den nachfolgenden Gewerken vorgenommen werden.

Im Wettbewerb wurden bislang nur eingrenzende Angaben zum Nivellement der zugeordneten Grundstücksflächen angegeben, Demnach müssen für das Grundstück von home maximale Höhenentwicklungen bis 45 cm angenommen werden. Um die Vielzahl der Auflagerpunkte zu reduzieren, werden die Module deshalb nur an den vier Eckpunkten und im Bodenbereich (Querriegel) zusätzlich über je 2 × 2 zusätzliche Auflagerpunkte abgestützt. Die Auflagerung der vier Module mit Fuge lässt sich somit auf $4 \times 8 = 32$ Punkte reduzieren. Jedes diese Auflagerpunkte besteht aus einem höhenjustierbaren Gewindestab, der über einen Hartholzwürfel mit dem Gebäude thermisch getrennt verbunden wird. Die Auflagerpunkte werden durch Flachstähle so miteinander verbunden, dass die Winkeltreue und Abstände der Fugen und Module untereinander eingehalten werden und die Auflagerung der Module innerhalb der möglichen Toleranzen erfolgt. Die sich rund um das Modul anschließende Terrassenkonstruktion aus ebenfalls höhenjustierbaren Trägern, Querträgern und vorgefertigten Belägen ist über weitere Laschen mit dem Modul verbunden, womit eine Aussteifung der Terrasse erreicht wird.

Team Wuppertal

Die Idee des Teams Wuppertal basiert auf der Entwicklung eines nachhaltigen "Europäischen Hauses". Dies beinhaltet die Konzeption eines Hauses, das nicht allein auf den Wettbewerb und die Wettkampfbedingungen in Madrid ausgerichtet ist, sondern auch in Klimazonen von Stockholm bis Madrid in gleicher Weise mit kleineren Anpassungen bestehen kann. Anett-Maud Joppien

Die Entwicklung eines hoch transparenten, fließenden, die Grenzen zwischen Innenund Außenfaum aufhebenden Raumgefühls verbindet die Bedingungen des nachhaltigen Bauens mit der Idee des Europäischen Hauses als der Wiege der Moderne. Mit diesem Gedanken konnte der sehr begrenzt zur Verfügung stehende Raum optisch erweitert werden. Weitere Voraussetzung, das Leben auf einer knapp bemessenen Fläche so komfortabel wie möglich zu gestalten, war, ein flexibles und die verschiedenen Funktionen überlappendes Raumkonzept zu entwickeln. Zwei "Solarwände" greifen weit aus dem Baukörper aus, unterstreichen, den Raumfluss zwischen Innen und Außen und symbolisieren zugleich die Verbindung von Architektur

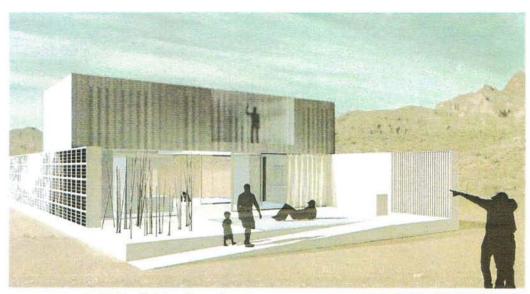
und moderner Energietechnik. Das Haus misst 13,00 x 22,30 m bei einer Höhe von 5,45 m. Aus Grunden aus der Transportfähigkeit und der lokalen Situation des Wettbewerbsgrundstücks in Madrid wird das Gebäude auf einem 50 cm hohen Sockelelement errichtet, das zwei großzugige Terrassen einschließt. Zwischen den Endzonen der beiden Solarwande, die die Terrassen jeweils auf einer Seite rahmen, spannt sich der Wohnraum von 54 m. Der obere Teil des Hauses besteht aus einer Rahmenkonstruktion die, getragen von den beiden Solarwänden, den Innenraum 12.00 m frei überspannt. Eingebettet in diesen oberen Raumbereich ist ein geschützter Dachpatio. Der Innenraum öffnet sich an beiden Längsseiten über raumhohe Glas-Schiebeelemente zu den Terrassen. Vor den Glasschiebeelementen befindliche Vorhänge gewähren, wenn gewünscht, eine intime Atmosphäre und sind zugleich hoch effizienter Sonnenschutz. Der Innenraum wird durch ein multifunktionales Raumelement, die Smartbox, bestimmt, die Bad, Schlafen und Arbeiten in einem Kubus integriert. Der komprimierten und mit beweglichen Oberschränken ausgestatteten Küchenwerkstatt wird eine bewegliche Theke mit integriertem Esstisch und Bestuhlung vorgelagert.

Das gesamte Gebäude einschließlich aller Außenterrassen wurde so konzipiert, dass es mit wenigen, vorfabrizierten Großeiementen gefügt werden kann. Die Elemente werden einerseits aus den mög-

lichen Transportmaßen, die auf Plan-Sattelauflegern transportiert werden können, und andererseits durch die Gewichtsbegrenzung für den Montagevorgang bestimmt. In Abwägung verschiedener Konstruktionsweisen wie Stahl und "Dickholz"- Systeme wurde eine Kombination aus Holz-Fachwerkkonstruktion und Paneel- Elementen gewählt. Alle Bauteile bestehen aus einem Verbund aus tragenden Profilhölzern, isolierten Holzprofilen, integrierter Wärmedämmung (teilweise Vakuum) und OSB- Schalen, die zugleich auch als Flächenaussteifung wirken.

Das statische System folgt konsequent der Idee des frei fließenden Raums. Alle statisch wirksamen Holzbauelemente sind so konstruiert, dass sie zugleich die Außenhülle des Gebäudes bilden. Die beiden Solarwände sind ebenso Teile dieses statischen Systems. Die stützenfreie Überspannung des gesamten Raums über eine Länge von 12 m zu den beiden Terrassen wird durch hohe, mit nur 9 cm Stärke äußerst schlanke Schichtträger ermöglicht. Dieses System trägt das gesamte Dach einschließlich des kleinen Dachpatios. Die Konstruktion wird aus FSC-(Forest Stewardship Council)-zertifizierten Hölzern gefertigt.

Die Lasten aus der Dachkonstruktion und dem Dachpatio werden durch die aus Kerto-Board (Finnforest) gefertigten Träger In die vertikalen Tragelemente der Solarwände geführt. Diese statisch wirksamen Träger der Solarwände sind ebenfalls im Finnforest-System (Schichtholz-OSB-Verbundträger) hergestellt. Die Fügung der Bauelemente erfolgt zur Aussteifung des Systems über Stahlplatten. Von den Stützelementen der Wände werden die Lasten in die Unterstützungspunkte des Bodensystems geführt. Dieses Flachgründungssystem konstituiert sich aus Holzträgern mit Winden zur Höhenjustierung und ist auf einem Schwerlast-Boden aus Kunststoffmatten gelagert. Das gesamte System gründet sich somit durch sein Eigengewicht und bedarf keiner Verankerung im Erdreich.



Zwei "Solarwände" greifen weit aus dem Baukörper aus, unterstreichen den Raumfluss zwischen Innen und Außen und symbolisieren zugleich die Verbindung von Architektur und moderner Energietechnik.



Alle Bauteile bestehen aus einem Verbund aus tragenden Profilhölzern, isolierten Holzprofilen, integrierter Wärmedämmung (teilweise Vakuum) und OSB-Schalen, die zugleich auch als Flächenaussteifung wirken.

Die Verwendung von Joist- und Wall-Verbundsystemen (Steico) für das Trägerund Wandsystem füht zu einer sehr leichten und thermisch hoch effizienten Konstruktionsweise mit hoher, besonders auch für den Transport gewährleisteter Präzision. Das Holzfaser-Dämmsystem (Steico) und zementgebundene Spanplatten (Egger) gewähren hohe Dämmeigenschaften und Stabilität für die flächenhaften Bauteile. Die ausladenden Terrassen werden zur Vermeidung von Verottungsprozessen in der Fügung einschließlich der gesamten Unterkonstruktion aus Thermowood-Buche (Firstwood), also warmebehandeltem Holz, hergestellt. Die Montage erfolgt, um Verletzungsgefahr vorzubeugen, als verdeckte Konstruktion (Terrassenfix/Firstwood). Auf eine weitere Behandlung, etwa durch Ölen der Oberflächen, wird zugunsten einer möglichst optimalen Patinierung (silbergrau) verzichtet, und die Effizienz des Thermowood-Verfahrens wird hiermit demonstriert.

Der laufende Bauprozess bestätigt die gute Montagefähigkeit und leichte Verarbeitbarkeit bei optimaler maßlicher Präzision der gewählten Konzeption für eine Ausführung durch das hoch motivierte, aber natürlich im Bauhandwerk ungeschulte Team Wuppertal.



Publikationen > Projektinfos > Internationaler Wettbewerb Solares Wohnen

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Abb. 6: Hochschule für Technik und Wirtschaft Berlin © living EQUIA



Abb. 7: Solarhaus der Hochschule © Hochschule Rosenheim



Abb. 8: Hochschule für Technik Stuttgart © HFT Stuttgart



Abb. 9: Bergische Universität © Team Wuppertal

Solar Decathlon Europe 2010

Beim Solar Decathlon Europe in Madrid treten vier deutsche Studententeams an und präsentieren ihren Prototypen für das Wohnen der Zukunft, gefördert durch das BMWi und unterstützt durch viele Sponsoren. Alle Konzepte beruhen auf einem optimalen Wärmeschutz durch eine sehr gut gedämmte Gebäudehülle und konsequentem Sonnenschutz. Neben passiven Elementen zur Innenraumtemperierung wie z. B. PCM, ist in Madrid der Einsatz aktiver Systeme unerlässlich, um im Sommer ein $angenehmes\ Raumklima\ zu\ gewährleisten\ (max.\ Innenraumtemperatur\ 25\ ^{\circ}C).\ Alle\ Konzepte\ verfügen\ über\ eine\ Lüftungsanlage\ mit\ WRG\ und\ reversibler$

Hochschule für Technik und Wirtschaft Berlin:

Moderne Technik wird kombiniert mit traditioneller Bauweise in Holz und Lehm. Heizung, Kühlung, Lüftung erfolgen über eine Lüftungsanlage mit Entfeuchtung. PCM in den Lehmwänden und ein natürliches Nachtlüftungssystem sorgen für ein gutes Raumklima. Aktiv wird die Kühlung durch wasserdurchströmte Rohre in den Lehmbauplatten unterstützt. Zwei Lichtachsen, die sich an den vier Himmelsrichtungen orientieren, öffnen das Gebäude und geben dem Innenraum eine natürliche Beleuchtung. Sie definieren den Grundriss, die Innenraumaufteilung und vor allem die Form und die Struktur der Gebäudehülle. Satteldach und Fassade sind mit gebäudeintegrierten PVModulen (Leistung: 5,7 kWp) und Solarkollektoren zur Warmwasserbereitung ausgestattet. www.living-equia.com

Solarhaus der Hochschule Rosenheim:

Ziel ist, ein nachhaltiges Gebäude zu errichten. Das Gebäudekonzept beruht auf einer flexiblen Grundrissgestaltung, bestehend aus vier Modulen, die eine hohe Vorfertigung ermöglichen. Ein außenliegender, aus dem Boden nach oben fahrbarer Sicht- und Sonnenschutz reduziert die solaren Lasten und sorgt gleichzeitig für ausreichend Tageslicht, Heizen, Kühlen und Lüften erfolgen mit einer Lüftungsanlage sowie über eine Heiz- bzw. Kühldecke, Warmwasser wird in einem Wärmetauscher mit Hilfe der Abwärme der Wärmepumpe bereitet. Ein luftdurchströmter PCM-Puffer nimmt tagsüber die Wärme auf und gibt diese nachts wieder ab. Die Stromversorgung leisten monokristalline PV-Zellen im Dach (Leistung: 12 kWp). www.solar-decathlon.fh-rosenheim.de

Hochschule für Technik Stuttgart:

Ausgangspunkt des Entwurfes ist ein kompaktes Gebäude, das aus mehreren Modulen aufgebaut ist, die mit etwas Abstand zueinander angeordnet sind. Die entstehenden Fugen dienen der Belichtung und der Belüftung. Eine Besonderheit ist der "Energieturm", der nach Vorbild der Windtürme im arabischen Raum das Prinzip der Verdunstungskühlung nutzt. Die Haustechnik sorgt im Zusammenspiel mit PCM in der Decke für ein angenehmes Raumklima. Aktiv wird die Kühlung durch wasserdurchströmte Rohre in der Decke unterstützt. Dach und Fassaden sind mit mono- und polykristallinen PV-Zellen (Leistung: 12 kWp) bestückt und gewährleisten eine ausreichende Stromversorgung, Farbige PV-Module an der Fassade prägen das äußere Erscheinungsbild, www.sdeurope.de

Bergische Universität Wuppertal:

Das Gebäude erreicht nicht nur in Madrid, sondern auch an weiteren europäischen Standorten eine ausgeglichene Energiebilanz, einschließlich seiner Herstellung. Die Grundstruktur des Gebäudes entwickelt sich aus einem Raum mit zwei Wandschotten, den Solarwänden. Die Gebäudehülle in Passivhausbauweise sorgt für einen niedrigen Heiz-und Kühlenergiebedarf. Heizung, Kühlung, Lüftung und Warmwasserbereitung erfolgen über ein Kompaktgerät. Eine Fußbodenheizung steht im Sommer als Kühlfläche zur Verfügung. Der Strombedarf wird über eine in das Flachdach und in die südliche Solarwand integrierte PV-Anlage mit unterschiedlichen Zelltypen gedeckt (Leistung: 10 kWp). Effiziente Haushaltsgeräte und eine komplette LED-Beleuchtung runden das Konzept ebenso ab, wie die PCM-Anwendung. www.sdeurope.uni-wuppertal.de

Solar Decathlon Europe

Erstmalig findet im Juni 2010 der internationale Wettbewerb Solar Decathlon Europe statt, initiiert und ausgelobt vom spanischen Bauministerium und der Universität für Technik in Madrid. Eine Übereinkunft zwischen dem US-Ministerium für Energie und dem spanischen Bauministerium macht diesen Wettbewerb in Madrid möglich. 19 Teams verschiedener Universitäten aus aller Welt werden ihr innovatives und energieeffizientes Wohngebäude präsentieren. In den Grundzügen entsprechen sich der europäische und der amerikanische Solar Decathlon. Neu sind die Bewertungskriterien für Innovation und Nachhaltigkeit des Konzeptes. Den Sieger kürt eine interdisziplinär besetzte Fachjury. Ca. die Hälfte der Punktzahl ist in den Bereichen Architektur, resultierende Energiebilanz, Komfortbedingungen und Nachhaltigkeit zu holen. Die andere Hälfte kann man gleichrangig in den Kategorien Planung und Konstruktion, Solarsystem, Ausstattung/Geräte, kommunikativer und sozialer Anspruch, Marktfähigkeit und Innovation erreichen.

Solar Decathlon USA

Der Solar Decathlon findet alle 2 Jahre an der National Mall von Washington D.C. statt. Ausgeschrieben vom US-Ministerium für Energie wird im Rahmen dieses internationalen Wettbewerbs das attraktivste und energieeffizienteste Solarhaus gekürt. Teilnehmen können studentische Teams aus der ganzen Welt, Ziel ist ein energieeffizientes Gebäude mit max. 75 m2 Wohnfläche, das mehr Strom solar produziert als es verbraucht (Plusenergiehaus). Der Strombedarf muss alle nach heutigem amerikanischen Standard zum Leben notwendige Energie generieren. Eine Jury vergibt maximal 1.000 Punkte auf Grundlage subjektiver Wertungen und objektiver Messwerte in zehn Einzeldiziplinen; zukunftsfähige Wohnformen; Konstruktion und Technik; Vermarktungsstrategie; PR; Behaglichkeit; Energieeffizienz und Haushaltsgeräte; Brauchwarmwassererzeugung; Qualität Tages- und Kunstlicht; Unterhaltungselektronik; Energiebilanz. Der Wettbewerb verlangte bis 2007 ein energieautarkes Gebäude, das nicht an das öffentliche Stromnetz angeschlossen ist. Der solar produzierte Strom wird in Batterien gespeichert, um den Energiebedarf, z. B. nachts, zu decken. Seit 2009 wird ein Netto-Nullenergiehaus gefordert, das über eine ausgeglichene Jahresenergiebilanz verfügt. Der Betrieb der Photovoltaikanlage erfolgt netzgekoppelt. Die Energiebilanz (Net Metering) wird insgesamt mit 150 Punkten am höchsten bewertet – 100 Punkte für ein Netto-Nullenergiehaus und weitere 50 Punkte erhält ein Plusenergiehaus, das über eine positive Bilanz verfügt, d. h. es wird mehr Energie produziert als verbraucht.

Inhaltsübersicht Projektinfo 04/2010:

Seite 3 von 4

- ▼ Internationaler Wettbewerb Solares Wohnen
- ▼ Prototyp "Wohnen 2015"
- ► Solar Decathlon Europe 2010

12 I SOLAR DECATHLON EUROPE 2010

Solar Decathlon Europe 2010 Beitrag HTW Berlin Gebäudehüllen

Beim "Solaren Zehnkampf" treten 21 ausgewählte Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein 75 m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Dann werden die Häuser aller Teams eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt.

Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

xia berichtet an dieser Stelle fortlaufend über die Entwicklung des Solar Decath-Ion Europe, bis die Sieger gekürt werden. Nach der allgemeinen Vorstellung des Wettbewerbs in xia 67, der Vorstellung der deutschen Teilnehmer und ihrer Projekte in xia 68, dem näheren Eingehen auf die unterschiedlichen Kühlkonzepte der deutschen Beiträge in xia 69 und der Erläuterung der Energiekonzepte in xia 70, folgt heute die Darstellung der Gebäudehüllen und ihrer solaren Merk-

Weitere Informationen zum SD Europe 2010 finden Sie unter:

Das Berliner Team wählte für seinen Entwurf ganz bewusst die traditionelle mitteleuropäische Gebäudetypologie eines Einfamilienhauses. Die Architekturstudenten von living EQUIA spiegeln mit dieser Formensprache ihre Interpretation von Wohlfühlklima und Raumqualität wider und lockern den puristischen Charakter mit modernen und provokanten architektonischen Highlights auf. Auf typische Schmuckelemente wie Balkon oder Dachüberstände wurde gänzlich verzichtet und anstelle dessen, mit den in Nord-Süd- und Ost-West Richtung verlaufenen Lichtachsen ein Kommunikationselement geschaffen, das sich in dem gesamten Entwurf des Berliner Solarhauses wiederfindet. Die Achsen sorgen nicht nur für einen ästhetischen Bezug des Baukörpers zu seiner unmittelbaren Umwelt, sondern definieren den Grundriss, die Innenraumaufteilung und vor allem die Form und die Struktur der Gebäudehülle. Sie bilden den First des um rund 29 Grad geneigten Satteldaches, was einen schrägen Anschnitt der Traufen erzeugt und dem Haus seine ganz eigene Dynamik verleiht.

Eine weitere Besonderheit des Berliner Prototyp stellt die vorgehängte Fassade dar. Sie wird entsprechend der Rasterung des Fassadenbildes aus 1 x 1 Meter großen Lärchenholzplatten gefertigt, die vor ihrer Anbringung mittels eines speziellen, von der Hochschule für nachhaltige Entwicklung Eberswalde entwickelten Verfahrens, abgeflammt werden. Die oberflächliche Verkohlung der Holzpaneele ermöglicht einen natürlichen und nachhaltigen Witterungsschutz, verfügt zudem über die notwendigen positiven Brandschutzeigenschaften und verleiht

der Fassade seine einzigartige dunkle Erscheinung.

Für die Umsetzung der vom Wettbewerb geforderten Gebäudeintegration der solaraktiven Flächen hat sich das Berliner Team mit ausgesuchten Unternehmen der Branche zusammengetan und individuelle Lösungen entwickelt. So fügt sich die auf dem Süddach angebrachte Photovoltaikanlage, bestehend aus rahmenlosen, quadratischen Modulen der Design Line von Solon, durch ihre rein schwarze Optik harmonisch in das Gesamtbild des Hauses ein. Dies gilt ebenso für die gemeinsam mit der Firma Colt entwickelte und mit maßgeschneiderten Sunovation® Kunststoffmodulen bestückte, in den Sonnenschutz integrierte PV-Anlage, die als innovatives Faltladensystem ausgeführt ist und vor den Glasflächen der Süd- und Westfassade montiert wird. Auch die Solarthermiekollektoren der Firma Solvis, die auf der Südfassade des Gebäudes neben den Terrassentüren untergebracht sind, wurden passend zum Gebäuderaster

Durch den planen Abschluss der PVund Solarthermieanlage in Verbindung mit den abgeflammten Holzpaneelen entsteht eine ästhetisch anspruchsvolle Integration der Solartechnik. Das sich so ergebende homogene Erscheinungsbild bildet eine Symbiose zwischen moderner Architektur und innovativer Technologie. Aufgelockert durch die durchgängigen Lichtachsen weist der Berliner Entwurf eine starke und klare Haltung auf, ohne Verzicht auf Komfort und Funktionalität.

Beitrag Hochschule Rosenheim

Autoren: B.A. Gitte Henning (Architektur), M.Eng. Marcus Wehner (Projektleitung)

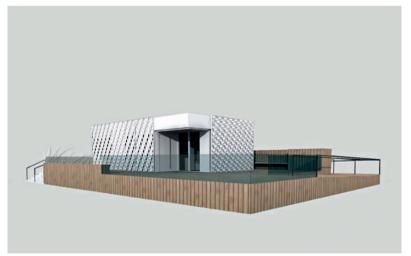
Mit einem völlig neuentwickelten Fassaden- und Sonnenschutzdesign "Die Zacken-Fassade" erhält die Architektur des Gebäudes einen individuellen Charakter. Die besondere Gestaltung der Außenhülle ist aus dem Gedanken entstanden, einen Sonnenschutz zu entwickeln, der sich im Laufe des Tages und im Jahresverlauf verändert. Durch die verschiedenen Positionen der Sonne über den Tag spielt die Fassade mit Licht und Schatten und bekommt dadurch fortlaufend ein anderes Gesicht. Die Südfassade des Gebäudes ist mit einer Dreischeiben-Isolier-, Sonnenschutz- und Schallschutzverglasung (U-Wert = 0,5 Wm²/k, g-Wert = 0,3, RW,R = 40 dB (A)) ausgeführt. Während der Mittagsstunden, wenn die solaren Lasten am größten sind, kann der im Boden versenkbare Sonnenschutz vom Boden bis zur Traufe hochgefahren werden. Selbst bei bedecktem Himmel und vollständig geschlossenem Sonnenschutz kann an der ungünstigsten Stelle im Raum noch ein Tageslichtquotient von über einem Prozent erzielt werden.

Durch die stufenlose Positionierung des Sonnenschutzes und den dadurch entstehenden Oberlichtstreifen, kann die verfügbare Tageslichtmenge individuell eingestellt werden. Um die Wärmeverluste so gering wie möglich zu halten, wurde eine hochwärmedämmende und luftdichte Gebäudehülle ausgeführt. Die Außenwände (U-Wert < 0,1 W/m²k, n50 = 0,5 1/h) sind mit Vakuum-Isolierpaneelen der Firma Variotec GmbH & Co. KG wärmebrückenfrei ausgeführt.





Modelldarstellung living EQUIA



Rendering Südost Ansicht des Hauses



Die Zacken-Fassade



Sonnenstandsimulation im Winter

Beitrag HFT Stuttgart

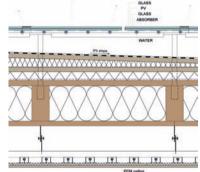
Die Energiehülle des Stuttgarter Hauses home+ liefert nicht nur Strom sowie warmes und kaltes Wasser, sondern verleiht dem Gebäude auch ein charakteristisches Erscheinungsbild. Um die Holzmodule legt sich eine zweite Haut aus großformatigen PV-Modulen (max. 1,20 x 3,00 m), die an den Fassaden und in den Randbereichen des Daches mit goldund bronzefarbenen polykristallinen PV-Zellen belegt sind. Durch einen Abstand der Zellen voneinander und die dahinter durchscheinende helle Oberfläche der Raummodule, sowie durch eine minimierte Unterkonstruktion erhält die Energiehülle einen leichten und filigranen Charakter. Im unteren Bereich der Fassaden werden ausschließlich goldfarbene Zellen verwendet, die sich dann in Richtung des oberen Fassadenbereiches mehr und mehr mit bronzefarbenen Zellen mischen. Diese Aufpixelung zieht sich über die Dachkante hinweg fort und bildet einen weichen Übergang zu den im mittleren Dachbereich liegenden PV-Modulen mit schwarzen monokristallinen Zellen. Die installierte Gesamtleistung liegt bei etwa 12 kWp (6 kWp an den Fassaden Ost und West, 6 kWp auf dem Dach), der zu erwartende jährliche Stromertrag für den Standort Madrid bei 11.500 kWh. Die PV-Zellen und die Wechselrichter werden von der Firma Sunways zur Verfügung gestellt, die PV-Module werden von der Firma Ertex Solar hergestellt und gesponsert.

Die PV-Module mit monokristallinen Zellen auf dem Dach werden auf ihrer Rückseite mit Leitblechen und Rohrschlangen versehen. Durch diese wird nachts Wasser geleitet, das sich über die Abstrahlung der Moduloberflächen gegen den Nachthimmel abkühlt und für die Kühlung

des Gebäudes verwendet werden kann. Diese Doppelnutzung der PV-Flächen ist gerade für heiße Regionen mit hohem solarem Energieeintrag, also auch gleichzeitig hohem Kühlbedarf, ein vielversprechendes Konzept, dass am Haus der HFT Stuttgart getestet werden soll. Über den Glasfugen im Dach werden Vakuumröhrenkollektoren mit einer Absorberfläche von insgesamt 6.6 m² installiert. Damit kann der Warmwasserbedarf in Madrid nahezu vollständig (Deckungsgrad 96%) gedeckt werden. Gleichzeitig dienen die in einem Winkel von etwa 25° gegen Süden angestellten Absorberbleche als feststehender Sonnenschutz im Dachbereich.

Der Sonnenschutz an der Südfassade wird durch den Dachüberstand des vorgesetzten Terrassenmoduls sichergestellt, in den vertikalen Fugenfenstern über Stoffrollos.

Die Nordfassade wurde mit einer Sonnenschutzverglasung ausgeführt, um den Wärmeeintrag in den frühen Morgen- und Abendstunden in Madrid zu minimieren. Die Holzmodule sind an Fassade, Dach und Boden mit Vakuumdämmpaneelen gedämmt und alle Verglasungen als 3-fach-Verglasungen ausgeführt.



Dachaufbau PV

Beitrag Bergische Universität Wuppertal

Die Gebäudehülle des Wuppertaler Projektbeitrags zum Solar Decathlon Europe 2010 kombiniert verschiedene Elemente, um sowohl auf energetischer wie auch gestalterischer Ebene ein ausgewogenes Gesamtergebnis zu erreichen. Nach dem Passivhausstandard ausgeführte Bauteile und ein leistungsfähiger Sonnenschutz minimieren den Energiebedarf für Heizen und Kühlen.

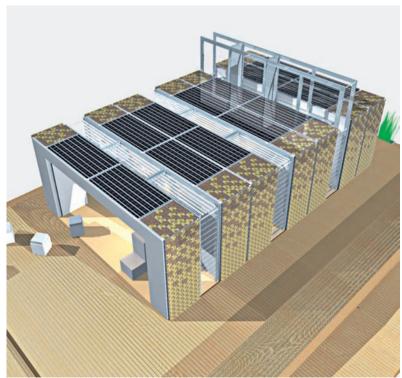
Die Integration von solaraktiven Flächen elektrisch und thermisch - dient zur Deckung des eigenen Energiebedarfs und der Einspeisung von überschüssigem Strom in das Netz.

Zwei solaraktive Wandscheiben fungieren als Hauptmerkmal des architektonischen Konzeptes. Auf einer Länge von rund 13 Metern überspannt ein auf den Wandscheiben aufliegendes Tragwerk den Innenraum stützenfrei und bildet den oberen Gebäudeabschluss. Die Fassade kann im unteren Bereich nach Westen und Osten über Glasschiebeelemente vollständig zum Außenraum hin geöffnet werden. Ein einheitliches Bodenmaterial verbindet den Außenraum mit dem Innenraum (Firstwood). Mit U-Werten von 0,1 W/m2K im Bereich der opaken Bauteile und 0,8 W/m²K bei den Fenstern, weisen alle Komponenten der Gebäudehülle einen sehr hochwertigen Wärmeschutz auf.

