

## PROJECT MANUAL

Solar Decathlon 2011  
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Team Belgium – Ghent University  
E-Cube

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# 1 Summary of Changes

## 1. General

- Sheet size changed to 8.5x11.
- Where possible we upgraded the images to 300 dpi.

## 2. Rules Compliance Checklist

- *rule 4.2 – Specifications for heavy machinery*  
all heavy machinery is listed in division 41. Material processing and handling equipment. For constructing the building the only heavy machinery that is needed is a forklift. All other house components are manipulated by manpower.
- *Rule 4-4 – Drawing(s) showing the location, contact area, and soil-bearing pressure of every component resting directly on the turf.*  
drawings C101 and L 103 were added and updated in BIM model
- *Rule 4-5 – Specifications for generators*  
Generators meet sound level regulations as communicated with the US department organization. This Honda generator will supply enough power. Only the site lighting, see division 26, has to be foreseen from power.
- *Rule 4-6 – Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event*  
drawing L107 was added to the BIM model.  
Datasheets of the fabric of custom made water storage tanks can be found in the project manual in division 21 and division 22
- *Rule 4-7 – Drawing(s) showing shimming methods*  
Drawing S 103 was added to the BIM model
- *Rule 5-2 – Drawing(s) showing the location of all house and site components relative to the solar envelope*  
drawing G 201-202 was added to the BIM model
- *Rule 8-1 – PV Technology Limitations Specifications for photovoltaic components*  
Calculations and specifications of the PV wiring and connection were added in the project manual, division 26, see datasheets
- *Rule 8-5 Village Grid – Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means*  
Meter housing and wire specifications were added in the project manual, division 26. Drawings A114, E 101 – 102 and E 202 were upgraded in the BIM model  
Specifications were added to the project manual in division 26, and division 23 (Niko

house control system)

- *Rule 8-5 Village Grid – Calculation of service/feeder net computed load per NEC 220*  
Drawings E 621-627 were added to the BIM model  
Calculations can be found in the project manual, division 26, more specific: 26 05 00  
Common Work Results for Electrical Distribution
- *Rule 8-5 Village Grid – Site plan showing the house, decks, ramps, tour paths, and terminal box*  
Drawings G 102 / E 102 / E 202 were upgraded in the BIM model
- *Rule 8-5 Village Grid - Elevation(s) showing the meter housing, main utility disconnect, and other service equipment*  
Drawing E 201 was upgraded in the BIM model
- *Rule 9-1 – Container Locations Drawing(s) showing the location of all liquid containers relative to the finished square footage*  
Drawings A 101 and L 102 were upgraded in the BIM model
- *Rule 9-1 Container Locations – Drawing(s) demonstrating that the primary supply water tank(s) is fully shaded from direct solar radiation between 9 a.m. and 5 p.m. EDT or between 8 a.m. and 4 p.m. solar time on October 1*  
Drawing A 102 was added to the BIM model
- *Rule 9-2 Team-Provided Liquids – Quantity, specifications , and delivery date(s) of all team-provided liquids for irrigation, thermal mass, hydronic system pressure testing, and thermodynamic system operation*  
We are no longer using thermal storage systems in the E-cube
- *Rule 9-6 Thermal Mass \_ Specifications for components of liquid-based thermal mass systems*  
We are no longer using thermal storage systems in the E-cube
- *Rule 9-8 Water Delivery \_ Drawing(s) showing the complete sequence of water delivery and distribution events*  
drawings L102 - 103 were added to the BIM model
- *Rule 9-8 Water Delivery – Specifications for the containers to which water will be delivered*  
Datasheets of the fabric of custom made water storage tanks can be found in de project manual in division 21 and division 22.
- *Rule 9-9 Water Removal \_ Drawing(s) showing the complete sequence of water consolidation and removal events*  
drawing L102 was added to the BIM model
- *Rule 9-9 Water Removal \_ Specifications for the containers from which water*

*will be removed*

Datasheets of the fabric of custom made water storage tanks can be found in de project manual in division 21 and division 22

- *Rule 11-4 Public Exhibit. Interior and exterior plans showing entire accessible tour route*

Drawings F 602/ G 102 were added to the BIM model

### 3. Architecture Design Narrative

- Alternates are not allowed to be presented in materials that will be considered by the Architecture, Engineering or Market Appeal juries.

- At the competition we will only show the current plan of the house.

### 10. Energy Analysis Results and Discussion

An initial energy analysis of the house is added. Precise analysis of the as build version of the house will be ready by the start of the competition.

### 11. Construction Specifications

- DIVISION 09 – FINISHES

The metal grating will be used as flooring for the second floor hallway

- DIVISION 11 – EQUIPMENT

11 30 00 Residential Equipment specifications of electrical appliances were added

- DIVISION 21 – FIRE SUPPRESSION

21 10 00 Water Based Fire-Suppression Systems

the stainless steel g-press piping system – vds wet, is approved for up to and including ordinary hazard class 3

- DIVISION 22 - PLUMBING

The water storage containers are custom made by Sioen.

Specifications of the waterstorage tankfabric can be found in the datasheets.

We will use two different kinds of PVC coats PES fabrics. B6303 PVC coating, for the fresh water containers. (B6303 coating can be used for fresh water and dry foods, you can find this information in the datasheets). B6000 PVC coating for the waste water containers.

- DIVISION 26 – ELECTRICAL

Manufacturer's specifications for all electrical equipment, devices and luminaries installed in this structure were added.



## 2 Rules Compliance Checklist

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 4-2	Construction Equipment	Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site	O 101 -103
Rule 4-2	Construction Equipment	Specifications for heavy machinery	PM: 41 62 23
Rule 4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	E 101
Rule 4-4	Impact on the Turf	Drawing(s) showing the location, contact area, and soil-bearing pressure of every component resting directly on the turf	C 101/ L 103
Rule 4-5	Generators	Specifications for generators	PM: 41 65 16
Rule 4-6	Spill Containment	Drawing(s) showing the locations of all equipment, containers, and pipes that will contain liquids at any point during the event	L 101 P 102-105
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	PM: 22 10 00 Specs PM: 22 40 00 Specs
Rule 4-7	Lot Conditions	Calculations showing that the structural design remains compliant even if 18 in. (45.7 cm) of vertical elevation change exists	PM: Struct. 5.12
Rule 4-7	Lot Conditions	Drawing(s) showing shimming methods and materials to be used if 18 in. (45.7 cm) of vertical elevation change exists on the lot	S 103
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	G 201-202
Rule 5-2	Solar Envelope Dimensions	List of solar envelope exemption requests accompanied by justifications and drawing references	N/A
Rule 6-1	Structural Design Approval	List of, or marking on, all drawing and project manual sheets that have been or will be stamped by the qualified, licensed design professional in the stamped structural submission; the stamped submission shall consist entirely of sheets that also appear in the drawings and project manual	PM: Struct. 5.1
Rule 6-2	Finished Square Footage	Drawing(s) showing all information needed by the rules officials to measure the finished square footage electronically	G 101

Rule 6-2	Finished Square Footage	Drawing(s) showing all movable components that may increase the finished square footage if operated during contest week	N/A
Rule 6-3	Entrance and Exit Routes	Drawing(s) showing the accessible public tour route and the ground surface area that will be covered by organizer-provided walkway material	C 102
Rule 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	N/A
Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of greywater irrigation systems	N/A
Rule 8-1	PV Technology Limitations	Specifications for photovoltaic components	PM: 26 30 00 Specs
Rule 8-3	Batteries	Drawing(s) showing the location(s) and quantity of all primary and secondary batteries and stand-alone, PV-powered devices	No batteries used
Rule 8-3	Batteries	Specifications for all primary and secondary batteries and stand-alone, PV-powered devices	No batteries used
Rule 8-4	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	M 105
Rule 8-4	Desiccant Systems	Specifications for desiccant system components	PM: 42 31 16 Specs
Rule 8-5	Village Grid	Completed interconnection application form.	Interconnection Application Form
Rule 8-5	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	A 114 / E 101 – 102 / E 202
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	PM: 26 31 00 Specs
Rule 8-5	Village Grid	One-line electrical diagram	E 601
Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	E 621 - 627 PM: 26 05 00
Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	G 102 / E 102 / E 202
Rule 8-5	Village Grid	Elevation(s) showing the meter housing, main utility disconnect, and other service equipment	E 201
Rule 9-1	Container Locations	Drawing(s) showing the location of all liquid containers relative to the finished square footage	A 101 / L 102
Rule 9-1	Container Locations	Drawing(s) demonstrating that the primary supply water tank(s) is fully shaded from direct solar radiation between 9 a.m. and 5 p.m. EDT or between 8 a.m. and 4 p.m. solar time on October 1	A 102

Rule 9-2	Team-Provided Liquids	Quantity, specifications , and delivery date(s) of all team-provided liquids for irrigation, thermal mass, hydronic system pressure testing, and thermodynamic system operation	N/A
Rule 9-3	Greywater Reuse	Drawing(s) showing the layout and operation of greywater reuse systems	N/A
Rule 9-4	Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	N/A
Rule 9-6	Thermal Mass	Drawing(s) showing the locations of liquid-based thermal mass systems	N/A
Rule 9-6	Thermal Mass	Specifications for components of liquid-based thermal mass systems	N/A
Rule 9-7	Greywater Heat Recovery	Drawing(s) showing the layout and operation of greywater heat recovery systems	N/A
Rule 9-8	Water Delivery	Drawing(s) showing the complete sequence of water delivery and distribution events	L 102 / L 103
Rule 9-8	Water Delivery	Specifications for the containers to which water will be delivered	PM: 22 12 00 Specs
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	L 102
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	PM: 22 12 00 Specs
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	F 602/ G 102

### 3 Architecture Design Narrative

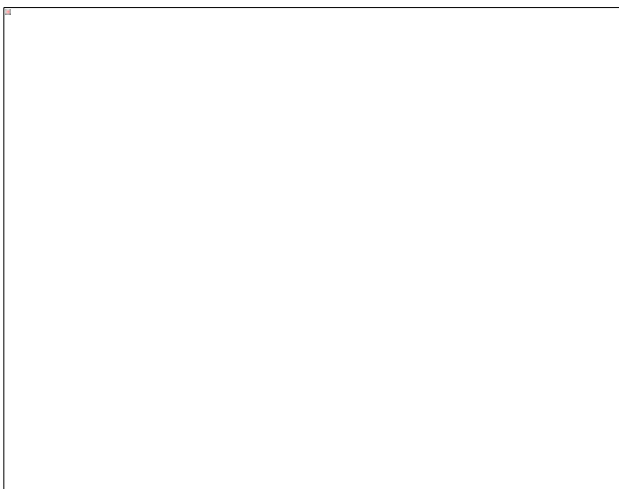
The architectural design of team Belgium's 2011 Solar Decathlon house aims to make a statement that the primary goal is not to make eye candy suiting the glamour of a public exhibition, but instead to demonstrate that a cost effective solar house can be within reach, thus allowing people to dream of what they may be able to afford. Besides this, we aim to illustrate that this restriction does not mean a loss of architectural qualities.



While the design and realization of zero energy homes remains challenging, the technical feasibility of this proposition has already been demonstrated by previous Solar Decathlon competitions and other initiatives. The challenge ahead is therefore not only to design an attractive zero-energy house, but to accomplish this objective in a manner that is economically feasible for a large segment of the population. Houses remain very expensive commodities even when using current standards and techniques, therefore we have identified **AFFORDABILITY** as our pivotal criteria for the design of our house. In order to accomplish an affordable and attractive zero energy house, we have adopted the following principles:

#### **principle 1: people-energy**

There exists a strong tradition in Belgium (and many other parts of the world) for a DIY approach to housing, at least among some segments of the population. While major structural portions of a house are generally contractor built and supervised by professional designers, interior finishes and small alterations and additions are often completed by the owners with help of their families. This practice is primarily done out of cost considerations, as initial cost savings can be realized when owners complete some of the work themselves. In addition, important financing cost savings can also be realized since less money is needed from the bank.



Building upon this DIY-approach we want to optimize the ability of people to assemble their own houses, safely and according to appropriate building standards. We have extended the DIY approach to all components of house construction, including foundations, structure, enclosure, interior finishes, and mechanical and electrical installations. For the 2011 Solar Decathlon we developed an affordable modular DIY "building-kit" for a zero energy house that is pre-engineered, factory built, and that can be easily assembled on-site without the need for special skills or equipment. By doing so, we empower people to build their own house by

lessening dependence on financial institutions, special skills and trades, or equipment. To accomplish

these objectives we have placed some restrictions on the maximum weight and scope of each component of the house. We also developed guidelines regarding the means and complexity by which components are to be connected.

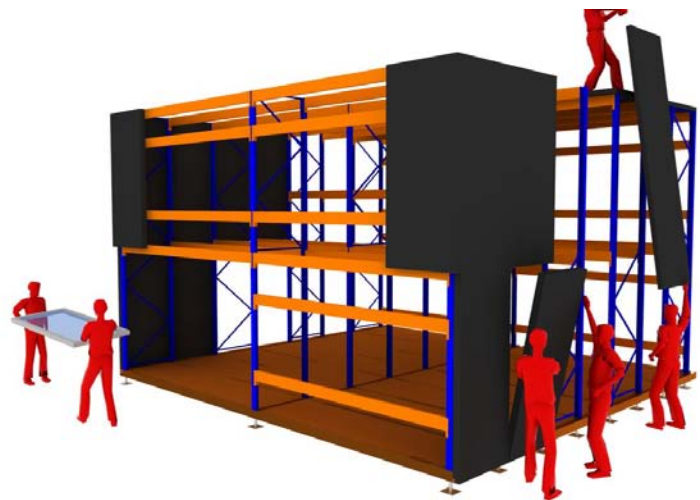
The “building-kit” approach is aimed at providing an affordable house construction method that thrives on the energy that people are willing to invest when yearning for a home. Building upon a global DIY market, the approach is also intended to offer an alternative to trailer and modular home types. Our efforts can be seen as a further optimization of historic building-kit examples, such as the *CECA* house in Belgium and the *Sears Roebuck* houses in the US (as vividly illustrated by Buster Keaton in the 1920 silent movie “One week”). Some of the shortcomings of previous (and current) house kit systems is that they still demanded relative high skill levels, contained too many parts (~30,000 parts), were quite heavy (~50-100 Ton), and required onsite installation of most systems (electrical, plumbing,...). Our design eliminates these handicaps, by reducing weight (structural optimization), by reducing the number of parts (system integration), and by reducing skill level requirements (pre-assembly and convenient deployment procedures).

### **Principle 2: Phased**

The house can be accomplished in several phases if so desired by the clients. Starting with a “starter unit” one can gradually upgrade the house. This includes upgrades to the PV system, interior finishes, extensions, etc. This strategy minimizes initial financial needs and thus reduces the financing costs. The house becomes more affordable by spreading the investment over time and by allowing people to finish it according to their own pace and budget (=less money from the bank).

### **Principle 3: Plug and Play**

In previous editions of the Solar Decathlon, teams have often adopted a manufacturing approach whereby the entire house (or large segments thereof) are constructed off-site and subsequently shipped to Washington DC. The main advantage of this approach is that it warrants an easy and predictable on-site construction process. One of the disadvantages however, as revealed by some of the 2009 teams, is that this approach results in a high level of structural redundancy because of the transportation requirements, and therefore increases cost. In line with our overall “building-kit” approach and emphasis on affordability our design exists of an on-site dry assembly process for our house using the plug and play principle. For example, we use a flexible base box that contains all technical amenities used in our house. Additional house systems plug into the base box, which also stands ready for future expansion. This system integration strategy for water distribution, heat pumps, and other related systems can significantly reduce costs.



#### **Principle 4: Structural flexibility**

We use an open source industrial pallet rack system for the main structure. The benefits include the very low cost and availability of such systems, standardized and pre-engineered connection details that require no tools, and the fact that the performance of these systems is strictly regulated in existing building codes, including their seismic performance. These systems also allow for ample implementation flexibility as they come in various sizes and structural capacities.