Die hochwärmegedämmte Außenhülle wird durch Stegträger mit einer 30 cm dicken Dämmschicht aus einer neuartigen Mineralwolle (Isover Generation 032) mit reduzierter Wärmeleitfähigkeit (Dach, Boden, Wandscheiben Nord/Süd), durch mehrlagige Vakuumdämmpaneele (Microtherm) vor den Massivholzträgern

sowie durch eine Dreifachverglasung in wärmegedämmten Rahmen aus Buchenholz erreicht. Das außenliegende Vorhangsystem aus aluminisiertem Gewebe (Twilight von Sattler) reduziert den Energieeintrag auf unter 10% bei gleichzeitig ausreichendem Sichtbezug nach außen. Der Vorhang dient gleichzeitig als wichtiges architektonisches Element im Kontext der Gestaltung. Entsprechend erhält der freitragende Riegel im Obergeschoß eine textile Hülle gleichen Materials. Die 6 m² vertikal eingebaute Vakuumröhrenkollektoren vom Typ Viess-mann Vitosol nehmen im nördlichen Wandriegel in ihrer Struktur den Faltenwurf des Vorhangs auf. Besonderes Augenmerk bekommt gemäß Wettbewerb die Integration der Flächen zur Solarenergienutzung. Auf 40 m² sind hocheffiziente Photovoltaik-Module bündig in das Flachdach eingebunden. Auffälliges architektonisches Merkmal ist die Solarwand. Hier erzeugen 115 speziell designte PV-Module auf der Südwand mit einer Länge von rund 12 Metern ein individuelles Bild. Die Kombination aus Modulen unterschiedlicher Zellentypen - blaue polykristalline und schwarze monokristalline Zellen – als Vorhangfassade lässt eine Art Pixelgrafik entstehen. Alle Solarmodule stammen vom deutschen Hersteller SolarWorld.

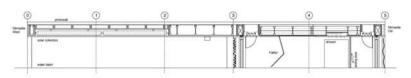
www.sdeurope.org www.living-EQUIA.com www.solar-decathlon.fh-rosenheim.de www.sdeurope.de



Rendering Fassade/Dach



Solarwand mit Modulen unterschiedlicher Zelltypen



Detailschnitt Nordwand mit Integration der Solarkollektoren



m 20.04.2010 wurde das Richtfest für home gefeiert. Neben Vertretern des Landes Baden-Württemberg. der Landeshauptstadt Stuttgart und der Hochschulleitung waren auch die Mitglieder des Teams sowie Sponsoren und Unterstützer mit von der Partie. Bei sonnigem Wetter wurde der Richtspruch gesprochen und das Haus von zahlreichen interessierten Besuchern besichtigt. Bis Mitte Mai wird es fertig gebaut, und dann nach Madrid gebracht werden. Dort tritt das Team der HFT Stuttgart dann im Juni mit seinem Haus im internationalen Wettbewerb Solar Decathlon Europe 2010 an.



Richtfest home

Beim "Solaren Zehnkampf" treten 20 ausgewählte Hochschulteams aus der ganzen Welt an, um ein 74rn großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen. Die Häuser aller Teams präsentieren sich vom 18.-27. Juni in Madrid im "Solar Village" einer breiten Öffentlichkeit, bevor am Ende die Sieger gekürt werden.

Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer Energiegewinnung in das Konzept stellen auch der Transport und die schnelle und zuverlässige Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden auch architektonische Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet.

Ziel des Wettbewerbs ist es, bei Studenten und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Darüber hinaus soll die Markteinführung innovativer solarer Energietechnologien gefördert und der Nachweis erbracht werden, dass energieeffizientes Bauen mit hohem Wohnkomfort und architektonischer Qualität verwirklicht werden kann.

home verbindet Gestaltung und traditionelle Methoden mit der sinnvollen Nutzung moderner Technologien und Materialien. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das in einzelne Module aufgeteilt wird, die mit etwas Abstand zueinander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Der Energieturm und die

Hochschule für Technik Stuttgart

Energiehülle sind wichtige Komponenten des Energiekonzeptes und prägen gleichzeitig die Erscheinung des Gebäudes. Beide Komponenten sind in besonderem Maße auf das in Madrid vorherrschende heiße und trockene Klima zugeschnitten.

Der Energieturm trägt über Verdunstungskühlung zu einem angenehmen Innenraumklima bei. Dazu werden Tücher im Inneren des Turmes befeuchtet und die Zuluft daran entlang geführt. Ein bewährtes Prinzip, das auch bei den alten Windtürmen im arabischen Raum bekannt ist. Die Energiehülle aus PV-Modulen erzeugt tagsüber Strom und nachts kaltes Wasser. Dabei wird die Abstrahlung der Dachflächen gegen den in Madrid häufig klaren Nachthimmel genutzt.

Sowohl der Energieturm, wie auch die modifizierten PV-Module zur Kühlung von Wasser wurden als Mock-up an der HFT Stuttgart getestet. Im Juni 2010 werden sie sich dann in Madrid unter Wettbewerbsbedingungen in der Realtität bewähren müssen.

Weitere Informationen

http://www.sdeuorpe.de http://www.hft-stuttgart.de http://www.zafh.net



Das Team der HFT Stuttgart setzt sich aus Studenten der Masterstudiengänge Architektur, Sustainable Energy Competence (SENCE) und Konstruktiver Ingenieurbau, sowie den Bachelorstudiengängen Architektur, Bauphysik und Infrastrukturmanagement zusammen. Unterstützt werden Sie von Professoren, z. T. aus weiteren Studiengängen (z.B. Innenarchitektur), sowie Mitarbeitern der HFT Stuttgart und des eigenen Forschungsinstituts zafh.net. Projektleitung: Prof. Dr.-Ing. Jan Cremers / Projektmanagement: Dipl.-Ing. Sebastian Fiedler

STUTTGARTER TEAM AUF DEM WEG NACH MADRID SOLAR DECATHLON IM JUNI 2010

Nach mehr als anderthalb Jahren intensiver Planungs- und Bauzeit ist es Ende Juni endlich soweit: Ein Team der Hochschule für Technik Stuttgart nimmt in Madrid am Solar Decathlon Europe teil – einem internationalen Wettbewerb, bei dem 19 Hochschulen aus aller Welt darum wetteifern, das beste vollständig mit solarer Energie versorgte Wohnhaus zu präsentieren. Eine Woche lang müssen sich die Gebäude im heißen spanischen Sommer bewähren. Dabei können sie in zehn Disziplinen Punkte sammeln – von der architektonischen Qualität über die Energiebilanz und das Raumklima bis zur Marktfähigkeit der ausgestellten Prototypen. Neben den beteiligten Studenten, die durch ihre Arbeit an dem Projekt einen tiefen Einblick in zeitgemäße energiesparende Technologien erhalten haben, soll auch die Öffentlichkeit von dem Wettbewerb profitieren: Die im "solaren Dorf" erwarteten 100 000 Besucher können sich selbst ein Bild davon verschaffen, dass energieeffizientes Bauen mit hohem Wohnkomfort verwirklicht werden kann.

Das Hauptziel des Wettbewerbs ist es, bei Studierenden, aber auch in der breiten Öffentlichkeit das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Darüber hinaus soll die Markteinführung innovativer solarer Energietechnologien gefördert und der Nachweis erbracht werden, dass energieeffizientes Bauen mit hohem Wohnkomfort und architektonischer Qualität verwirklicht werden kann.

home+ Konzept

Der Name home+ steht für ein Wohnhaus der Zukunft – ein Plusenergiehaus mit einem Mehrwert in allen Bereichen. Der Entwurf basiert auf gestalterischen und energetischen Überlegungen. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch ergibt sich eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs. Das Volumen wird in einzelne Module aufgeteilt, die mit etwas Abstand zueinander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer.

Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas in heißen und trockenen Regionen, zu denen auch Madrid zählt, beiträgt.

Der modulare Aufbau des Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können damit nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles, Paare, Familien oder Wohngemeinschaften entstehen. Darüber hinaus kann das Gebäude, insbesondere durch die Ausgestaltung der Fugen, an die klimatischen Gegebenheiten des jeweiligen Standortes funktional angepasst werden.

Letzte Vorbereitungen

Für zwei Monate befand sich der Rohbau in Stuttgart, wo er hinter dem Bau 4 der HFT aufgestellt, die Haustechnik installiert und der Innenausbau fertiggestellt wurde. Hier fand am 20. April auch das Richtfest unter großem öffentlichem Interesse statt.





So wurde unter anderem in der Stuttgarter Zeitung das Haus der Doch nach dem Wettbewerb soll es weiter gehen. Im Rahmen Hochschule für Technik als "klein, aber pfiffig" bezeichnet und nach des Verbundes der deutschen SDE Teilnehmer haben sich die einem ganzseitigen Bericht stellte man fest: "...ein Energiesparhaus deutschen Teams zusammengeschlossen, um eine Vortragsreider Extraklasse..." he an europäischen Hochschulen zu initiieren. Das Stuttgarter Team stellte bereits zusammen mit den drei anderen deutschen Durch angebotene Rundgänge, konnte man das Solarhaus home+ Teilnehmern den Wettbewerb und die jeweiligen Projekte an den im Rohbau von innen betrachten und ausführlich von Studenten renommierten Architekturfakultäten TU München und TU Delft des Kernteams erklären lassen, "Im Klima von Madrid produziert vor. Dies ist ein weiterer Schritt, das Bewusstsein und das Wissen das Haus doppelt so viel Energie wie es selbst verbraucht", so um die Möglichkeiten und Chancen energieeffizienter und nach-Dalet Bodan, eine der Masterstudentinnen. Anschließend an das haltiger Architektur zu steigern. Gleichzeitig birgt ein solches Richtfest wurden die Holzmodule ausgerüstet und ausgebaut. Zusammentreffen die Chance eines hochschulübergreifenden

Austausches.

Nach erfolgreichen Messungen und Testläufen wurde das

Gebäude ab Mitte Mai wieder zerlegt und für den Transport nach Madrid vorbereitet. Zur Zeit befindet sich das Gebäude schon

auf dem Weg zum Austragungsort des Wettbewerbes in Madrid.

Das Projekt wurde bereits auf zahlreichen Messen, bei wissen-

schaftlichen Tagungen und anderen Veranstaltungen vorgestellt.

Das Heldenheft wünscht allen Mitstreitern ein erfolgreiches Abschneiden beim Wettbewerb Weitere Informationen: www.sdeurope.de

Heldenhaft

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In Zeiten, da die Regierung Fördermittel für das erst vor zwei Jahren aufgelegte "Marktanreizprogramm für Erneuerbare Energien" strich, fand in Madrid in Sichtweite des Königspalastes eine Königsdisziplin statt: der "Solare Zehnkampf". 17 Unis und Hochschulen aus aller Welt, darunter 4 aus Deutschland, zeigten Hausentwürfe, die bei allen Unterschieden eines können mussten - ihre Energie ausschließlich von der Sonne beziehen und wohnlich sein. Aus Madrid Reiner Oschmann



ren haben guten Whiskey und Lebensweisheiten, die sich sehen lassen können. Vermutlich hat das eine mit dem anderen zu tun. Eine ihrer Erfahrungen, die sich dem Berichterstatter bei dem Wettkampf im sonnesatten Madrid in Erinnerung brachte, lautet: Es gibt keine Fremden – es gibt nur Freunde, die man noch nicht kennt.

Im Fall Madrid war der Fremde ein alter Bekannter, den wir noch nicht gut genug nutzen: die Sonne. Eine der 17 Universitäten und Hochschulen aus aller Welt, die am "Solar Decathlon Europe 2010" teilnahm und am Ende des Zehnkampfes Platz 2 belegte, sprach das Potenzial im Motto für die inoffizielle WM zum Bau von Solarhäusern an. Die Hochschule für angewandte Wissenschaften aus Rosenheim erklärte: "Die Zukunft der Energieversorgung liegt nur 150 Millionen Kilometer entfernt, in einem Fusionsreaktor, der schon lange stabil läuft. Wir verbinden, wir spalten nicht …"

Der "Solar Decathlon" ist ein junger Wettbewerb für Studententeams mit dem Ziel, Pilothäuser zu entwickeln, die so innovativ sind, dass sich ihre Bewohner energetisch allein aus der Kraft der Sonne versorgen. Vor knapp zehn Jahren im Land des damals größten Energieverschwenders der Erde, den USA, entstanden und seither viermal in Washington veranstaltet, wurde er in Madrid

nun erstmals in Europa ausgetragen. 768 Unis weltweit waren angeschrieben worden. 140 äußerten Interesse. Nach Prüfung der strengen Kriterien bewarben sich 40 fürs Finale. 21 qualifizierten sich. 17 gingen an den Start, nachdem einige Unis aus finanziellen Gründen verzichten mussten.

"Decathlon" heißt der Wettkampf, weil jedes Team mit seinem Prototyp von einer internationalen Jury in zehn Disziplinen geprüft wurde. Dabei ging es um Energiebilanz und technische Werte, Solaranlage, Architektur und Konstruktion, Komfort und soziales Bewusstsein, Innovation, Nachhaltigkeit und Marktfähigkeit. Entscheidend: Jedes der Pilothäuser aus Spanien und Frankreich, China und Großbritannien, Finnland, den USA und Deutschland sollte nicht bloß nachweisen, dass es mittels Sonne die Energie für den Bedarf eines Zwei-Personen-Haushaltes decken und darüber hinaus weitere Energie bereitstellen kann (Plus-Energie-Haus). Das Haus, das außen nicht mehr als 75 Quadratmeter Stellfläche beanspruchen durfte, sollte wohnlich sein. Gesucht wurde kein Kraftwerk, sondern ein einladendes Haus auch wenn die Madrid-Häuser Pilothäuser für den Wettbewerb und nicht eins zu eins zum Wohnen bestimmt sind.

Die Häuser zeigten sich nur in einem einheitlich: Sie erfüllten mit ihrer Bauweise die

Anforderungen an ein Null- oder Plus-Energie-Haus und waren ausnahmslos von Studenten entwickelt worden. Architektur, Technik- und Raumkonzept hingegen wiesen erfreulich große Unterschiede und teils gegensätzliches Herangehen auf. Es gab Häuser wie das des Gesamtsiegers vom Virginia Polytechnic Institute & State University, dessen Technik vom Öffnen der Fenster bis zur WC-Spülung per Taste auf dem iPhone zu bedienen ist. Und es gab Häuser wie das "Luukku" aus Finnland, das in der Einzeldisziplin "Architektur" neben Virginia den 1. Preis gewann und auf genau solche Bedienung verzichtete.

Mark Auvray (24) aus England, seit zwei Jahren Architekturstudent an der Aalto-Uni in Helsinki, sagte mit Blick auf das schöne Holzhaus: "Wir haben bewusst High-Tech-Bedienung ausgespart, weil wir überzeugt sind, dass Menschen nicht in einer Maschine leben wollen."

Architekturprofessor Pekka Heikkinen von Aalto sagte zum selben Thema: "Wir zielten auf Bequemlichkeit und einfache Bedienung. Man soll keinen Ingenieurabschluss benötigen, um "Luukku" bewohnen zu können. Sowieso denke ich, dass die Entwicklung zu natürlicherer Lebensweise mit einfacheren technischen Systemen gehen wird. Ich glaube nicht an die Zukunft hochtechnischer

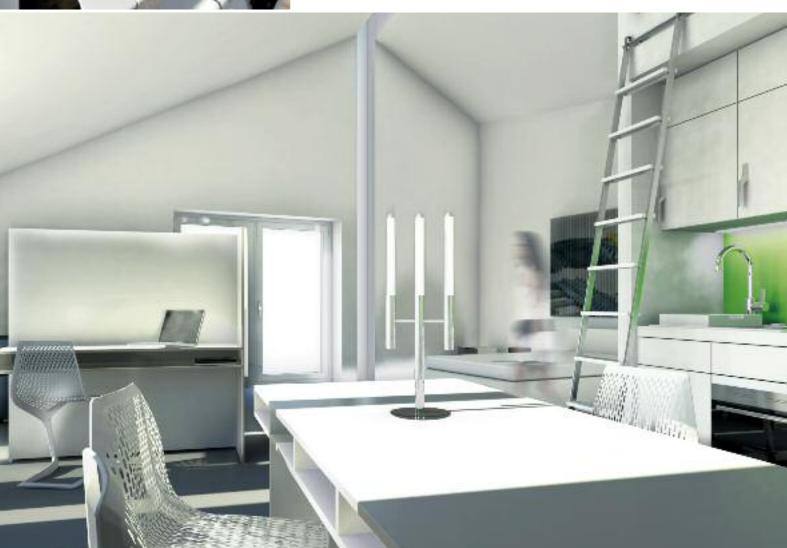


Rosenheim überzeugt

links: Außen eine wandelbare, patentierte Zickzackfassade, die ergiebig Sonne sammelt und Schatten spendet, innen Behaglichkeit in höchster Verarbeitungsqualität, mit der Küche als absolutem Lebensmittelpunkt – Haus "Ikaros" von der Hochschule Rosenheim verfehlte den Gesamtsieg in Madrid am Ende um ein halbes Pünktchen. Nach Meinung von Experten besteht Nachnutzungswert für die nächsten zwölf Jahre und weitgehende Marktreife.

Berlin polarisiert

unten: Hinter der schwarzen Fassade, mit dem das Berliner "living EQUIA" Jury und Publikum spaltete, offenbart sich im Inneren ein lichtes, gewinnendes Wohnambiente, das auch schärfste Fassaden-Kritiker für sich einnahm. Die glatten Oberflächen sind mit Lehmputz verarbeitet und mit Lehmfarbe gestrichen. Sie sorgen gemeinsam mit den Lehmplatten für wohliges Raumklima.





Materialien wie Vakuumpaneele. Deren ökologischer Fußabdruck ist einfach verheerend." Die vier deutschen Teams aus Berlin (Hochschule für Technik und Wirtschaft, Universität der Künste, Beuth Hochschule), Rosenheim, Stuttgart (Hochschule für Technik) und Wuppertal (Bergische Universität) zählten zu den Attraktionen. Sie schnitten stark ab und kamen auf die Plätze 2 (Rosenheim), 3 (Stuttgart), 6 (Wuppertal) und 10 (Berlin). Rosenheim und Stuttgart überzeugten mit allseits bewunderter Verarbeitungsqualität, Wuppertal mit aufsehenerregender Modulbauweise und alltagserleichternder Beweglichkeit von Möbeln und Technik, Berlin im "living EQUIA" mit polarisierendem Kontrast zwischen schwarzer Fassade und lichtem Inneren sowie mit einem quasi nahtlos in die Architektur integrierten Solarsystem (Platz 1 in dieser Kategorie).

Das "schwarze Haus" wird übrigens in Kürze wieder auf dem Campus der Hochschule für

Technik und Wirtschaft in Berlin, direkt an der Spree aufgebaut.

Das Fertighausunternehmen Haacke hatte das Berliner Team in der WM-Vorbereitung mit Arbeitskraft, Logistik und Fachkompetenz unterstützt. Arlett Ruhtz von den Berlinern: "Geschäftsführer Detlef Bühmann und Technischer Leiter Thomas Hoffmann standen uns mit ihren Montage-Teams beim Fertigen der Module im Werk und beim Aufbau des Rohbaus auf dem Berliner Campus tatkräftig zur Seite. Sie unterstützten uns, wo es nur ging. Ohne sie hätten wir arge Probleme bekommen."

Einer der prägnantesten Unterschiede des Berliner Hauses zu allen anderen Beiträgen waren Form, Struktur und Farbe des Gebäudes. Arlett Ruhtz: "Ein Satteldach findet sich nur bei uns. Die Fassade aus abgeflammtem Lärchenholz ist auf natürliche Weise Oberflächenversiegelung und Hingucker. Sämtliche solaraktiven Flächen

schließen plan mit ihr ab und erzeugen so eine geschlossene Gebäudehülle. Die beiden Lichtachsen in Nord-Süd- und Ost-West-Richtung sorgen für natürliche Beleuchtung. Die Lehmplatten an den Wänden haben schadstoff- und schallschluckende Wirkung. Sie sind einer der passiv agierenden Bestandteile des Systems von Heizen, Kühlen und Lüften."

Gerade die Berliner Studenten haben die Arbeit ganz in eigene Hände genommen. Deshalb war Marcus Bui (25), der Umwelttechnik und Regenerative Energien studiert, in Madrid "kein bisschen enttäuscht", dass es Platz 10 wurde. "Wir wollten unbedingt dabei sein. Das bleibt für jeden von uns eine große Erfahrung."

Bui versteht die Irritation, die die dunkle Fassade auf manchen Besucher und Juroren ausübte, und steht dazu: "Mir gefällt sie sehr. Man sieht die Holzstruktur, Maserung und Äste. Das oberflächliche Verkohlen ist



Stuttgart glänzt

oben und links: "home"" (Gesamtwertung Bronze) von der Hochschule für Technik Stuttgart ist ein Technikpaket mit Lebensqualität. Die Modulbauweise erlaubt Erweiterung sowie leichten Aufund Abbau. Ideal als Alterssitz für ein Paar, das heute im Norden, morgen woanders leben will? Oft bewundert – galt ebenfalls als Gold-Kandidat

Wuppertal zieht an

"Europäisches Haus" nannte die Bergische Universität Wuppertal ihren Beitrag (gesamt Platz 6), um zu unterstreichen, dass seine nachhaltige Konzeption nicht nur auf den Wettkampf in Madrid ausgerichtet war, sondern auch in anderen Klimazonen bestehen kann. Ein Publikumsliebling



"Virginia Tech" siegt

rechts: Im Pavillon-Stil und inspiriert von Mies van der Rohes "Farnsworth House" (1951) in der Nähe von Chicago, zeigte sich in Spanien das "lumenhaus" von Virginia Polytechnic Institute & State University. Im solaren Zehnkampf erhielt es die besten Effizienznoten und wurde Gesamtsieger von Madrid. Raffinierte Haustechnik, offener Grundriss mit schöner Grün- und Wassereinbindung prägen das Siegergebäude.

Barcelona steigt aus ...

unten: Das "FabLab"-Haus aus Barcelona vom Instituto de Arquitectura Avanzada de Cataluña ist ein Aussteigerhaus. Zu 100 Prozent aus Sperrholz suchte es einen fundamental alternativen Ansatz. Ältere schreckte das "Gewächshaus" eher ab, Junge zog es an, im Zehnkampf wurde es Letzter, in der Publikumswertung – Erster.





Solarhaus-Weltmeisterschaft

[Loos: | audieurean/Nestvau | [le 1]

kein bloßer Gag. Die natürliche Versiegelung schützt vor Schädlingen und konserviert das Holz – Nachhaltigkeit eben."

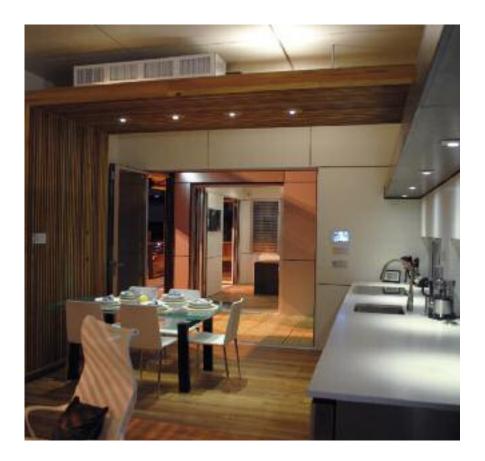
Ein Gutteil der Schönheit lag bei der Meisterschaft im Auge des Betrachters. In einem jedoch gab es übereinstimmend Begeisterung. Keiner hat sie treffender formuliert als der Projektleiter des Bronze-Teams von der Stuttgarter Hochschule für Technik, Architekt Prof. Dr.-Ing. Jan Cremers (39): "Hier herrscht olympischer Geist – nicht nur wegen des Wettbewerbs, sondern vor allem im Sinne der Arbeit aller Studenten an dem gemeinsamem Ziel, schonender mit unserer Umwelt und ihren Ressourcen umzugehen. Das war und ist ja das Hauptanliegen des "Solar Decathlon:"

Befragt nach auffälligen Beispielen, in denen sich die heutige Tauglichkeit der Pilothäuser für morgen zeigt, nennt Professor Cremers die neuen Wege beim Umgang mit Photovoltaik (PV) – Technologie zur direkten Umwandlung von Sonnenenergie in elektrische Energie – in der Fassadengestaltung. "Funktionalität genügt nicht mehr. Sie muss mit der Qualität der Erscheinung harmonieren. Ein weiteres Moment ist die Modulbauweise

des Stuttgarter "home". Sie erlaubt sowohl seine beliebige Erweiterung als auch die Ortsveränderung. Das eröffnet Chancen, deren Bedeutung für die Gesellschaft allgemein bisher nicht reflektiert werden."

Professor Karsten Voss von der Universität Wuppertal betonte den Pilotcharakter der Wettbewerbshäuser. "Sie sind experimentelle Beiträge zum Wohnen von morgen. Das ändert nichts daran, dass es für das Wuppertaler Haus bereits industrielle Kaufinteressenten gibt." Dies erklärt sich mit der energetischen Güte der Häuser. Professor Voss

zum Wuppertaler "Europäischen Haus": "Es hat keine Energiekosten. Sein Eigenbedarf an Energie ist mit den solaren Gewinnen so gut zu decken, dass circa 4.000 Kilowattstunden fürs Netz übrig bleiben. Das heißt, der Besitzer verdient mit dem Haus etwa 1.000 bis 1.500 Euro im Jahr." Letzteres korrespondiert mit der Nachricht, die nach der WM verkündet wurde: Die 17 Pilothäuser produzierten während der 10 Wettkampftage fast dreimal so viel Energie, wie sie verbrauchten. Wenn das kein heißer Draht zur Sonne ist.



Florida erneuert mit Erinnerung

"ReFocus" von der University of Florida belegte Platz 8 im Gesamtklassement und Platz 1 in der Kategorie "Kommunikation und gesellschaftliches Bewusstsein". Letzteres belohnt nicht zuletzt die Verwendung von Recyclingholz (Zypressen aus Flüssen) und die Rückbesinnung auf natürliche Formen von Verschattung und Luftzirkulation (Veranda und Luftkorridor) aus alten Häusern Floridas. Architekturstudentin Paige Mainor in Madrid: "Innovation bedeutet nach unserem Verständnis nicht nur neue Technologie, sondern auch Rückgriff auf Erfahrung und ihre neuartige Nutzung unter heutigen Bedingungen."

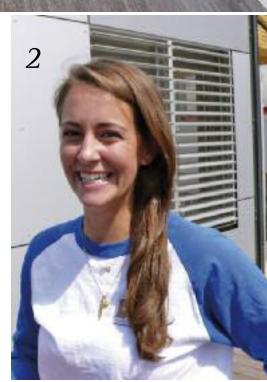




"Olympioniken"

1 Der Dortmunder Daniel Kurzius (26) hat im bayerischen Rosenheim studiert. Das Haus von Silbermedaillengewinner "Ikaros" gefiel auch mit im Duschglas eingelegten Grashalmen.
2 Architekturstudentin Paige Mainor war für die Universität Florida in der spanischen Hauptstadt.

- 3 Engländer Mark Auvray (24) studiert Architektur in Finnland und gehörte zum Team von Holzhaus "Luukku", das den Architektur-Preis mit gewann.
- 4 Der Stuttgarter Marcus Bui (25) vom Team des Berliner "living EQUIA"
- 5 Die künftigen Architekten Travis Rookstool (24, links) und Matt Vibberts (20) von Architektur- und Gesamtsieger "lumenhaus" aus Virginia in den USA







Helsinki huldigt dem Holz

Eine unverschämte Verneigung vor dem Baustoff Holz machte der Beitrag der finnischen Aalto-Universität aus Helsinki. Das "Luukku" (oben und links) gewann damit Platz 1 im Architektur-Wettbewerb und 5 in der Gesamtwertung. Die Verwendung erneuerbarer, CO2-freundlicher Materialien ist sein Markenzeichen. Das unverkennbar nordische Design mit traumhaft schönen Details (Esstischleuchte, Stühle!) "stellte Wohnkomfort und Bedienungsfreundlichkeit in den Vorder-, technische Spielereien bewusst in den Hintergrund", wie Team-Mitglied und Architekturstudent Mark Auvray aus dem englischen Devon hervorhob. "Wir haben uns ganz auf die natürlichen Vorzüge von Holz, seine Wärme, wohnklimatischen und Anfass-Qualitäten verlassen – und bewiesen, dass mit kompaktem Bau, guter Dämmung und energiesparenden Detaillösungen ein Solarhaus sowohl für die Sonne Spaniens als auch die Kälte Finnlands gebaut werden kann." Die Besucher liebten es. Das Modell-Haus wird kommendes Frühjahr in Finnland an den höchsten Bieter versteigert. Es gibt Pläne für eine Serienproduktion.