#### **Principle 5: Passive Standard**

Rather than a restrictive objective, we use the passive standard as a directive to search for an optimum between the cost of limiting the energy demand and the cost of the PV system. We have adopted the passive house standard in a critical manner which implies performance standards for the building envelop.

When addressing issues of affordability in the context of zero energy house design, it is critically important to minimize the energy demand, especially considering the cost associated with installing a PV system. A delicate balance is sought between the cost of the PV system in relation to its surface area and efficiency, and the buildings overall energy demand. The added cost of a high performing envelop is offset by a reduced energy demand, allowing for a more affordable PV system. These are not fixed targets as the efficiency of PV systems increases and their cost decreases when newer technologies become available. Buildings also typically outlive their technical installations. Fortunately there are some certainties in this equation, namely to keep energy demand low, optimize direct solar gain/shading, and allow for PV system updates. Therefore, in order to assure long term viability of our design we adopt a passive house standard as our starting point and allow for periodic updates of the PV system, while also adopting passive solar design strategies.

## 4 Engineering Design Narrative

### Energy - heating, ventilation & air-conditioning

One of the design goals is to apply the concept of 'plug & play and affordability & flexibility' throughout the whole design process. The design of the E-cube is aimed to demonstrate the different possibilities for creating an energy-efficient and sustainable environment with a minimum of resources. Both the (1) decisions made in the concept phase, (2) the engineering decisions and (3) the integration of technical building services were faced towards a sustainable solution for providing thermal comfort. This interaction between passive and active measures for reducing thermal loads is expected to provide an optimal result.

### Concept phase

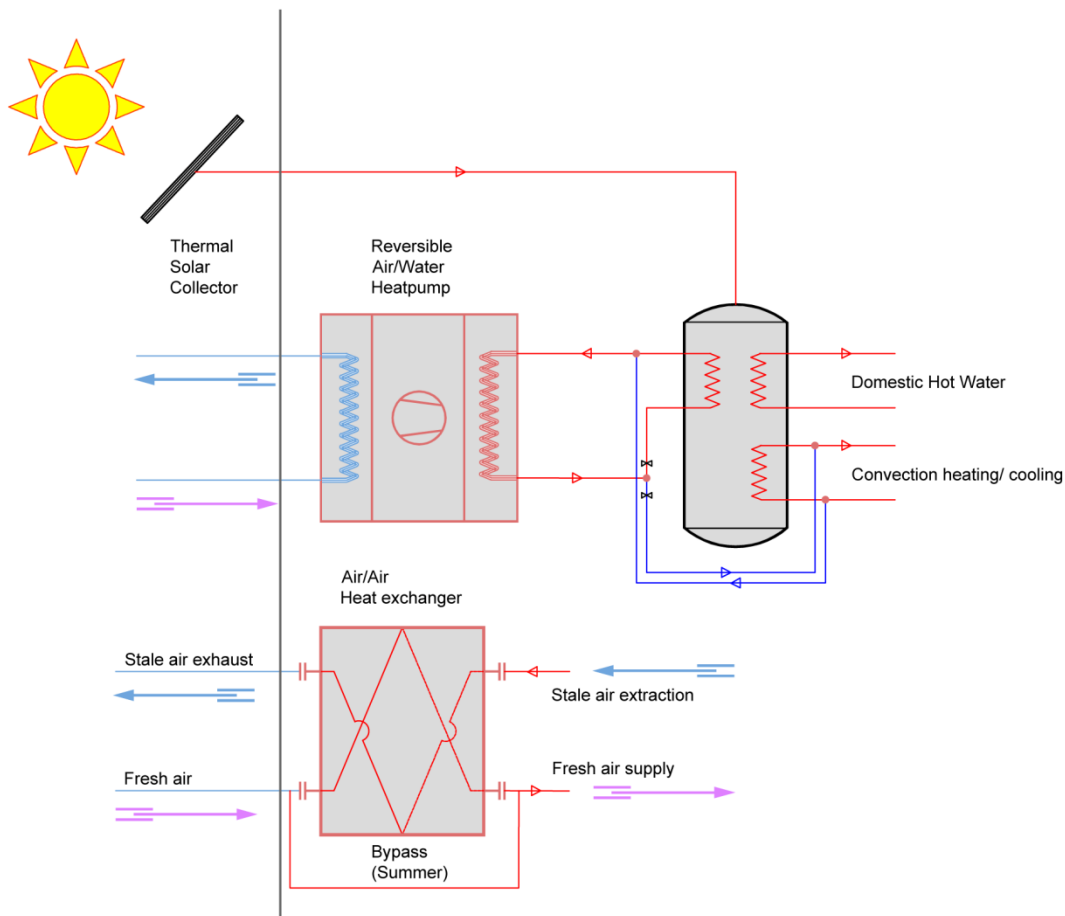
The E-cube is conceptualized as a simple rectangular building, whereby compactness is assured by optimizing the ratio of surface area to the building's volume. Windows are placed at strategic locations to optimize solar gains in winter conditions and avoid overheating in the summer. In addition, the total number of windows are limited and are placed at architecturally interesting locations. The flat roof of the building provides space for solar panels and makes it possible to increase the energy gains.

Secondly, we opted for the interior space not to be overly divided, and thus create one large room. This concept has several thermal and spatial advantages, such as a great sense of spaciousness and the possibility to use natural ventilation flows as a measure to reduce heating and cooling loads. This single-zone concept provides the possibility to use a simple, flexible heating/cooling distribution system. The technical facilities are located in a central area and heating/cooling energy is transported through a flexible water pipe system, with convection heating and cooling elements.

### Engineering

The building envelope consists of flexible panels equipped with highly efficient thermal insulation. All the requirements to achieve a "passive house" standard are met: walls U-value = **0,12** W/m<sup>2</sup>K, windows U-value = **0,6** W/m<sup>2</sup>K and an air tightness of < 0,6 h<sup>-1</sup>. Also, solar shading is essential to either benefit from solar energy in winter conditions and keep solar radiation away in summer conditions.

## Building services



**Fig. Building services scheme**

Besides the introduction of passive energy reducing measures, in order to accomplish a zero energy design, the remaining energy needs will be generated on-site in a sustainable way. To meet this demand, active systems (heat pump, ...) are integrated. We have opted for a combined system for domestic hot water and heating in a single boiler. This concept is in line with our concept of 'plug & play, affordability and flexibility'. The boiler is initially driven by thermal solar collectors on the roof. A reversible heat pump is used as a back-up driver of the boiler in winter conditions. In summer, it is possible to use the reversible heat pump for cooling, so it is possible to provide domestic hot water and cooling at the same time.

A system for mechanical ventilation with highly efficient heat-recovery (>80%) is integrated in the technical area. A summer bypass and dehumidification are provided for summer conditions to achieve an optimal environment.



## 5 Structural Calculations

### 5.1 Personnel

Design of the structure and structural calculations made by:

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Structural calculation checked by:

Rolf Van Steenwegen & Klaas De Rycke

### 5.2 Design Codes & References

2011 Solardecathlon Building Code

2011 Solardecathlon Rules & Regulations

EN 1990 'Eurocode: Basis of structural design'

EN 1991 'Eurocode: Actions on structures'

EN 1993 'Eurocode: Design of steel structures'

EN 1995 'Eurocode: Design of timber structures'

The European design codes are used because the building will also be constructed in Belgium. If the SD rules are more severe than those prescribed in the Eurocodes the SD rules will be applied.

### 5.3 Symbols used in the structural part of the project manual

$A$  Area

$c_e$  Exposure factor

$c_{dir}$  Directional factor (wind loads)

$C_{pe}$  External wind pressure coefficient

$C_{pi}$  Internal wind pressure coefficient

$c_{season}$  Seasonal factor (wind loads)

$C_t$  Thermal coefficient

$I$  Second moment of area

$i$	Radius of gyration
$f_y$	Yield strength
$M$	Bending moment
$N$	Normal force
$q_b$	Basic velocity pressure
$q_p$	Peak velocity pressure
$s_k$	Characteristic snow load
$V$	Shear force
$V_{B,0}$	Fundamental basic wind speed
$V_B$	Basic wind speed
$W$	Section modulus
$\alpha$	Imperfection factor
$\delta$	Relative deformation
$\lambda$	Slenderness
$\gamma$	Partial safety factor
$\chi$	Reduction factor for the relevant bucking mode
$\psi$	Combination factor
$\mu_i$	Snow load shape coefficient

## 5.4 Loads

### 5.4.1 Dead Loads

In this paragraph the dead loads will be determined. In this design stage the exact weight of non-structural bearing elements such as wall panels is unknown. A conservative estimation is made for those elements.

#### 5.4.1.1 Roof

Sandwich panel:	<b>0,3 kN/m<sup>2</sup></b>
PV-modules:	<b>0,3 kN/m<sup>2</sup></b>

Roof finish  $\frac{0,2 \text{ kN/m}^2 +}{0,8 \text{ kN/m}^2}$

#### 5.4.1.2 1ste Floor

Floor:  $0,3 \text{ kN/m}^2$

Decking  $\frac{0,3 \text{ kN/m}^2 +}{0,6 \text{ kN/m}^2}$

#### 5.4.1.3 Ground Floor panels

Sandwich panel:  $0,3 \text{ kN/m}^2$

Decking  $\frac{0,3 \text{ kN/m}^2 +}{0,6 \text{ kN/m}^2}$

#### 5.4.1.4 Wall Panels

Sandwich panel:  $0,3 \text{ kN/m}^2$

Wall finish:  $\frac{0,2 \text{ kN/m}^2 +}{0,5 \text{ kN/m}^2}$

#### 5.4.1.5 Structural steel elements

The exact value of the dead loads of these elements is determined using:

$$\gamma_{\text{steel}} = 77 \text{ kN/m}^3$$

### 5.4.2 Live Loads

SD Building Code: Interior floors:

$$\underline{\text{Live load} = 50 \text{ psf} = 2,39 \text{ kPa}}$$

EN 1991-1-4 (Eurocode 1 part 4): Residential Area -> Category A

$$\text{Live load} = 2,0 \text{ kPa}$$

→ Event condition is governing the design

### 5.4.3 Snow Loads

SD Building Code: Snow roof live load:

$$\underline{\text{Live load} = 20 \text{ psf} = 0,96 \text{ kPa}}$$

EN 1991-1-4: Access for normal maintenance -> Category H ->  $0,4 \text{ kPa}$

Snow loads: Locations is below 100m AMSL:

$$s = \mu_i C_e C_t S_k = 0,8 \cdot 1 \cdot 1 \cdot 0,5 = 0,4 \text{ kPa}$$

Total Live load using the Eurocodes:

$$0,4 + 0,4 = 0,8 \text{ kPa}$$

→ Event condition is governing the design

#### 5.4.4 Wind Loads

SD Building Code: 60 mph (3-sec gust)

$$60 \text{ mph}^{3\text{sec}} = 26,82 \text{ m/s}^{3\text{sec}}$$

This is equal to a 10 min mean velocity of <sup>1</sup>

$$0,67 \cdot (26,82 \text{ m/s}^{3\text{sec}}) = 17,55 \text{ m/s}^{10\text{min}}$$

EN 1991-1-1: Belgium 26,2 m/s (characteristic 10 min mean wind velocity)

Lungu, D., Van Gelder, P.H.A.J.M., and Trandafir, R., 1996. [Comparitive study of Eurocode 1, ISO and ASCE procedures for calculating wind loads](#), IABSE Report. Vol. 74, pp. 345-354, Delft, March 1996.

It is very difficult to compare the different procedures for calculating wind loads. We can't just compare the basic wind speed, other factors like terrain influence and gust parameters are also different in these codes. In this document we use the Eurocode wind load procedure for permanent structures, instead of the SD building code which assumes temporary structures (the normal 3-sec gust wind speed in Washington D.C. equals 90mph instead of 60mph in the SD building code).

##### 5.4.4.1 Determination of the basic wind pressures

In this paragraph the wind pressures will be determined as prescribed in the Eurocodes. The wind action is represented by a simplified set of pressures whose effects are equivalent to the extreme effects of the turbulent wind. Normally for each wind direction a different set of pressures is determined. Our building, the E-cube, has an almost square footprint, vertical walls and a flat roof. Thus for simplicity a set of pressure zones will be determined for one wind direction (the most severe), and all other wind directions will result in the same set of pressure zones. This method results in a small overestimation of the wind pressures for the other wind directions, this is a safe approach.

##### 5.4.4.1.1 Basic values

The fundamental value of the basic wind velocity  $V_{B,0}$  is the characteristic 10 minutes mean wind velocity, irrespective of wind direction and time of year, at 10 m above ground level in open country terrain with low vegetation such as grass and isolated obstacles with separations of at least 20 obstacle heights. At the pre-event location in Belgium the fundamental value of the basic wind velocity is equal to:

$$V_{B,0} = 26,2 \text{ m/s}$$

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<sup>1</sup>: (Comparative study of Eurocode 1, ISO and ASCE procedures for calculating wind loads by Dan Lungu, Professor at the Technical University of Civil Engineering of Bucharest, Romania)

The basic wind velocity shall be calculated using the following expression:

$$V_b = c_{dir} \cdot c_{season} \cdot V_{B,0} = 1 \cdot 1 \cdot 26,2 = 26,2 \text{ m/s}$$

- The value of the directional factor  $c_{dir}$  for various wind directions may be found in the National Annex. The recommended value is 1,0.
- The value of the season factor  $c_{season}$  may be given in the National Annex. The recommended value is 1,0.

#### 5.4.4.1.2 Basic velocity pressure

The basic velocity pressure  $q_b$  is calculated using:

$$q_b = \frac{1}{2} \cdot \rho \cdot V_{B,0}^2 = \frac{1}{2} \cdot 1,25 \cdot 26,2^2 = 429 \text{ N/m}^2$$

- $\rho$  is the air density, which depends on the altitude, temperature and barometric pressure to be expected in the region during wind storms. The recommended value is  $1,25 \text{ kg/m}^3$ .

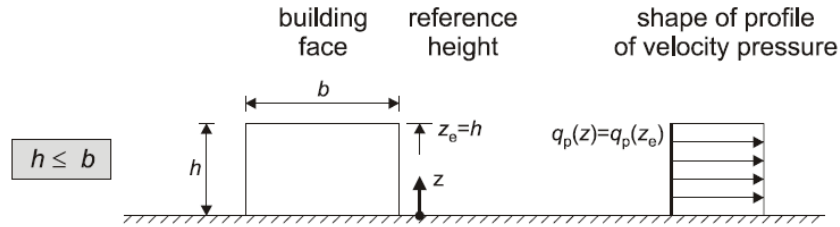
#### 5.4.4.1.3 Terrain category

The structure must be able to withstand wind actions in an terrain category II: an area with low vegetation and isolated obstacles (trees, buildings) with separations of at least 20 obstacle heights. This is a common situation in the countryside of Belgium. The terrain parameters for this Class II terrain category are the roughness length  $z_0$  and is the minimum height  $z_{min}$  are given:

Terrain category		$z_0$ m	$z_{min}$ m
0	Sea or coastal area exposed to the open sea	0,003	1
I	Lakes or flat and horizontal area with negligible vegetation and without obstacles	0,01	1
II	Area with low vegetation such as grass and isolated obstacles (trees, buildings) with separations of at least 20 obstacle heights	0,05	2
III	Area with regular cover of vegetation or buildings or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest)	0,3	5
IV	Area in which at least 15 % of the surface is covered with buildings and their average height exceeds 15 m	1,0	10
The terrain categories are illustrated in Annex A.1.			

#### 5.4.4.1.4 Shape profile of the velocity pressure

The shape profile of the velocity pressure is depended of aspect ratio  $h/b$ . For buildings whose height  $h$  is less than  $b$  the shape profile is:

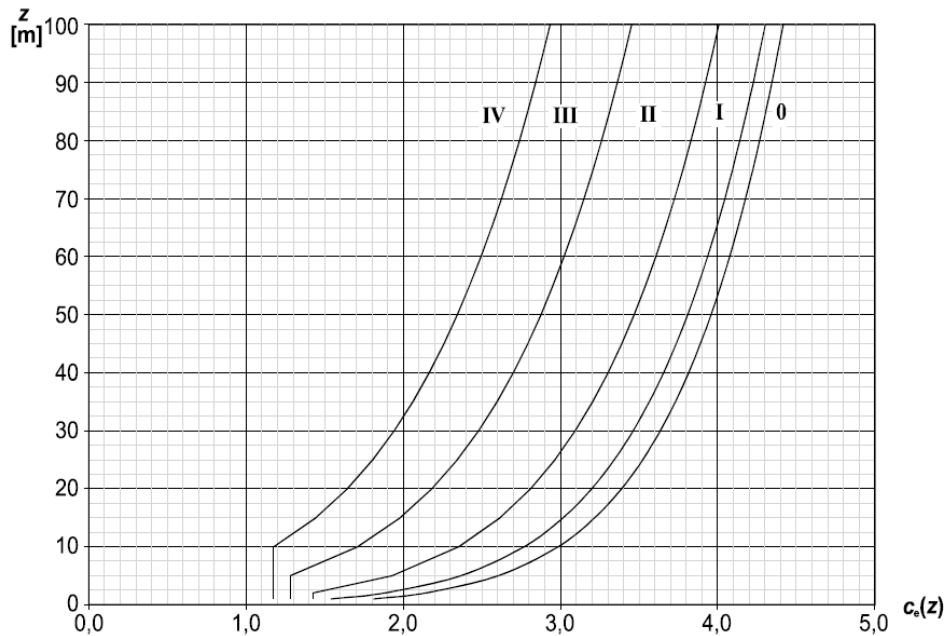


#### 5.4.4.1.5 Peak velocity pressure

The peak velocity pressure  $q_p(z)$  at height  $z$ , which includes mean and short-term velocity fluctuations, is calculated using using:

$$q_p(z) = c_e(z) \cdot q_b$$

- $c_e(z)$  is the exposure factor determined by figure 4.2 of EN 1991-1-1:



For terrain category II at 20ft height (5,48m) the value of  $c_e(z_e)$  is 2,0.

The peak velocity pressure is than, taking into account the shape profile the velocity pressure:

$$q_p(z) = q_p(z_e) = c_e(z_e) \cdot q_b = 2,0 \cdot 0,43 \frac{kN}{m^2} = 0,86 \frac{kN}{m^2}$$

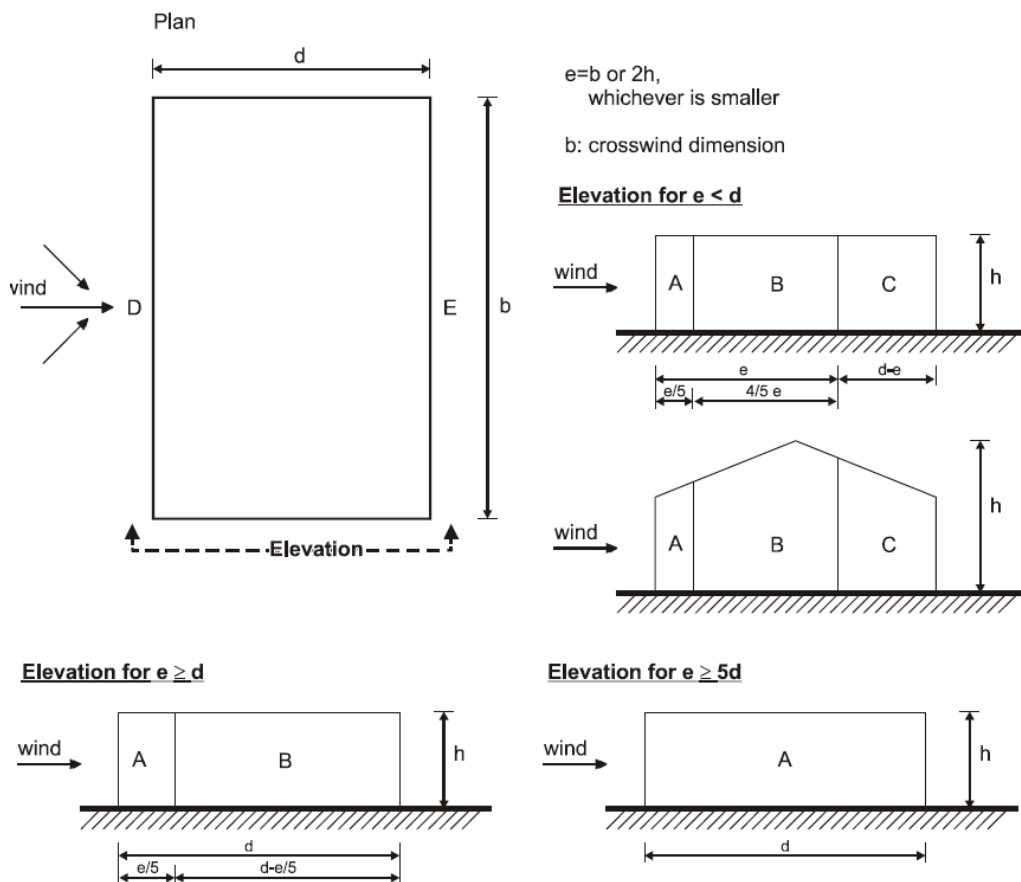
#### 5.4.4.2 External pressure coefficients

The external pressure coefficients  $C_{pe}$  for buildings and parts of buildings depend on the ratio  $h/d$  and the size of the loaded area  $A$ , which is the area of the structure that produces the wind action in the section to be calculated. The external pressure coefficients are given for loaded areas  $A$  of 1 m<sup>2</sup> and 10 m<sup>2</sup> for a specific type of building. Values for  $C_{pe,10}$  may be used for the design of the overall load bearing

structure of buildings. These values will be determined below and will be used later on to design the steel load bearing frame (STOW structure).

For vertical walls the external pressure coefficients and the division in pressure zones are given below:

Zone	A		B		C		D		E	
$h/d$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$
5	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0		-0,7
1	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0		-0,5
$\leq 0,25$	-1,2	-1,4	-0,8	-1,1	-0,5		+0,7	+1,0		-0,3



For the design of the steel frame ( $A > 10m^2$ ) the values of  $C_{pe}$  for the vertical wall zones are given below.

Then the wind pressure acting on the external surfaces  $W_e$  is obtained using the following expression:

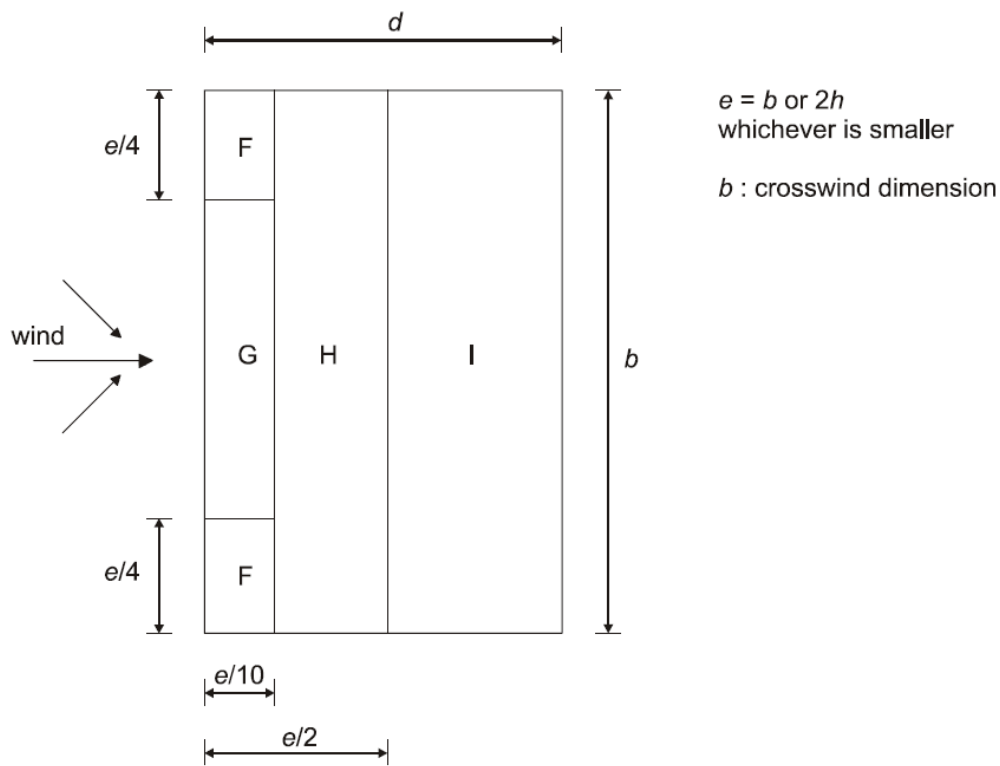
$$W_e = q_p(z_e) \cdot C_{pe}$$

Zone	A	B	C	D	E	
$C_{pe}$		-1.20	-0.80	-0.50	0.80	-0.48

We [kN/m <sup>2</sup> ]	-1.03	-0.69	-0.43	0.69	-0.41
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The external pressure coefficients  $C_{pe}$  for a flat roof and the division in pressure zones are given below:

Roof type	Zone							
	F		G		H		I	
	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$
Sharp eaves	-1,8	-2,5	-1,2	-2,0	-0,7	-1,2	+0,2	-0,2



For the design of the steel frame ( $A > 10m^2$ ) the values of  $C_{pe}$  for the flat roof zones together with the external pressures  $W_e$  are given below.

Zone	F	G	H	I
Cpe	-1.80	-1.20	-0.70	0.20
We [kN/m <sup>2</sup> ]	-1.54	-1.03	-0.60	0.17



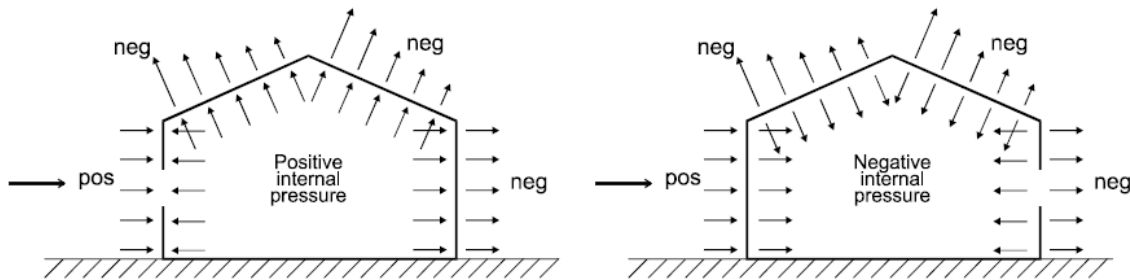
### 5.4.4.3 Internal pressure coefficients

The internal pressure coefficient  $C_{pi}$  depends on the size and distribution of the openings in the building envelope. For buildings without a dominant face, the internal pressure coefficient  $C_{pi}$  is a function of the ratio of the height and the depth of the building,  $h/d$ , and the opening ratio  $\mu$  for each wind direction  $\theta$ . But it is permitted where it is not possible, or not considered justified, to estimate  $\mu$  for a particular case then  $C_{pi}$  should be taken as the more onerous of +0,2 and -0,3. We use this last assumption, this results in two possible internal pressures  $W_i$ .

Cpe	Wi [kN/m <sup>2</sup> ]
0.2	0.17
-0.3	-0.26

### 5.4.4.4 Wind pressures on surfaces

To determine the a set of wind pressures the internal and external pressures shall be considered to act at the same time. The worst combination of external and internal pressures shall be considered.



This results in two set of wind pressures, the values are in kN/m<sup>2</sup>

Zone	A	B	C	D	E	F	G	H	I
W (Cpi=0.2)	-1.20	-0.86	-0.60	0.51	-0.58	-1.72	-1.20	-0.77	-0.34
W (Cpi=-0.3)	-0.77	-0.43	-0.17	0.94	-0.15	-1.29	-0.77	-0.34	0.43

These pressures will be used to determine for example a line load on a structural roof beam. The derivation of this list of pressure zones used two assumptions. First for buildings with a height less than 15 m the value of  $C_{d1}C_{d2}$  may be taken as 1 and second we assume the friction forces are negligible which is a acceptable simplification.

### 5.4.5 Seismic Loads

There are no requirements for seismic design in the SD building code, neither is the pre-event location a seismic zone.

### 5.4.6 Transportation Loads

The construction is build on site, there are no transportation loads to consider.

## 5.5 Load combinations

### 5.5.1 Ultimate limit states (ULS)

To satisfy the ultimate limit state, the structure must not collapse when subjected to the peak of loads for which it was designed. The failure mechanisms that must be checked are bending, shear, compression/tension and buckling for elements of the structural system. For the whole structure sliding, uplift and lateral stability are checked.

The load combination in Ultimate limit state is:

$$\gamma_G \cdot G_k \oplus \gamma_Q \cdot Q_k \oplus \sum_{i>1} \gamma_{Qi} \cdot \psi_{0i} \cdot Q_{ki}$$

$\gamma_G$  is a partial safety factor for dead loads  $G_k$ , it's value depends on the nature of the effect caused by the dead loads.

$\gamma_G = 1,35$  For generally negative effects

$\gamma_G = 1,00$  For generally positive effects

$\gamma_Q$  is a partial safety factor for variable loads  $Q_k$ , it's value depends on the nature of the effect caused by the variable load (e.g. wind loads, live load)

$\gamma_Q = 1,50$  For generally negative effects

$\gamma_Q = 0,00$  For generally positive effects

$\psi_0$  is a factor for a combination of variable loads. It's purpose is to take in account the improbability that all variable loads will peak at the same time.

$\psi_0 = 0,70$  For live loads

$\psi_0 = 0,50$  For snow loads

$\psi_0 = 0,60$  For wind loads

Note that  $\oplus$  is not an algebraic summation because the load can be different in nature an occurrence.

This method, prescribed by the Eurocode, is based on a probability of failure of 1/1000 during a lifetime of 100 years.

### 5.5.2 Serviceability limit states (SLS)

To satisfy the serviceability limit state criteria, a structure must remain functional for its intended use subject to routine (everyday) loading, and as such the structure must not cause occupant discomfort under routine conditions. This implies that the deformations must be limited to certain values.

The load combination in Serviceability limit state is:

$$G_k \oplus \gamma_Q \cdot Q_k \oplus \sum_{i>1} \gamma_{Qi} \cdot \psi_{0i} \cdot Q_{ki}$$

$\gamma_Q$  is a partial safety factor for variable loads  $Q_k$ , the values are different than those used in ULS.

$\gamma_Q = 1,00$  For generally negative effects

$\gamma_Q = 0,00$  For generally positive effects

The combination factors  $\psi_0$  are the same as those in Ultimate limit state.

### 5.5.3 Summary of loads

A summary of the loads acting on the structure is given:

Dead Loads	
Roof	0.8 kN/m <sup>2</sup>
Wall	0.5 kN/m <sup>2</sup>
First floor	0.6 kN/m <sup>2</sup>
Ground floor	0.6 kN/m <sup>2</sup>
Structural steel	77 kN/m <sup>3</sup>

Live Loads	
Interior	2.39 kN/m <sup>2</sup>
Roof snow load	0.96 kN/m <sup>2</sup>

Wind Loads [kN/m <sup>2</sup> ]									
Zone	A	B	C	D	E	F	G	H	I
W (Cpi=0.2)	-1.20	-0.86	-0.60	0.51	-0.58	-1.72	-1.20	-0.77	-0.34

W (Cpi=-0.3)	-0.77	-0.43	-0.17	0.94	-0.15	-1.29	-0.77	-0.34	0.43
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## 5.6 Calculation methods - Resistance of cross sections

Resistance of cross sections of structural members is verified according to Eurocode 3 part 1.2 section 5.4. The calculation methods given in the following paragraphs, these calculations made automatically in the structural program Powerframe from Buildsoft.