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SCHWEIZERISCHE FACHZEITSCHRIFT FÜR FENSTER- UND FASSADENBAU

JOURNAL SUISSE DE LA TECHNIQUE POUR FENÊTRES ET FAÇADES

Drucken

Schliesser

home+, ein innovatives Netto-Plus-Energie-Haus aus Stuttgart

Solar-Decathlon 2010 Bauen für die Zukunft

* Dr.-Ing. Jan Cremers

Der Solar Decathlon Europe ist ein internationaler Wettbewerb für Hochschulteams aus der ganzen Welt. Das Ziel ist die Entwicklung und Umsetzung eines netzgekoppelten Netto-Plus-Energie-Hauses, das die Sonne als einzige Energiequelle nutzt und das maximal effiziente Technologien einsetzt – und das Ganze gestalterisch auf höchstem architektonischen Niveau. Mit dem Projekt home⁺ nahm die Hochschule für Technik in Stuttgart im Juni dieses Jahres am internationalen Wettbewerb «Solar Decathlon Europe 2010» in Madrid teil und erreichte den dritten Platz – mit extrem knappem Abstand auf den ersten, weniger als 5 von 1000 möglichen Punkten haben gefehlt.



Ostfassade und Dachansicht

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Exciting but exhausting

The first Solar Decathlon Europe took place in Madrid in June. In the solar architecture competition, 17 university teams from three continents presented their vision of a zero-energy house.

> The contrast could scarcely have been greater. In the background, to the west of the Manzanares River in Madrid, high-rises jutted skyward as they do in rapidly growing cities - functional but not exactly aesthetic. Nondescript energy guzzlers. On the opposite side of the river in late June, 17 houses overlooking the royal palace offer a counterpoint to the high-rises with individualism and innovation - a Chinese bamboo house with curved roofs, compact bungalows with white, black, green or blue façades made of glass, wood, or plastic; a wooden house on four legs and a shimmering metallic abode in the style of a container. Photovoltaic modules and solar collectors are on many of the roofs and façades. The structures show how 17 university teams from

Spain, France, Germany, England, Finland, China, and the US envision the future of energy-efficient construction.

With their zero-energy houses, they qualified for the first-ever Solar Decathlon Europe (SDE), a solar architecture competition for universities, which took place for the first time in the Spanish capital. In a neck and neck race, the American team from Virginia Polytechnic Institute & State University won the competition with its Lumenhaus, followed closely by two German teams.

Born in the USA

The Solar Decathlon Europe is the progeny of the Solar Decathlon, held for the first time at the National Mall in Washington D.C. in 2002. The competition has been held biennially on the same spot since 2005. While university teams from around the globe are invited to participate, most of the teams were from the US. Until 2007, the US Department of Energy, which organises the competition, called for an off-grid, is required.



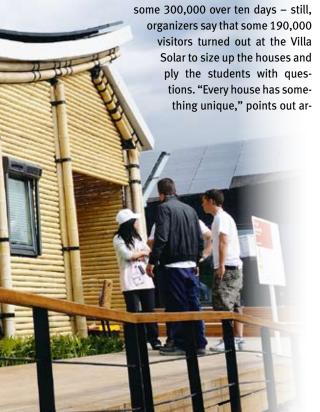
The competition is not concerned with which house has the best energy concept. Interdisciplinary expert juries examine the houses in ten categories; hence the name, decathlon. Up to 1,000 points are awarded, based on subjective jury decisions and objective measurements. The categories are: architecture, engineering and construction, solar systems, electrical energy balance, comfort conditions, appliances, communications and social awareness, industrialization and market viability, innovation and sustainability. To make them comparable, the houses may not have more than 75 m² of living space and are limited to a height of 5.5 m.

The Universidad Politécnica de Madrid (UPM), which participated in the Washington event in 2005, 2007 and 2009 drummed up interest in holding such an event in Europe as well. In cooperation with the Spanish Ministry of Housing and with the support of the US Department of Energy, the plan became a reality. The criteria for the US competition were adopted for the most part.

It takes steady nerves

The students from fields such as architecture, interior design, engineering, structural engineering, sustainability, and energy systems worked on their projects for an average of two years. They waded arduously through 300 pages of performance test codes and formulated 500 page project reports. They sought sponsors, negotiated with manufacturers, and built furniture, façades, and shading systems. They drafted communication concepts and brochures, then organised the transport of the houses to Madrid. Once in Madrid, they built their prototypes at lightning speed and presented them to the interested public for ten days in the blazing heat.

And, while the event did not attract as many visitors as the Solar Decathlon 2009 in Washington –





chitecture student and assistant juror Roberto Steck-Ibarren. The following houses show the broad spectrum of construction and energy concepts, as well as the wealth of the students' ideas.

The only thing all of the houses shared in common was the optimised thermal insulation, which the teams achieved through very well insulated building envelopes (at least 30 cm thick walls) and excellent solar shading. Many of the teams used passive elements, such as phase change material (PCM) for interior tempering. But none of the houses in Madrid could completely do away with active systems. In the hot, dry climate of the Spanish metropolis, cooling stood in the foreground. Ventilation systems with heat recovery and reversible heat pumps were often used to achieve comfortable indoor temperatures. The competition rules required the houses to maintain room temperatures no greater than 25°C.

The Lumenhaus from Virginia

"If it gets too hot outside, the house reduces the need for air conditioning by drawing its shade panels. When temperatures drop in winter, high-efficiency insulation panels slide in place to conserve heat." That is how the team from Virginia described the advantages of its Lumenhaus. The name comes from lumen, meaning "power of light", and haus, a nod to the Bauhaus architecture movement which inspired the prototype. All of the building services systems can be controlled via Apple's new iPad tablet PC. The interface can also communicate with a weather station set up in front of the house.

Easy to transport. The house arrived at its location on four wheels, which were easily removed once it was in the correct spot. It can be taken away just as easily. Virginia Polytechnic Institute & State University achieved first place in the competition with 811.83 points. The university had already participated in the Solar Decathlon in Washington in 2009. Meanwhile, the team had "modified some systems," according to architecture student Travis Rookstool.

German team right on the heels

That made it all the more satisfying for the team from the Rosenheim University of Applied Sciences which like the other 15 teams took part in the Solar Decathlon for the first time. The 30 members of team First place in the Solar Decathlon Europe went to the Virginia Polytechnic Institute & State University team for its Lumenhaus.





The entry from Florida (left) was distinctive for its breezeway, which provides natural ventilation for the house. The Finns (right) emphasised sustainability, using only natural materials.

Rosenheim finished an extremely close second with 810.96 points. Right on their heels with 807.49 points, was the Stuttgart University of Applied Sciences. In addition to these two teams, two other German teams participated, one from the Bergische Universität Wuppertal (6th place) and one from the Hochschule für Technik und Wirtschaft Berlin (10th place). Even though they entered separately, the four teams were often referred to as "Team Germany."

What their prototypes demonstrated in particular was the diverse range of possible façade types. The team from Rosenheim developed a privacy and sun shade made of white aluminium. Installed on the exterior walls, the system can be raised from the ground level as needed. While the Rosenheim students concealed their 12.6 kW of PV behind a slightly elevated exterior wall, the team from Stuttgart decided to integrate some of their modules into the façade. Maximilian Martin, now a graduate, who worked on the project from the very beginning, explains, "We wanted to use the photovoltaics not only as a technical element, but as a design element as well."

The students from Wuppertal also installed PV modules on the south-facing façade surfaces. Their entry stood out for the gray envelope covering the entire house. The aluminium-coated awning fabric offers a high degree of shading, while at the same time offering a view to the outside. The Berlin team's house, called Living Equia, attracted attention with its black façade. The students treated the larch wood with a gas burner to make it weatherproof and resistant to insects.

As simple as possible

While the German houses had a reputation for being expensive and high-tech, there were others in which the designers emphasised simplicity of materials and systems. The Finnish entry was such a house. "We wanted to create a house that used all natural materials," says Mark Auvray from the Helsinki University of Technology team. "It is a very modest house. The owner does not have to do much." The 50 cm thick walls are made of wood fibres and engineered wood and absorb moisture. The windows are frameless and are recessed into the building envelope. This method of construction saves builders costs and reduces

thermal bridges. The Finns generate power with 60 m² of monocrystalline PV modules on the roof; they installed 5 m² of flat plate collectors to cover heating. While Auvray was disappointed that the team did not take first place in the sustainability category, he said that he was nonetheless proud that it was Finland's first net zero energy house.

The Tongji University team from Shanghai also used typical Chinese building material – namely, bamboo. "It is a traditional Chinese residential house with the double-curved roof and the bamboo inside and outside," says team member Jiawei Wu. Vacuum insulation panels were used for insulation. The students mixed PCM into the concrete-like wall material in order to keep the room temperature stable. PCM is also integrated into the floor of the bedroom, allowing residents to get by without ventilation. The Chinese installed bamboo mats on the exterior. Active systems included a 9 kW system with modules provided by Chinese manufacturer ENN and tube collectors for hot water.

Like the house from China, the University of Florida building was built in a style typical of its country of origin. The students modelled their entry on so-called "cracker houses." This typically Florida-style construction is tailored to the hot, humid climate in the American state. The characteristic feature is the breezeway, a corridor between the night area with bedrooms and bath, and the living area with the kitchen and work area. The breezeway naturally ventilates the house.

A "second skin" surrounds the façade and parts of it are moveable, allowing privacy or visibility as needed. The wood, a variety of pine, was treated with an acid solution, making it resistant to fungi and insects and ensuring that it will last at least 80 years, according to Maruja Torres-Antonini, a professor at the university. The team from Florida installed 2 kW of PV modules from California manufacturer Solyndra on the south façade. Their appearance is reminiscent of tube collectors. On the roof is a traditional PV system with an output of 12.6 kW. "Heating is not our concern in Florida," answers Torres-Antonini when asked about the heating system. "When it gets a bit colder in winter, we put on more clothes." For cooling, on the other hand, there is air conditioning. There is also an air-to-water heat pump in the cracker house.

50 Sun & Wind Energy 8/2010

People's favourite from Spain

Of the five Spanish competition entries, the Universidad CEU Cardenal Herrera of Valencia finished best at 9th place. The entry was called SML, which stands for small-medium-large. The key characteristic of the house is the modular concept, seen in many of the entries at the competition. The house consists of various blocks, which can be expanded based on how much space is needed. In Madrid the team led by faculty advisor Fernando Sanchez presented the medium version, comprising six blocks. The wall construction of this house was unique in the Solar Villa; it was a combination of photovoltaic modules integrated into the façade and a white building material called Corian. The material consists of acrylic plastic and mineral salts. While it is not particularly environmentally friendly, it is visually appealing. That could very well be a reason why this house was one of the two favourites of the visitors, who were allowed to cast votes on site.

The visitors' first choice, however, was from the Instituto de Arquitectura Avanzada de Cataluña, Barcelona. The university's Fab Lab house was the most unusual in the competition in terms of shape. The house has an arched superstructure standing on four "legs." Team member Guillem Camprodon explains the shape, "It is the perfect shape to get as much energy as possible during the whole day." The angle is somewhat more steep toward the north, flattening out toward the south. The arched wood panels of the exterior façade were cut by a robot using CNC technology. Under the house, residents can enjoy the shade.

Because efficiencies of the flexible PV modules currently on the market were too low, the students developed their own. They used monocrystalline cells from SunPower with an efficiency of 22 %, according to Camprodon. Students bonded the cells to flexible Teflon which they applied to the arches. From the outset, they planned the house using Ecotech software. The programme rendered the shape as the ideal for the weather conditions in Barcelona. The name "Fab Lab" is derived from Fabrication Laboratory, a global network of institutions. Three "sun bubbles" on the roof were real eye catchers. Inside the transparent shells were plastic pipes which generate heat energy for the 300 L boiler.

Despite the somewhat haggard appearance of participants on the final weekend of the competition, and their apparent relief that the competition was coming to an end, they were nonetheless positive. "It was very exhausting but a great experience. All of the students learned definitely more than in class," said Kevin Priest, a PhD student at the University of Florida. His view was echoed by a number of the students. Travis Rookstool of Virginia Polytechnic Institute & State University said, "This is probably one of the best interdisciplinary studies we can work on." This experience may attract other university teams, which should ensure

A ventilation tower on the roof and PV modules on the façade: team Stuttgart combined traditional with modern technologies.





that the organisers will have no problem finding enough participants for the next Solar Decathlon Europe to be held in Madrid in 2012.

Ina Röpcke

Further information:

Solar Decathlon Europe: www.sdeurope.org Solar Decathlon: www.solardecathlon.gov



Team Deutschland glänzt

Ende Juni fand in Madrid der erste "Solar Decathlon Europe" statt – ein Solararchitekturwettbewerb für Hochschulen. Zwei deutsche Teams schafften es auf das Siegertreppchen.

17 Hochschulteams von drei Kontinenten präsentierten beim ersten "Solar Decathlon Europe" in Madrid Prototypen für Null- und Plusenergiehäuser.

> Foto: Schneider Electric/ Manuel García Meléndez

er Kontrast hätte kaum größer sein können. Auf der Westseite des Flusses Manzanares in Madrid ragen Hochhäuser in den Himmel, wie sie in rasch wachsenden Großstädten zu finden sind. Energieschlucker im Einheitslook. Funktional, aber nicht sonderlich ästhetisch. Auf der gegenüberliegenden, dem Königspalast zugewandten Uferseite, kontern Ende Juni 17 Häuser mit Kreativität, Individualität und Energieautarkie: ein chinesisches Bambushaus mit geschwungenen Dächern, streng symmetrische Pavillons mit weißen, schwarzen, blauen oder grünen Fassaden aus Holz, Glas oder Plastik, ein käferförmiges Holzhaus mit "Solar-Bubbles", die aussehen wie Glubschaugen, und eine metallisch schimmernde Bleibe im Container-Stil. Auf vielen Dächern und an Fasaden Photovoltaikmodule und Solarkollektoren: So stellen sich 17 Hochschulteams aus China, Finnland, Spanien, Frankreich, England, Deutschland und den USA das Bauen und Wohnen von morgen vor.

Mit ihren Nullenergiehaus-Entwürfen hatten sie sich für den ersten "Solar Decathlon Europe" (SDE) qualifiziert, einen Solararchitekturwettbewerb für Hochschulen, der vom 17. bis 27. Juni erstmals in Madrid stattfand. Aus Deutschland beteiligten sich vier Bildungseinrichtungen: die Bergische Universität Wup-

pertal, die Fachhochschule für Technik und Wirtschaft Berlin, die Hochschule für angewandte Wissenschaften – Fachhochschule Rosenheim und die Hochschule für Technik (HFT) Stuttgart. Am Tage der Siegerehrung hatten besonders letztere beiden Grund zum Jubeln.

Ursprung in den USA

Der Solar Decathlon findet seit 2002 zweijährlich in Washington D.C. statt. Teilnehmen können Hochschulteams aus aller Welt, in erster Linie treten jedoch nordamerikanische Teams zum solaren Zehnkampf an. Bis 2007 verlangte der Veranstalter, das US-Ministerium für Energie, ein energieautarkes Haus, das nicht an das öffentliche Netz angeschlossen ist. Seit 2009 wird ein Netto-Nullenergiehaus gefordert, das über eine ausgeglichene Jahresenergiebilanz verfügt.

In dem Wettbewerb dreht es sich nicht nur darum, welches Haus das beste Energiekonzept hat. Interdisziplinär besetzte Fachjurys nehmen die Häuser in zehn Kategorien unter die Lupe, daher der Name "Decathlon". Auf Basis subjektiver Urteile und objektiver Messungen können insgesamt 1.000 Punkte erreicht werden. Etwa die Hälfte davon sind in den Kategorien Architektur, Energiebilanz, Komfortbedingungen und Nachhaltigkeit zu holen. Die andere Hälfte gibt es in den Bereichen Planung und Konstruktion, Solarsystem, Ausstattung/Geräte, kommunikativer und sozialer Anspruch, Marktfähigkeit und Innovation. Die Häuser dürfen nicht mehr als 75 m² Wohnfläche haben und maximal 5,5 m hoch sein.



mit dem 1. Platz in Washington für Furore. In der Zwischenzeit regte die Universität für Technik in Madrid an, den Wettbewerb auch in Europa stattfinden zu lassen. Gemeinsam mit dem spanischen Bauministerium und mit Unterstützung des US-amerikanischen Energieministeriums setzte sie den Plan in die Tat um. Die Wettbewerbskriterien wurden aus den USA übernommen

Starke Nerven gefragt

Doch bevor die Studierenden der Fachbereiche Architektur, Innenarchitektur, Ingenieurswesen, Bauphysik, Sustainability und Energietechnik der Jury ihre Konzepte erläutern konnten, hatten sie einen weiten Weg mit einigen Strapazen hinter sich. Durchschnittlich zwei Jahre arbeiteten sie an ihren Projekten. Nur das Team aus Shanghai hatte lediglich sechs Monate Zeit. Die Entwickler und Erbauer des Bambushauses waren für die Hochschule aus Mexico nachgerückt, für die sich der Transport ihrer Häuser zwischenzeitlich als zu teurer erwiesen hatte.

Die Studierenden entwarfen und verwarfen Pläne für ihre Prototypen. Sie quälten sich durch 300 Seiten Regelwerke und formulierten Projektberichte mit 500 Seiten. Sie suchten Sponsoren, verhandelten mit Herstellern und bauten Möbel, Fassaden, Dächer und Wände. Sie entwarfen Kommunikationskonzepte, Broschüren und Websites. Und sie organisierten den Transport der Häuser über Ozeane oder Tausende von Kilometern auf Straßen. Die Container aus Florida waren drei Wochen auf dem Meer unterwegs. Ein Container des Teams aus Valencia steckte wegen eines Streiks fest und konnte nur mit viel Diplomatie herausgeholt werden.

Genau eine Woche hatten die Teams für den Aufbau ihrer Häuser Zeit. In genau dieser Woche vor der offiziellen Eröffnung am 17. Juni regnete es für spanische Verhältnisse überdurchschnittlich viel. Damit hatten auch die Organisatoren nicht gerechnet. Sie hatten die Fläche entlang des Flussufers zwar eigens für die Villa Solar vorbereitet, doch das Team aus Rosenheim hatte Pech: Als die Männer und Frauen mit dem Bau loslegen wollten, rutschte der Boden weg, die Bagger mussten ran und den Untergrund neu aufschütten.

Auch die Stuttgarter Studenten bewiesen Nervenstärke. Während des Transportes war eine Decke im Container gerissen. Die herunterstürzenden Teile zerstörten Graphitplatten, sie verbogen Aluminiumträger und beschädigten PCM-Platten. Jetzt war Krisenmanagement gefragt. In Deutschland orderten sie Ersatz und beauftragten ein Fuhrunternehmen, die Teile mit einem Transporter so schnell wie möglich nach Madrid zu bringen. Drei Tage warteten sie. Kein Sprinter kam. Als sie gerade auf spanische Gipsplatten ausweichen wollten, traf die Fuhre ein.

Von solchen Erlebnissen können die Teams reichlich erzählen. Deshalb war es verständlich, dass viele am Ende der Wettbewerbswoche etwas erschöpft und der Sache überdrüssig wirkten. Von der spanischen Organisation war man ebenfalls nicht überzeugt. "Da trifft deutsche Gründlichkeit auf spanische Gelassenheit",

meinte ein deutscher Student süffisant und erwähnte Sensoren, die andere Messergebnisse zeigten als die mitgebrachten, vom Fraunhofer ISE kalibrierten. Auch irritierte die Tatsache, dass die in den Einzeldisziplinen erzielten Punkte irgendwann nicht mehr mitgeteilt wurden. Bemerkenswert war da, wie die Studenten immer professionell, auskunftsbereit und freundlich blieben. Und das, obwohl laut Veranstalter rund 190.000 Menschen die Villa Solar besuchten und die Studenten bei 30 °C im Schatten mit ihren Fragen löcherten.

Das Schlangestehen, das viele Besucher gerade an den Wochenenden in Kauf nahmen, lohnte sich. "Jedes Haus hat etwas Bemerkenswertes", brachte es Roberto Steck-Ibarren, Architekturstudent und Jury-Assistent, auf den Punkt. Wie groß die Bandbreite an Bau- und Energiekonzepten und der Einfallsreichtum der Studierenden waren, zeigen exemplarisch die vier deutschen

Wärmeschutz bitter nötig

Allen gemeinsam war der optimale Wärmeschutz, den die Teams mit Hilfe einer sehr gut gedämmten Gebäudehülle und konsequentem Sonnenschutz erzielten. Zur Innenraumtemperierung nutzen sie passive Elemente wie PCM (phase change material). Ganz ohne aktive Systeme ging es in Madrid aber nicht. Um im Sommer ein angenehmes Raumklima zu schaffen, kamen Lüftungsanlagen mit Wärmerückgewinnung und reversible Wärmepumpen zum Einsatz. Laut Wettbewerbsregeln musste eine Innenraumtemperatur von maximal 25 °C gehalten werden können.

Das Haus der HFT Stuttgart trug den Namen "Home+". "In der Simulation erzielen wir drei mal so viel Energie wie nötig, hier sind es zu gewissen Zeiten sechs mal soviel", sagte Maximilian Martin, der von Anfang an im Team mitarbeitete. Das Haus ist, wie viele

Den ersten Platz machte das Team der Virginia Polytechnic Institute & State University mit seinem Lumenhaus.

> Fotos (6): SDE Detailfotos (4): Ina Röpcke





Das Rosenheimer Team entwickelte einen Sicht- und Sonnenschutz, der sich vom Boden her ausfahren lässt.

ebaut. Module en den Trans
Passivhausstandard unterbieten

der Wettbewerbsbeiträge, modular aufgebaut. Module erleichtern die Vorfertigung, vereinfachen den Transport und sie ermöglichen es, das Haus einfach zu erweitern und umzugestalten. Die Zwischenräume lassen bei dem Stuttgarter Haus zudem Licht und Luft in das kompakte Gebäude.

Das Team kombinierte traditionelle und moderne, aktive und passive Technologien. Traditionell ist der Ventilationsturm, der nach dem Vorbild der Windtürme im arabischen Raum das Prinzip der Verdunstungskühle nutzt. Ein passives System sind die PCM in der Decke. Die Kühlung wird aktiv durch wasserdurchströmte Rohre in der Decke unterstützt.

"Die Photovoltaik wollten wir nicht nur als technisches, sondern auch als gestalterisches Element nutzen", erläutert Martin. Deshalb wählten sie farbige Solarzellen von Sunways mit einer Beschichtung von Ertex Solar für die Fassade. Mono- und polykristalline Module mit insgesamt 12,5 kW Leistung sind an den Fassaden und auf dem Dach montiert. Darüber hinaus entwickelte das Team in Eigenregie einen Hybridkollektor, um die nutzbare Wärme bei der Stromerzeugung abzuführen. Die Absorber sind mit einem einkomponentigen, hochwärmeleitfähigen Kleber an den Modulrückseiten aufgeklebt. 16 Module mit jeweils 3 m² Fläche bauten die Studierenden. "Bei dem Klima in Madrid liegt der Fokus auf Kühlung, deswegen wollten wir einen unabgedeckten Kollektor", erklärt Martin die Eigenentwicklung. Für das warme Wasser gibt es 6,6 m² Röhrenkollektoren mit einem 300-L-Trinkwasserspeicher.

Sieger der Herzen: Das Team Ikarus aus Rosenheim freut sich über den 2. Platz.



Das Team Ikarus aus Rosenheim versteckte die PV-Module mit einer Leistung von 12,6 kW auf dem Flachdach seines aus vier Steckmodulen zusammengesetzten Hauses. Basis des Hauskonzeptes ist wieder die Dämmung. Dank Vakuumisolationspaneelen und Hanfdämmung haben die Wände und die Decke einen U-Wert von nur 0,1 W/(m²·K). "Wir wollten den Passivhausstandard noch unterbieten", erklärt Robert Spang, Student im Fachbereich Holz und Ausbau. Das Besondere an dem Haus ist der Sicht- und Sonnenschutz aus Aluminium an den Außenwänden. "Unser Ziel war eine Fassade, die sich mit der Sonneneinstrahlung verändert", sagt Spang. Das aus dem Boden nach oben fahrbare System bietet Sichtschutz, schützt vor Sonne und lässt zugleich Tageslicht in das Gebäude. Die Oberfläche ist so gestaltet, dass sie mit flexiblen Dünnschichtmodulen bestückt werden kann. Heizen, Kühlen und Lüften geschieht über eine Lüftungsanlage. Ein Wärmetauscher bereitet mit Hilfe der Abwärme der Wärmepumpe warmes Wasser. Zusätzlich nimmt ein luftdurchströmter PCM-Puffer tagsüber Wärme auf und gibt sie nachts wieder ab.

Draußen leben

"Unser Haus sollte in Madrid, aber auch in Deutschland funktionieren. Wir wollten ein europäisches Haus schaffen", betont Bettina Tietz, Master-Studentin in Architektur an der Bergischen Universität Wuppertal. Das Haus erreiche an vielen Standorten eine ausgeglichene Energiebilanz. Eine extrem gut gedämmte Gebäudehülle sorgt auch hier für einen niedrigen Heizund Kühlenergiebedarf. Wie andere Teams auch, verfolgten die Wuppertaler zudem das Ziel, "das Leben weitgehend draußen stattfinden zu lassen". Hierfür planten sie große Terrassen mit ein. In die Südwand sowie auf dem Dach sind PV-Module mit 10 kW Leistung integriert. An der zweiten herausragenden Wand sind Röhrenkollektoren montiert. Eine Besonderheit ist der graue Stoff, in den das Haus eingehüllt ist. Bei dem Markisenstoff handelt es sich um eine Kunstfaser, die



mit Aluminium bedeckt ist. Sie bietet einen hohen Verschattungsgrad, gewährt aber gleichzeitig den Blick nach außen.

Das Team der Hochschule für Technik und Wirtschaft in Berlin war das einzige deutsche Team, das ein Haus mit Satteldach entwarf. Auf dem Dach produziert ein PV-System von Solon Strom. An der Südfassade des Hauses sind insgesamt 8 m² Solarkollektoren von Wagner montiert. Zwischen den beiden Kollektorflächen ist ein PV-Verschattungssystem in die Fassade integriert. Dabei sind Zellen von Q-Cells auf Plexiglas eingebracht. Über Schienen können die PV-Wandflächen verstellt werden. Die Berliner drehten ihr Haus 12° nach Südosten, um die Morgensonne besser einzufangen.

Ebenso auffällig wie besonders an dem Haus ist die schwarze Gebäudehülle. Das Lärchenholz wurde mit einem Gasbrenner behandelt und so wetterbeständig und resistent gegen Ungeziefer gemacht. Innen sorgen Lehmwände mit integrierten PCM sowie ein natürliches Nachtlüftungssystem für ein angenehmes Raumklima. Wasserdurchströmte Rohre in den Lehmbauplatten unterstützen die Kühlung aktiv.

Team Deutschland

In der Bewertung landete das Haus aus Berlin mit 728,85 auf Platz 10. "Wir sehen es olympisch", sagte Volker Quaschning, Professor für Regenerative Energiesysteme, der mit dem Team nach Madrid gereist war. "Hauptsache, wir sind dabei." Das Team Wuppertal erzielte 772,72 Punkte und damit den 6. Platz. Die Teams aus Rosenheim und Stuttgart hingegen verfehl-



ten nur knapp den 1. Platz. Sieger des ersten Solar Decathlons Europe wurde das Lumenhaus der Virigina Polytechnic Institute & State University mit 811,83 Punkten. Mit dem Haus waren die Amerikaner schon einmal beim Solar Decathlon in Washington vertreten. Sie hatten so insgesamt vier Jahre Zeit für Planung und Modifikation.

Umso beachtlicher ist daher, dass die beiden deutschen Teams mit zwei Jahren Vorbereitungszeit fast ebenso viele Punkte erzielten. Das Team Ikarus aus Rosenheim landete auf Platz 2 mit 810,96, das Stuttgarter Team mit 807,49 Punkten auf Platz 3. Entsprechend groß war der Jubel bei der Siegerehrung. Da feierte das "Team Deutschland", als welches die vier Mannschaften oft bezeichnet wurden, zusammen. "Viel Arbeit war es" und "sehr anstrengend": So blickten viele der Studierenden auf den Wettbewerb zurück. Positiv seien insbesondere der Austausch und der Lerneffekt gewesen. "Es war spannend, das Haus zu verstehen und zu betreiben", meint Maximilian Martin aus Stuttgart. Am Reißbrett hätten die Studierenden sicher nicht halb so viel gelernt. Einige Teilnehmer meinten, auch die Veranstalter hätten so einiges zu lernen und nachzubessern, bis es in zwei Jahren dann wieder heißt: Willkommen zum Solar Decathlon in Madrid! Ina Röpcke

Weitere Informationen:

Bergische Universität Wuppertal: www.sdeurope.uni-wuppertal.de Hochschule für angewandte Wissenschaften – Fachhochschule Rosenheim: www.solar-decathlon.fh-rosenheim.de Hochschule für Technik und Wirtschaft Berlin: www.living-equia.com Hochschule für Technik Stuttgart: www.hft-stuttgart.de Solar Decathlon Europe: www.sdeurope.org

Sonnenhaus – ein Haus mit Zukunft

Das Buch "Das Sonnenhaus" beschreibt praxisnah, wie Sonnenheizungen mit hohem solarem Deckungsgrad gebaut werden können. SW&W verlost fünf Exemplare des Buches von Josef Jenni. Schreiben Sie bis zum 23. Juli eine E-Mail an info@sonnewindwaerme. de, Stichwort "Sonnenhaus". Die Gewinner veröffentlichen wir in der SW&W 12/2010, die am 16. August erscheint.