### 5.6.1 Classification of cross-sections

In Eurocode 3 four classes of cross-sections are defined, as follows:

Class 1 cross-sections are those which can form a plastic hinge with the rotation capacity required for plastic analysis.

Class 2 cross-sections are those which can develop their plastic moment resistance, but have limited rotation capacity.

Class 3 cross-sections are those in which the calculated stress in the extreme compression fibre of the steel member can reach its yield strength, but local buckling is liable to prevent development of the plastic moment resistance.

Class 4 cross-sections are those in which it is necessary to make explicit allowances for the effects of local buckling when determining their moment resistance or compression resistance.

The classification of a cross-section depends on the proportions of each of its compression elements. A cross-section is normally classified by quoting the highest (least favourable) class of its compression elements.

The limiting proportions for Class 1, 2, and 3 compression elements should be obtained from the tables below. An element which fails to satisfy the limits for Class 3 should be taken as Class 4.

The determination of the cross-section classification of the STOW elements is given in Annex C. This determination is done manually because of the rare cross-sections.

Table 5.3.1 — Maximum width-to-thickness ratios for compression elements (Sheet 1)

a) Webs: (internal elements perpendicular to axis of bending)

Class	Web subject to bending	Web subject to compression	Web subject to bending and compression	
Stress distribution in element (compression positive)				
1	$d/t_w \leq 72\epsilon$	$d/t_w \leq 33\epsilon$	when $\alpha > 0,5$ : $d/t_w \leq 396\epsilon/(13\alpha - 1)$ when $\alpha \leq 0,5$ : $d/t_w \leq 36\epsilon/\alpha$	
2	$d/t_w \leq 83\epsilon$	$d/t_w \leq 38\epsilon$	when $\alpha > 0,5$ : $d/t_w \leq 456\epsilon/(13\alpha - 1)$ when $\alpha \leq 0,5$ : $d/t_w \leq 41,5\epsilon/\alpha$	
Stress distribution in element (compression positive)				
3	$d/t_w \leq 124\epsilon$	$d/t_w \leq 42\epsilon$	when $\psi > -1$ : $d/t_w \leq 42\epsilon/(0,67 + 0,33\psi)$ when $\psi \leq -1$ : $d/t_w \leq 62\epsilon(1-\psi) \sqrt{(-\psi)}$	
$\epsilon = \sqrt{235/f_y}$	$f_y$	235	275	355
	$\epsilon$	1	0,92	0,81

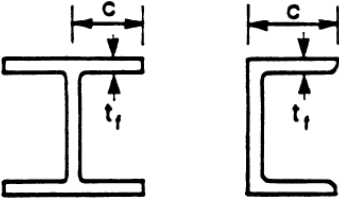
Table 5.3.1 — Maximum width-to-thickness ratios for compression elements (Sheet 2)

b) Internal flange elements: (internal elements parallel to axis of bending)

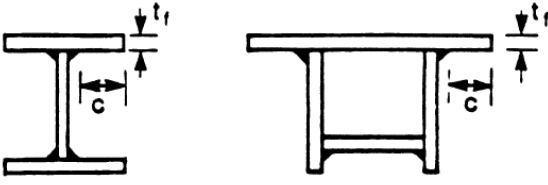
Class	Type	Section in bending		Section in compression	
Stress distribution in element and across section (compression positive)					
1	Rolled Hollow Section Other	$(b-3t_f)/t_f \leq 33\varepsilon$	$b/t_f \leq 33\varepsilon$	$(b-3t_f)/t_f \leq 42\varepsilon$	$b/t_f \leq 42\varepsilon$
2	Rolled Hollow Section Other	$(b-3t_f)/t_f \leq 38\varepsilon$	$b/t_f \leq 38\varepsilon$	$(b-3t_f)/t_f \leq 42\varepsilon$	$b/t_f \leq 42\varepsilon$
Stress distribution in element and across section (compression positive)					
3	Rolled Hollow Section Other	$(b-3t_f)/t_f \leq 42\varepsilon$	$b/t_f \leq 42\varepsilon$	$(b-3t_f)/t_f \leq 42\varepsilon$	$b/t_f \leq 42\varepsilon$
$\varepsilon = \sqrt{235/f_y}$	$f_Y$	235	275	355	
	$\varepsilon$	1	0,92	0,81	

Table 5.3.1 — Maximum width-to-thickness ratios for compression elements (Sheet 3)

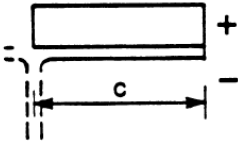
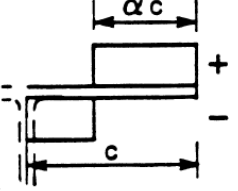
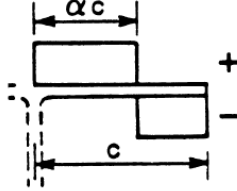
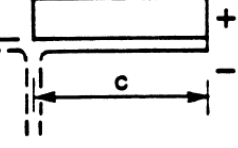
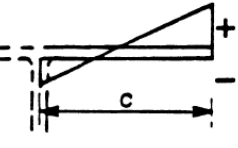
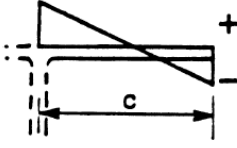
c) Outstand flanges:



**Rolled sections**



**Welded sections**

Class	Type of section	Flange subject to compression	Flange subject to compression and bending		
			Tip in compression	Tip in tension	
Stress distribution in element (compression positive)					
1	Rolled	$c/t_f \leq 10\epsilon$	$c/t_f \leq \frac{10\epsilon}{\alpha}$	$c/t_f \leq \frac{10\epsilon}{\alpha \sqrt{\alpha}}$	
	Welded	$c/t_f \leq 9\epsilon$	$c/t_f \leq \frac{9\epsilon}{\alpha}$	$c/t_f \leq \frac{9\epsilon}{\alpha \sqrt{\alpha}}$	
2	Rolled	$c/t_f \leq 11\epsilon$	$c/t_f \leq \frac{11\epsilon}{\alpha}$	$c/t_f \leq \frac{11\epsilon}{\alpha \sqrt{\alpha}}$	
	Welded	$c/t_f \leq 10\epsilon$	$c/t_f \leq \frac{10\epsilon}{\alpha}$	$c/t_f \leq \frac{10\epsilon}{\alpha \sqrt{\alpha}}$	
Stress distribution in element (compression positive)					
3	Rolled	$c/t_f \leq 15\epsilon$	$c/t_f \leq 23\epsilon \sqrt{k_\sigma}$		
	Welded	$c/t_f \leq 14\epsilon$	$c/t_f \leq 21\epsilon \sqrt{k_\sigma}$		
			For $k_\sigma$ see Table 5.3.3		
$\epsilon = \sqrt{235/f_y}$		$f_y$	235	275	355
		$\epsilon$	1	0,92	0,81

### 5.6.2 Axial tension

For members in axial tension, the design value of the tensile force  $N_{sd}$  at each cross-section shall satisfy:

$$N_{pl,Ed} = \frac{Af_y}{\gamma_{M0}}$$

And at holes for fasteners the net cross-section shall satisfy:

$$N_{pl,Rd} = 0,9A_{net} \frac{f_y}{\gamma_{M2}}$$

### 5.6.3 Axial compression

For members in axial compression, the design value of the compressive force  $N_{sd}$  at each cross-section shall satisfy:

$$N_{pl,Rd} = A \frac{f_y}{\gamma_{M0}}$$

### 5.6.4 Bending about one axis

In the absence of shear force, the design moment resistance of a cross-section without holes for fasteners may be determined for class 1 and 2 cross-sections as follows:

$$M_{c,Rd} = \frac{W_{pl}f_y}{\gamma_{M0}}$$

For a Class 3 cross-section the design moment resistance of the gross section shall be taken as the design elastic resistance moment given by:

$$M_{c,Rd} = \frac{W_{el}f_y}{\gamma_{M0}}$$

### 5.6.5 Bending and axial compression

In the absence of shear force, Class 3 cross-sections will be satisfactory if the maximum longitudinal stress  $\sigma_{x,Ed}$  satisfies the criterion:

$$\sigma_{x,Ed} \leq f_{yd}$$

Where  $f_{yd} = f_y/\gamma_{M0}$

This criterion is equal to the following expression for cross-sections without holes for fasteners:

$$\frac{N_{sd}}{Af_{yd}} + \frac{M_{y,sd}}{W_{el,y}f_{yd}} + \frac{M_{z,sd}}{W_{el,z}f_{yd}} \leq 1$$

### 5.6.6 Shear

The design value of the shear force  $V_{sd}$  at each cross-section shall satisfy:

$$V_{pl,Rd} = A_V \frac{f_y}{\gamma_{M0}\sqrt{3}}$$



### 5.6.7 Bending, axial compression and shear

If the design value of the shear force  $V_{sd}$  does not exceed 50% of  $V_{pl,Rd}$  the shear force may be neglected and the resistance moments of bending and compression may be used.

If the design value of the shear force  $V_{sd}$  exceeds 50% of  $V_{pl,Rd}$  the design resistance of the cross-section is calculated using the expressions for 'bending and axial compression' with a reduced yield strength

$$f_{y, reduced} = \left( 1 - \left( 2 \frac{V_{sd}}{V_{pl,Rd}} - 1 \right)^2 \right) f_y$$

### 5.6.8 Flexural buckling

The design buckling resistance of a compression member shall be taken as:

$$N_{b,Rd} = \frac{\chi \beta_A A f_y}{\gamma_{M1}}$$

Where:  $\beta_A = 1$  for class 1, 2 or 3 cross-sections

$\chi$  is the reduction factor for flexural buckling

Values of the reduction factor  $\chi$  for the appropriate non-dimensional slenderness  $\lambda_z$  and relevant buckling curve may be obtained from the following table:

$\lambda_s$	Buckling curve			
	a	b	c	d
0,2	1,0000	1,0000	1,0000	1,0000
0,3	0,9775	0,9641	0,9491	0,9235
0,4	0,9528	0,9261	0,8973	0,8504
0,5	0,9243	0,8842	0,8430	0,7793
0,6	0,8900	0,8371	0,7854	0,7100
0,7	0,8477	0,7837	0,7247	0,6431
0,8	0,7957	0,7245	0,6622	0,5797
0,9	0,7339	0,6612	0,5998	0,5208
1,0	0,6656	0,5970	0,5399	0,4671
1,1	0,5960	0,5352	0,4842	0,4189
1,2	0,5300	0,4781	0,4338	0,3762
1,3	0,4703	0,4269	0,3888	0,3385
1,4	0,4179	0,3817	0,3492	0,3055
1,5	0,3724	0,3422	0,3145	0,2766
1,6	0,3332	0,3079	0,2842	0,2512
1,7	0,2994	0,2781	0,2577	0,2289
1,8	0,2702	0,2521	0,2345	0,2093
1,9	0,2449	0,2294	0,2141	0,1920
2,0	0,2229	0,2095	0,1962	0,1766
2,1	0,2036	0,1920	0,1803	0,1630
2,2	0,1867	0,1765	0,1662	0,1508
2,3	0,1717	0,1628	0,1537	0,1399
2,4	0,1585	0,1506	0,1425	0,1302
2,5	0,1467	0,1397	0,1325	0,1214
2,6	0,1362	0,1299	0,1234	0,1134
2,7	0,1267	0,1211	0,1153	0,1062
2,8	0,1182	0,1132	0,1079	0,0997
2,9	0,1105	0,1060	0,1012	0,0937
3,0	0,1036	0,0994	0,0951	0,0882

The non-dimensional slenderness  $\lambda_s$  is calculated using the following expression:

$$\lambda_s = \frac{\lambda}{\lambda_1} (\beta_A)^{0,5}$$

Where:

$$\lambda_1 = 93,9\varepsilon = 93,9 \left( \frac{235}{f_y} \right)^{0,5}$$

And  $\lambda$ , the slenderness for flexural buckling, is calculated using:

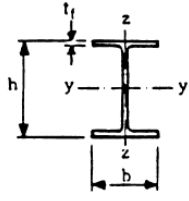
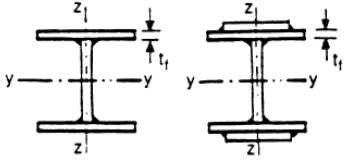

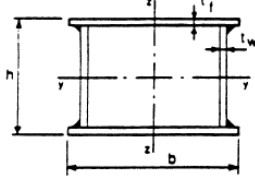

$$\lambda = \frac{l}{i}$$

$l$  is the bucking length, this conservatively be taken as equal to its system length L.

$i$  is the radius of gyration about the relevant axis.

For flexural buckling the appropriate buckling curve is determined from the following table:

Table 5.5.3 — Selection of buckling curve for a cross-section

Cross section	Limits	Buckling about axis	Buckling curve
<b>Rolled I-sections</b> 	$h/b > 1,2:$ $t_f \leq 40 \text{ mm}$	y-y z-z	a b
	$40 \text{ mm} < t_f \leq 100 \text{ mm}$	y-y z-z	b c
	$h/b \leq 1,2:$ $t_f \leq 100 \text{ mm}$ $t_f > 100 \text{ mm}$	y-y z-z y-y z-z	a b d d
<b>Welded I-sections</b> 	$t_f \leq 40 \text{ mm}$ $t_f > 40 \text{ mm}$	y-y z-z y-y z-z	b c c d
<b>Hollow sections</b> 	hot rolled	any	a
	cold formed — using $f_{yb}$ <sup>a</sup>	any	b
	cold formed — using $f_{ya}$ <sup>a</sup>	any	c
<b>Welded box sections</b> 	generally (except as below)	any	b
	thick welds and $b/t_f < 30$ $h/t_w < 30$	y-y z-z	c c
<b>U-, L-, T- and solid sections</b> 		any	c

<sup>a</sup> See 5.5.1.4(4) and Figure 5.5.2

### 5.6.9 Lateral torsional buckling

The design buckling resistance moment of a laterally unrestrained beam shall be taken as:

$$M_{b,Rd} = \frac{\chi_{LT} \beta_W W_{pl} f_y}{\gamma_{M1}}$$

Where:  $\beta_W = 1$  for class 1 or 2 cross-sections

$\beta_W = W_{el}/W_{pl}$  for class 3 sections

$\chi_{LT}$  is the reduction factor for lateral torsional buckling

The value of  $\chi_{LT}$  for the appropriate non-dimensional slenderness may be determined from:

$$\chi_{LT} = \frac{1}{\phi_{LT} + (\phi_{LT}^2 - \lambda_{LTS}^2)^{0,5}} \quad \text{but } \chi_{LT} \leq 1$$

$$\phi_{LT} = 0,5(1 + \alpha_{LT}(\lambda_{LTS} - 0,2) + \lambda_{LTS}^2)$$

The values of the imperfection factor  $\alpha_{LT}$  for lateral torsional buckling should be taken as:

$$\alpha_{LT} = 0,21 \text{ for rolled sections}$$

$$\alpha_{LT} = 0,49 \text{ for welded sections}$$

The value of  $\lambda_{LTS}$  may be determined from:

$$\lambda_{LTS} = \left( \frac{\beta_W W_{pl,y} f_y}{M_{cr}} \right)^{0,5}$$

$M_{cr}$  is calculated using annex F of Eurocode 3 part 1.