Der Rechtsweg ist ausgeschlossen.

"Das Sonnenhaus" kann auf www.jenni.ch zum Preis von 30 CHF / 20 € bestellt werden.

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S-Mitte

Nr. 20 | Freitag, 27. August 2010



Haus der Geschichte

Ausgezeichnete Ausstellung

Das Haus der Geschichte blickt nach dem Ende der Großen Landesausstellung "Ihr und Wir. Integration der Heimatvertriebenen Baden-Württemberg" auf ihre bisher erfolgreichste Schau zurück. Insgesamt fünf Preise erhielt das Haus für die Vertriebenenausstellung. Ebenfalls positiv bewertet wurde die Erzählwerkstatt, bei der Schulklassen auf Senioren trafen, die über ihre Erfahrungen berichteten. Die Ausstellung dauerte vom 13. November 2009 bis zum 22. August und wurde von rund 22 000 Menschen besucht. Ein Ergebnis, mit der das Haus der Geschichte zufrieden ist. "Angesichts des schwierigen und komplizierten Themas ist das eine beachtliche Besucherzahl", so die Projektleiterin Paula Lutum-Lenger.

Keller Klub

Kreative Malschlacht mit Witz und Können

Urban Art heißt die Bewegung, die weltweit gerade die Künstlerszene beschäftigt. Auf seiner Tour kommt der Paint Club nach Europa und gastiert am 20. September im Keller-Klub. Dort treten zwei Künstlerteams gegeneinander an. Beide müssen innerhalb von 90 Minuten ihr kreatives Können beweisen und ihre Gegner mit Witz, Ironie und gekonnten Motiven ausstechen. Als Vorlage gibt es ein Thema, zu dem sie sich dann auf einer weißen Leinwand austoben. Die Battle-Tour soll die interaktive Plattform für Künstler der Urban Art-Bewegung aus aller Welt stärken. Interessierte bewerben sich bis zum 3. September auf www.the-paint-club.com.

Kurz berichtet

Haus der Wirtschaft Farbige Improvisationen

Im Haus der Wirtschaft ist noch bis morgen die Kunstausstellung "Color Improvisation" zu sehen. Die ausgestellten Werke entstanden, nachdem die amerikanische Künstlerin Nancy Crow 28 Textilschaffende aus Nordamerika und Europa dazu eingeladen hatte, zum Thema Farbe zu improvisieren. Die 50 großformatigen Werke, bei denen die Künstler mit den unterschiedlichsten Techniken wie Drucken, Färben oder Transferieren gearbeitet haben, wurden bis dato nicht ausgestellt. Nach der Schau in Stuttgart wandert die Ausstellung weiter an Orte in Europa, Amerika und in Japan. Die Besucher können täglich von 11 bis 18 Uhr in das Haus der Wirtschaft, Schlossstraße 19, kommen und die stofflichen Werke besichtigen.

Musikpavillon Jazz am Schlossplatz

Am Sonntag, 29. August, spielt im Rahmen der Reihe "Jazzstadt Stuttgart - Die Clubs" die Solid Old Jazzband. Los geht's um 14 Uhr am Musikpavillon. Das Konzert dauert bis 17 Uhr. Gespielt werden die Jazz-Richtungen Dixie, Swing, Chicago, Blues und Latin. Mit der zwölfteiligen Konzertreihe wollen die Stuttgarter Jazz-Institutionen auf den Stellenwert der Stadt in der Jazzszene hinweisen.

Café Künstlerbund Realisten und Symbolisten

Derzeit ist im Café Künstlerbund am Schlossplatz der zweite Teil der Sommertrilogie zu sehen. Nach der Kategorie "Abstrakte, Gegenstandslose" sind nun die "Realisten und Symbolisten" an der Reihe. Noch bis zum 11. September werden die Werke von zehn Künstlern gezeigt. Vom 13. September an bis zum 9. Oktober runden dann noch die Fotografen und Fotokünstler die Trilogie ab. Das Café hat täglich von 9 bis 1 Uhr geöffnet, freitags und samstags bis 3 Uhr. ktm



Das Ergebnis nach zweijähriger Arbeit kann sich sehen lassen. Das Solarhaus ist optisch ein Hingucker und ein wahres Energiebündel.

Foto: Technische Hochschule

Solarhaus von Studenten gewinnt einen Preis

Campus Die Technische Hochschule präsentiert ein Gebäude, das selbstständig seine eigene Energie produziert. Von Sybille Neth

in Haus, das dreimal mehr Energie erzeugt, als es selbst benötigt. Ein Haus, das glitzert wie die Bauhaus-Version eines Palastes aus tausendundeiner Nacht. Ein Haus, das je nach Bedürfnissen vergrößert werden kann und mit 250 000 Euro Baukosten zwar teuer, aber nicht unerschwinglich ist. Ein Haus, das in Madrid beim internationalen Wettbewerbe "Solar-Decathlon" den dritten Preis für sein innovatives Konzept erhielt. Dieses Haus steht zurzeit auf dem Parkplatz der Technischen Hochschule (TH) an der Holzgartenstraße bei der Liederhalle.

Entstanden ist das Wunderding in zweijähriger Arbeit an der TH. Mitgearbeitet haben in diesem Zeitraum 150 angehende Architekten, Innenarchitekten, Bauphysiker. Konstruktionsingenieure sowie Studierende aus den Fachbereichen der nachhaltigen Energietechnik und des Infrastrukturmanagements. Denn für die Realisierung des Wettbewerbsbeitrags ließen Jan Cremers und Sebastian Fiedler, die das Projekt leiteten, eine eigene Fundraisingabteilung aufbauen: 1,5 Millionen Euro mussten sie für Entwicklung, Bau, Honorare und den Transport nach Madrid aus eigener Kraft über Sponsorengelder aufbringen. Jetzt sitzen 65 Partnerfirmen mit im Boot. "Alle haben Interesse an einzelnen Komponenten des Hauses", so Cremers.

Das Solarhaus hatte sich bei der Bewerbung 2008 im Kreis von weltweit 100 Mitbewerbern durchgesetzt und wurde von der Jury für den Hochschulwettbewerb in Madrid im Juni ausgewählt. 20 Teams konkurriertem mit den Stuttgartern.

Konzipiert ist das Haus für die klimatischen Verhältnisse Madrids, wo es in zehn Disziplinen (Decathlon heißt Zehnkampf) von der Innenarchitektur bis zur Funktionsweise der besonders kleinen Wärmenumpe bestehen musste. "In den Bereichen Innovation und Konstruktion bekamen wir sogar den ersten Preis", freut sich Cremers. In der Gesamtwertung belegte es den dritten Platz.

Die Außenwände des Solarhauses sind durchgehend mit golden bis bronze schil-

lernden Solarzellen verkleidet. "Ein Thema des Wettbewerbs ist es, Solartechnik in den Innenraum und in die Architektur einzubringen", so Fiedler. Dabei werden strenge ästhetische Maßstäbe angelegt. Deshalb wären für das Wettbewerbsprojekt die unattraktiven üblichen grauen Solarzellen optisch indiskutabel gewesen.

Das Haus besteht aus 16 Quadratmeter großen Modulen. Das Wettbewerbshaus ist aus sieben solchen Elementen zusammen-

65 Firmen haben ein Interesse an einzelnen Teilen des

gesetzt und soll ausreichend Platz zum Wohnen und Arbeiten für zwei Personen bieten. Für den Platzbedarf einer Familie wäre es dementsprechend erweiterbar.

Hauses. Verbunden sind die Module mit Fugen aus Glas, die zur Warmwasserversorgung dienen: Auf dem Hausdach sind auf jeder Glasden Transport fast unbeschadet. fuge so genannte Vakuumröhrenkollektoren installiert. Da hinein wird Wasser gepumpt, das von der Sonne erhitzt wird und zur Warmwasserversorgung dient.

Küche und Essbereich werden vom Wohn- und Schlafbereich durch den so genannten Energieturm räumlich getrennt: Nach dem Prinzip der Verdunstungskühlung und über eine selbst erzeugte Thermik werden die Räume ohne Energieverbrauch klimatisiert. Im Winter wird erhitztes Wasser aus den Kollektoren auf dem Dach in die Fußbodenheizung gepumpt.

"In Madrid erzeugt das Haus 96 Prozent seines Warmwasser- und Heizbedarfs selbst, in Stuttgart ist es ungefähr die Hälfte", erklärt Fiedler. Bei der Bilanz der Stromerzeugung über die Photovoltaikanlage sind die Unterschiede noch krasser: Unter spanischen Bedingungen produzieren die bunten Solarzellen dreimal mehr Strom, als das Haus selbst benötigt. Unter süddeutschem Himmel wird etwas mehr als der Eigenbedarf erzeugt.

190 000 Besucher wurden in den zehn Tagen während des Decathlon gezählt und Abends feierten die Stuttgarter in ihrem Solarhaus mit Holzterrasse rundum Dinnerpartys. Das Haus überstand das und

Jetzt suchen Cremers und Fiedler für das Ausstellungsstück einen festen Standplatz "hochschulnah" sollte er sein, betonen sie, denn das Musterhaus soll auch für kommende Semester wertvolle Anregungen bieten und für deutsche Verhältnisse weiter entwickelt werden.

"Am Ende wird das Haus etwas fetter sein"

Hospitalviertel Für Götz Guggenberger ist das Jugendhaus ein gelungenes Beispiel für Nachkriegsarchitektur. Von Kathrin Thimme

orbei an Stapeln mit Baumaterial gelangt man derzeit nur über lose Bretter in das Kinder- und Jugendhaus in Stuttgart-Mitte. In einigen Räumen sind die Fenster bereits herausgebrochen, darüber genagelte Holzbretter schließen die Öffnungen nur provisorisch. Von den alten Holzrahmen splittert die Farbe ab, der Putz bröckelt an einigen Ecken von der Wand und der ganze Boden ist mit einer feinen Staubschicht bedeckt.

Das Kinder- und Jugendhaus gleicht gerade einer Ruine, ein Zustand, der in diesem Fall gewünscht ist. Die Arbeiter auf der Baustelle liegen zeitlich im Plan, und bisher kam es auch zu keiner Überraschung, die die Sanierung des Jugendhauses teurer werden lässt, was besonders Sieghard Kelle, den Geschäftsführer der Stuttgarter Jugendhaus gGmbH, freut.

"Momentan werden die Heizkörper ausgetauscht und die Fenster neu ersetzt", sagt Kelle. "Demnächst geht es dann mit der Fassade los." Das Gerüst dafür ist schon aufgebaut. Vom ersten Obergeschoss an aufwärts packen die Arbeiter das Haus und die Flachdächer in dicke Pakete aus Dämmstoff ein. "Am Ende wird das Haus dann etwas fetter sein", sagt der Jugendhaus-Geschäftsführer.

Diese optische Veränderung lässt sich nicht vermeiden, immerhin werden die Arbeiten an dem Bau aus dem Jahr 1952 ausschließlich aus energetischen Gründen gemacht. So sieht es das Konjunkturprogramm II vor, das die drei Millionen Euro teure Sanierung mitfinanziert.

Dass das Gebäude, entworfen und gebaut vom Regierungsbaumeister Karl Elsässer, anschließend wieder originalgetreu aussieht, darum kümmert sich der zuständige Architekt Götz Guggenberger vom Büro Guggenberger und Ott. "Das Haus hat eine sehr filigrane Erscheinung und eine interessante Z-Form", beschreibt Guggen-

UMBAU DRINNEN UND DRAUSSEN

Jugendhaus Die Sanierung dauert bis Ende Juni 2011. Die Maßnahme ist ein Teilprojekt des Sanierungsgebiets 26, dem Hospitalviertel. Die Kosten für die Modernisierung des Gebäudes betragen drei Millionen Euro. Ein Teil des Geldes stammt aus einem objektbezogenen Förderprogramm, weshalb die Umbauarbeiten einer strengen zeitlichen Frist unterliegen.

Außenbereich Bereits 2007 wurden die Freiund Grünflächen modernisiert. Zwei Ballspielfelder sind seither vorhanden, Wege und Sitzflächen wurden neu gestaltet. Im noch folgenden Bauabschnitt soll vor allem der öffentliche Straßenraum neu definiert werden. An der Firnhaberstraße entstehen 26 Querparker. Die Außenfläche des Jugendhauses wird durch diese Umstrukturierung vergrößert. ktm

berger das Gebäude. "Es ist ein gelungenes Beispiel für süddeutsche Nachkriegsarchitektur in Reinform", so Guggenberger.

Besonders beeindruckend aus architektonischer Sicht sei die gegliederte Fassade mit den gerahmten Fenstern, die stark an Schmitthenners traditionelle Baukunst erinnert, und gleichzeitig durch ihre längliche Form an den Bauhausstil. "Das Haus ist absolut erhaltenswert und bis heute funk-

tional stimmig", sagt der Architekt. Zudem sticht, mit Blick auf das gesamte Hospitalviertel, das Jugendhaus heraus, weil der Bau und der Hospitalhof die einzigen beiden Komplexe sind, die sich von der ansonsten typischen Blockbebauung des Quartiers abheben. Im Zuge der Sanierung des Hospitalviertels gewinnt das Kinderund Jugendhaus auch neue Freiflächen. "Zur Firnhaberstraße hin vergrößert sich das Gelände, in dem die dortigen Parkbuchten zu Querparkern werden", sagt Sieghard Kelle. Und auch zur Lange Straße hin kann Platz gewonnen werden. Die Grünfläche zwischen Gehweg und Jugendhaus-Gelände gehört zum Areal dazu. "Man hat es bisher nicht genutzt, und so war es die vergangenen Jahr nicht mehr als ein Hundeklo", sagt Kelle.

Den gewonnenen Platz möchten die Betreiber mit Liegen zum Chillen bestücken und eine Bühne bauen, auf der Theater gespielt werden kann. Möglich sein sollte dies im Sommer kommenden Jahres. Bis dahin müssen die Arbeiten in und um das Haus fertig sein, und auch die Gestaltung des Außenbereichs für rund 600 000 Euro soll 2011 abgeschlossen werden.



Nach der Sanierung ist das Jugendhaus in dicken Dämmstoff eingepackt. Foto: Zweygarth

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 η green-4-2010 > Solar Decathlon Europe

Solar Decathlon Europe

Innovationen für hohen Wohnkomfort von Prof. Dr. Jan Cremers, Sebastian Fiedler

Im Juni 2010 wurde in Madrid der erste Solar Decathlon Europe ausgetragen. Für diesen internationalen Wettbewerb entwarfen und bauten 20 Hochschulteams aus der ganzen Welt Prototypen für ein Netto-Plusenergie-Wohnhaus. Prof. Dr. Jan Cremers und Sebastian Fiedler vom Team der Hochschule für Technik Stuttgart mit dem Haus home+ berichten über ihr Projekt, das nach einer spannenden Wettbewerbsphase unter Madrids Sommersonne einen Platz auf dem Siegertreppchen erringen konnte.



Das Teilnehmerfeld des ersten Solar Decathlon Europe (SDEurope) war international besetzt. Neben Teams aus Spanien, Deutschland, Frankreich, Finnland und Großbritannien beteiligten sich auch außereuropäische Teams aus den USA, Mexiko, Brasilien und China. Die Aufgabe bestand darin, einen

Prototyp für ein Netto- Plusenergie Wohnhaus zu entwerfen, zu bauen, nach Madrid zu bringen und 'dort in zehn Disziplinen anzureten. Die Bewertung erfolgte durch die Auswertung von Messungen – z.B. Lufttemperatur und Luftfeuchte im Innenraum –, durch die Erfüllung gestellter Aufgaben – z.B. Waschen und Trocknen von Handtüchern – und durch Fachjurys. Dabei ging der Wettbewerb weit über bloße gestalterische und technische Aspekte hinaus, auch die Marktfähigkeit der Prototypen und die Kommunikation des eigenen Beitrags und der Wettbewerbsziele spielten entscheidende Rollen.

Die für den SDEurope entwickelten Häuser stellen die Bandbreite des heutigen Standes der Technik dar und weisen gleichzeitig weit darüber hinaus innovative Ansätze für zukünftige Entwicklungen im Bereich des energieeffizienten und nachhaltigen Bauens auf. home+, das Haus der Hochschule für Technik Stuttgart (HFT Stuttgart), verbindet dabei architektonischen Anspruch und traditionelle Methoden der Raumkonditionierung mit der sinnvollen Nutzung moderner Technologien und Materialie. Dafür wurde es in zwei der zehn Disziplinen des "solaren Zehnkampfes" mit dem ersten Preis ausgezeichnet: in den Disziplinen "Engineering and Construction" und "Innovation". Zweite Preise erlangte home+ in den Disziplinen "solare Systeme" und "Hausgeräte und Funktionalität", einen dritten Preis in der Disziplin "Nachhaltigkeit". Auch in den verbleibenden fünf Disziplinen wurde das Haus gut bewertet, sodass in einem äußerst knappen Finale in der Gesamtplatzierung der dritte Platz errungen werden konnte – der Abstand auf den Sieger betrug nur 4,5 von 1000 möglichen Punkten.

Herausforderung Gebäudekühlung

Das Klima in Madrid ist heiß und trocken, gerade auch zur Zeit des Wettbewerbs im Juni. Gleichzeitig gaben die Wettbewerbsregeln vor, dass im Inneren der Häuser die Temperatur zwischen 23–25°C und die relative Luftfeuchte zwischen 40–55 % gehalten werden sollte, auch wenn diese Vorgaben im Hinblick auf die sinnvolle Verwendung regenerativer Energien sicher infrage zu stellen sind. Die Vermeidung von Überhitzung und die Kühlung des Hauses waren also im Wettbewerb von entscheidender Bedeutung. Der Energieturm und die Energiehülle sind zwei wichtige und innovative Komponenten des Energiekonzeptes, die einen hohen Komfort bei gleichzeitig geringem Energieaufwand sicherstellen. Gleichzeitig prägen sie die Erscheinung des Gebäudes von außen und im Innenraum. [1]

Energieturm – ein altes Prinzip neu gedacht

Ausgabe η green 4 / 2010

Dieser Artikel wurde veröffentlicht in der Ausgabe η green 4 / 2010.

Die Autoren:



Prof. Dr. Jan Cremers



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Der Energieturm leistet in trockenen und heißen Regionen wie Madrid im Zusammenspiel von Wind, Verdunstungskälte und thermischem Auftrieb die Belüftung und Kühlung der Zuluft des Gebäudes, ohne dabei weitere Energie für den Lufttransport oder die Kältebereitstellung zu benötigen. Im Inneren des Turms verrieselt an abgehängten Tüchern Wasser. Hierdurch wird die Temperatur der durchströmenden Luft über Verdunstungskühlung abgesenkt. Anschließend tritt diese gekühlte Luft im Sockelbereich des Turmes quellluftartig in den Innenraum ein und trägt zum Wohnkomfort bei. Die Abluft verlässt das Gebäude durch die Bereiche links und rechts des Turmes, unterstützt durch so genannte Solarkamine. In diesen heizen sich mobile-artig gestaltete Absorberflächen durch die solare Einstrahlung auf und geben die Wärme an die umgebende Luft ab. Der dadurch entstehende thermische Auftrieb unterstützt die Durchströmung der Kamine und führt zu einem Unterdruck im Gebäude, wodurch die Funktion des kühlenden Teils des Turms gestärkt wird.

PVT-Kollektoren - Strom und Kühlenergie aus einer Hand

Die Energiehülle aus Photovoltaik-Modulen erzeugt tagsüber Strom und nachts Kälte. Dazu wird Wasser aus einem Rückkühlspeicher durch Rohre hinter den PV-Modulen auf das Dach gepumpt (Abb.1). Durch die Abstrahlung gegen den regelmäßig wolkenlosen Nachthimmel kühlen die PV-Module aus und entziehen dem dahinter vorbeifließendem Wasser Wärme. Das Prinzip der Strahlungskühlung beruht auf der Wärmeabgabe durch langwellige Abstrahlung eines Körpers an einen anderen Körper mit niedrigerer Temperatur, der als Wärmesenke dient. In der Anwendung zur Kühlung von Gebäuden stellt die Gebäudeoberfläche den zu kühlenden Körper dar, die Wärmesenke ist der klare Himmel. Dieser eignet sich dafür besonders gut, da die Himmelstemperatur – insbesondere in der Nacht – niedriger ist als die der meisten Gegenstände auf der Erde. Wie Experimente im Vorfeld gezeigt haben, sind dabei ie nach Wassertemperatur. Außentemperatur und Bewölkungsgrad Kühlleistungen von ca. 50-120 W/m² Dachfläche realistisch, gerade am Wettbewerbsstandort Madrid mit regelmäßig wolkenlosen Nächten im Sommer. Um diesen Effekt auszunutzen, wurde home+ mit einem Strahlungskühlungssystem ausgestattet, das an der HFT Stuttgart im Rahmen des Projekts neu entwickelte photovoltaisch-thermische Hybridkollektoren (PVT Kollektoren) verwendet. Das so gekühlte Wasser wird zur Regenerierung einer PCM-Decke, zur direkten Kühlung des Fußbodens und zur Kühlung von 1.200 Liter Wasser in einem "Rückkühlspeicher" genutzt. Dieser Speicher dient zur Rückkühlung einer reversiblen Wärmepumpe, die zur Abdeckung von Spitzenlasten vorgehalten wird. [2]

Regenerative Warmwasserbereitung und Heizung

Der Warmwasserbedarf wird über Vakuumröhren-Kollektoren gedeckt, die gleichzeitig in der Energiehülle als Verschattungselemente eingesetzt werden. Im Heizfall werden die überschüssigen und aufgrund des niedrigen Temperaturniveaus nicht zur Warmwasserbereitung nutzbaren Erträge der Vakuumröhren-Kollektoren genutzt, um den Wasserspeicher zu laden. Dabei handelt es sich um den oben erwähnten "Rückkühlspeicher", der im Heizfall der reversiblen Wärmepumpe als Wärmequelle zur Heizung des Gebäudes und zur Warmwasserbereitung dient. Ein Lüftungsgerät mit Wärmetauscher minimiert die Lüftungswärmeverluste im Winter und unterstützt durch Befeuchtung der Abluft mit einem weiteren Wärmetauscher die Kühlung der Zuluft.

Plusenergiehaus durch innovative Photovoltaik

Der Energiebedarf für Heizen, Kühlen, Lüftung und Warmwasser wird durch die oben beschriebenen passiven und aktiven Maßnahmen minimiert, ein Plusenergiehaus wird home+ aber natürlich erst durch regenerativ erzeugten Strom. Diesen liefern PV-Module an der Ost- und Westfassade sowie auf dem Dach, die sich wie eine zweite aktive Haut um die Gebäudemodule legen. Ihren besonderen Charakter erhält diese Hülle durch den Einsatz mehrfarbiger PV-Zellen aus polykristallinem Silizium (Titelbild). Die goldenen und bronzenen polykristallinen PV-Zellen weisen einen Zellenwirkungsgrad von etwa 13 % auf und lassen sich somit auch in einem Modul verbauen, ohne Einbußen beim Stromertrag in Kauf nehmen zu müssen. Mit einem Zellwirkungsgrad von etwa 17 % liefern die polykristallinen Zellen auf dem Dach aber natürlich den größten Anteil des jährlichen Stromertrags. Bei einer installierten Gesamtleistung Leistung von etwa 12 kWp (6 kWp an den Fassaden, 6 kWp auf dem Dach) liegt der jährliche Stromertrag am Standort Madrid bei etwa 11.400 kWh, der simulierte Jahresverbrauch von home+ bei etwa 3.800 kWh. Über ein Jahr gesehen wird also etwa dreimal so viel Strom produziert wie verbraucht.



Auch für den Standort Stuttgart ist das Haus mit einem Ertrag von etwa 7.400 kWh und einem Verbrauch von 5.300 kWh noch in den schwarzen Zahlen.

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Wer baut das beste solar betriebene Wohnhaus?

Innovatives aus Architektur, Wohnen, Bau, Immobilien Di 25.11.2008

Solar Decathlon Europe 2010

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Der Startschuss ist bereits gefallen. Seit Anfang Oktober arbeiten Studierende des Masterstudiengangs Architektur am konzeptionellen Entwurf des Hauses, der bis Ende dieses Jahres abgeschlossen sein wird. Innovative Materialien und die intelligente Abstimmung von Gebäude, Anlagentechnik und Nutzung sind die Grundlagen für eine ansprechende Gestaltung, einen geringen Energieverbrauch und hohen Wohnkomfort.

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Autor: Fachhochschule Stuttgart, Hochschule für Technik



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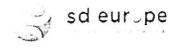






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Stuttgarter Hochschule für Technik tritt beim Solar Decathlon Europa 2010 an



Die Hochschule für Technik Stuttgart ist beim Solar Decathlon Europe 2010 dabei! Bei diesem "Solaren Zehnkampf" treten 15 bis 20 ausgewählte Hochschulteams an, um bis Juni 2010 ein

ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Zum Abschluss des Wettbewerbs werden die Häuser aller Teams in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet. Der Solar Decathlon Europe wird zum ersten Mal in Europa ausgetragen. Auslober des europäischen Wettbewerbs ist das spanische Wohnungsministerium in Zusammenarbeit mit dem amerikanischen Energieministerium. Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinführung innovativer solarer Energietechnologien soll gefördert und der Beweis angetreten werden, dass energieeffizientes Bauen auch mit einer Steigerung des Komforts, sowie der Gestaltungs- und Lebensqualität, einhergehen kann.

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29.11.2008 Quelle: Fachhochschule Stuttgart, Hochschule für Technik Solarserver.de © Heindl Server GmbH

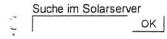
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- ▶ 07.12.2008: Potsdamer Forscher zeigen Grenzen des Bioenergie-Potenzials auf
- 07.12.2008: <u>Biogas-Einspeisung</u>: <u>Innovative Bioerdgasanlagen ausgezeichnet</u>
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Pressemitteilung

Solar Decathlon Europe 2010: Die ersten Entwürfe sind abgegeben

Petra Dabelstein, Pressestelle Fachhochschule Stuttgart, Hochschule für Technik

10.02.2009 08:39



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10.02.2009, 15:17 Uhr

Artikel empfehlen

Erste Entwürfe für den Solar Decathlon Europe 2010

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Weitere Meldungen und Informationen zum Thema energieffizientes Bauen KfW-Award: Wohneigentum energetisch sanieren und ästhetisch bewahren Bauministerium: Sanierungs-Wettbewerb für Großwohnsiedlungen gestartet **IWR-Themengebiet Bauen und Energie** Weitere News aus Wissenschaft und Forschung © IWR, 2009



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Solar Decathlon Europe 2010: Die ersten Entwürfe sind abgegeben



Zehnkampf um das beste Solar-Haus.

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TOP 10 SOLAR-NEWS die wichtigsten Solarnachrichten auf einen Blick



10.02.2009 Quelle: HFT Stuttgart Solarserver.de © Heindl Server GmbH Bildquelle: Solar Decathlon Europe 2010, TOP 10 SOLAR-NEWS die wichtigsten Solarnachrichten auf einen Blick







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Quelle: (idw) Fachhochschule Stuttgart, Hochschule für Technik

11.02.2009

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05.08.2009 10:11 1 von 2



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 $Trinationales\ Doktoranden-Kolloquium\ Nachhaltigkeit\ in\ Architektur\ und\ Stadtplanung,\ Karlsruhe\ (URL:\ http://www.fona.de/de/7802)$

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2 von 2 05.08.2009 10:11 Stuttgart 18.02.2009. Die HFT Stuttgart ist eine von 20 Hochschulen weltweit, die beim Solar Decathlon Europe 2010 dabei ist. Bei diesem "Solaren Zehnkampf" - Wettbewerb treten ausgewählte Hochschulteams an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Die teilnehmenden Hochschulen kommen unter anderem aus Spanien, Großbritannien, den USA, Mexiko und China. Innerhalb Deutschlands steht die HFT Stuttgart im Wettbewerb mit drei weiteren Hochschulen.



Ende Januar haben alle Hochschulteams die Pläne und Konzepte ihrer Entwürfe in Madrid abgegeben. Damit ist die erste Phase abgeschlossen und es geht in die zweite Phase der Weiterentwicklung, Detailplanung und Bauvorbereitung.

An der HFT Stuttgart soll unter der Projektleitung von Professor Dr. Jan Cremers der Beweis angetreten werden, dass energieeffizientes Bauen mit einem hohen architektonischen Anspruch einhergehen kann. In interdisziplinären Teams wird ein leichtes Elementbausystem entwickelt und umgesetzt.

Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden der HFT Stuttgart einen wichtigen neuen Baustein ihrer interdisziplinären und praxisnahen Ausbildung anzubieten. Das Kernteam für den Beitrag der HFT Stuttgart stammt aus dem Master-Studiengang Architektur, welches den Wettbewerb kontinuierlich über seine Laufzeit bis in den Sommer 2010 bearbeiten und begleiten wird. Es wird dabei unterstützt und betreut durch zahlreiche Professoren der Fakultät Architektur und Gestaltung. Weitere beteiligte Studiengänge sind Sustainable Energy Competence (SENCE), Bauphysik, Innenarchitektur und Konstruktiver Ingenieurbau.

Momentan konzentrieren sich die Anstrengungen in der frühen Phase des Wettbewerbs besonders darauf, Förderer und Sponsoren zu gewinnen, die das Team der HFT Stuttgart mit Erfahrungswissen, Sachleistungen und auch finanziell unterstützen.

Zum Abschluss des Wettbewerbs werden die Häuser aller Teams in Madrid eine Woche lang einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet.

Das Hauptziel des Wettbewerbs ist es, bei Studierenden und in der breiten Öffentlichkeit das Bewusstsein für und das Wissen um die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Die Markteinführung innovativer solarer Energietechnologien soll gefördert.

Quelle: HFT Stuttgart



Solar Decathlon Europe 2010

Erste Entwürfe

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☐ Wohnungsbau der Zukunft mit HOME+ - Solar Decathlon Europe 2010



Stuttgart, 20.06.2009: Wie sieht der Wohnungsbau der Zukunft aus? Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010", der ein in den USA sehr erfolgreich etabliertes Modell nach Europa holt. Beim "Solaren

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Um den zwar niedrigen, aber dennoch vorhandenen, Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert. Das <u>Dach</u> und die Fassaden werden mit einer Art zweiten Hülle mit <u>Photovoltaik-Solarmodulen (PV) zur Stromerzeugung versehen. Erste Simulationen lassen erwarten, dass der Energiebedarf mit den Erträgen der PV-Flächen nicht nur gedeckt werden kann, sondern sogar noch zusätzlich <u>Strom</u> ins Netz eingespeist werden kann. Damit wird das Gebäude HOME+ der HFT Stuttgart zum Plusenergiehaus.</u>

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Bild: HFT Stuttgart

Autor: Fachhochschule Stuttgart, Hochschule für Technik

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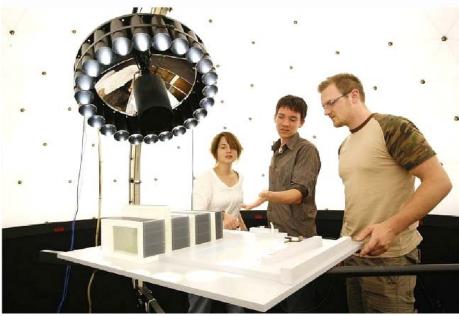
Wohnungsbau der Zukunft mit HOME+

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HOME+ heißt das Gebäude der HFT Stuttgart. Der Name steht für ein Wohnhaus und Zuhause, welches als Plusenergiehaus mehr Energie produziert, als es verbraucht. Die Modularität des Bausystem bietet vielfältige Nutzungsmöglichkeiten. Quelle: HFT Stuttgart

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2 of 3 02.04.2010 18:12

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Die Wettbewerbsteilnahme der HFT Stuttgart steht unter der Schirmherrschaft von Ministerpräsident Günther H. Oettinger. Neben dem BMWi konnte die HFT Stuttgart müllerblaustein (Müller Holzbau GmbH) als wichtigen Sponsor gewinnen. Weitere Förderer sind die Margarete Müller-Bull Stiftung, die Knödler Decker Stiftung, der Allgemeine Studierendenausschuss der HFT Stuttgart (AStA) und die Transsolar Energietechnik GmbH.

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Internet: http://www.hft-stuttgart.de

« zurück zur Übersicht

WETTBEWERB

Wohnungsbau der Zukunft mit HOME+

Autor : HfT Stuttgart aus : Stuttgart | NER Weitere Themen : STUTTGART | ZUKUNFT



Wie sieht der Wohnungsbau der Zukunft aus? Diesem Thema widmet sich der internationale Wettbewerb "Solar Decathlon Europe 2010", der ein in den USA sehr erfolgreich etabliertes Modell nach Europa holt. Beim "Solaren Zehnkampf" tritt die HFT Stuttgart als eine von 20 ausgewählten Hochschulteams aus der ganzen Welt an, um bis Juni 2010

ein 75m² großes und ausschließlich mit solarer Energie versorgtes Wohnhaus zu entwerfen und zu bauen.

"Wir vereinen für diesen Wettbewerb unsere gesamte umfassende Kompetenz, indem wir das Knowhow der Studiengänge Architektur, Bauphysik, Innenarchitektur, Konstruktiver Ingenieurbau und Sustainable Energy Competence sowie unses Instituts

für Gebäudeenergieforschung (zafh.net) einbringen." Projektleiter Professor Dr. Jan Cremers sieht die HFT Stuttgart bestens gerüstet, diese Aufgabe von der Konzeption des Entwurfs über die technische Durcharbeitung bis hin zur Realisierung vor Ort

in Madrid erfolgreich und auf hohem Niveau zu bewältigen. "Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden einen wichtigen interdisziplinären, zukunftsrelevanten und praxisnahen Baustein in ihrer Ausbildung anzuhieten '

Das Entwurfs- und Energiekonzept der HFT Stuttgart stellt eine Kombination von traditionellen Grundprinzipien mit modernem Material und neuer Technologie dar. Ausgangspunkt ist ein kompaktes und sehr gut gedämmtes Volumen, das eine geringe

Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch erreicht man eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs.

Die einzelnen Module werden mit etwas Abstand zueinander angeordnet. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der Energieturm, der im Zusammenspiel von Wind und Verdunstungskühlung zur Erzeugung eines angenehmen Innenraumklimas beiträgt. Dabei bedient er sich der Grundprinzipien traditioneller Vorbilder aus entsprechenden Regionen, wie der Windtürme im arabischen Raum und der in Spanien weitverbreiteten Patios. In Kombination mit heute verfügbaren neuen Materialien und Technologien entsteht ein Element, das hohen Komfort bei niedrigem Energieverbrauch ermöglicht und

gleichzeitig die gestalterische und räumliche Wahrnehmung des Gebäudes maßgeblich prägt. Um den zwar niedrigen, aber dennoch vorhandenen, Energiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert

Das Dach und die Fassaden werden mit einer Art zweiten Hülle mit Photovoltaik Solarmodulen (PV) zur Stromerzeugung versehen. Erste Simulationen lassen erwarten, dass der Energiebedarf mit den Erträgen der PV-Flächen nicht nur gedeckt werden

kann, sondern sogar noch zusätzlich Strom ins Netz eingespeist werden kann. Damit wird das Gebäude HOME+ der HFT Stuttgart zum Plusenergiehaus. Der modulare Aufbau des Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem. Durch die Addition der Module und Fugen können nachhaltige, energieeffiziente und architektonisch hochwertige Wohngebäude mit hohem Wohnwert für Singles

Paare, Familien oder Wohngemeinschaften entstehen. Der Zeitplan des Proj sieht vor, im Herbst 2009 mit den ersten Bauteilen zu beginnen, für April 2010 ist die Fertigstellung des Gebäudes geplant. In einer Testphase werder Gebäudetechnik

und Regelung optimiert, bevor im Juni 2010 die Demontage des Gebäudes und der Transport nach Madrid ansteht. Nach dem Wettbewerb wird das Gebäude am Hochschulstandort Stuttgart aufgestellt und soll dort als Veranstaltungs- und Forschungsgebäude dienen.

Zum Abschluss des Wettbewerbs, im Juni 2010, werden die Häuser aller Te eine Woche lang in Madrid einer breiten Öffentlichkeit präsentiert und die Sieger gekürt. Neben hohen Anforderungen an die Energieeffizienz und die Einbindung solarer

Energiegewinnung in das Konzept stellen auch der Transport und die Montage in Madrid eine große Herausforderung dar, die es zu meistern gilt. Darüber hinaus werden architektonische

Qualitäten des Gebäudes, die Kommunikation der Ideen und Konzepte und ihre Marktfähigkeit bewertet. Auslober ist das spanische Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium (DOE). Die beteiligten deutschen Hochschulen werden vom Bundesministerium für Wirtschaft und Technologie (BMWi) aufgrund eines Beschlusses des Deutschen Bundestages durch einen substantiellen Beitrag unterstützt.

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Weitere Informationen unter www.hft-stuttgart.de und www.sdeurope.de



Solar News

Zu Favoriten hinzufügen

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Solarhaus-Forschungsprojekt "living EQUIA" wird umgesetzt



Das von living Equia entworfene Solarhaus.

Anfang Juli trafen sich die Mitglieder des Berliner Studententeams "living EQUIA" in der Universität der Künste in Berlin, um der Öffentlichkeit, den Professoren und Sponsoren die aktuellen Fortschritte und Arbeitsergebnisse des interdisziplinären Forschungsprojektes zu präsentieren, berichtet living EQUIA in einer Pressemitteilung. Die konzeptionelle Ausarbeitung zum Bau eines energieeffizienten und technisch innovativen Solarhauses im Rahmen des internationalen Wettbewerbes "Solar Decathlon Europe" sei nahezu

abgeschlossen und werde nun umgesetzt. Auch aus diesem Grund seien im Mai 2009 12 Mitglieder des living EQUIA-Teams nach Madrid zum Austragungsort des Wettbewerbes gereist. In einem dreitägigen Workshop wurden das Miniatur-Hausmodell den spanischen Juroren vorgestellt, offene organisatorische Fragen besprochen und das Wettbewerbsgelände "Villa Solar" besichtigt, auf dem im Juni 2010 die Häuser aller Teilnehmer aufgebaut werden.

Kooperation der deutschen Teilnehmer am "Solar Decathlon Europe"

Darüber hinaus haben sich die vier deutschen Teilnehmer des Wettbewerbes - die Hochschule für Technik und Wirtschaft Berlin, die Hochschule für Angewandte Wissenschaften Rosenheim, die Hochschule für Technik in Stuttgart und die Bergische Universität Wuppertal auf eine Zusammenarbeit bei der Öffentlichkeitsarbeit geeinigt, berichtet living Equia in der Pressemitteilung. Künftig würden überregionale und fachspezifische Artikel und Publikationen gemeinsam veröffentlicht und auch bei Auftritten auf Fach- und Publikumsmessen wird zusammengearbeitet. Zum Abschluss des Treffens in der Universität der Künste in Berlin wurde der Kurzfilm zum Projekt erstmals in deutscher Sprache aufgeführt.

Der Film zum Solarhaus-Projekt kann angesehen werden unter: http://www.youtube.com/watch?v=FG9MJFR_7j0

12.07.2009 Quelle: Living Equia Solarserver.de © Heindl Server GmbH Bildquelle: living Equia, TOP 10 SOLAR-NEWS die wichtigsten Solarnachrichten auf einen Blick

Solar-Magazin

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- Solar-News
- Solar-Links
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Solar Nachrichten der Woche

- 09.11.2009: Photovoltaik-Unternehmen systaic bekräftigt Wachstumsprognose und erwartet über 30 % Umsatzanstieg für 2010
- 09.11.2009: Photovoltaik in China: Suntech und Huadian bauen 10 MW-Solarkraftwerk in der Provinz Jiangsu
- 09.11.2009: Applied Materials übernimmt Betriebsvermögen des Photovoltaik-Produzenten Advent Solar
- 09.11.2009: WATTNER SUNASSET 2 kurz vor dem Start; Initiator unterzeichnet Liefervereinbarung für schlüsselfertige Solarkraftwerke mit ET Solar
- 09.11.2009: <u>Indisches Marktforschungsunternehmen RCNOS erwartet rapides Wachstum des</u> globalen Photovoltaik-Marktes
- 08.11.2009: Solarpark Bischwind: 500 Haushalte in Seßlach decken ihren Bedarf künftig mit Solarstrom
- ▶ 08.11.2009: Wärmenetz solar ergänzt: Große Solarthermie-Anlage trotzt rauem Nordseeklima
- 08.11.2009: Greenpeace: Merkel verfehlt Klimaschutzziel; Analyse zeigt mangelndes Engagement aller Industrienationen beim Klimaschutz
- 07.11.2009: <u>Universität Tokai (Japan) gewinnt "Global Green Challenge 2009" in einem mit Sharp-Solarzellen bestückten Solar-Rennwagen</u>
- 07.11.2009: co2online: Berliner Klimaschützer Johannes Hengstenberg erhält das Bundesverdienstkreuz
- ▶ 07.11.2009: SCHOTT Solar und Energiebau spenden Photovoltaik-Anlagen für sechs

- ländliche Krankenhäuser in Ghana
- ▶ 06.11.2009: Photovoltaik: KEMPER stattet Solarpark in Hessen mit Nachführsystemen aus
- 06.11.2009: Sunfilm liefert Module für größte Photovoltaik-Dachanlage in Deutschland mit Tandem-Junction-Technologie auf Silizium-Basis
- 06.11.2009: <u>Photovoltaik: Solar-Fabrik meldet historisch bestes Ergebnis im Kernsegment Solarstrom-Systeme</u>
- ▶ 06.11.2009: Photovoltaik: SANYO weiht Modulproduktion in Mexiko ein
- 06.11.2009: Rückgang des Energieverbrauchs hält an; erneuerbare Energien legen um rund zwei Prozent zu
- ▶ 06.11.2009: Forschung für deutsche Erneuerbare-Energien-Branche zwischen Spitzenposition und Konkurrenzdruck
- 06.11.2009: Agritechnica 2009: SCHOTT Solar präsentiert Photovoltaik-Module für den landwirtschaftlichen Einsatz
- ▶ 05.11.2009: Neuer EU-US-Energierat berät über entscheidende Energiefragen
- 05.11.2009: Signet Solar liefert 10 MW Dünnschicht-Solarmodule an Tejados Industriales de Fotovoltaica (TIF) Group
- 05.11.2009: Photovoltaik-Produktionsanlagenhersteller Roth & Rau AG: Anhaltend schwaches Branchenumfeld führt zu niedrigerem Auftragseingang im dritten Quartal
- 05.11.2009: Photovoltaik: SOLON SE erhält Zuschlag für weiteres 11 MW-Projekt in Spanien
- ▶ 05.11.2009: Photovoltaik-Produzent Q-Cells SE beendet Wafer-Liefervertrag mit LDK Solar
- 05.11.2009: <u>Unionspolitiker Pfeiffer zur Photovoltaik-Förderung</u>: "Erstickungsgefahr trotz atmenden Deckels"
- 05.11.2009: Photovoltaik: Hochleistungsmodule von Canadian Solar mit neuem Wirkungsgrad-Rekord für P-Silikonmodule
- 05.11.2009: Photovoltaik: Conergy Deutschland und solar-konzept bringen Megawatt-Solarpark "Heimpersdorf" an das Netz
- 05.11.2009: sonnen systeme Projektgesellschaft bietet spezielle Photovoltaik-Nachführsysteme für Griechenland an
- 04.11.2009: Aufsichtsratsmitglieder der aleo solar AG legen ihre Ämter nieder
- ▶ 04.11.2009: Fraunhofer ISE: Kolloquium zu Ehren von Prof. Eicke R. Weber
- 04.11.2009: Solarstrom und Wärme mit Photovoltaik: SYSTAIC erhält Hauptpreis der Bau- und Architekturmesse Batimat
- 04.11.2009: Photovoltaik-Konzern SolarWorld steigert Absatz um 22 Prozent; Umsatz wächst um drei Prozent zum Vorquartal
- 04.11.2009: <u>Photovoltaik: Bosch übernimmt Mehrheit an der aleo solar AG und am</u> <u>Dünnschicht-Hersteller Johanna Solar</u>
- 04.11.2009: Photovoltaik in Italien: Solarig-Gruppe baut Freiflächen-Anlagen mit einer Gesamt-Nennleistung von 8 MW
- ▶ 04.11.2009: HAWI Energietechnik AG baut 3,5-MW-Solarpark in Bruck bei Triftern
- 04.11.2009: Solarkraftwerk auf Mülldeponie am Netz; 562-kWp-Photovoltaik-Anlage als "Appetithappen" für geplanten Tauberlandpark
- 03.11.2009: <u>Startschuss für ein 5,67-MW-Photovoltaikkraftwerk in Niederbayern</u>
- 03.11.2009: FLABEG Solar US eröffnet neue Fabrik für Solar-Spiegel mit erweitertem Produktportfolio
- 03.11.2009: <u>OPV-Hersteller Konarka und Enviromena Power Systems planen Photovoltaik-</u> Schattenspender im Nahen Osten
- 03.11.2009: <u>US-Präsident Obama weiht größte Photovoltaik-Anlage der USA ein und kündigt Millionen-Förderung für intelligentes Stromnetz an</u>
- 03.11.2009: Photovoltaik-Systemintegrator IBC SOLAR eröffnet italienisches Tochterunternehmen in Ancona
- 02.11.2009: Pforzheim: Spatenstich für Megawatt-Solarstromanlage; Umweltministerin warnt vor Schnellschuss bei geplanter Anpassung der Solarstromvergütung
- ▶ 02.11.2009: Photovoltaik: Beck Energy baut Freiflächen-Solarkraftwerk auf dem Gelände einer ehemaligen Zuckerfabrik in Thüringen
- ► 02.11.2009: Dr. Jürg Henz löst Jeannine Sargent als Vorstand bei Oerlikon Solar ab
- ▶ 02.11.2009: Photovoltaik: AT&M Co., Ltd. und Odersun AG gründen Joint Venture in China
- ▶ 02.11.2009: Bundesnetzagentur: Vergütung für Solarstrom sinkt ab 2010 um rund 10 %
- 02.11.2009: Applied Materials: Neue IEC-zertifizierte SunFab-Modultechnologie senkt Photovoltaik-Herstellungskosten

Der Solarserver - Ihr Internetportal zur Sonnenenergie:

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VERANSTALTUNGEN

Jetzt auch in Europa: der Solar Decathlon [14.07.2009]

In Amerika gibt es ihn seit 2002. 2007 machte ihn der Sieg der Universität Darmstadt auch in Deutschland bekannt, und nun wird der Studentenwettbewerb "Solar Decathlon" erstmals auch in Europa veranstaltet. Vier deutsche Universitäten bearbeiten derzeit ihre Gebäudekonzepte für die Endrunde, die im Juni 2010 in Madrid stattfindet.

Die Idee, den Solar Decathlon nach Europa zu holen, hatte die Universität Madrid, die bereits 2005 erstmals an dem Studentenwettbewerb in Washington teilnahm. Nun wird die europäische Variante des "solaren Zehnkampfs" auf ihr Betreiben im Juni 2010 am Ufer des Rio Manzanares in Madrid Premiere feiern. Erwartet werden 21 Studententeams aus 10 Ländern, darunter neben Spanien auch Deutschland, Großbritannien, Israel, die USA, Mexiko, Brasilien und China. Damit ist der "Solar Decathlon Europe auf Anhieb weitaus internationaler aufgestellt als sein Vorbild in Washington, an dem zuletzt lediglich Universitäten aus den USA, Kanada, Spanien und Deutschland teilnahmen.



Foto: Hochschule für Technik Stuttgart

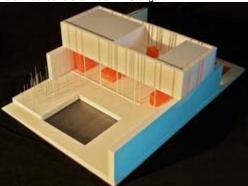


Foto: Bergische Universität Wuppertal



Grafik: Hochschule Rosenheim

Die Grundidee des Wettbewerbs: Studententeams sind aufgerufen, gemeinsam mit ihren Professoren und Sponsoren aus der Industrie Prototypen für energetisch selbstversorgende Wohnhäuser zu entwerfen, zu bauen und – eine Woche lang – zu betreiben. Dass dies eine interdisziplinäre Anstrengung ist, versteht sich von selbst. In den meisten Hochschulen arbeiten daher Studenten der Architektur und des Bauingenieurwesens mit den Fachbereichen anderer Ingenieur- und Umweltwissenschaften zusammen. Mit dem Wettbewerb sollen nicht nur die Kenntnisse der Studenten gefördert werden: Der Solar Decathlon ist auch ein öffentlichkeitswirksames Schaufenster für Solartechnologie und energieeffizientes Bauen. Bei der Veranstaltung 2007 auf der nationalen "Museumsmeile", der National Mall in Washington, wurden über 100.000 Besucher gezählt.

Für den "Solar Decathlon Europe" wurden folgende vier deutsche Hochschulen von den Madrider Veranstaltern ausgewählt, ihre Gebäudeentwürfe im Maßstab 1:1 zu realisieren:

- Bergische Universität Wuppertal
- Fachhochschule für Technik und Wirtschaft Berlin
- Hochschule für Technik Stuttgart
- Hochschule Rosenheim

Sie stellen sich einem Zehnkampf, der weit über den architektonischen Entwurf hinausgeht und der quantitative (also messbare) ebenso wie qualitative Kriterien umfasst. Letztere werden durch verschiedene Expertenjurys bewertet, die die realisierten Häuser vor Ort in Augenschein nehmen. Der Kriterienkatalog umfasst den architektonischen Entwurf, die Baukonstruktion, die Solarsysteme, den Wohnkomfort, die Funktionsfähigkeit der (solar betriebenen) Haushaltsgeräte, aber auch die Marktfähigkeit und das Kommunikationskonzept, mit dem die Universitäten ihre Gebäude in der Öffentlichkeit bekannt machen.

Schon im Oktober 2009 geht der "originale" Solar Decathlon in Washington in eine neue Runde. Als einziges deutsches Team ist der Sieger des letzten Wettbewerbs 2007, die Technische Universität Darmstadt am Start. Einziger weiterer europäischer Vertreter ist die Universidad Politécnica de Madrid. Die Öffentlichkeit wird die Häuser vom 15. bis 18. Oktober 2009 auf der National Mall in Washington besichtigen können. Neuerungen gibt es in einigen der Bewertungskategorien: Mussten die Gebäude beim Solar Decathlon 2007 "lediglich" ihren Strombedarf durch Photovoltaik selbst decken, gibt es diesmal Extrapunkte für jede Kilowattstunde, die darüber hinaus ins öffentliche Netz eingespeist wird. Wichtig ist den Veranstaltern auch die tatsächliche Bewohnbarkeit der Häuser. Sie muss von den Teams unter Beweis gestellt werden, indem diese während der Wettbewerbswoche zwei Dinnerpartys in

1 of 2 02.04.2010 17:31

Grafik: Fachhochschule für Technik und Wirtschaft Berlin

ihren Häusern veranstalten. Auf diese Weise haben die Juroren für ihr Abendessen bereits vorgesorgt ...

zur Galerie

Link-URL: http://www.detail.de/artikel_solar-decathlon-europa-madrid_24122_De.htm

2 of 2 02.04.2010 17:31

29. INTERNATIONALE FACHMESSE FÜR BAUMASCHINEN, BAUSTOFFMASCHINEN, BERGBAUMASCHINEN, BAUFAHRZEUGE UND BAUGERÄTE

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HFT Stuttgart beim Architekturwettbewerb Solar Decathlon 2010 vertreten. Von Rüdiger Sinn, Stuttgart

Wie meistern wir die Zukunft in bautechnischer Sicht und wie sehen Häuser in 20 Jahren aus? Fragen, die sich aufgrund der gegebenen Umstände wie Ressourcenverbrauch und Klimaveränderung seit langem Wissenschaftler aus aller Welt stellen. Schon lange weiß man, dass in der Kraft der Sonne, als fast unerschöpflichen Energieträger, die Zukunft steckt. Dementsprechend groß sind die Bestrebungen von Wissenschaftlern, solares Bauen weiterzuentwickeln.

Die innovativsten Häuser, die ausschließlich mit solarer Energie versorgt werden, sollen nun in einem europäischen Wettbewerb gesucht und prämiert werden. Nach amerikanischem Vorbild werden Studierende von Hochschulen für Architektur und Bauwesen bis zum nächsten Jahr im Juni in einer Art Zehnkampf Häuser entwickeln, die mehr als nur Passivhaus-Standard erreichen. Für den "Solar Decathlon Europe 2010" werden Energie-plus-Häuser angestrebt. Häuser also, die mehr Energie produzieren als sie verbrauchen.

Diesem ehrgeizigen Ziel darf sich auch die Hochschule für Technik (HFT) in Stuttgart stellen. In einer Vorauswahl qualifizierte sich das Team aus rund 40 Teilnehmern für die Endausscheidung. Die rund 20 Studierenden haben nun ein knappes Jahr Zeit, ein Haus für die Präsentation im Juni 2010 in Madrid zu planen und zu realisieren. Dabei sind zum einen Architekten gefragt, denn es gilt, das solare Bauen mit hohen gestalterischen Ansprüchen zu verknüpfen. Gleichzeitig wird aber auch Fächer übergreifend gearbeitet, das heißt, dass der Bachelorstudiengang Innenarchitektur und Bauphysik ebenfalls mit einbezogen wird. "Der Wettbewerb ist eine hervorragende Gelegenheit, den Studierenden einen wichtigen interdisziplinären, zukunftsrelevanten und praxisnahen Baustein in ihrer Ausbildung anzubieten", sagte Professor Jan Cremers, Projektleiter des Teams Stuttgart. Auch das Institut für Gebäudeenergieforschung wird seine Kenntnisse einbringen.

Ein Teil des interdisziplinären Vorgehens bei dem Projekt ist auch die Einbeziehung von Unternehmen, die als Partner und Sponsoren auftreten. So wird das Haus in Holzständerbauweise gefertigt werden. Als Partner ist die Müller Holzbau GmbH aus Blaustein mit im Boot.

Der Entwurf und das Energiekonzept der Stuttgarter Studierenden ist eine Kombination von traditionellen Grundprinzipien aus der Architektur und modernen Materialien und Technologien. Ausgangspunkt ist ein kompakter und sehr gut gedämmter Kubus, der eine geringe Hüllfläche im Verhältnis zum umschlossenen Raum aufweist. Dadurch soll eine Minimierung der Transmissionswärmeverluste und damit auch des Energiebedarfs erreicht werden. Die Oberflächen des Volumens (Dach und Fassaden) wird wie eine zweite Haut großflächig mit Solarmodulen bestückt. Erste Simulationen ergaben, dass der Energiebedarf mit den Erträgen aus den Photovoltaik-Modulen nicht nur gedeckt werden kann, sondern auch noch Energie für das allgemeine Netz übrig bleibt, die dann eingespeist wird.

Um die Sonneneinstrahlung effektiv zu nutzen, ist als konstruktive Grundvoraussetzung der Bau in Nord-Süd-Ausrichtung geplant. Im Sommer sorgt ein Vordach für die nötige Verschattung. Der Kubus ist in einzelne Module unterteilt. Die entstehenden Fugen dienen dabei der Belüftung, der Vorwärmung im Winter und der passiven Kühlung (adiabate Verdunstungskühlung) im Sommer. Eine besondere Rolle spielt der Energieturm, der über die Dachfläche hinausragt und an Vorbilder aus dem arabischen Raum erinnert. Im Zusammenspiel von Wind und Verdunstungskühlung wollen die Studierenden so ein angenehmes Wohnraumklima zu jeder Jahreszeit erreichen. Der modulare Aufbau des Gebäudes soll zum einen die Weiterentwicklung zu einem Bausystem ermöglichen, zum anderen die Flexibilität beim Fertigen und bei der Montage erhöhen.

Zehn Punkte bis zum Erfolg

Bei der Bewertung und Gewichtung der einzelnen Bausysteme werden bei dem Wettbewerb

DBZ-NEWSLETTER

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1 of 3 02.04.2010 17:50

zehn Punkte berücksichtigt. Dabei sind bei der Architektur, der elektrischen Energiebilanz, der Komfortbedingung und der Nachhaltigkeit die meisten Punkte zu holen. Aber auch Disziplinen wie die Konstruktion, Auswahl der Solarsysteme und innovative Bauweisen werden bei der Gesamtpunktzahl berücksichtigt.

Im April 2010 ist die Fertigstellung des Gebäudes geplant. In einer Testphase werden dann die Gebäudetechnik und die Regelung optimiert, bevor das Haus mit einer Grundfläche von 75 m² im Juni demontiert und in Madrid wieder aufgebaut wird, um es eine Woche lang der Öffentlichkeit zu präsentieren. Und damit die Studierenden auch nach dem Wettbewerb noch Freude an dem HOME+ (so der offizielle Name) haben, soll der Bau am Hochschulstandort für die Forschung und Lehre, aber auch als Veranstaltungsgebäude zur Verfügungen stehen.

Der Dekan der HTW Stuttgart, Professor Andreas Löffler, beglückwünschte die Studierenden zu dem aus seiner Sicht hervorragenden Entwurf und fasste die Präsentation mit wenigen Worten zusammen. "Wir wollen in Madrid nicht nur dabei sein, wir wollen gewinnen."

Am Solar Decathlon 2010 sind insgesamt 20 Mannschaften aus Spanien, Großbritannien, Frankreich, Finnland, USA, Mexiko, Brasilien, China und Israel vertreten. Aus Deutschland sind neben der HFT Stuttgart auch die Bergische Universität Wuppertal, die Hochschule Rosenheim und die Hochschule für Technik und Wirtschaft Berlin beteiligt.

Weitere Informationen zum internationalen Wettbewerb unter Solardecathlon.org

Bilder & weitere Infos



Studenten erklären das Modell "HOME+", das beim... Foto: Rüdiger Sinn



Gruppenbild mit Studierenden der HFT Stuttgart,... Foto: Rüdiger Sinn

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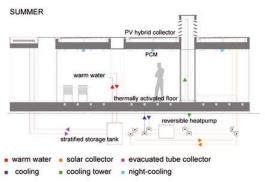
Im Juni 2010 findet in Madrid erstmals der europäische Solar Decathlon nach dem Muster der gleichnamigen amerikanischen Variante statt. Aus Deutschland nehmen insgesamt vier Hochschulen an dem "Solaren Zehnkampf" teil, die auf die Erfahrungen des Solardecathlon-Teams der TU Darmstadt aufbauen können, das 2007 in Washington den ersten Platz abgeräumt hatte. Inzwischen haben die teilnehmenden Studenten ihre Gebäude- und Energiekonzepte ausgearbeitet, allmählich nähert sich der Punkt der baupraktischen Umsetzung.



Im Juni 2010 kämpfen in Madrid 20 Hochschulteams um die Siegertrophäe des Solar Decathlon Europe.

Den ersten Solar Decathlon lobte das amerikanische Energieministerium (DOE) bereits im Jahr 2002 aus - auch damals waren die teilnehmenden Hochschulen aufgefordert, ihre ausschließlich mit solarer Energie versorgten Wohnhaus-Prototypen auf der National Mall mitten in Washington D.C. zu präsentieren und sich dem Wettbewerb zu stellen. Nach dem viel beachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA wird der Wettbewerb nun erstmals in Europa ausgetragen. Damit man sich nicht ins Gehege kommt, findet der europäische Solar Decathlon immer im wechselseitigen Rhythmus mit seinem amerikanischen Pendant in den geraden Jahren statt. Für die erste Veranstaltung in Madrid haben sich insgesamt 20 Hochschulteams qualifizieren können, die meisten aus Europa und davon vier aus Deutschland. Dazu gehören die Berliner Hochschule für Technik und Wirtschaft, die Hochschule Rosenheim, die Hochschule für Technik Stuttgart und die Bergische Universität Wuppertal. Jedes der vier deutschen Teams ist mit seinem Projekt im Zeitplan, derzeit wird intensiv an den Konstruktionsplänen getüftelt und gezeichnet. Im Mai 2009 hatten sich alle Wettbewerbsteilnehmer in Madrid zu einem gemeinsamen Workshop getroffen, der zugleich die letzte Gelegenheit geboten hatte, der Konkurrenz mal eben kurz über die Schulter zu schauen, um sicherzugehen, dass man selbst auf gutem Weg ist. Finanzielle Unterstützung und Förderung erhalten die deutschen Teams nicht nur von ihren jeweiligen Sponsoren aus der Industrie, sondern aufgrund eines Beschlusses des Deutschen Bundestages auch vom Bundesministerium für Wirtschaft und Technologie.



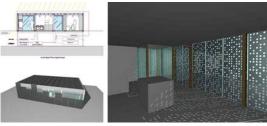


Auffälligstes Merkmal an dem Kubus des Teams der HFT Stuttgart ist der Energieturm, der nach dem Vorbild arabischer Windtürme für eine energiesparende Klimatisierung sorgen soll. (Bilder: HFT Stuttgart)

An der HFT Stuttgart baut man auf ein sehr gut gedämmtes Volumen mit optimiertem A/V-Verhältnis, um die Transmissionswärmeverluste und damit auch den Energiebedarf auf ein Minimum zu reduzieren. Eine zentrale Rolle spielt der auffällige Energieturm, der nach dem Vorbild der Windtürme im arabischen Raum den Wind zur Verdunstungskühlung nutzt, um den

1 von 3 05.08.2009 10:17

Innenraum bei geringstem Energieverbrauch zu klimatisieren. Auch finden sich in dem modular aufgebauten Kubus neben der klassischen Haustechnik Phasenwechselmaterialien (PCM). In sehr heißen Phasen wird über ein Verrieselungssystem auf dem Dach nachts durch Verdunstung und Abstrahlung gegen den Nachthimmel Wasser abgekühlt und in einem Speicher gesammelt. Mit diesem gekühlten Wasser werden dann die PCM entladen und über den Fußboden wird Wärme aus dem Innenraum entzogen. Für kalte Tage stehen ein Lüftungsgerät mit Wärmerückgewinnung und eine reversible Wärmepumpe bereit. Zur Deckung des Strombedarfs sind Dach, Ost-, Süd- und Westfassaden mit PV-Dünnschichtzellen belegt.



Bei dem Rosenheimer Konzept dienen zwei Wintergärten als Klimapuffer. Ungewöhnlich: der außenliegende Sicht- und Sonnenschutz. (Bilder: Hochschule Rosenheim)

Das Team Ikaros Bavaria von der Hochschule Rosenheim legt bei seinem modular aufgebauten Gebäudekonzept großen Wert auf Nachhaltigkeit und hat deshalb eine Zertifizierung nach DGNB für das Pilotprojekt beantragt. Das technische Konzept baut auf hochwärmegedämmte Bauteile, eine geregelte Lüftung mit Wärmerückgewinnung und eine reversible Wärmepumpe für Heizen und Kühlen. Auch hier ist die Hülle mit verschiedenen solaren Systemen wie monokristallinen PV-Zellen und Vakuumröhrenkollektoren für die Energiegewinnung ausgestattet. Ein vor der Glasfassade montierter Sonnen- und Sichtschutz verhindert zu hohe solare Energieeinträge und bewahrt die Intimsphäre der Bewohner. Zwei Wintergärten kommt die Aufgabe eines Klimapuffers zu – im Südosten ist er zugleich Eingangsbereich, im Nordwesten ein überdachter und geschützter Sitzplatz im Freien.





Das Team aus Wuppertal tüftelt an einem zukunftsfähigen "europäischen Haus", das im heißen Süden ebenso autark funktioniert wie im kühlen Skandinavien. (Bilder: Bergische Universität Wuppertal)

Die Studenten aus Wuppertal verfolgen das Ziel, für den Solar Decathlon ein zukunftsfähiges "europäisches Haus" zu entwickeln, das nicht nur im heißen Madrid, sondern auch an anderen Standorten Europas mit ausgeglichener Energiebilanz funktioniert. Dazu haben sich rund 30 Studierende aus unterschiedlichen Fachbereichen (Architektur, Design, Wirtschaftswissenschaften) interdisziplinär zusammengefunden. Leitidee ist ein funktional offenes, mit dem Außenraum verwebtes Gebäude, dessen Grundstruktur sich aus zwei solar und energetisch relevanten Wandschotten entwickelt. Das Energiekonzept folgt den Prinzipien eines Null-Energiegebäudes. Zentrales Element der Gebäudetechnik ist ein Lüftungskompaktgerät mit integrierter Wärmepumpe. Die Kühlung wird durch eine hydraulische Umschaltung erreicht. Zusätzlich wird in wärmeren Klimazonen mit einer indirekten, adiabatischen Kühlung gearbeitet. Die solare Stromversorgung gewährleisten eine in das Flachdach integrierte, netzgekoppelte Solarstromanlage und PV-Module an der Südwand.



Einen ganz anderen Weg als die Konkurrenz bestreitet das Berliner Team mit "Living EQUIA": Weniger Transparenz zugunsten spannender Lichtachsen. Auffällig das Satteldach. (Bilder: HTM Berlin)

Das Team aus Berlin taufte sein Projekt "Living EQUIA" ("living ecologic and integration of ambience"). Architektonisches Highlight sind zwei Lichtachsen,

2 von 3 05.08.2009 10:17

die sich nach den vier Himmelsrichtungen orientieren. Holz und Lehm gehören zu den wesentlichen Baumaterialien, die Fassaden und das Satteldach sind mit gebäudeintegrierten PV-Elementen bestückt. Zu den gebäudetechnischen Komponenten zählen ein Solarthermiesystem aus Flachkollektoren und einem Kombi- beziehungsweise Pufferspeicher, ein Lüftungsgerät mit Wärmerückgewinnung, eine reversible Kompressionswärmepumpe, Kühldecken und eine Fußbodenheizung im Bad sowie ein Unterbodenwassertank mit zwei Kubikmeter Fassungsvermögen. Zur Energiegewinnung dienen PV-Systeme auf dem Dach und an der Fassade. si

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3 von 3 05.08.2009 10:17

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Energietechnik

Ein Haus als Öko-Kraftwerk

Asja Bernd, veröffentlicht am 15.07.2009



Bis das Solarhaus gebaut ist, testen die Studenten das Modell unter einer künstlichen Sonne. Die dunklen Flächen sollen einmal mit Fotovoltaikfolien überzogen werden. Foto: HfT

Stuttgart - Ein Gebäude zu entwerfen und zu planen ist für angehende Architekten nichts Ungewöhnliches. Es während des Studiums auch zu bauen allerdings schon, denn üblicherweise entsteht lediglich ein Modell. Studenten der Stuttgarter Hochschule für Technik dürfen sich nun an einem richtigen Haus versuchen - es ist ihr Beitrag zum Solar Decathlon, einem "Zehnkampf" der Solarhäuser. Es ist das erste Mal, dass der Wettbewerb in Europa stattfindet.

"2050 leben 75 Prozent der Menschen in Städten. Die Flächen sind bereits bebaut. Daher lautet die Zukunft des Bauens: Umbau."

Umwelttechnologe Matthias Schuler

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Im Juni kommenden Jahres soll sich das Stuttgarter Energiesparhaus in Madrid durchsetzen. Jetzt haben die Studenten ein Modell ihres geplanten Hauses präsentiert. Am Solar Decathlon nehmen 20 Teams teil, darunter vier deutsche. Wie der Name des Wettbewerbs schon andeutet, gilt es in zehn Kategorien zu punkten. Von der Architektur über den Komfort bis zur Nachhaltigkeit wird das Einfamilienhaus von einer Fachjury geprüft.

Zeitweise haben rund 90 Studenten an dem interdisziplinären Projekt mitgearbeitet, koordiniert werden die verschiedenen Arbeitsgruppen von einem Kernteam von etwa 20 Personen. Die Studenten können schon auf Erfahrungen verweisen: Vor zwei Jahren haben sie das Sieger-Team der Universität Darmstadt beim Solar Decathlon in den USA unterstützt.

Das Modell ist auf das Klima Spaniens ausgelegt

Das Modell zeigt ein quaderförmiges Gebäude mit schmalen, hohen Fenstern - und natürlich mit vielen Solarzellen an den Wänden und auf dem Dach. "Durch die Form ist die Oberfläche klein, das hilft, den Wärmeverlust zu minimieren", erklärt Nansi Palla, eine Studentin des Kernteams. Der Entwurf, home+ genannt, ist ein sogenanntes Plusenergiehaus, das mehr Energie erzeugt, als es verbraucht.

Das Modell ist auf das Klima Spaniens ausgelegt. So wird das Haus mittels eines Windturmes gekühlt: Heiße Luft wird oben angesaugt, im Turm angefeuchtet und ins Hausinnere geleitet. Das Wasser in der Luft verdunstet und benötigt dafür Energie, die es der Umgebung entzieht. So kühlt sich die Luft ab.

Neben Strom wird auf dem Dach auch kaltes und warmes Wasser erzeugt. Nachts kühlt sich das Wasser in Leitungen auf dem Dach stärker ab als die Umgebung, da das Dach seine Wärme

1 of 3 02.04.2010 17:44

abstrahlt. Tagsüber wird das Wasser dort von der Sonne erwärmt. "Zusätzlich zu diesen passiven Systemen kann man auch noch eine aktive Lüftung oder ein Wärmesystem einschalten", erläutert Palla.

Neben Strom wird auf dem Dach auch warmes Wasser erzeugt

Aber das sei nur für ungewöhnlich hohe Temperaturen vorgesehen. Das Gebäude, das unter der Schirmherrschaft von Ministerpräsident Günther Oettinger entsteht, muss mehr als nur nachhaltig sein. "Wir müssen auch die Konkurrenz und die Jury einladen und bekochen", erklärt Projektleiter Jan Cremers.

Von Oktober an soll das Haus auf dem Campus aufgebaut und getestet werden. Anschließend wird es zerlegt und nach Madrid transportiert. "Nach dem Wettbewerb werden wir es an der Hochschule weiter erforschen", sagt Cremers. So werde man das Haus an das deutsche Klima anpassen. "Der Windturm wird dann zum Wärmen statt zum Kühlen verwendet, indem die ausströmende warme Luft die frisch hereinkommende aufwärmt."

Das Projekt ist Cremers zufolge vor allem für die Studenten eine Chance. "Manche schreiben ihre Masterarbeit über ein Thema des Hauses", sagt er. "Sonst ist eine Abschlussarbeit doch nur eine theoretische Trockenarbeit." Finanziert wird das Projekt vom Bundesministerium für Wirtschaft und Technik sowie Stiftungen und Förderern aus der Industrie. Zu den Kosten will sich Cremers nicht äußern.

Bei der Projektvorstellung lobte auch der Umwelttechnologe Matthias Schuler von der Universität Harvard das Haus. Er glaubt aber, dass man in Zukunft eher auf große Gebäude setzen wird. "2050 leben 75 Prozent der Menschen in Städten", sagte er. "Die Flächen sind bereits bebaut. Daher lautet die Zukunft des Bauens: Umbau."

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2 of 3 02.04.2010 17:44

Solar Decathlon Europe (24/07/2009 07:00:00)

Vier Hochschulen aus Deutschland beteiligt

Im Juni 2010 findet in Madrid erstmals der europäische Solar Decathlon nach dem Muster der gleichnamigen amerikanischen Variante statt. Aus Deutschland nehmen insgesamt vier Hochschulen an dem "Solaren Zehnkampf" teil, die auf die Erfahrungen des Solardecathlon-Teams der TU Darmstadt aufbauen können, das 2007 in Washington den ersten Platz



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Den ersten Solar Decathlon lobte das amerikanische Energieministerium (DOE) bereits im Jahr 2002 aus – auch damals waren die teilnehmenden Hochschulen aufgefordert, ihre ausschließlich mit solarer Energie versorgten Wohnhaus-Prototypen auf der National Mall mitten in Washington D.C. zu präsentieren und sich dem Wettbewerb zu stellen. Nach dem viel beachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA wird der Wettbewerb nun erstmals in Europa ausgetragen. Damit man sich nicht ins Gehege kommt, findet der europäische Solar Decathlon immer im wechselseitigen Rhythmus mit seinem amerikanischen Pendant in den geraden Jahren statt. Für die erste Veranstaltung in Madrid haben sich insgesamt 20 Hochschulteams qualifizieren können, die meisten aus Europa und davon vier aus Deutschland. Dazu gehören die Berliner Hochschule für Technik und Wirtschaft, die Hochschule Rosenheim, die Hochschule für Technik Stuttgart und die Bergische Universität Wuppertal.

Jedes der vier deutschen Teams ist mit seinem Projekt im Zeitplan, derzeit wird intensiv an den Konstruktionsplänen getüftelt und gezeichnet. Im Mai 2009 hatten sich alle Wettbewerbsteilnehmer in Madrid zu einem gemeinsamen Workshop getroffen, der zugleich die letzte Gelegenheit geboten hatte, der Konkurrenz mal eben kurz über die Schulter zu schauen, um sicherzugehen, dass man selbst auf gutem Weg ist. Finanzielle Unterstützung und Förderung erhalten die deutschen Teams nicht nur von ihren jeweiligen Sponsoren aus der Industrie, sondern aufgrund eines Beschlusses des Deutschen Bundestages auch vom Bundesministerium für Wirtschaft und Technologie.

Klaus Siegele schaute hinter die Kulissen und berichtet, welche Konzepte die verschiedenen Hochschulteams verfolgen:



HFT Stuttgart

An der HFT Stuttgart baut man auf ein sehr gut gedämmtes Volumen mit optimiertem A/V-Verhältnis, um die Transmissionswärmeverluste und damit auch den Energiebedarf auf ein Minimum zu reduzieren. Eine zentrale Rolle spielt der auffällige Energieturm, der nach dem Vorbild der Windtürme im arabischen

Raum den Wind zur Verdunstungskühlung nutzt, um den Innenraum bei geringstem Energieverbrauch zu klimatisieren. Auch finden sich in dem modular aufgebauten Kubus neben der klassischen Haustechnik Phasenwechselmaterialien (PCM). In sehr heißen Phasen wird über ein Verrieselungssystem auf dem Dach nachts durch Verdunstung und Abstrahlung gegen den Nachthimmel Wasser abgekühlt und in einem Speicher gesammelt. Mit diesem gekühlten Wasser werden dann die PCM entladen und über den Fußboden wird Wärme aus dem Innenraum entzogen. Für kalte Tage stehen ein Lüftungsgerät mit Wärmerückgewinnung und eine reversible Wärmepumpe bereit. Zur Deckung des Strombedarfs sind Dach, Ost-, Süd- und Westfassaden mit PV-Dünnschichtzellen belegt.

Hochschule Rosenheim: Team Ikaros Bavaria

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Glasfassade montierter Sonnen- und Sichtschutz verhindert zu hohe solare Energieeinträge und bewahrt die Intimsphäre der Bewohner. Zwei Wintergärten kommt die Aufgabe eines Klimapuffers zu – im Südosten ist er zugleich Eingangsbereich, im Nordwesten ein überdachter und geschützter Sitzplatz im Freien.





Wuppertal: "europäisches Haus"

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1 of 2 02.04.2010 17:39

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Berlin: Projekt "Living EQUIA"

Das Team aus Berlin taufte sein Projekt "Living EQUIA" ("living ecologic and integration of ambience"). Architektonisches Highlight sind zwei Lichtachsen, die sich nach den vier Himmelsrichtungen orientieren. Holz und Lehm gehören zu den wesentlichen Baumaterialien, die Fassaden und das Satteldach sind mit gebäudeintegrierten PV-Elementen bestückt. Zu den gebäudetechnischen Komponenten zählen ein Solarthermiesystem aus Flachkollektoren und einem Kombi- beziehungsweise Pufferspeicher, ein Lüftungsgerät mit Wärmerückgewinnung, eine reversible Kompressionswärmepumpe, Kühldecken und eine Fußbodenheizung im Bad sowie ein Unterbodenwassertank mit zwei Kubikmeter Fass

Autor: Klaus Siegele

Bilder: HFT Stuttgart, Hochschule Rosenheim, Bergische Universität Wuppertal, HTW

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2 of 2 02.04.2010 17:39

Vie rHochschulen aus Deutschland beteiligt

Im Juni 2010 findet in Madrid erstmals der europäische Solar Decathlon nach dem Muster der gleichnamigen amerikanischen Variante statt. Aus Deutschland nehmen insgesamt vier Hochschulen an dem "Solaren Zehnkampf" teil, die auf die Erfahrungen des Solardecathlon-Teams der TU Darmstadt aufbauen können, das 2007 in Washington den ersten Platz abg Gaumt hatte. Inzwischen haben die teilnehmenden Studenten ihre Gebäude- und Energiekonzepte aus Garbeitet, allmahlich nahert sich der Punkt der baupraktischen Umsetzung.

Den ersten Solar Decathlon lobte das amerikanische Energieministerium (DOE) bereits im Jahr 2002 aus – auch dannas waren die teilnehmenden Hochschulen aufgefordert, ihre ausschließlich mit solarer Energie versorgten Wohnhaus-Prototypen auf der National Mall mitten in Washington D.C. zu präsentieren und sich dem Wettbewerb zu sitellen Nach dem viel beachteten Sieg der TU Darmstadt beim Solar Decathlon 2007 in den USA wird der Wet trewerb nun erstmals in Europa ausgetragen. Damit man sich nicht ins Gehege kommt, findet der europäische Solar Decathlon immer im wechselseitigen Rhythmus mit seinem amerikanischen Pendant in den geraden Jahren statt. Für die erste Veranstaltung in Madrid haben sich insgesamt 20 Hochschulteams qualifizieren können, die meisten aus Europa und davon vier aus Deutschland. Dazu gehören die Berliner Hochschule für Technik und Wirt schaft, die Hochschule Rosenheim, die Hochschule für Technik Stuttgart und die Bergische Universitat Wuppertal.

Jedes der vier deutschen Teams ist mit seinem Projekt im Zeitplan, derzeit wird intensiv an den Konstruktionsplänen getüfelt und gezeichnet. Im Mai 2009 hatten sich alle Wettbewerbsteilnehmer in Madrid zu einem gemeinsamen V.orlsnop getroffen, der zugleich die letzte Gelegenheit geboten hatte, der Konkurrenz mal eben kurz über die Schuler zu schauen, um sicherzugehen, dass man selbst auf gutem Weg ist. Finanzielle Unterstützung und Forderung erhalten die deutschen Teams nicht nur von ihren jeweiligen Sponsoren aus der Industrie, sondern aufgrund eines Beschlusses des Deutschen Bundestages auch vom Bundesministerium für Wirtschaft und Technologie

Klaurs Siegele schaute hinter die Kulissen und berichtet, welche Konzepte die verschiedenen Hochschulteams verfolgen

HFT Stuttgart

An der HFT Stuttgart baut man auf ein sehr gut gedämmtes Volumen mit optimiertem A/V-Verhaltnis, um die Transmissionswärmeverluste und damit auch den Energiebedarf auf ein Minimum zu reduzieren. Eine zentrale Rolle spielt der auffällige Energieturm, der nach dem Vorbild der Windtürme im arabischen

Raumden Wind zur Verdunstungskühlung nutzt, um den Innenraum bei geringstem Energieverbrauch zu klimatisieren. Auch finden sich in dem modular aufgebauten Kubus neben der klassischen Haustechnik Phasenwechselmaterialien (PCM). In sehr heißen Phasen wird über ein Verrieselungssystem auf dem Dach nachts durch Verdunstung und Abstrahlung gegen den Nachthimmel Wasser abgekühlt und in einem Speicher gesammelt. Mit diesem gekühlten Wasser werden dann die PCM entladen und über den Fußboden wird Wärme aus dem Innenraum entzogen. Für kalte Tage stehen ein Lüftungsgerät mit Wärmerückgewinnung und eine reversible Warmepumpe bereit. Zur Deckung des Strombedarfs sind Dach, Ost-, Süd- und Westfassaden mit EV-Dunnschichtzellen belegt

Hochschule Rosenheim: Team Ikaros Bavaria

Das Team Ikaros Bavaria von der Hochschule Rosenheim legt bei seinem modular aufgebauten Gebaudekonzept großen Wert auf Nachhaltigkeit und hat deshalb eine Zertifizierung nach DGNB für das Pilotprojekt beantragt. Das technische Konzept baut auf hochwarmegedämmte Bauteile, eine geregelte Lüftung mit Warmerückgewinnung und eine reversible Wärmepumpe für Heizen und Kühlen. Auch hier ist die Hülle mit verschiedenen solaren Systemen wie monokristallinen PV-Zellen und Vakuumrchrenkollektoren für die Energiegewinnung ausgestattet. Ein vor der

Glas fassade montierter Sonnen- und Sichtschulz verhindert zu hohe solare Energieeinträge und bewahrt die Intimsphare der Bewohner. Zwei Wintergärten kommt die Aufgabe eines Klimapuffers zu – im Südosten ist er zugleich Eingangsbereich, im Nordwesten ein überdachter und geschützter Sitzplatz im Freien





Wuppertal: "europäisches Haus"

Die Studenten aus Wuppertal verfolgen das Ziel, für den Solar Decathlon ein zukunftsfähiges "europäisches Haus" zu entwickeln, das nicht nur im heißen Madrid, sondern auch an anderen Standorten Europas mit ausgeglichener Energiebilanz funktioniert.

Dazu haben sich rund 30 Studierende aus unterschiedlichen Fachbereichen (Architektur, Design, Wirtschaftswissenschaften) interdisziplinar zusammengefunden. Leitidee ist ein funktional offenes, mit dem

Außenraum verwebtes Gebäude, dessen Grundstruktur sich aus zwei solar und energetisch relevanten Wandschotten entwickelt. Das Energiekonzept folgt den Prinzipien eines Null-Energiegebäudes. Zentrales Element der Gebäudetechnik ist ein Luftungskompaktgerat mit integrierter Wärmepumpe. Die Kühlung wird durch eine hydraulische Umschaltung erreicht. Zusätzlich wird in wärmeren Klimazonen mit einer indirekten, adiabatischen Kühlung gearbeitet. Die solare Stromversorgung gewährleisten eine in das Flachdach integrierte, netzgekoppelte Solarstromanlage und PV-Module an der Südwand.

Berlin: Projekt "Living EQUIA"

Das Team aus Berlin taufte sein Projekt "Living EQUIA" ("Ilving ecologic and integration of ambience"). Architektonisches Highlight sind zwei Lichtachsen, die sich nach den vier Himmelsrichtungen orientieren. Holz und Lehm gehören zu den wesentlichen Baumaterialien, die Fassaden und das Satteldach sind mit gebaudeintegrierten PV-Elementen bestückt. Zu den gebäudetechnischen Komponenten zahlen ein Solarthermiesystem aus Flachkollektoren und einem Kombi- beziehungsweise Pufferspeicher, ein Lüftungsgerat mit Wärmerückgewinnung, eine reversible Kompiessionswarmepumpe. Kühldecken und eine Fußbodenheizung im Bad sowie ein Unterbodenwassertank mit zwei Kubikmeter Fass

Autor Klaus Siegele

Bilder HFT Stuttgart, Hochschule Rosenheim, Bergische Universität Wuppertal, HTW Berlin

Quelle german-architects com magazin

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Startseite » Presse » Pressemitteilungen

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Energie Europa

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Pressekontakt Pressefotos

Service Medienraum 4.12.2009

Hintze: "Die deutschen Teilnehmer beim Solar-Decathlon sind unsere Botschafter für das Gebäude der Zukunft"

Das Bundesministerium für Wirtschaft und Technologie ist Schirmherr der vier deutschen Beiträge beim internationalen Wettbewerb "Solar Decathlon Europe", der 2010 in Madrid stattfindet. Heute haben angehende Architekten und Ingenieure aus Wuppertal, Stuttgart, Berlin und Rosenheim ihre ambitionierten Entwürfe von energieoptimierten und architektonisch anspruchvollen Wohnhäusern im BMWi ausgestellt und gemeinsam mit ihren Professoren die innovativen Wettbewerbskonzepte präsentiert. So konnten 60 Experten aus Wissenschaft und Politik einen Einblick in das "Nullenergie-Gebäude der Zukunft" bekommen.

Die Bergische Universität Wuppertal stellte ihr "Haus für Europa" vor. Außergewöhnliche Architektur gepaart mit intelligenten Energielösungen ermöglicht Nutzungs- und Standortflexibilität und verleiht dem Projekt europäischen Charakter. "Wohnen von morgen schon heute!" ist die Devise der Hochschule für Technik aus

"Wohnen von morgen schon heutel" ist die Devise der Hochschule für Technik aus Stuttgart. Der Entwurf verbindet Grundprinzipien traditioneller Bauweisen mit heute verfügbaren neuen Materialien und Technologien. Die Hochschule für Technik und Wirtschaft aus Berlin zeigte mit ihrem Vorschlag

Die Hochschule für Technik und Wirtschaft aus Berlin zeigte mit ihrem Vorschlag "Living equia - living ecologic quality and integrated ambience", wie ein ökologisches Leben im Einklang mit der Natur möglich ist, ohne an Lebensqualität einzubüßen.

Mit dem Konzept "Team IKAROS" demonstrierte die Hochschule für angewandte Wissenschaft aus Rosenheim, dass modulare Bauweise und ein flexibler und offener Grundriss sich an die Bedürfnisse der Bewohner anpassen lässt.

Bereits im Jahr 2007 nahm ein Team der Technischen Universität Darmstadt mit maßgeblicher Unterstützung des BMWi am Solar Decathlon 2007 in Washington teil und gewann. Dass der Erfolg in diesem Jahr wiederholt werden konnte, belegt das hohe Niveau deutscher Energieeffizienztechnologien im internationalen Vergleich.

Der Parlamentarische Staatssekretär beim Bundesministerium für Wirtschaft und Technologie, Peter Hintze, dazu: "Deutschland nimmt auf dem Gebiet der Energieeffizienztechnologien international eine Vorreiterrolle ein. Mit der langfristig angelegten Förderung der Energieforschung leistet das BMWI einen wichtigen Beitrag. Mit insgesamt 1,6 Mio. Euro unterstützen wir die deutschen Hochschulen bei ihrer Teilnahme am "Solar Decathion Europe 2010". Sie sind unsere Botschafter für das 'Gebäude der Zukunft' und werden unsere Spitzenposition beim solaren Zehnkampf verteidigen. Mit unseren Exportinitiativen Energieeffizienz und Erneuerbare Energien unterstützen wir zusatzlich mittelständische Unternehmen bei der weltweiten Vermarktung ihrer energieeffizienten Produkte."