### 5.6.10 Buckling: bending and axial compression

Members with Class 3 cross-sections subject to combined bending and axial load shall satisfy:

$$\frac{N_{Sd}}{\chi_{min} A \frac{f_y}{\gamma_{M1}}} + \frac{k_y M_{y,Sd}}{W_{el,y} \frac{f_y}{\gamma_{M1}}} + \frac{k_z M_{z,Sd}}{W_{el,z} \frac{f_y}{\gamma_{M1}}} \leq 1$$

Where

$$k_y = 1 - \frac{\mu_y N_{Sd}}{\chi_y A f_y} \quad \text{but } k_y \leq 1,5$$

$$\mu_y = \lambda_{S,y} (2\beta_{My} - 4) \quad \text{but } \mu_y \leq 0,90$$

$$k_z = 1 - \frac{\mu_z N_{Sd}}{\chi_z A f_y} \quad \text{but } k_z \leq 1,5$$

$$\mu_z = \lambda_{S,z} (2\beta_{Mz} - 4) \quad \text{but } \mu_z \leq 0,90$$

$$\chi_{min} = \min(\chi_y, \chi_z)$$

### 5.6.11 Buckling: bending, axial compression, torsional buckling

Members with Class 3 cross-sections subjected to combined bending and axial force for which lateral-torsional buckling is a potential failure mode shall satisfy:

$$\frac{N_{Sd}}{\chi_z A \frac{f_y}{\gamma_{M1}}} + \frac{k_{LT} M_{y,Sd}}{\chi_{LT} W_{el,y} \frac{f_y}{\gamma_{M1}}} + \frac{k_z M_{z,Sd}}{W_{el,z} \frac{f_y}{\gamma_{M1}}} \leq 1$$

### 5.6.12 Bolted connections

The design resistances given apply to standard manufactured bolts of strength grades from grade 4.6 up to and including grade 10.9. The nominal values of the yield strength  $f_{yb}$  and the ultimate tensile strength  $f_{ub}$  for these grades are given:

Bolt grade	4.6	4.8	5.6	5.8	6.8	8.8	10.9
$f_{yb}$ (N/mm <sup>2</sup> )	240	320	300	400	480	640	900
$f_{ub}$ (N/mm <sup>2</sup> )	400	400	500	500	600	800	1 000

Bolts subject to both shear force and tensile force shall in addition satisfy the following expression:

$$\frac{F_{v,Sd}}{F_{v,Rd}} + \frac{F_{t,Sd}}{1,4F_{t,Rd}} \leq 1,0$$

Where  $F_{v,Rd}$  is the shear resistance:

$$F_{v,Rd} = \frac{0,6f_{ub}A_s}{\gamma_{Mb}} \quad \text{for grades 4.6, 5.6, 8.8}$$

$$F_{v,Rd} = \frac{0,5f_{ub}A_s}{\gamma_{Mb}} \quad \text{for grades 4.8, 5.8, 10.9}$$

$A_s$  is the tensile stress area of the bolt, values for standard diameters listed in the table below.

$\gamma_{Mb} = 1,25$  is a partial safety factor for bolts.

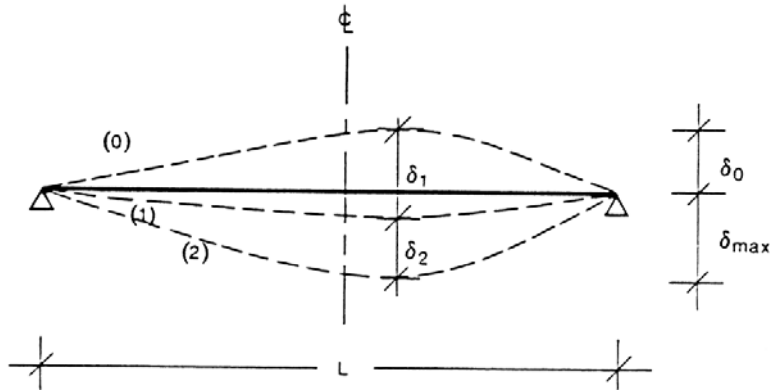
Nominal diameter [mm]	Nominal screw diameter [mm]	Tensile stress area $A_s$ [mm <sup>2</sup> ]
8	50,3	36,6
10	78,5	58
12	113	84,3
14	154	115
16	201	157
18	254	192
20	314	245
22	380	303
24	452	353
27	573	459
30	707	561

$F_{t,Rd}$  is the tension resistance:

$$F_{t,Rd} = \frac{0,9f_{ub}A_s}{\gamma_{Mb}}$$

## 5.7 Deflections

The limiting values for vertical deflections given below are illustrated by reference to the simply supported beam shown:



$\delta_{max}$  is the sagging in the final state relative to the straight line joining the supports.

$\delta_0$  is the pre-camber (hogging) of the beam in the unloaded state (not applicable in our building).

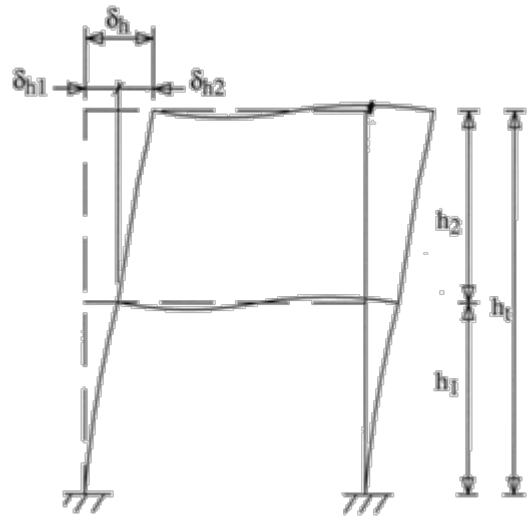
$\delta_1$  is the variation of the deflection of the beam due to the permanent loads immediately after loading.

$\delta_2$  is the variation of the deflection of the beam due to the variable loading plus any time dependent deformations due to the permanent loads.

For buildings the recommended vertical deflection are given in the table below. These deflections are more severe than normally applied for a steel or wood framed buildings. This to prevent the failure of brittle finishes and to prevent visible deformations.

	$\delta_{max}$	$\delta_2$
Roofs	$L/300$	$L/500$
Floors	$L/400$	$L/500$

For buildings the recommended limits for horizontal deflections at the tops of the columns are:



$$\delta_{hi} \leq \frac{h_i}{300} \quad \text{and} \quad \delta_h \leq \frac{h_t}{500}$$

## 5.8 Steel Frame - STOW structure

The steel frame load bearing structure is normally applied for pallet racking in industrial building. The STOW Pal Rack system consists of a full range of basic components and accessories. The fastening of the elements is very easy thus the structure can be build with basic tools. The dead weight of these components is relatively low. It's possible to assemble the structure yourself with help of some friends without needing a crane.

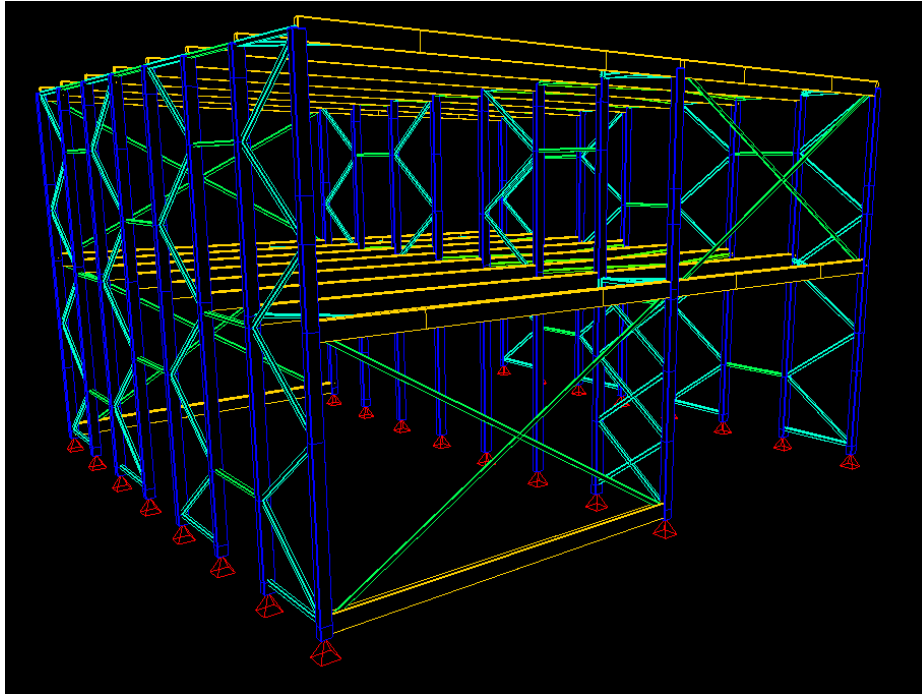
The components are in mass production so they are easy and inexpensive to obtain. Stow racks and shelving components are normally finished in a high quality epoxy coating. For the E-cube some components have a galvanized finish in order to prevent rusting and to better withstand accidental damage to the finish. Other components have a powder coating finish to create a hard finish that is tougher than conventional paint, this is the standard finish of STOW elements.





### 5.8.1 Overview of the STOW structure

A general impression of the E-cube STOW structure is given.



Detailed drawings can be found in the Annex A of the Structural calculation part of the Project Manual. The structural design was made in consultation with the architects. In this version the structural design is corresponding with the architectural design.

The orientation of the structure (which facade is oriented to the north) is chosen by the author. This affects the structural calculations not at all.

#### 5.8.1.1 General load bearing system

The vertical loads on the roof and first floor are transferred on the steel STOW joists. The joists are connected to the uprights. These uprights are bolted on top of the ground floor panels. The ground floor panels are supported by steel beams. A row of columns is also connected/supported with this steel beam to assure alignment and to minimize the effect of different settlements. These beams are supported by foundation supports which can be adjusted to the correct height (more detailed information in chapter 12).

The lateral stability in East-West is secured by the horizontal wind bracers located in the first floor and roof and by vertical wind bracers the North and South facade.

In North-South direction the lateral stability is secured by extra support of the horizontal load bearing joists located near the facade and by the triangular framework between the columns.

For visual guidance the drawings in annex A are recommended.

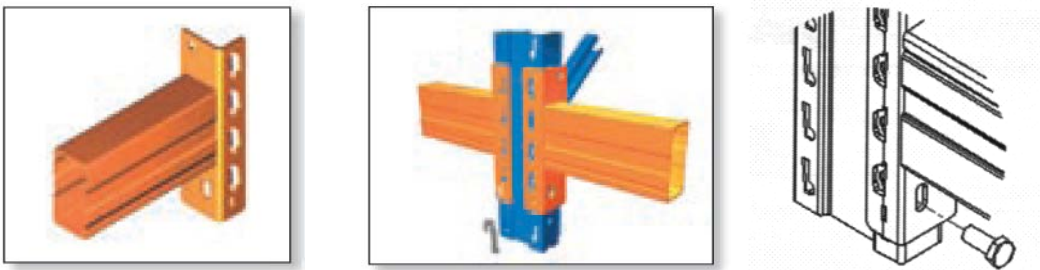
### 5.8.1.2 Most critical elements

To limit the amount of calculations only the most critical elements of the structure are considered. These critical elements are shown in annex B. In part 7.3 structural stability and deflection are calculated for these critical elements.

## 5.8.2 Components

### 5.8.2.1 Joist PNB 0436/2

The joist is composed of two cold-formed C-profiles made of steel grade S355MC. They form together a hollow box girder which is welded at both ends to connection plates. The connection plates are fitted with hooks for fastening the joist to the column. When attached the joist is secured by a bolt.



For structural calculations the connection to the column is considered as hinged.

The main specifications of this cross-section are given in Annex C.

### 5.8.2.2 Upright PLU 16

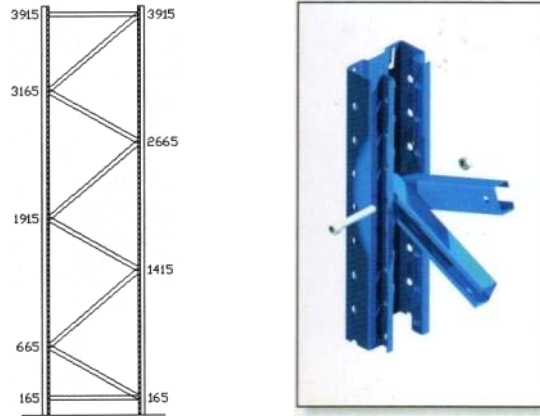
The uprights are cold-rolled profiles made of steel S355MC. The uprights have perforations to be able to fasten the joists on the uprights. The influence of these openings is incorporated in the manufacturer's specifications. A typical STOW frame element consists of two uprights connected by a triangular framework.



The main specifications of this cross section are given in Annex C.

### 5.8.2.3 Diagonals

Diagonals are placed between two uprights to reduce the buckling length of the frames. They are bolted on the uprights, we consider this connection as hinged.



The main specifications of this cross-section are given in Annex C.

### 5.8.2.4 Footplates

The uprights are placed on footplates. This connection is also considered as hinged.



### 5.8.2.5 Row spacer PNAG 0482

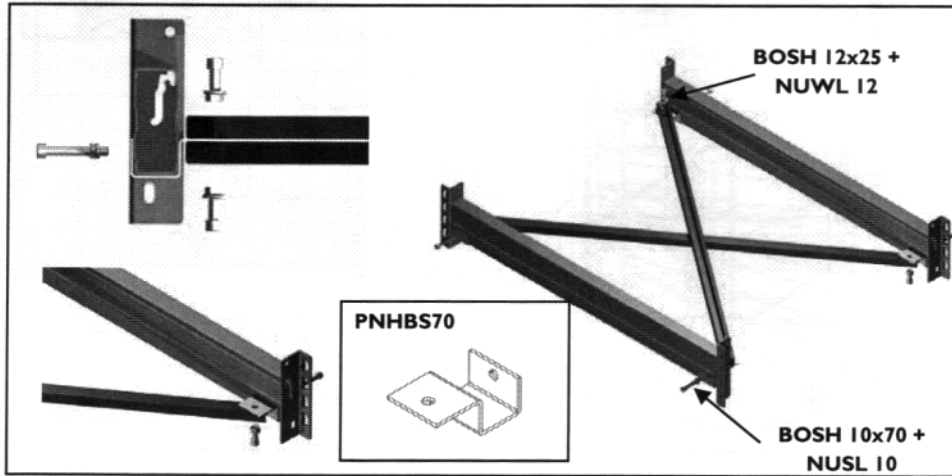
Row spacers are installed between each pair of frames. They are fastened with one bolt at each side to the uprights. This connection is considered as hinged.



The main specifications of this cross section are given in Annex C.

### 5.8.2.6 Horizontal wind bracings

A horizontal wind bracing system consists of two crossed beams. They are bolted to clamps PNHBS70, the clamps are bolted on the joists.



The cross-section of these horizontal wind bracings is the same as the diagonals used in the frames.

### 5.8.2.7 Vertical wind bracings

These wind bracings are custom made by STOW for the E-cube. They consist of 4mmx40mm tie rods which are tightened using a turnbuckle. The vertical wind bracers are bolted to the joists PNB 0436/2.

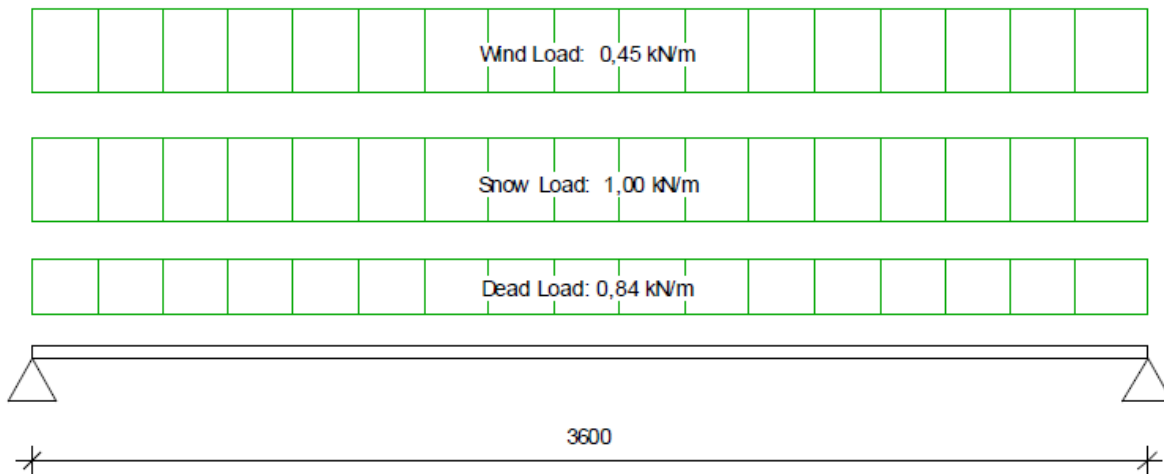
The main specifications of the cross-section are given in Annex C.