BMWi im Überblick

Themen	Ministerium	Presse	Service	Medienraum
Wirtschaft	Minister und Staatssekretäre	Pressemitteilungen	Publikationen	Fotoreihen
Technologie	Aufgaben und Struktur	Reden und Statements	Ausschreibungen	Magazine
Energie	Haushalt	Tagesnachrichten	Gesetze	Infografiken
Europa	Geschichte	Pressekontakt	Veranstaltungen	Videos
Außenwirtschaft	Geschäftsbereich des BMWi	Pressefotos	Abo-Service	Audio
Ausbildung & Beruf	Beiräte		Warenkorb	
Mittelstand	Aufbaustab		Lexikon	
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	Stellenangebote		Forum	
	Wettbewerbe			
	Sonderseiten im Internet			

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1 von 1 07.12.2009 10:38

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Vier deutsche Teilnehmer beim "Solar Decathlon Europe"

(6.12.2009) Das Bundesministerium für Wirtschaft und Technologie ist Schirmherr der vier deutschen Beiträge beim internationalen Wettbewerb "Solar Decathlon Europe", der 2010 in Madrid stattfindet.



18.10.2009 (Bild vergrößern)

Am 4.12, haben angehende Architekten und Ingenieure aus Wuppertal, Stuttgart, Berlin und Rosenheim ihre ambitionierten Entwürfe von energieoptimierten und architektonisch anspruchvollen Wohnhäusern im BMWi ausgestellt und gemeinsam mit ihren Professoren die Wettbewerbskonzepte präsentiert. So konnten 60 Experten aus Wissenschaft und Politik einen Einblick in das "Nullenergie-Gebäude der Zukunft" bekommen.

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Bild aus dem Beitrag "Solarhaus der TU Darmstadt gewin Washington" vom 28.10.2007 nt Solar Decathlon 2007 ir

Der Parlamentarische Staatssekretär beim Bundesministerium für Wirtschaft und Technologie, Peter Hintze, sagte während der Präsentation der deutschen Teilnehmer: "Deutschland nimmt auf dem Gebiet der Energieeffizienztechnologien international eine Vorreiterrolle ein. Mit der langfristig angelegten Förderung der Energieforschung leistet das BMWi einen wichtigen Beitrag. Mit insgesamt 1,6 Mio. Euro unterstützen wir die deutschen Hochschulen bei ihrer Teilnahme am "Solar Decathlon Europe 2010". Sie sind unsere Botschafter für das "Gebäude der Zukunft" und werden unsere Spitzenposition beim solaren Zehnkampf verteidigen. Mit unseren Exportinitiativen Energieeffizienz und Erneuerbare Energien unterstützen wir zusätzlich mittelständische Unternehmen bei der weltweiten Vermarktung ihrer energieeffizienten Produkte."

siehe auch für zusätzliche Informationen:

- Solar Decathlon Europe
- Exportinitiative Erneuerbare Energien
- Bundesministerium für Wirtschaft und Technologie

ausgewählte weitere Meldungen

- CO2NTRA fördert 9 Projekte im Bereich "kommunaler Klimaschutz" (6.12.2009)
- Kesseltauschbonus läuft Ende 2009 aus (22.11.2009)
- Model Home 2020 ein Experiment von Velux (18.11.2009)
- Ingenieurkammern fordern "Europäische Standards" und "Europäisches Gütesiegel Nachhaltiges Bauen" (16.11.2009)
- Wärmepumpen-Aktionswochen auch 2010 (13.11.2009)
- Architekten-Trendstudie (8.11.2009)
- Fassadenkonstruktion des Solar Decathlon 2009-Gewinners (2.11.2009)
- BUND-Jahrbuch 2010 Ökologisch Bauen und Renovieren (1.11.2009)
- <u>EU-Datenbank zum Recht der Erneuerbaren Energien</u> (28.10.2009)
- Deutsche Beitrag gewinnt den Solar Decathlon 2009 (18.10.2009)
- Solar Decathlon 2009: TU Darmstadt tritt zur Titelverteidigung an (11.10.2009)
- Sechs-Punkte-Plan für eine nachhaltige Energiepolitik (11.10.2009) • Photovoltaik-Fassade "ARTLine Invisible" mit farbigen CIS-Modulen (8.6.2009)
- Temperaturerhöhung und Energieeinbuße bei PV-Modulen (2.6.2009)
- Das Erneuerbare-Energien-Gesetz EEG (1.6.2009)
- PV-Tests I: Neues PV-Prüfsiegel von Solarpraxis und TÜV (1.6.2009)
- PV-Tests II: Photon Laboratory GmbH gegründet (1.6.2009)
- Photovoltaiklamelle für Sonnenschutz und Solarstrom (24.5.2009)
- Bauen im Bestand mit Wiconas TEmotion-Fassade (13.5.2009)

07.12.2009 10:40 1 von 2

- Solarstrom auf der Schwelle zur Wettbewerbsfähigkeit (3.5.2009)
- Weltneuheit Schüco 2° Concept nutzt Layer-Prinzip (22.1.2009)
- Barrieren bei der Verbreitung gebäudeintegrierter Photovoltaik (4.12.2007)
 Maximale Transparenz mit Hinterschnitt-Glaspunkthaltern (7.8.2007)
- Gebäude ästhetischer Energiesammler statt dröge Energieschleuder (31.7.2007)
 Neue WDV– und VHF–Systeme mit Naturstein und Glas (18.10.2006)

Textquelle: http://www.baulinks.mobi/news/2009/2082.htm URL des Beitrages im QR-Code:



07.12.2009 10:40 2 von 2



Teilnehmer des Solar Decathlon Europe zum Gespräch beim BMWi

von I living EQUIA - Team BERLIN 07.12.2009 - 0:21 Uhr - Umwelt & Natur



Deutsche Finalisten des SDE 2010 zum Gespräch beim "living EQUIA")

(prcenter.de) Berlin, 07.12.2009 - Das Bundesministerium für Wirtschaft und Technologie (BMWi) öffnete am Freitag, 04.12.2009 den deutschen Teilnehmern des Solar Decathlon Europe 2010 (SDE 2010) seine Türen. Die studentischen Teams aus Berlin, Stuttgart, Rosenheim und Wuppertal, die sich erfolgreich für den Solar-Wettbewerb 2010 in Madrid qualifizieren konnten, wurden von ihrem Schirmherrn, dem BMWi, zu einem fachlichen Austausch eingeladen, um die verschiedenen Hauskonzepte und aktuellen Entwicklungsstande zu präsentieren.

Am Freitag 04.12.2009 traten die deutschen Teilnehmer des SDE 2010 erstmals BMWi (Quelle: Team BERLIN persönlich ihrem Schirmherrn gegenüber. Die auf dem Gebiet der Solarenergie engagierten Studenten aus Berlin, Stuttgart, Rosenheim und Wuppertal konnten das BMWi bereits im Sommer dieses Jahres von ihren Ideen für den solaren Hausbau

überzeugen und als öffentlichen Schirmherm und finanziellen Förderer gewinnen. Gemeinsam mit den betreuenden Professoren stellten die Studenten ihre Architektur- und Energiekonzepte im Detail vor und sprachen über Strategien und weitere Pläne. Der parlamentarische Staatssekretär Peter Hintze ließ es sich nicht nehmen, den Teams persönlich zu ihren Entwürfen zu gratulieren und für die bevorstehende Zeit viel Erfolg zu wünschen.

Auch die Studenten der TU Darmstadt, das Gewinnerteam des Solar Decathlon 2009, sprachen den Teilnehmern Mut zu und gaben einen ausführlichen Einblick in ihre Erfahrungen und Erlebnisse der vergangenen Monate. "Dieser gemeinsame Austausch hat uns sehr geholfen, die nächsten Schritte zu planen und ist ein Ansporn, den Titel auch 2010 wieder nach Deutschland zu holen", so Christian Hodgson, Leiter der Öffentlichkeitsarbeit des Berliner Teams living EQUIA.

Am 9. Dezember beginnt für die Berliner Studenten die nachste große Etappe: Das Team erhält die offizielle Baugenehmigung für ihr Solarhaus. Professor Hans-Herwig Atzorn, Vizepräsident der Hochschule für Technik und Wirtschaft

Berlin (HTW), wird symbolisch das Grundstück direkt an der Spree, auf dem Campus der HTW in Berlin Oberschöneweide, übergeben.

Weitere Informationen finden Sie unter http://www.living-equia.com/de/ Projektfilm des Berliner Teams living EQUIA: www.youtube.com/watch?v=FG9MJFR_7j0

Angaben zum Autor (Angaben als Text-Datei downloaden): living EQUIA Team BERLIN for Solar Decathlon Europe 2010

Hochschule für Technik und Wirtschaft Wilhelminenhofstraße 75A 12459 Berlin

www.living-equia.com

living EQUIA ist das Berliner Team vereint aus Studenten der drei größten Hochschulen der Hauptstadt - der Hochschule für Technik und Wirtschaft (HTW), der Beuth Hochschule (BTH) und der Universität der Kunste (UdK). Unter der Federführung der Hochschule für Technik und Wirtschaft sind angehende Ingenieure und Architekten für die Entwicklung, Planung und Konstruktion des Hauses zuständig. Organisation und Strukturierung der internen und externen Kommunikation übernehmen zukünftige Wirtschaftswissenschaftler, Medieninformatiker und Kommunikationsfachwirte. Beratend begleitet wird das mittlerweile über vierzigköpfige Studententeam von ProfessorenInnen der drei beteiligten Hochschulen. Der Titel des insgesamt zweijährigen Projektes stellt zugleich die Leitmaxime der Mannschaft dar: "living EQUIA - living ecologic quality and integrated ambience". Die Vision von energieeffizientem und technisch innovativem Bauen und Wohnen zu verwirklichen - das ist der Motivation aller freiwillig und ehrenamtlich arbeitenden Teammitglieder dieser hochschulübergreifenden und interdisziplinären Kooperationsarbeit. Projektkurzfilm: http://www.youtube.com/watch?v=OngkQShrBRk

Direktlink auf diese Pressemitteilung

Wenn Sie diese Pressemitteilung verlinken möchten, nutzen Sie diesen Direktlink:

http://www.prcenter.de/Teilnehmer-des-Solar-Decathlon-Europe-zum-Gespraech-beim-BMWi.97506.html

Die beliebtesten Pressemitteilungen aus dieser Kategorie

Solar Decathlon hits the road to catch some Spanish sun

By Paul Ridden 17:05 February 4, 2010



The FABLABHOUSE entry from Instituto de Arquitectura Avanzada de Cataluna is shaped for optimum solar capture

Image Gallery (21 images)



7 shares

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Madrid will host the first European version of the Solar Decathlon competition this summer which sees teams from universities throughout the world designing, building and displaying efficient and sustainable solar homes. The overall competition winner being decided after the completion of ten trials aimed at gauging each entry's energy efficiency and sustainability credentials.

First seen in the US in 2002, the Department of Energy organized the Solar Decathlon to be exported to Europe for the first time this year. The idea of the competition is to design, build and operate "an energetically self-sufficient house that runs only on solar energy, is connected to a power grid, and incorporates technologies that maximize its energy efficiency."

50

Following an agreement between the US Government and Spain's Ministry of Housing

signed in 2007, 19 universities across the globe were invited to participate in Solar Decathlon Europe 2010 and have spent the last couple of years developing their entries. Each team has received financial support from Spain's Ministry to the tune of 100,000 Euros (about US\$140,000) to help realize their projects.

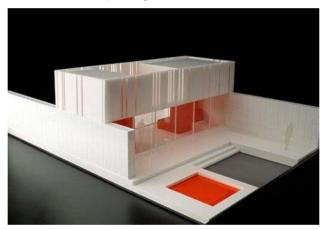
This year, teams from universities in Germany, France, the US, the UK, and of course Spain (amongst others) will assemble their prototype homes in a special 30,000 square meter "Solar Village" within view of the famous 'Cornisa de Madrid' in Madrid where they will then compete in ten trials to test for energy efficiency and self sufficiency to determine an overall winner.

A traveling exhibition showcasing scale models of the Solar Decathlon Europe entries has been created where video introductions from each team outlines projects to visitors. The exhibition has already enjoyed a lot of interest from the public and media when it visited several Spanish centers of learning, fairs, city halls and shopping malls.

The Solar Decathlon sees 19 entries competing in ten contests that are designed to simulate the way in which we use energy in our daily lives. Last year's US Decathlon saw the reigning champions from Technische Universität Darmstadt in Germany take first place with their two-story Cube House, where the exterior was almost completely covered in two kinds of solar panels, one more efficient in direct sunlight and the other managing to produce power from indirect light too.

What will we see at this year's Decathlon?

This year sees teams including Team Bergische Universität Wuppertal, looking to "produce as much electricity at the end of the year as was consumed in the grid" with its two story entry which sees all of the "technological elements relevant for the house's services" above an open living area.



France's Ecole National Supérieure d'architecture de Grenoble present the Armadillo Box. Enclosed in 52 square meters of solar paneling, with the living space organized around a technical nucleus the designers see the home producing enough energy to satisfy both the occupants and to charge an electric car.



Rather than opting for the popular box and panel design, the unique-looking Fablabhouse from Instituto de Arquitectura Avanzada de Cataluña is shaped for optimum solar capture and incorporates photovoltaic imprinted textiles on a ribcage of reinforced bars.



Building on the Chinese philosophy of striking a harmonious balance between man, nature and housing the Sunflower from Team Tianjin University makes maximum use of passive solar technologies in a commercially viable sustainable design.



There's a lot of sun in Florida and its university team was inspired by the simple principles of the native Cracker Houses "intended to provide natural light and ventilation to the interior in hot climates". Modular in approach, a technology wall to the south of the house is home to all the plumbing and electronics with the rest of the structure given to divided living space.



The competition entrants will need to construct their full-scale houses between June 7 and 17th, with the ten contests to decide the winner taking place between June 18th to 27th.



Studentische Gebäudeprototypen im Bau

02.03.2010

Solar Decathlon Europe

Architekturentwürfe aus der Studienzeit bleiben im Normalfall Theorie. Der Solar Decathlon Europe eröffnet vier deutschen Studententeams die Möglichkeit, ihren Entwurf eines energetisch selbstversorgenden Wohnhauses an den Ansprüchen der Wirklichkeit zu messen und mit

anderen ehrgeizigen Protoypen in Wettstreit zu treten. Zur Zeit ist die Fertigung der transportfähigen Gebäude in vollem Gange.

Der Wettbewerb

Der europäische <u>Solar Decathlon</u> nach dem Vorbild der gleichnamigen amerikanischen Variante findet im Juni in Madrid erstmals statt. Er verfolgt das Ziel, nicht nur die Studierenden, sondern auch die allgemeine Öffentlichkeit für den verantwortungsvollen Umgang mit Energie und natürlichen Ressourcen zu sensibilisieren. Die Gebäude sollen zeigen, wie gute Solararchitektur, Energieeffizienz und Wohnkomfort Hand in Hand gehen.

Seit Anfang 2009 entwickeln ausgewählte, fachübergreifend zusammengesetzte Studententeams dafür gemeinsam mit ihren Professoren und Sponsoren und Partnern aus der Industrie jeweils ein 75 m² großes, ausschließlich solar betriebenes Wohngebäude. Die Herausforderung besteht darin, dass dies nicht nur auf dem Papier stattfindet. Die Entwürfe werden 1:1 umgesetzt und müssen sich während einer Woche im Betrieb beweisen.

Den Sieger kürt eine interdisziplinär besetzte Fachjury aus der Gesamtwertung über zehn Einzeldisziplinen (Decathlon). Fast die Hälfte der Punktzahl ist in den Bereichen Architektur, Elektrische Energiebilanz, Komfortbedingungen und Innovation zu holen. Die andere Hälfte kann man gleichrangig in den Disziplinen Konstruktion, Solarenergie, Ausstattung / Geräte, kommunikativer und sozialer Anspruch, Industrialisiertes Bauen / Marktfähigkeit und Nachhaltigkeit erreichen.

Unterstützung erhalten die deutschen Teams nicht nur von ihren jeweiligen Industriepartnern, auch das Bundesministerium für Wirtschaft und Technologie fördert die vier Projekte im Rahmen der Forschungsinitiative EnOB Forschung für Energieoptimiertes Bauen.

Terminplan

Während an der <u>Fachhochschule für Technik und Wirtschaft Berlin</u> letzte Woche Richtfest gefeiert wurde, zelebrierte die <u>Bergische Universität Wuppertal</u> gestern den symbolischen Akt der Grundsteinlegung. An der <u>Hochschule für Technik Stuttgart</u> sind die Holzmodule fertiggebaut und das Richtfest ist für April avisiert. Die <u>Hochschule Rosenheim</u> beginnt man gerade mit dem Innenausbau und plant das Richtfest Anfang Mai. Nach dem Testbetrieb an der heimischen Hochschule werden die Gebäude wieder demontiert und auf die Reise nach Madrid verschickt, um sich dort ab dem 18. Juni im Wettbewerb zu messen und sich einer breiten Öffentlichkeit zu präsentieren.

Hintergrund

2002 rief das US-amerikanische Energieministerium den Solar Decathlon ins Leben. In Deutschland bekannt machten ihn die Siege der Universität Darmstadt 2007 und 2009. Der europäische Ableger feiert in diesem Jahr in Madrid Premiere und soll auch in Zukunft alternierend zu dem amerikanischen Wettbewerb stattfinden. Für die erste Veranstaltung haben sich insgesamt 20 Hochschulteams qualifizieren können - aus Spanien, China, Israel, Frankreich, USA, Mexiko, England, Finnland und Brasilien.

Zur∳ck

PR inside



HAUS | HOLZ | ENERGIE vom 16.-18. April in Stuttgart

150 Aussteller und viele Sonderschauen sprechen private Hausbesitzer, Bauherren und Modernisierer an



150 Aussteller präsentieren auf der HAUS | HOLZ | ENERGIE (16.-18. April) in Stuttgart (fast) alles, was Bauherren und Immobilienbesitzer, die umbauen oder modernisieren wollen, brauchen. Foto: HAUS | HOLZ | ENERGIE / Fabry

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Bodenbeläge, Dämmmaterial, Fenster, Holzhäuser, Kamine, Küchen, Solaranlagen, Treppen und Türen: Die Liste dessen, was 150 Aussteller auf der HAUS | HOLZ | ENERGIE vom 16. bis zum 18. April auf der Stuttgarter Messe bieten, ließe sich lange fortsetzen. Außerdem gibt es Sonderschauen und -stände zu Energie-Themen und "Wohnen im Alter Eine Ausstellung mit künstlerischen Arbeiten Konstanzer Studenten hinterfragt Wohn-Gewohnheiten. "Mein Traumhaus" heißt ein Gewinnspiel, das zum Mitmachen anregt. Ein Highlight im Vortragsprogramm: Projekt-Architekt Daniel Walter stellt das Solar-Haus vor, mit dem sich die Hochschule für Technik Stuttgart am "Solar Decathlon Europe 2010" beteiligt.

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Modernisierungsplänen suchen. Von Alarmanlagen bis zu Wärmepumpen oder Wintergärten reicht die Angebotspalette. Besondere Schwerpunkte setzt die Messe auf die Themen "Energie" und "Holz das nicht nur als Bau-, sondern auch als Heizmaterial Furore macht. Sonderschauen und -stände, wie die Energie-Info-Stände des Wirtschaftsministeriums Baden-Württemberg und des GIH Landesverbands Baden Württemberg der Gebäudeenergieberater, Ingenieure und Handwerker, sowie ein kostenfreies Vortragsprogramm an allen drei Messetagen ergänzen das Angebot.

Sonderthema: Wohnen im Alter

Erstmals thematisiert die Messe 2010 ausdrücklich den zunehmend diskutierten Aspekt des Wohnens im Alter. Dazu gibt es eine vom Handwerks- und Dienstleistungsnetzwerk L.O.B. Leben ohne Barrieren konzipierte Sonderschau und vier Vorträge am Freitag, 16. April, dem ersten Messetag.

"Un-gewohnt Studierende hinterfragen gängige Innenraumgestaltung

"Un-gewohnt so heißt eine Ausstellung in der Studentinnen und Studenten von Professor Myriam Gautschi von der Hochschule für Technik, Wirtschaft und Gestaltung in Konstanz, die gängige Seh- und Wohn-Gewohnheiten hinterfragen. Das gemeinsame Motto der Arbeiten, die auf der HAUS | HOLZ | ENERGIE zu sehen sind und sich mit Innenraumgestaltung befassen, lautet "Alles Vorhang. In ihrem Vortrag am Sonntag, 18. April, macht sich die Professorin – passend dazu - "Gedanken zu scheinbar Unverrückbarem

Stuttgarter Solar-Haus für internationalen Wettbewerb

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und PR-Evaluation von Landau Media professionell und individuell

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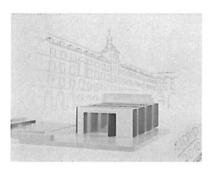
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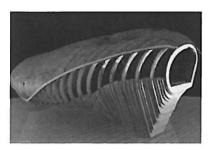
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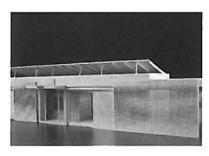
Nach den Siegen der TU Darmstadt in den Jahren 2005 und 2007 wird nun der "Solare Zehnkampf" erstmals auch Europa in ausgelragen. Ausgelobt vom spanischen Wohnungsbauministerium in Zusammenarbeit mit dem amerikanischen Energieministerium (DOE) Irelen 20 ausgewählte Hochschulteams aus der ganzen Welt an, um ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen.

Aus Deutschland nehmen die Fachhochschule für Technik und Wirtschaft aus Berlin, die Bergische Universität Wuppertal, die Stuttgarter Universität für Angewandte Wissenschaften sowie die Universität für angewandte Wissenschaften aus Rosenheim teil



Das beste und innovativste Konzept mit einer optimierten Energiebilanz wird im Juni in Madrid prämert. Weitere Kriterien sind Komfort, Gestaltung, Kommunikation und Marktfähigkeit. Damit soll bewiesen werden, dass energieeffizientes Bauen auch mit einer Steigerung des Komforts, sowie der Gestalt- und Wohnqualität einhergehen kann.

Die Teams der verschiedenen Universitäten haben während der vergangenen zwei Jahre bereits jeweils einen Prototyp entwickelt, der dann zur Präsentation in der "Villa Solar" in Madrid montiert wird. Die Ausstellungsfläche umfasst 30.000 qm und verläuft auf beiden Flußufern entlang des Manzanares



Auch der europäische Ableger des amerikanischen Solar Decathlon verspricht damit, nicht nur die Möglichkellen des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern, sondem auch ein architektonisches Event der Extraklasse zu werden

Die offizielle Seite des Wettbewerbs finden Sie hier: www sdeurope org

Eine deutsche Seile der Hochschule für Technik Stuttgart finden Sie hier: www.sdeurope.de

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Suchbegriff...



HOME +-Energiehaus der HFT Stuttgart

<u>a</u>

Beim Wettbewerb für energieeffizientes Bauen treten 20 Teams aus aller Welt in Madrid an

Solar Decathlon Europe heißt der europäische Wettbewerb für energieeffizientes Bauen, für den sich insgesamt 20 Teams aus der ganzen Welt angemeldet haben, um sich in Kürze in Madrid zu messen. Unter den vier deutschen Teams ist auch die Hochschule für Technik (HFT) in Stuttgart. Nun haben die Studierenden ihr Modulhaus HOME + vorgestellt, mit dem sie am Wettbewerb teilnehmen werden. Von Rüdiger Sinn, Stuttgart

Die Studierenden der HFT haben sich viel vorgenommen, um beim ersten Solar Decathlon auf europäischem Boden ein gutes Ergebnis zu erreichen. Mit ihrem HOME +-Haus produzieren sie unter Wettbewerbsbedingungen am Standort in Madrid doppelt so viel Energie, wie sie verbrauchen.

Die Grundlage für das Energiespar-Haus ist ein konstruktiver Mix aus verschiedenen Energiesystemen in einem modulhaft aufgebauten Gebäude. Eine sogenannte feuchtadiabatische Kühlung sorgt während der Sommermonate für kühle Luft in dem 75 gm-Wohnhaus. Das geschieht im sogenannten Kühlturm rein mechanisch (durch die abfallende kühle Luft, die zuvor an feuchten Tücher vorbeistreift), Eine thermische Solaranlage (96 Prozent des Warmwasserbedarfs werden darüber gedeckt) und eine reversible Wärmepumpe (als zusätzlicher Sicherheitspuffer) versorgen das Haus mit Wärme. beziehungsweise - für diesen Standort wichtig - mit Kühlenergie. Das ausgeklügelte Energiesystem bietet aber noch mehr. Unter der Photovoltaik (PV)-Anlage, die auf dem Dach in Richtung Süden ausgerichtet ist (die Oberlichter werden mittels thermischer Vakuum-Röhrenkollektoren verschattet), verbirgt sich eine weitere thermische Kühlung. Diese spricht nachts an und speichert die Nachtkühle des Weltalls als kaltes Wasser in einem Rückkühlspeicher. Das Wasser wird danach durch Kühldecken im Gebäudeinneren geschickt, deren Speicherfähigkeit durch Platten mit einem besonderen Phasenwechselmaterial (PCM = Phase Change Material) optimiert wurde. So reagiert die Decke träge und gibt die Kühle bei Tag wieder ab, dann wenn die Kälte benötigt wird.



Baustellenimpressionen ... Foto: Rüdiger Sinn, Stuttgart

Das ausgeklügelte Energiekonzept ist in die Module des HOME +, eingebettet. Die vier demontierbaren Teile, die wie Wohncontainer wirken, sind massiv aus Schichtsperrholz gefertigt und durch eine Vakuumdämmung hoch gedämmt (nach Angaben der Betreiber rund acht bis zehn Mal so gut wie mit einer konventionellen Dämmung). An den Schnittstellen (Verbindungsmodule) zeigen sich die energetischen Feinheiten. Die drei Verbindungseinheiten gliedern nicht nur den optisch wie ein Kubus wirkenden Bau, die Verglasung sorgt dort auch für den Lichteinfall. Zudem befinden sich hier Lüftungsmöglichkeiten. In zwei der Verbindungselemente ganz normal über das Öffnen der Fenster und den Luftaustausch über Lamellen, im dritten Fall über den länglichen Lüftungsturm, der - wie oben beschrieben - einen wichtigen (energetischen) Bestandteil des Hauses einnimmt. Die Höhe des "Energieturmes", der tatsächlich aber nur wenig über das Gebäude herausragt, bewirkt ein möglichst langes Vorbeistreifen der Luft an den feuchten Tüchern. Bei diesem Vorgang reichert sich die Luft mit Feuchtigkeit an und kühlt gleichzeitig ab, da das Wasser verdunstet (Energie wird der warmen Luft entzogen). "Für die Wettbewerbsbedingungen in Madrid ist das tatsächlich ideal", erklärt Sebastian Fiedler, einer der beiden Projektverantwortlichen. "In Madrid haben wir relativ trockene Luft, deshalb können wir diese noch befeuchten und kühlen müssen wir sie sowieso."

Das Haus ist genau für diese mediterranen Bedingungen ausgelegt, "Am Standort Madrid produzieren wir doppelt so viel Energie, wie wir verbrauchen", rechnet Jan Cremers von der

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HFT vor. Er ist mit Fiedler verantwortlich für die Realisation des Projektes. Und selbst am Standort Stuttgart – unter sehr viel schlechteren klimatischen Bedingungen – würde das Haus noch mehr Energie produzieren als verbrauchen. "Es ist deshalb auch Vieles möglich", sagt Cremers und spricht auf die Möglichkeit an, mit dem Haus in Serienproduktion zu gehen. Bislang sind die Entwicklungs- und Produktionskosten allerdings noch zu hoch. 1,4 Mio. Euro mussten an Sponsorengelder zusammenkommen, um das Projekt zu finanzieren. "Die Baukosten liegen jetzt noch sehr hoch, bei ca. einer halben Million Euro, da es sich um einen Prototyp handelt. Durch diverse Maßnahmen ließen sich diese Kosten jedoch bei einer Weiterentwicklung sehr deutlich reduzieren", ist sich Cremers sicher.

Dass das Haus oder das Konzept des Hauses in Produktion geht und zukunftsfähig ist, daran haben die Konstrukteure von der HFT keinen Zweifel. Möglichkeiten zur Verwendung und Orte zur Aufstellung gibt es für sie en masse. "Die vielen Flachdächer in Stuttgart oder in anderen Städten bieten sich dafür zum Beispiel an. Gerade dort, wo eine Nachverdichtung des urbanen Raumes schwierig ist", sagt Sebastian Fiedler. Aber auch Orte, die nicht an eine zentrale Energieversorgung angeschlossen sind, könnten sich als Standort eignen. Hier ist das Bild von dem Kubus am Strand im Gedächtnis, wie es in der Projektvorstellung als möglicher Standort gezeigt wird.