## 5.8.3 Structural calculations of the critical elements

### 5.8.3.1 Critical element no. 1

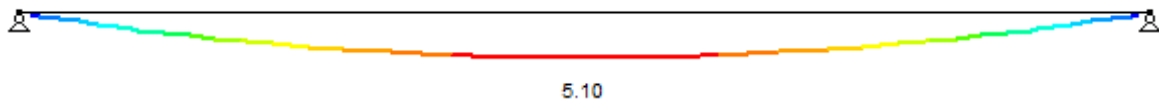
#### 5.8.3.1.1 System and Loads

The reference width of this beam is 1,05 m. The corresponding line loads on this joist are:



### 5.8.3.1.2 Results

Bending moments [kNm]



Shear forces [kN]

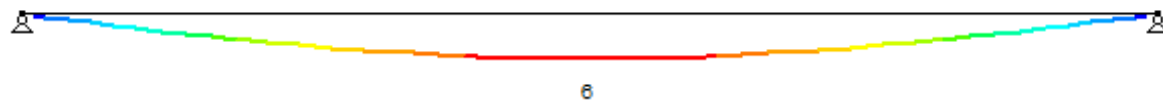


Deflection due to variable loads [mm]



$$4 \text{ mm} < \frac{L}{500} = 8 \text{ mm} \quad OK$$

Total deflection [mm]:



$$6 \text{ mm} < \frac{L}{300} = 13,3 \text{ mm} \quad OK$$

### 5.8.3.1.3 Cross-section resistance and buckling check

#### Results - Cross-section resistance check EC3 bar 1

cross-section : @S@-PNB0436

orientation : 0.00 °

$f_y$  : 355.00 N/mm<sup>2</sup>

tensile force 0.00 %

compressive force 0.00 %

▣ **moment  $M_{y'}$**  **33.59 %**

moment  $M_{z'}$  0.00 %

shear force  $V_{z'}$  5.72 %

shear force  $V_{y'}$  0.00 %

moment  $M_{y'}$  + shear force  $V_{z'}$  0.00 %

moment  $M_{z'}$  + shear force  $V_{y'}$  0.00 %

moment  $M_{y'}$  and  $M_{z'}$  + normal force 33.59 %  
moment  $M_{y'}$  and  $M_{z'}$  + shear force  $V_{z'}$  and  $V_{y'}$  + normal force 0.00 %

**detail design check : tensile force**

bar is not subjected to tension

**detail design check : compressive force**

bar is not subjected to compression

**detail design check : moment  $M_{y'}$**

distance from node 1 : 180 cm

for combination ULS FC 1

$M_y = 5.09$  kNm

section class : 3

$W_{ely} = 47.0$  cm<sup>3</sup>

$M_{y,Rd} = 15.17$  kNm

**detail design check : moment  $M_{z'}$**

bar is not subjected to bending  $M_{z'}$

**detail design check : shear force  $V_{z'}$**

maximum at node 2

for combination ULS FC 1

$V_z = 5.66$  kN

$A_{vz} = 5.31$  cm<sup>2</sup>

$V_{z,Rd} = 98.94$  kN

**detail design check : shear force  $V_{y'}$**

bar is not subjected to shear force  $V_{y'}$

**detail design check : moment  $M_{y'}$  + shear force  $V_{z'}$**

contribution of shear force  $V_{z'}$  is negligible

**detail design check : moment  $M_{z'}$  + shear force  $V_{y'}$**

contribution of shear force  $V_{y'}$  is negligible

**detail design check : moment  $M_{y'}$  and  $M_{z'}$  + normal force**

distance from node 1 : 180 cm

for combination ULS FC 1

$N = 0.00$  kN (tension),  $M_y = 5.09$  kNm,  $M_z = 0.00$  kNm

section class Y : 3, section class Z : 3

$A = 10.45$  cm<sup>2</sup>,  $W_{ely} = 47.0$  cm<sup>3</sup>,  $W_{elz} = 17.5$  cm<sup>3</sup>

$N_{pl,Rd} = 337.25$  kN,  $M_{y,Rd} = 15.17$  kNm,  $M_{z,Rd} = 5.65$  kNm

**detail design check : moment  $M_{y'}$  and  $M_{z'}$  + shear force  $V_{z'}$  and  $V_{y'}$  + normal force**

contribution of shear force is negligible

**detail design check : torsion**

bar is not subjected to torsion

Results - Buckling check EC3 bar 1
------------------------------------

cross-section : @S@-PNB0436      length: 360 cm      orientation : 0.00 °      fy : 355.00 N/mm<sup>2</sup>  
buckling length in-plane = 360 cm      buckling length out-of-plane = 360 cm  
Lat. torsional buckl. length(z'>0) : 180      (k = 0.50, kw = 1.00)  
Lat. torsional buckl. length(z'<0) : 360      (k = 0.50, kw = 1.00)

normal force, buckling in y'-plane	0.00 %
normal force, buckling in z'-plane	0.00 %
<b>▣ lateral torsional buckling</b>	<b>60.10 %</b>
normal force and moment, buckling	0.00 %
normal force and moment, lateral torsional buckling	0.00 %

**detail design check : normal force, buckling in y'-plane**

bar is not subjected to compression

**detail design check : normal force, buckling in z'-plane**

bar is not subjected to compression

**detail design check : lateral torsional buckling**

distance from node 1 : 180 cm  
for combination ULS FC 1  
My = 5.09 kNm  
section class : 3  
Wely = 47.0 cm<sup>3</sup>  
C1 = 0.97, Mcr = 17.82 kNm  
lambdaLTS = 0.97, sigmaLT = 0.49, chiLt = 0.56  
Mb.Rd = 8.48 kNm

**detail design check : normal force and moment, buckling**

bar is not subjected to compression nor bending

**detail design check : normal force and moment, lateral torsional buckling**

no risk for lateral torsional buckling  
lambdaLTS <= 0.40

### 5.8.3.2 Critical element no. 2

The joist is lateral supported with diagonal bars to minimize the horizontal displacements. We consider both the extreme positive and negative wind loads. This bar is loaded in vertical (roof wind loads) and horizontal (facade wind loads) direction. The results are given for both directions.

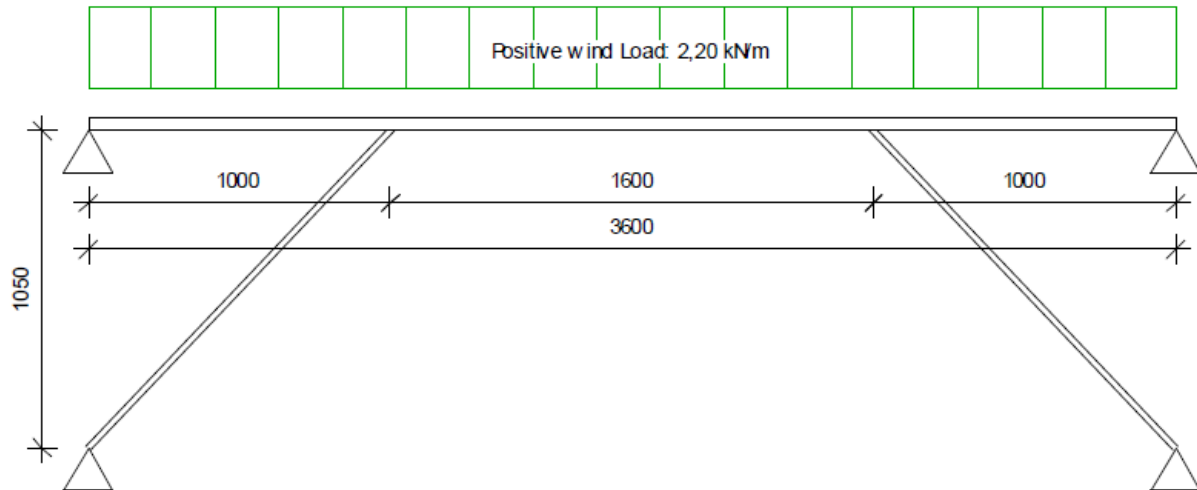
The reference width of this beam is 0,75 m for the vertical loads on the roof. The reference width for the wind loads equals 1,48 m. Because of the combined loading in two directions the most critical situation is not obvious to know, different wind directions are considered.



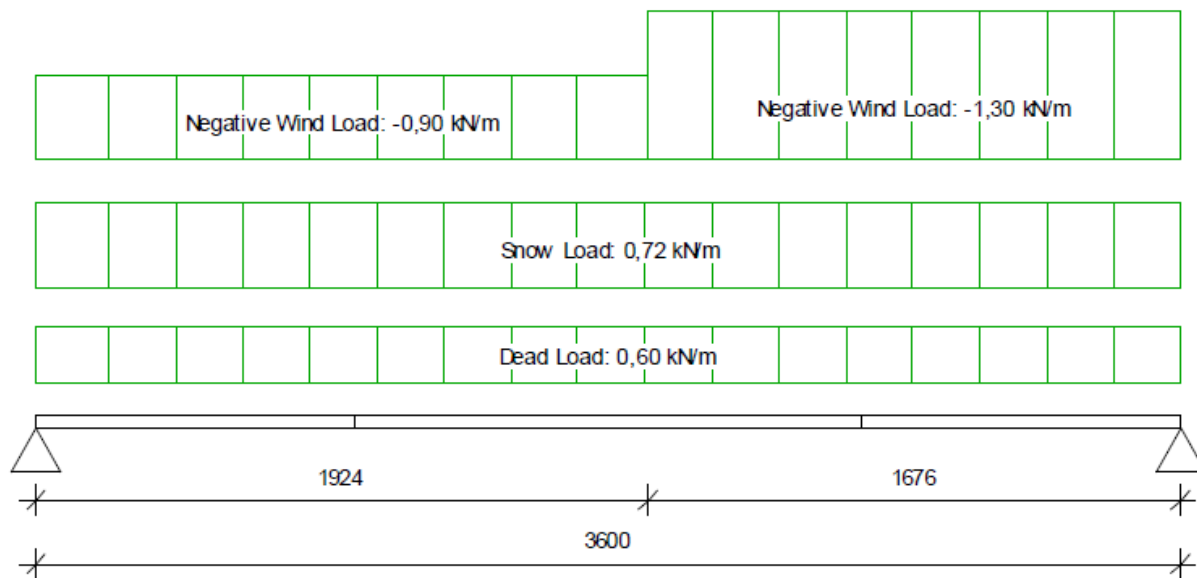
### 5.8.3.2.1 South Wind

#### 5.8.3.2.1.1 System and Loads

Horizontal loads:

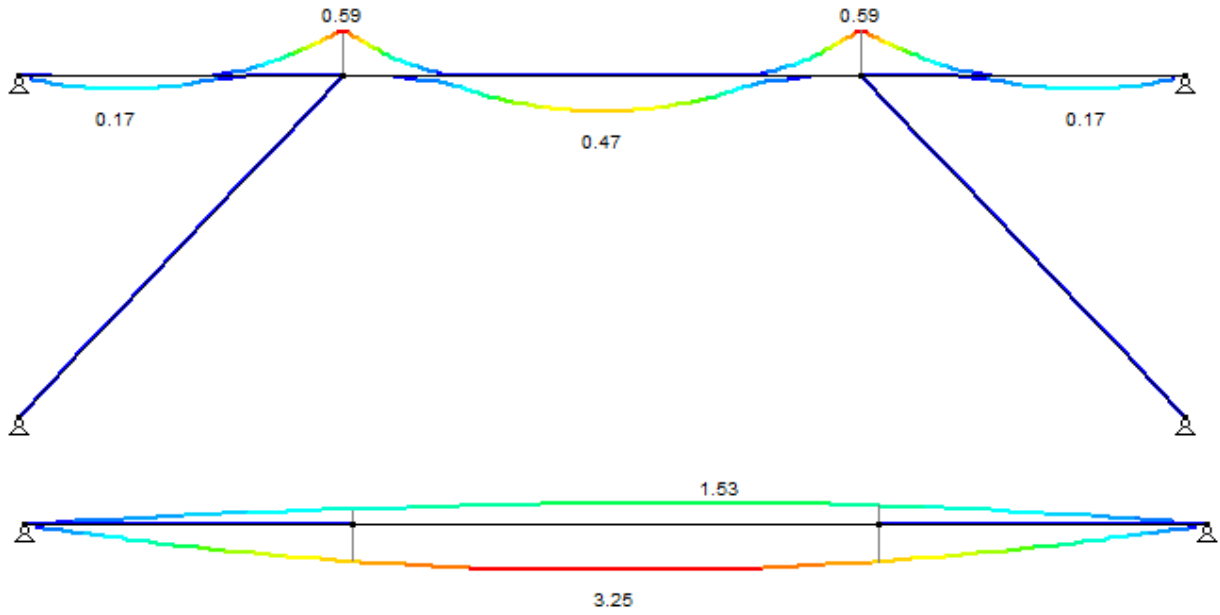


Vertical loads:

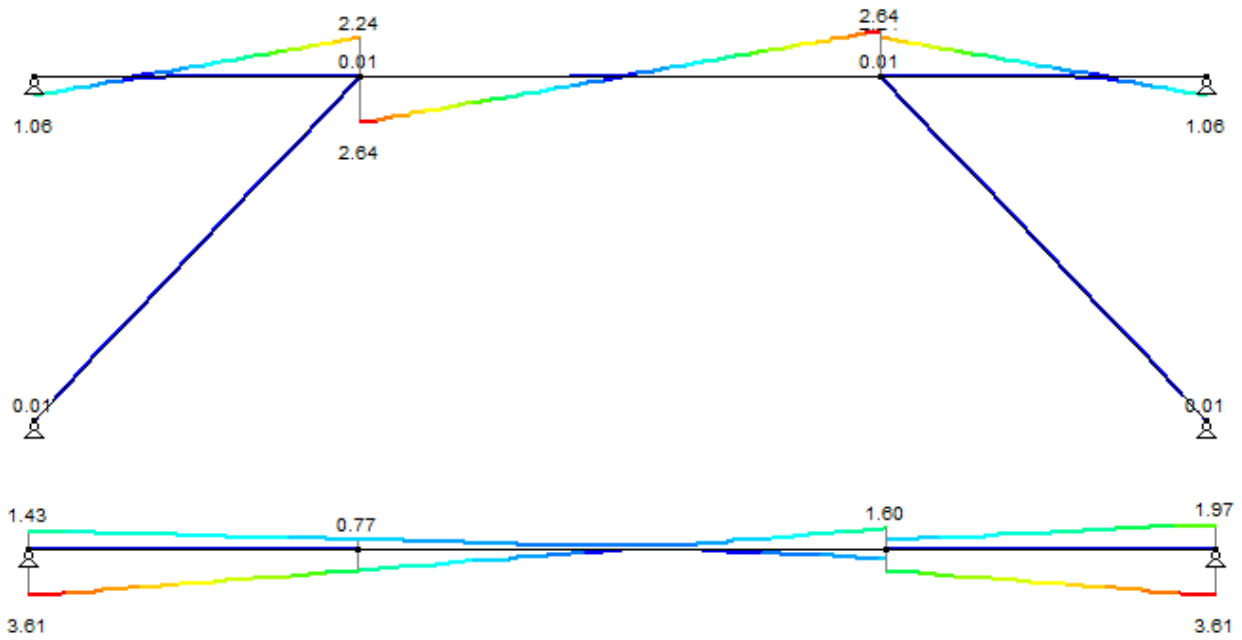


#### 5.8.3.2.1.2 Results

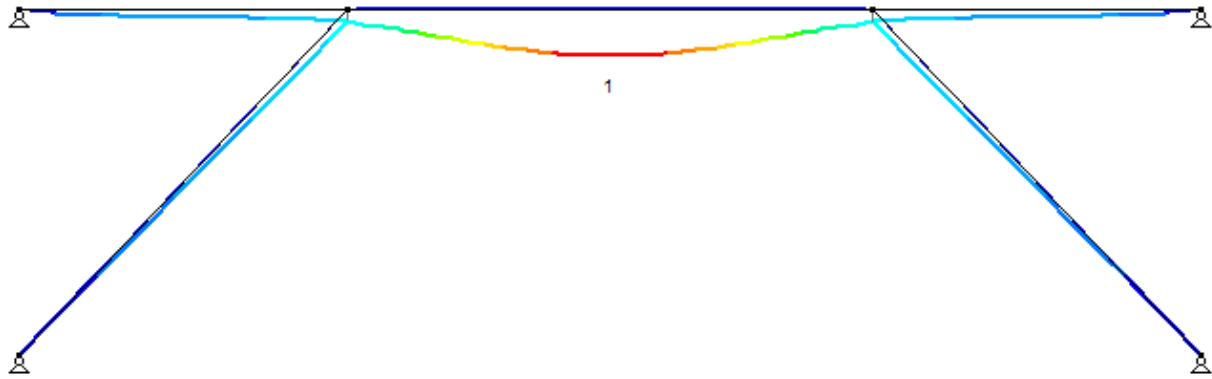
Bending moments [kNm]



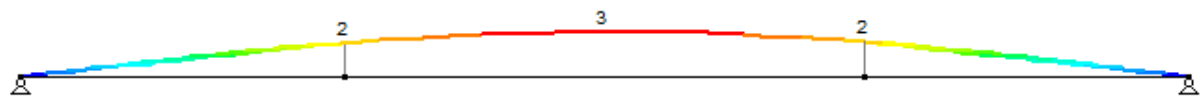
Shear forces [kN]



Horizontal deflections due to variable loads [mm] (=total deflection)

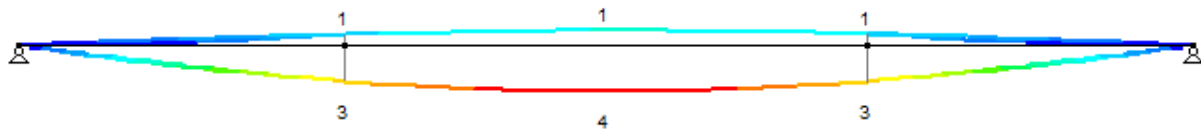


Vertical deflections due to variable loads [mm]



$$3 \text{ mm} < \frac{L}{500} = 8 \text{ mm} \quad \text{OK}$$

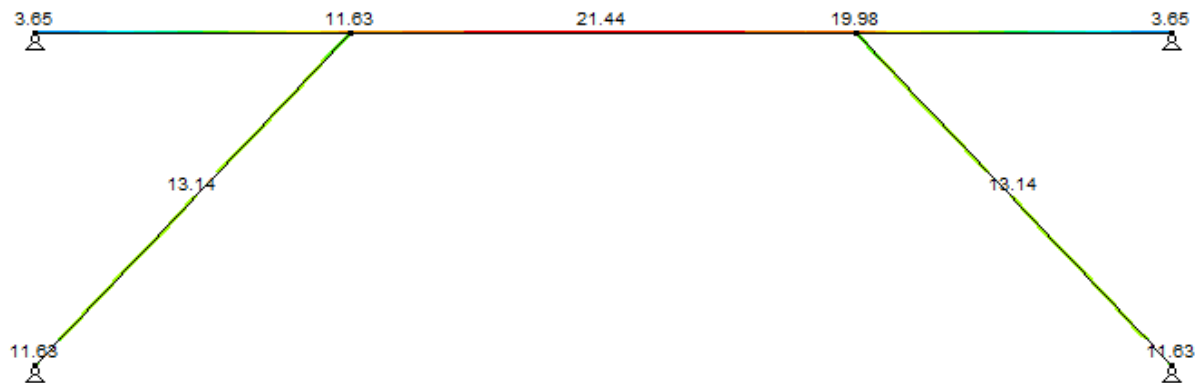
Total deflections [mm]



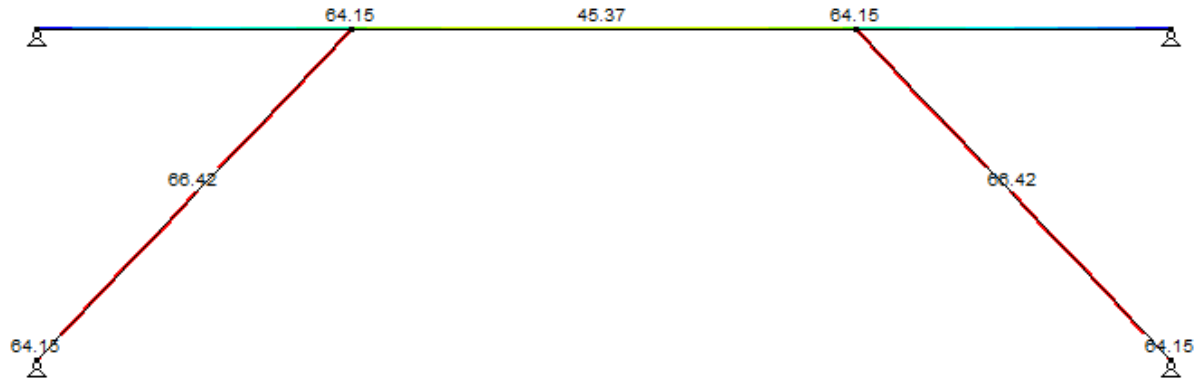
$$4 \text{ mm} < \frac{L}{300} = 13,3 \text{ mm} \quad \text{OK}$$

#### 5.8.3.2.1.3 Cross section resistance and buckling check

The cross-section resistance of the elements is checked:



The buckling resistance of the elements is checked:



The most critical elements to buckling are the diagonal bracers. Details of the cross section and buckling resistance for this element is given:

Results - Cross-section resistance check EC3 bar 1
--

cross-section : @S@-Diagonaal      orientation : 90.00 °       $f_y$  : 355.00 N/mm<sup>2</sup>

tensile force	0.00 %	
compressive force	11.63 %	
moment My'	0.00 %	
moment Mz'	1.51 %	
shear force Vz'	0.00 %	
shear force Vy'	0.09 %	
moment My' + shear force Vz'	0.00 %	
moment Mz' + shear force Vy'	0.00 %	
<b>moment My' and Mz' + normal force</b>	<b>13.14 %</b>	
moment My' and Mz' + shear force Vz' and Vy' + normal force	0.00 %	

**detail design check : tensile force**

bar is not subjected to tension

**detail design check : compressive force**

maximum at node 4  
 for combination ULS FC 16  
 N = 6.74 kN  
 section class : 3  
 A = 1.80 cm<sup>2</sup>  
 Npl.Rd = 57.93 kN

**detail design check : moment My'**

bar is not subjected to bending My'

**detail design check : moment Mz'**

distance from node 3 : 72 cm

for combination ULS FC 2

$M_z = 0.00$  kNm

section class : 3

$W_{elz} = 1.0$  cm<sup>3</sup>

$M_{elz.Rd} = 0.32$  kNm

**detail design check : shear force  $V_z'$**

bar is not subjected to shear force  $V_z'$

**detail design check : shear force  $V_y'$**

maximum at node 3

for combination ULS FC 2

$V_y = 0.01$  kN

$A_{vy} = 0.80$  cm<sup>2</sup>

$V_{y.Rd} = 14.88$  kN

**detail design check : moment  $M_y'$  + shear force  $V_z'$**

contribution of shear force  $V_z'$  is negligible

**detail design check : moment  $M_z'$  + shear force  $V_y'$**

contribution of shear force  $V_y'$  is negligible

**detail design check : moment  $M_y'$  and  $M_z'$  + normal force**

distance from node 3 : 72 cm

for combination ULS FC 2

$N = 6.74$  kN (compression),  $M_y = 0.00$  kNm,  $M_z = 0.00$  kNm

section class Y : 3, section class Z : 3

$A = 1.80$  cm<sup>2</sup>,  $W_{ely} = 1.9$  cm<sup>3</sup>,  $W_{elz} = 1.0$  cm<sup>3</sup>

$N_{pl.Rd} = 57.93$  kN,  $M_{ely.rd} = 0.61$  kNm,  $M_{elz.rd} = 0.32$  kNm

**detail design check : moment  $M_y'$  and  $M_z'$  + shear force  $V_z'$  and  $V_y'$  + normal force**

contribution of shear force is negligible

**detail design check : torsion**

bar is not subjected to torsion

Results - Buckling check EC3 bar 1

cross-section : @S@-Diagonaal      length: 145 cm      orientation : 90.00 °       $f_y : 355.00$  N/mm<sup>2</sup>

buckling length in-plane = 145 cm      buckling length out-of-plane = 145 cm

Lat. torsional buckl. length( $z' > 0$ ) : 145      ( $k = 1.00$ ,  $k_w = 1.00$ )

Lat. torsional buckl. length( $z' < 0$ ) : 145      ( $k = 1.00$ ,  $k_w = 1.00$ )

normal force, buckling in  $y'$ -plane      33.07 %

normal force, buckling in  $z'$ -plane      64.15 %

lateral torsional buckling      0.00 %

▣ **normal force and moment, buckling**      **66.42 %**

normal force and moment, lateral torsional buckling 66.42 %

**detail design check : normal force, buckling in y'-plane**

maximum at node 3

for combination ULS FC 2

$N = 6.74 \text{ kN}$

section class : 3

$A = 1.80 \text{ cm}^2$

$\alpha = 0.49$ ,  $\lambda_S = 1.39$ ,  $\chi = 0.35$

$N_{b.Rd} = 20.37 \text{ kN}$

**detail design check : normal force, buckling in z'-plane**

maximum at node 4

for combination ULS FC 16

$N = 6.74 \text{ kN}$

section class : 3

$A = 1.80 \text{ cm}^2$

$\alpha = 0.49$ ,  $\lambda_S = 2.09$ ,  $\chi = 0.18$

$N_{b.Rd} = 10.50 \text{ kN}$

**detail design check : lateral torsional buckling**

no risk for lateral torsional buckling

$\lambda_{LTS} \leq 0.40$

**detail design check : normal force and moment, buckling**

distance from node 3 : 72 cm

for combination ULS FC 2

$N = 6.74 \text{ kN}$  (compression),  $M_y = 0.00 \text{ kNm}$ ,  $M_z = 0.00 \text{ kNm}$

section class Y : 3, section class Z : 3

$A = 1.80 \text{ cm}^2$ ,  $W_{ely} = 1.9 \text{ cm}^3$ ,  $W_{elz} = 1.0 \text{ cm}^3$

$\alpha_Y = 0.49$ ,  $\alpha_Z = 0.49$ ,  $\lambda_{SY} = 1.39$ ,  $\lambda_{SZ} = 2.09$ ,  $\chi_Y = 0.35$ ,  $\chi_Z = 0.18$

$\mu_y = -2.51$ ,  $k_y = 1.50$ ,  $\mu_z = -3.77$ ,  $k_z = 1.50$

$N_{pl.Rd} = 10.50 \text{ kN}$ ,  $M_{ely.rd} = 0.61 \text{ kNm}$ ,  $M_{elz.rd} = 0.32 \text{ kNm}$

**detail design check : normal force and moment, lateral torsional buckling**

distance from node 3 : 72 cm

for combination ULS FC 2

$N = 6.74 \text{ kN}$  (compression),  $M_y = 0.00 \text{ kNm}$ ,  $M_z = 0.00 \text{ kNm}$

section class Y : 3, section class Z : 3

$A = 1.80 \text{ cm}^2$ ,  $W_{ely} = 1.9 \text{ cm}^3$ ,  $W_{elz} = 1.0 \text{ cm}^3$

$C_1 = 1.13$ ,  $M_{cr} = 0.91 \text{ kNm}$ ,  $\lambda_{LTS} = 0.86$ ,  $\sigma_{LT} = 0.21$

$\alpha_Y = 0.49$ ,  $\alpha_Z = 0.49$ ,  $\lambda_{SY} = 1.39$ ,  $\lambda_{SZ} = 2.09$ ,  $\chi_{LT} = 0.76$ ,  $\chi_Z = 0.18$

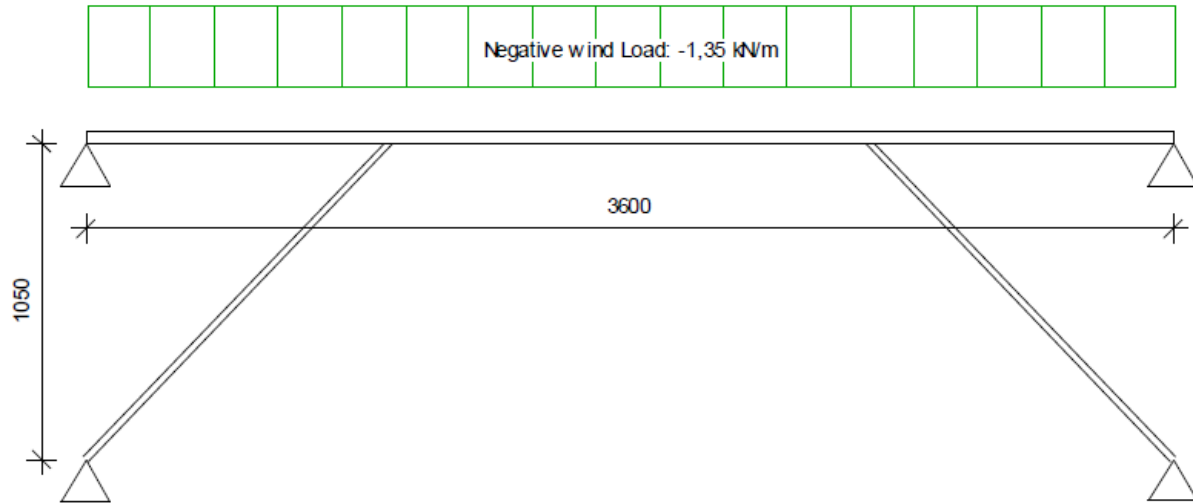
$k_{LT} = 1.00$ ,  $\mu_z = -3.77$ ,  $k_z = 1.50$

$N_{pl.Rd} = 10.50 \text{ kN}$ ,  $M_{ely.rd} = 0.47 \text{ kNm}$ ,  $M_{elz.rd} = 0.32 \text{ kNm}$