In den nächsten drei Wochen wird das energieautarke Haus unweit des Campus der HFT fertig gestellt und Tests unterzogen. Dann geht es mitsamt der studentischen Mannschaft nach Madrid. Dort muss es von den Studierenden in zehn Tagen wieder aufgebaut werden und unterliegt dann den realen Bedingungen. Danach entscheidet eine Jury, ob das Haus den geforderten Kategorien standhält. Neben der Architektur und der Konstruktion gibt es für die Kategorien "Solar" (Solarsysteme, Elektrische Energiebilanz), "Komfort" (Komfortbedingungen, Haushaltsgeräte), "Sozial & Ökonomisch" (Kommunikation und soziales Bewusstsein, Industrialisierung und Marktfähigkeit) und "Strategie" (Innovation und Nachhaltigkeit) Punkte. Beim Thema Nachhaltigkeit sind die Erbauer jetzt schon stolz, dass ihr Haus bereits nach 20 Jahren über eine positive Energiebilanz (miteingerechnet ist hier die Herstellung des Hauses – also die sogenannte "graue Energie") verfügt. Zudem seien alle Baustoffe ohne weiteres trenn- und recyclebar, betont Cremers.

"Wir wollen natürlich siegen", sagt Sebastian Fiedler, "aber" – und da bestätigt Fiedler die Aussage des Dekans der Hochschule – "wir haben auch jetzt schon gewonnen!" Dabei betrachtet er zum einen die Wettbewerbsziele – die Studenten sollen an die Thematik des energieeffizienten Bauens herangeführt werden und Projekte entwickeln, die zukunftsfähig sind – und zum anderen den Nutzen für die HFT: Das fakultätsübergreifende Projekt hat Studierende der Architektur, des Bauingenieurswesens, der Nachhaltigen Energietechnik (sence = sustainable energy competence), Innenarchitektur, Bauphysik und Infrastrukturmanagement zusammengeführt. Dazu kommt die enorme Praxisorientierung. Seit Januar haben im Schnitt zehn Studierende die Module bei einer Holzbaufirma vormontiert. Zum Kernteam gehören rund 15 Studierende, weit über 200 seien darüber hinaus in irgendeiner Weise am Projekt beteiligt gewesen. Das Projekt hat sich also auch für die Studierenden gelohnt: "Wenn die später in die Praxis gehen, dann sind sie fit", prognostiziert Jan Cremers zufrieden.

Bilder & weitere Infos



Baustellenimpressionen
...
Foto: Rüdiger Sinn, Stuttgart



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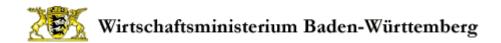
Baden-Württemberg auf der Expo 2010

Read Die universelle Weltausstellung EXPO 2010 findet vom 1. Mai bis 31. Oktober in der Millionen-Metropole Shanghai statt. Das Thema "Better City, Better Life" soll den Wunsch der Menschheit nach einem besseren Leben in den Städten der Zukunft aufgreifen und fordert Konzepte zur nachhaltigen, integrierten Stadtentwicklung. Während im Jahr 1800 nur zwei Prozent der Menschheit in Städten lebten, sind es heute mehr als die Hälfte – Prognose weiter wachsend.

Der Deutsche Pavillon greift mit seinem Namen "balancity", ein Kunstwort aus "Balance" und "City", das Thema der EXPO 2010 auf. Der Besucher von balancity begibt sich auf eine Reise durch eine Stadt der Ideen. Die Botschaft des Deutschen Pavillons lautet: Es ist durchaus erstrebenswert in einer Stadt zu leben, die in Balance ist.

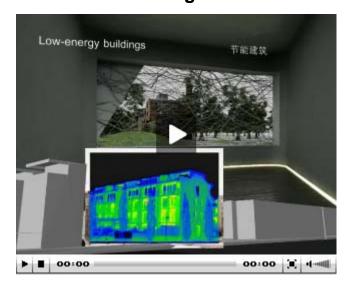
Baden-Württemberg-Tag und Film "Our ideas for a better life in the city"

Baden-Württemberg präsentiert sich auf der Expo gleich doppelt: Zum einen mit den Baden-Württemberg-Tag am 22. Oktober 2010 in und um den Deutschen Pavillon herum und zum anderen während der gesamten Dauer der Expo als Teil des Freiburg-Standes in der Urban Best Practices Area. Allen Interessierten, die keine Gelegenheit haben, die Expo in Shanghai zu besuchen, wollen wir die Möglichkeit bieten, dennoch einen Teil der Expo mitzuerleben. Lassen Sie sich auch hier zu Hause inspirieren von unseren Ideen für ein besseres Leben in der Stadt: Nachhaltige Stadtentwicklung, nachhaltige Mobilität und nachhaltige Produktion – drei Filmbeiträge zur Baden-Württemberg-Präsentation im Auftrag des Wirtschaftsministeriums.



Wirtschaftsministerium Baden-Württemberg http://www.wm.baden-wuerttemberg.de

Baden-Württemberg Film zur EXPO 2010: Nachhaltige Stadtentwicklung



Um den Film zu starten, klicken Sie bitte auf "Start/Wiedergabe".

Hinweise und technische Anforderungen

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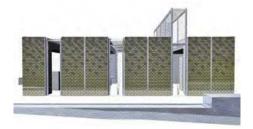
Datum: 03.05.2010

572 Ausstellungen 2010 🗆 6 **DETAIL**

Internationaler Wettbewerb Solar Decathlon Europe 2010

Die Hochschule für Technik Stuttgart (HFT Stuttgart) wurde Ende 2008 als einer von 20 Teilnehmern aus einer Vielzahl internationaler Bewerber ausgewählt. Aus Deutschland schafften es darüber hinaus ein Berliner Team (Hochschule für Technik und Wirtschaft Berlin, Beuth Hochschule für Technik Berlin, Universität der Künste Berlin), die Hochschule Rosenheim und die Bergische Universität Wuppertal in die Endrunde. Die Häuser aller Teams präsentieren sich von 18. bis 27. Juni 2010 als »Solar Village« im Zentrum von Madrid einer breiten Öffentlichkeit. Hauptziel des Wettbewerbs ist es. das Bewusstsein für die Möglichkeiten des energieeffizienten Bauens und der Nutzung regenerativer Energien zu steigern. Darüber hinaus soll die Markteinführung innovativer solarer Energietechnologien gefördert und der Nachweis erbracht werden, dass energieeffizientes Bauen mit hohem Wohnkomfort und architektonischer Qualität verwirklicht werden kann.

Ausgangspunkt des Stuttgarter Entwurfs (s. Abb.) ist ein kompaktes und sehr aut gedämmtes Volumen, das in einzelne Module aufgeteilt wird, die mit etwas Abstand zueinander angeordnet werden. Die entstehenden Fugen dienen der Belichtung, der Belüftung, der Vorwärmung im Winter und der passiven Kühlung im Sommer. Eine besondere Rolle spielt dabei der gestalterisch und räumlich prägende »Energieturm«, der im Zusammenspiel von Wind, Verdunstungskälte und thermischem Auftrieb die Belüftung und Kühlung der Zuluft des Gebäudes übernimmt, ohne dabei Strom für den Lufttransport oder die Kühlung zu benötigen. Dabei bedient er sich der Grundprinzipien traditioneller lokaler Vorbilder, wie der Windtürme im arabischen Raum und der Patios in Spanien. Im Innenraum erhöhen Phasenwechselmaterialien (PCM) die thermisch wirksame Masse der aus Holz gefertigten Module. Um den niedrigen Restenergiebedarf zu decken, wird die gesamte Gebäudehülle solar aktiviert: Das Dach und die Ostund Westfassaden werden mit einer zweiten Haut aus neuartigen Photovoltaik-Modulen zur Stromerzeugung versehen. Damit wird das Gebäude zum »Plusenergiehaus«. Die Energiehülle erzeugt tagsüber Strom und stellt zusätzlich nachts Kälte bereit. Dazu wird Wasser aus einem Rückkühlspeicher durch Rohre hinter den PV-Modulen auf dem Dach gepumpt. Durch die Abstrahlung gegen den Nachthimmel kühlen die PV-Module aus und entziehen dem dahinter vorbeifließenden Wasser Wärme. Das so gekühlte Wasser wird zur Regenerierung der PCM-Decke im Gebäudeinneren, zur direkten Kühlung des Fußbodens und zur Rückkühlung einer kleinen neu entwickelten reversiblen Wärmepumpe genutzt, die zur Ab-





deckung von Spitzenlasten vorgehalten wird. Diese Kombination aus PV-Modul und »Kälte-Kollektor« haben wir an der HFT entwickelt. Der modulare Aufbau des Gebäudes ermöglicht die Weiterentwicklung zu einem Bausystem.

18.–27.6.2010, Madrid, www.epia.org, www.sdeurope.de, www.sdeurope.org



DETAILplus: weitere Bilder: www.detail.de/0281

Otto Neurath. Gypsy Urbanism – Vater aller Piktogramme

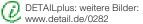
Die kleine und sehr prägnante Ausstellung im Kunstblättersaal des Museums für Angewandte Kunst (MAK) in Wien über den österreichischen Philosophen, Ökonomen und Universalgelehrten Otto Neurath (1882–1945) widmet sich mit vielen Originaldokumenten den beiden wichtigsten Aspekten seiner Arbeit: der Wiener Siedlerbewegung der 1920er-Jahre und seiner Auseinandersetzung mit Schrift und Bild sowie Leitsystemen und deren Anwendung in Architektur und Stadtentwicklung. Seine Arbeit hat bis heute Einfluss auf unterschiedliche Diszipli-



nen wie Architektur, Philosophie, Wirtschaft, Stadtplanung und Grafikdesign. Er arbeitete mit führenden Architekten, Designern und Künstlern seiner Zeit, u.a. Franz Schuster, Josef Frank und Margarete Schütte-Lihotzky, die später die »Frankfurter Küche« als Vorläuferin aller Einbauküchen entwickelte. Für Neurath entwarf sie den Prototyp eines als Notunterkunft gedachten, erweiterbaren Fertigteil-Siedlungshauses, dessen Planzeichnungen und Innenansichtsskizzen in der Schau zu sehen sind. Diese Kleinhäuser konnten aus dem Katalog bestellt und vom Käufer selbst aufgebaut werden. Die optische Gestaltung dieser frühen Verwirklichungen verweist auf das zentrale Element von Neuraths Arbeit: sein Streben nach einer standardisierten Bildsprache, deren leicht zu erfassende visuelle Grammatik die Idee der Bildung und der Demokratisierung unterstützen sollte. So sind etwa Tafeln mit Bildstatistiken zu sehen, wie sie ab 1925 im neu gegründeten Österreichischen Gesellschafts- und Wirtschaftsmuseum gezeigt wurden. Ziel war es, dem Laien Statistiken und historische Daten bildhaft darzustellen. Mit dem Grafiker Gerd Arntz entwickelte Otto Neurath dazu die so genannte Wiener Methode der Bildstatistik »Isotype« (International System of Typographic Picture Education). Die Schautafeln widmen sich Themen wie »Wanderbewegung wichtiger Länder« oder »Wohndichte in Großstädten«. Diese



Tafeln sowie die Filme, Modelle, Diagramme und Plakate veranschaulichen Neuraths Vision von Sozial- und Stadtplanung – in deren Vielfalt spiegelt sich auch das kuratorische Engagement für diese Neuausgabe der Neurath-Ausstellung aus dem Schindler House des MAK Center for Art and Architecture in Los Angeles. Neuraths hochpolitische Haltung, soziale Demokratie, organisierte Selbsthilfe und kulturelle Bildung zu fördern, wirkt überraschend aktuell; die New York Times taufte seine Piktogramm-Pädagogik »Bild-Esperanto«.





SOLAR DECATHLON IM JUNI 2010

Wie wir schon in der Ausgabe 4/2009 des Heldenheftes berichteten, nimmt die Hochschule für Technik am diesjährigen Solar Decathlon 2010 in Madrid teil.

Beim "Solaren Zehnkampf" treten 20 ausgewählte Hochschulteams aus der ganzen Welt an, um bis Juni 2010 ein ausschließlich mit solarer Energie betriebenes Wohnhaus zu entwerfen und zu bauen. Neben dem Konzept, der Energiebilanz und dem Innovationsgehalt werden auch Komfort, Gestaltung, Kommunikation und Marktfähigkeit bewertet.

Am 4. Dezember 2009 stellte das Team home+ gemeinsam mit den drei anderen deutschen Teilnehmern aus Wuppertal, Berlin, Rosenheim sein Wohnhauskonzept beim Bundesministerium für Wirtschaft und Technologie vor. Mit der langfristig angelegten Förderung der Energieforschung leistet das BMWi als Schirmherr einen wichtigen Beitrag auf dem Gebiet der Energieeffizienztechnologien in Deutschland.

DIE BAUPHASE

Nach über 1,5 Jahren voran gegangener Planung, konnte Anfang Dezember 2009 mit dem Bau der tragenden Konstruktion begonnen werden.

WerkPartner (Müller Holzbau GmbH) aus-Blaustein bei Ulm wurde ein kompetenter Partner und Sponsor gefunden. "Nun entsteht das Gebäude nicht nur auf den Plänen, sondern wird ab sofort realisiert und wächst von Tag zu Tag", freuten sich die Studenten bei einer Besichtigung im Werk. Die vorgefertigten Module wurden dann im März 2010 von Ulm nach Stuttgar an die Hochschule transportiert und zusammengefügt.

So wird das Projekt auch von innovativen Elementen aufgewertet. Verschiedene innovative Elemente des Projekts haben den Forschergeist der beteiligten Studenten geweckt. Die Bachelorarbeit eines Bauphysik-Studenten befasst sich zum Beispiel mit dem "Energieturm", der das Prinzip der Verdunstungskühlung nutzt, um im heißen spanischen Sommer mit rein passiven Mitteln ein behagliches Baumklima zu schaffen

Eine weitere Bachelorabeit untersucht, wie die auf dem Dach des Gebäudes angeordneten Photovoltaikmodule neben ihrem primären Zweck, der Generierung von elektrischer Energie, auch zur Kühlung des Gebäudes genutzt werden können. Dazu werden auf der Unterseite der Module aufgebrachte Rohrschlangen nachts mit Wasser durchströmt. Durch di Wärmeabstrahlung an den Nachthimmel kühlt sich das Wasser ab und steht dann tagsüber für die im Raum vorhandenen Kühlflächen zur Verfügung.

"Da diese Funktionsweise der Kollektoren noch nicht ausreichend erforscht und



HOCHSCHULE FÜR UNIVERSITY OF TECHNIK STUTTGART APPLIED SCIENCES

auch nicht auf dem Markt erhältlich ist, wird auch dieses Modul von den Studenten selbst konstruiert und gebaut, so der begeisterte Begleiter der beiden Bachelorarbeiten Markus Binder, Mitarbeiter im Studiengang Bauphysik. "Bei so vielen innovativen Ideen in einem Gebäude kommt es natürlich nicht nur darauf an, dass jedes einzelne Element funktioniert, sondern auch, dass sie sinnvoll ineinandergreifen. Diese Koordination ist ein wichtiger Bestandteil unserer Arbeit."

Dass das Team viele technische Komponenten von Grund auf selbst entwickeln muss, hat aber auch seine Vorteile:



8 campus heldenheft





Sie können ganz gezielt gestalterisch an das architektonische Konzept angepasst werden. Eine architektonische Neuerung aus dem vergangenen Winter ist zum Beispiel die Auflösung der Fassade in einer Art Pixel-Struktur, die durch Verwendung verschiedenfarbiger Photovoltaikzellen zustande kommt. Somit entsteht ein fließender Übergang

TEAMSTRUKTUR

Das Kernteam für den Beitrag der HFT Stuttgart, das den Wettbewerb kontinuierlich über seine Laufzeit bis in den Sommer 2010 bearbeiten und begleiten wird, stammt aus dem Master-Studiengang Architektur. Unterstützt wird das Kernteam dabei von Studenten und Professoren aus folgenden HFT-Studiengängen:

Master Sustainable Energy Competence (SENCE), Bachelor Bauphysik, Bachelor Innenarchitektur, Master Konstruktiver Ingenieurbau. Um die Kommunikation untereinander und das integrative Entwerfen zu forcieren wurden Arbeitsgruppen gebildet, damit am Ende auch alles zusammen passt.

ENDSPURT BIS JUNI

Nach dem Innenausbau, den bauphysikalischen und montagetechnischen Tests wird das Gebäude wieder in Module zerlegt und diese treten die Reise nach Madrid an. Durch den hohen Planungs- und Zeitaufwand haben einige Studenten bereits ihr Studium verlängert, was die Begeisterung der Studenten für das Projekt verdeutlicht – und ihre Entschlossenheit, beim Wettkampf ein gutes Ergebnis abzuliefern.

Der Beitrag der HFT-Stuttgart für den Solar Decathlon 2010 wird dementsprechend nicht nur ein Projekt, das auf dem Markt vorhandene Produkte geschickt anwendet, sondern das durch die zahlreichen, in Bachelorarbeiten erforschten Eigenentwicklungen darüber hinaus einen innovativen Mehrwert schafft, der in Zukunft einen Beitrag zum energieeffizienten Bauen leisten kann.

Der Wettbewerb hat schon längst begonnen, denn auch die Öffentlichkeitsarbeit mit zahlreichen Berichten, Messeauftritten und dergleichen wird in die Punktewertung mit eingehen.

Das Heldenheft bleibt gespannt und wird das Geschehen weiter verfolgen.

Weitere Informationen zum home+ der HFT: www.sdeurope.de

PRINZ STUDENTEN JAHRES-ABO FÜR 12,60 EURO STATT 15,30 EURO. TEL. 040 / 87 97 35 50

Bitte Bestellnummer 27.398 angeben.



//Text: Sascha Bauer//

PRINZ – wir lieben diese Stadt.

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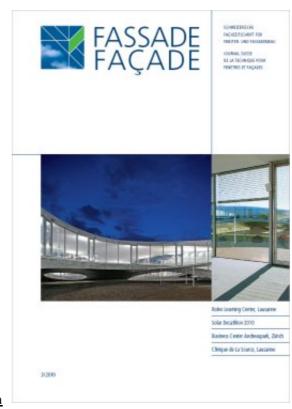
03/2010

Technik

- Solar-Decathlon 2010 Bauen für die Zukunft
- Dynamisch reagierende Gebäudehülle
- Innovative Fassadenelemente der SAW Spannbetonwerk AG, Widnau

Report

- Das neue Rolex Learning Center der EPFL in Lausanne
- Business Center Andreaspark
- Klare Linien beim Perron 1
- Rénovation de la facade d'une clinique à Lausanne
- Auditorium der Graubündner Kantonalbank in Chur
- Kaleidoskopische Chromstahlhülle
- Wiedererkennung dank Fassadendesign
- Identifikation durch Farbgestaltung
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- <u>Extension ouest du centre commercial Balexert SA à Genève</u>



Fordern Sie eine Probenummer an: fassade@szff.ch.

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Url: http://www.focus.de/immobilien/energiesparen/tid-17273/solarwettbewerb-stuttgart-vom-winde-gekuehlt_aid_481064.html

18.02.2010, 06:12



Solarwettbewerb

Das Wohnhaus als Kraftwerk

Der Nachwuchs macht es vor: Studenten bauen Häuser, die mehr Strom liefern, als die Bewohner verbrauchen. Sogar Wachs und feuchte Tücher gehören zum Energiekonzept.

Von FOCUS-Online-Autorin Claudia Raupach

Dämmung, effektiver Sonnenschutz, intelligente Kühl- und Heizsysteme – das Einsparpotenzial im Hausbau ist enorm. Wenn wenig Energie verbraucht wird, können Fotovoltaik & Co. einen Überschuss an Strom erwirtschaften. Studenten präsentieren ihre Vorstellungen von energieeffizientem Bauen bis Samstag auf der bautec-Messe in Berlin. Noch sind es Entwürfe, doch bis zum Sommer werden die Hochschulteams aus



living EQUIA/HTW Berlin
Der Entwurf von Studenten aus Berlin

Berlin, Wuppertal, Stuttgart und Rosenheim ihre Plus-Energiehäuser aus vorher gefertigten Modulen bauen. Auf dem Solar-Decathlon-Wettbewerb im Juni 2010 in Madrid messen sie sich anschließend mit internationaler Konkurrenz.

Das oberste Gebot des Solar Decathlon bezieht sich auf die Energieversorgung: Einzig und allein die Sonne ist als Quelle zulässig. Die Studenten versuchen Photovoltaik und Solarthermie nicht nur optimal zu nutzen, sondern zudem stimmig ins Design zu integrieren. Am Ende muss das ganze Paket stimmen.

Passiv kühlen ohne Strom

Wer sich die deutschen Beiträge ansieht, stößt immer wieder auf drei Buchstaben: PCM. Sie stehen für Phase Change Material oder Latentwärmespeicher. Materialien wie Wachs oder Salzhydrate nehmen bei Temperaturen um den Schmelzpunkt Energie auf. Umgekehrt geben sie Wärme ab, wenn sich der Aggregatzustand von flüssig zu fest ändert. Die Studenten nutzen dieses Prinzip. PCM-Speicher helfen im sommerlichen Madrid, ein angenehmes Wohnklima zu erreichen – und das ganz ohne Klimaanlage.

Während des Solar Decathlon müssen sich die Häuser zehn Tage lang im Praxistest bewähren. Sie sind für zwei Personen ausgelegt und dürfen nicht größer als 74 Quadratmeter sein. Organisatoren messen und bewerten nach zehn Kriterien wie Architektur, Konstruktion, Solarenergie, Innovation und Nachhaltigkeit. Beim Waschen, Kochen und Fernsehen beweisen die deutschen Studenten die Funktionsfähigkeit des Hauses und geben sogar Dinnerpartys für Mitglieder aus anderen Teams.

Die Vorzeichen stehen nicht schlecht, dass deutsche Teilnehmer auch am Ende

feiern dürfen. Zweimal ging die TU Darmstadt beim Solar Decathlon in den USA an den Start, zweimal gewann sie den ersten Preis. Im ersten europäischen Wettbewerb hat das Team Germany gleich vier Chancen.

Rosenheim: IKAROS mit zackigem Design

Der Solar Decathlon wäre kein Architekturwettbewerb, wenn es neben Solarenergie nicht auch um Design ginge. Das Team IKAROS von der FH Rosenheim entschied sich für eine schlichte, aber energetisch optimale Form: einen Kubus. Als hervorstechendes Merkmal haben sie ihr Haus in eine ungewöhnliche Zackenfassade gekleidet.



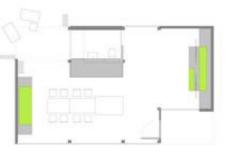
ikaROS/FH Rosenheim

Noch tüfteln sie an dem Material, das den Wänden eine dreidimensionale Struktur

verpassen soll. Auf der komplett verglasten Südseite dient der Fassadenschmuck als Sonnenschutz, der auf Wunsch im Boden verschwindet. Die Zacken sind so angeordnet, dass trotz Verschattung tagsüber Licht in den Raum fällt. Nachts strahlt das erleuchtete Haus nach außen.

Intelligente Einrichtung

Kochen, Wohnen, Schlafen und Arbeiten finden auf 45 Quadratmetern statt. Das funktioniert durch eine flexible Nutzung der Wohnfläche. Das Bett verschwindet tagsüber im Schrank und der Schlafbereich verwandelt sich in ein Arbeitszimmer. Wenn Gäste kommen, kann man die Arbeit wortwörtlich beiseiteschieben.



ikaROS/FH Rosenheim Aufteilung des Innenraums

Möbel lassen sich so verrücken, dass weder vom Büro, noch vom Schlafzimmer etwas zu sehen ist. Dafür offenbart der Küchenblock im Zentrum einen ausziehbaren Tisch für vier oder acht Personen. Der Schrank im Wohnbereich mit integriertem Sofa lässt sich zum Gästebett umfunktionieren.

Stuttgart: Vom Winde gekühlt

Beim Entwurf des Teams der Universität Stuttgart ist die zentrale Idee sofort zu sehen: Ein Energieturm ragt im hinteren Gebäudeteil aus der kompakten Hausform hervor. Von innen ist sichtbar, was sich darin verbirgt: Feuchte Tücher, die sich im Luftstrom bewegen und dabei einen klaren Zweck erfüllen: Durch Verdunstungskühlung soll ein angenehmes Raumklima entstehen. Gleichzeitig trennt das Element den Schlafvom Wohnbereich.



home+/HFT Stuttgart

DEL MILIO KALIIL MAS SOLALITANS

Das Haus setzt sich aus vier Modulen zusammen, denen unterschiedliche Nutzungen zugeordnet sind: vorne eine Loggia, hinten der Schlafbereich. Trennfugen aus Glas gliedern den Grundriss. Sie lassen Licht und Luft ins Innere und dienen zur passiven Kühlung im Sommer und zur Vorwärmung im Winter.

Solarthermie und Fotovoltaikanlage bilden die Energiehülle des Gebäudes. Dabei greift das Team auf gängige Technik zurück. Die Solarzellen setzt es zusätzlich als gestalterisches Mittel ein, indem es goldene und bronzefarbene Module kombiniert. Projektleiter Professor Jan Cremers fasst die Kernidee des Entwurfs so zusammen: "Wir transformieren traditionelle Techniken in die Neuzeit und schaffen ein Gebäude, das in höchstem Maße flexibel ist."



home+/HFT Stuttgart Der Energieturm in einer schematischen Darstellung

Wuppertal: Solaranlage als Designelement

Auch die Universität Wuppertal baut für den Wettbewerb ein Solarhaus und betont das in der auffälligen Fassade. Das Team setzt eine eigens angefertigte Fotovoltaikanlage als Designelement ein. Durch die Anordnung von poly- und monokristallinen Modulen wird eine Grafik sichtbar. Neben der optischen Besonderheit liefert das System auf der Fassade seinen Beitrag zur positiven Energiebilanz.

Den Hauptanteil der Energieversorgung übernimmt allerdings die Fotovoltaikanlage auf dem Dach: In Madrid stellt diese Komponente 75 Prozent der benötigten Energie zur Verfügung. In einer Gegend, in der die Sonne tiefer steht, würden sich die Erträge gleichmäßiger zwischen Fassade und Dach verteilen.

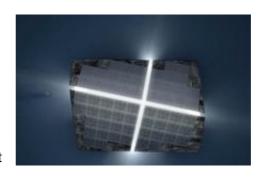
Die Wuppertaler werden damit ihrem Anspruch gerecht: Sie wollen kein Haus allein für den Wettbewerb bauen, sondern eines, das auch in Nordeuropa funktioniert. Die Technik läuft unabhängig vom Stromnetz, auch wenn keine Sonne scheint. Eine Batterie überbrückt die Nächte.



Bergische Universität Wuppertal Photovoltaik-Anlage als Designelement

Berlin: Mit Traditionen aufgebrochen

Optisch sticht das Haus des Teams der Hochschule für Technik und Wirtschaft Berlin dadurch hervor, dass die Studenten auf eine alte Bautradition Bezug nehmen: das Satteldach. Außerdem besitzt es im Unterschied zu anderen Entwürfen keine Glasfassade. Das Dach sitzt allerdings unkonventionell schief auf der Grundfläche, die unter dem Giebel um zwölf Grad verdreht



wurde. Doch nicht allein deswegen ist der Entwurf weit davon entfernt, altmodisch zu wirken.

living EQUIA/HTW Berlin Verglaste Lichtachsen teilen den Innenraum in vier Bereiche

Zwei verglaste Lichtachsen teilen den Innenraum in vier Bereiche. Zudem greift die Gruppe "living EQUIA" von der HTW Berlin auf moderne Materialien und Technologien zurück. Im Sinne der Nachhaltigkeit nimmt sie nicht nur auf die Energiebilanz des fertigen Hauses Rücksicht, sondern zuvor schon auf die Ökobilanz der einzelnen Bauteile. Auch in der dunklen Ansicht spiegelt sich der Umweltgedanke wider. Abgeflammtes Holz schützt die Fassade natürlich und giftstofffrei.

Solarthermie in der Fassade und Fotovoltaik auf dem Dach werden optisch in die dunkle Ansicht integriert. Wie die übrigen deutschen Teams greift auch Berlin auf Latentspeichermaterialien zurück. Wachskügelchen in der Wand nehmen Wärme aus dem Raum auf und regulieren so automatisch die Temperaturen. Ein ausgeklügeltes System sorgt dafür, dass das PCM-Material über Nacht wieder abkühlt. Darüber hinaus verfügt das Berliner Haus über eine automatische Lüftungsanlage.



living EQUIA/HTW Berlin Raumkonzept der Hochschule für Technik und Wirtschaft Berlin



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Anzeige