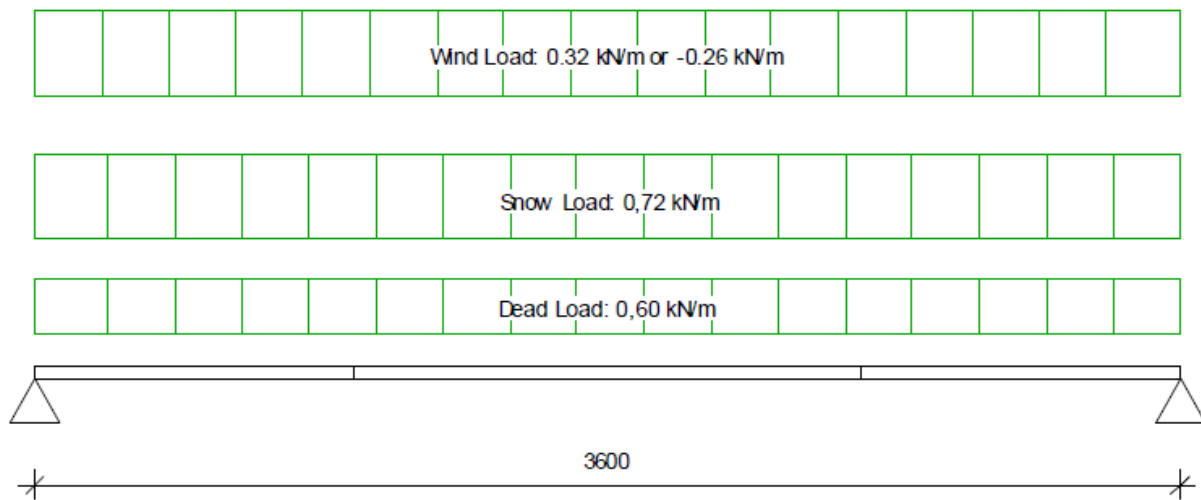
### 5.8.3.2.2 North Wind

#### 5.8.3.2.2.1 System and Loads

Horizontal loads:

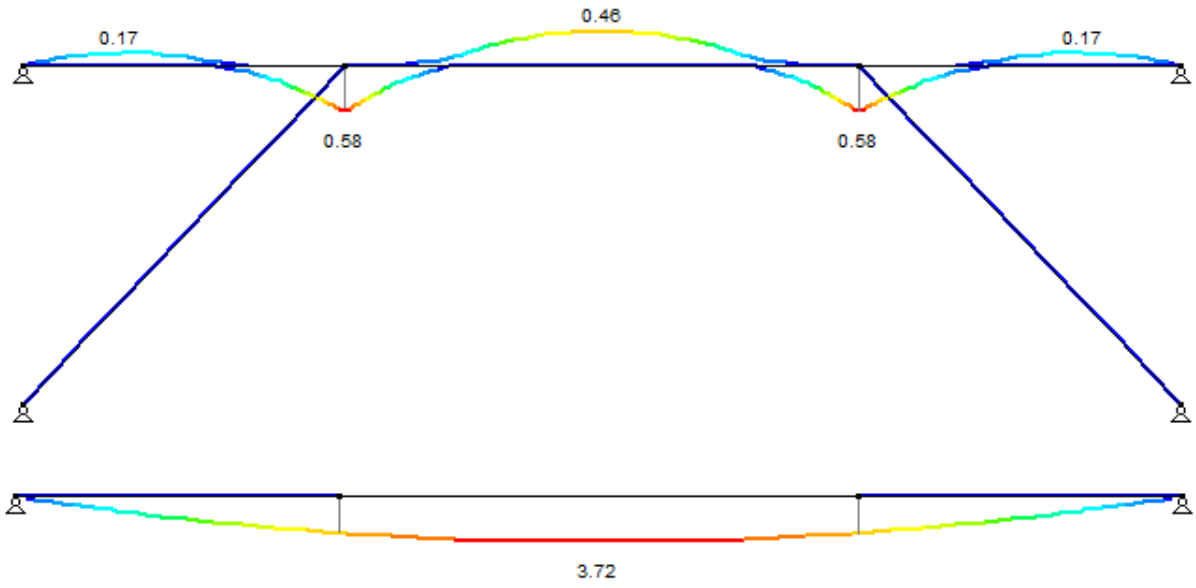


Vertical loads:

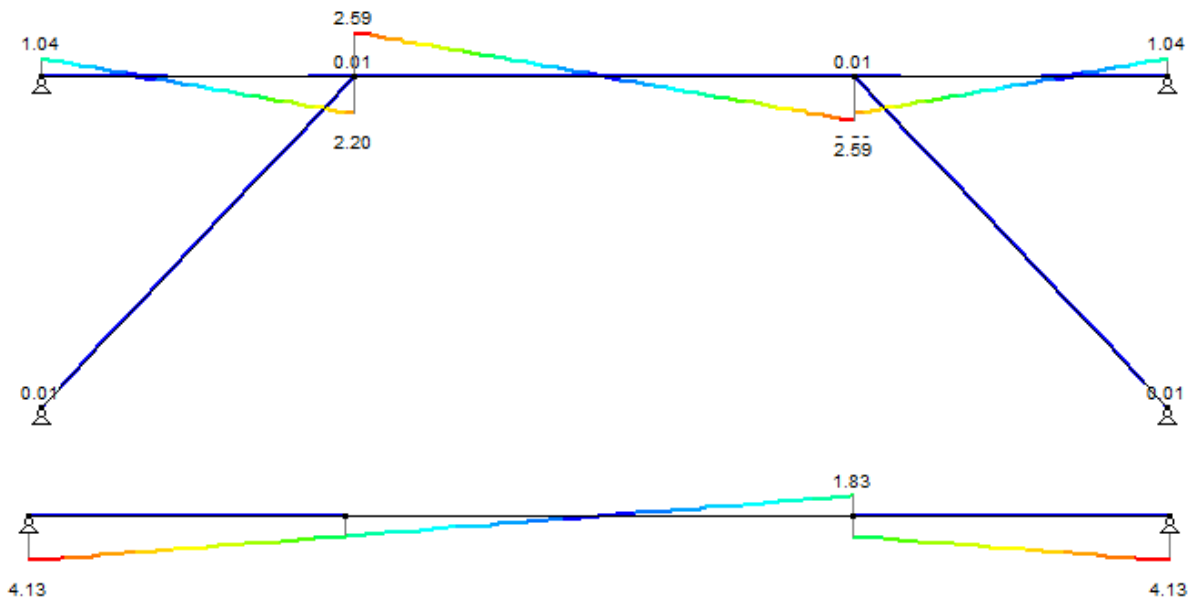


#### 5.8.3.2.2.2 Results

Bending moments [kNm]

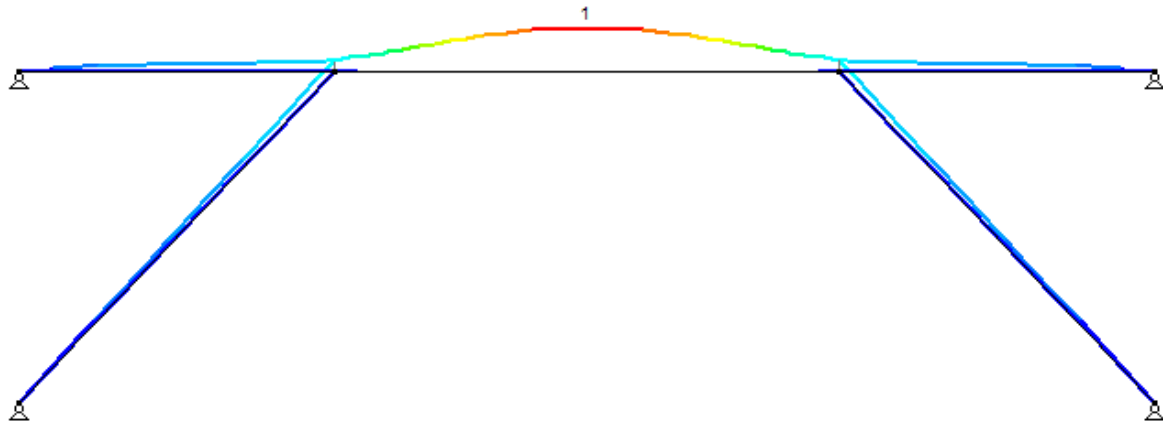


Shear forces [kN]

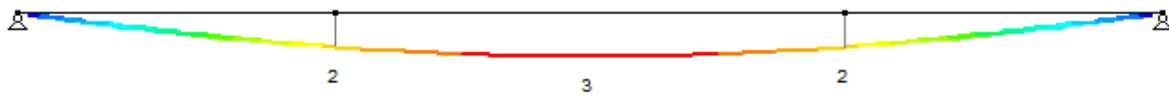


Horizontal deflections due to variable loads [mm] (=total deflection)





Vertical deflections due to variable loads [mm]



$$3 \text{ mm} < \frac{L}{500} = 8 \text{ mm} \quad \text{OK}$$

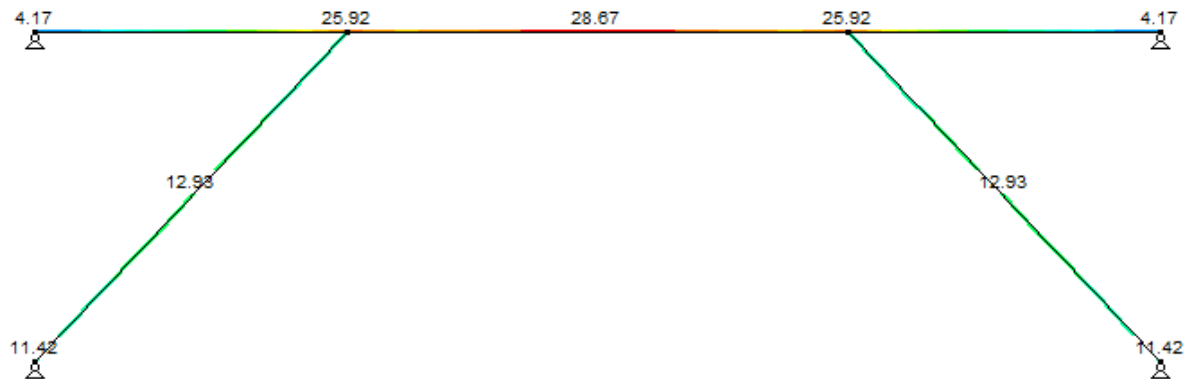
Total deflections [mm]



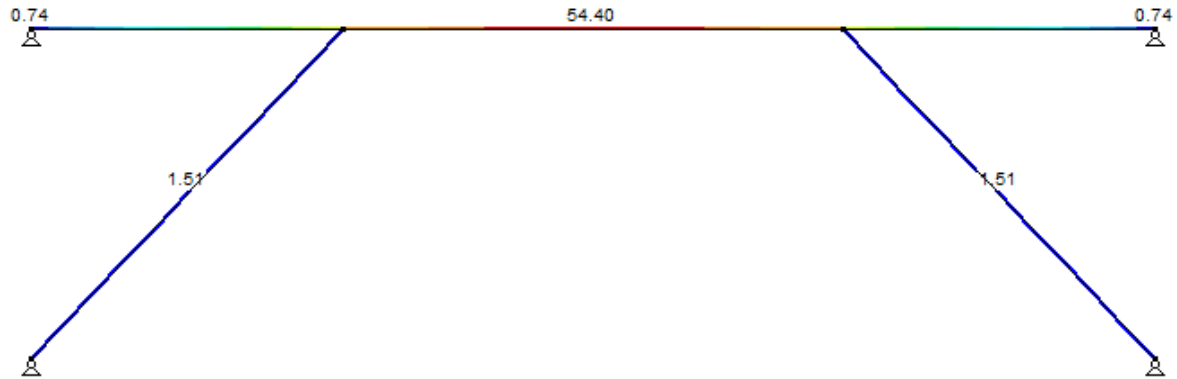
$$4 \text{ mm} < \frac{L}{300} = 13,3 \text{ mm} \quad \text{OK}$$

#### 5.8.3.2.2.3 Cross section resistance and buckling check

The cross-section resistance of the elements is checked:



The buckling resistance of the elements is checked:



The most critical elements to buckling are the not the diagonal bracers because they are subjected to tension due to the wind suction. Details of the cross section and bucking resistance for the joist are given:

Results - Cross-section resistance check EC3 bar 5

cross-section : @S@-PNB0436      orientation : 0.00 °       $f_y$  : 355.00 N/mm<sup>2</sup>

tensile force	0.75 %
compressive force	0.00 %
moment $M_{y'}$	24.51 %
moment $M_{z'}$	10.23 %
shear force $V_{z'}$	1.85 %
shear force $V_{y'}$	4.06 %
moment $M_{y'}$ + shear force $V_{z'}$	0.00 %
moment $M_{z'}$ + shear force $V_{y'}$	0.00 %
▣ <b>moment <math>M_{y'}</math> and <math>M_{z'}</math> + normal force</b>	<b>28.67 %</b>
moment $M_{y'}$ and $M_{z'}$ + shear force $V_{z'}$ and $V_{y'}$ + normal force	0.00 %

**detail design check : tensile force**

maximum at node 4  
 for combination ULS FC 2  
 $N = 2.53$  kN  
 $A = 10.45$  cm<sup>2</sup>  
 $N_{pl.Rd} = 337.25$  kN

**detail design check : compressive force**

bar is not subjected to compression

**detail design check : moment  $M_{y'}$**

distance from node 4 : 80 cm  
 for combination ULS FC 25  
 $M_y = 3.72$  kNm  
 section class : 3  
 $W_{ely} = 47.0$  cm<sup>3</sup>

Mely.Rd = 15.17 kNm

**detail design check : moment Mz'**

maximum at node 4

for combination ULS FC 2

Mz = 0.58 kNm

section class : 3

W<sub>elz</sub> = 17.5 cm<sup>3</sup>

Melz.Rd = 5.65 kNm

**detail design check : shear force Vz'**

maximum at node 5

for combination ULS FC 25

Vz = 1.83 kN

Avz = 5.31 cm<sup>2</sup>

Vz.Rd = 98.94 kN

**detail design check : shear force Vy'**

maximum at node 4

for combination ULS FC 2

Vy = 2.59 kN

Avy = 3.43 cm<sup>2</sup>

Vy.Rd = 63.91 kN

**detail design check : moment My' + shear force Vz'**

contribution of shear force Vz' is negligible

**detail design check : moment Mz' + shear force Vy'**

contribution of shear force Vy' is negligible

**detail design check : moment My' and Mz' + normal force**

distance from node 4 : 80 cm

for combination ULS FC 1

N = 1.90 kN (tension), My = 3.34 kNm, Mz = 0.34 kNm

section class Y : 3, section class Z : 3

A = 10.45 cm<sup>2</sup>, W<sub>ely</sub> = 47.0 cm<sup>3</sup>, W<sub>elz</sub> = 17.5 cm<sup>3</sup>

Npl.Rd = 337.25 kN, Mely.rd = 15.17 kNm, Melz.rd = 5.65 kNm

**detail design check : moment My' and Mz' + shear force Vz' and Vy' + normal force**

contribution of shear force is negligible

**detail design check : torsion**

bar is not subjected to torsion

Results - Buckling check EC3 bar 5

cross-section : @S@-PNB0436

length: 160 cm

orientation : 0.00 °

fy : 355.00 N/mm<sup>2</sup>

buckling length in-plane = 160 cm      buckling length out-of-plane = 160 cm  
Lat. torsional buckl. length( $z' > 0$ ) : 160 (k = 1.00, kw = 1.00)  
Lat. torsional buckl. length( $z' < 0$ ) : 160 (k = 1.00, kw = 1.00)

normal force, buckling in $y'$ -plane	0.00 %
normal force, buckling in $z'$ -plane	0.00 %
lateral torsional buckling	51.88 %
normal force and moment, buckling	27.33 %
<b>normal force and moment, lateral torsional buckling</b>	<b>54.40 %</b>

**detail design check : normal force, buckling in  $y'$ -plane**

bar is not subjected to compression

**detail design check : normal force, buckling in  $z'$ -plane**

bar is not subjected to compression

**detail design check : lateral torsional buckling**

distance from node 4 : 80 cm  
for combination ULS FC 25  
My = 3.72 kNm  
section class : 3  
Wely = 47.0 cm<sup>3</sup>  
C1 = 1.28, Mcr = 13.24 kNm  
lambdaLTS = 1.12, sigmaLT = 0.49, chiLt = 0.47  
Mb.Rd = 7.17 kNm

**detail design check : normal force and moment, buckling**

distance from node 4 : 80 cm  
for combination ULS FC 1  
N = 1.90 kN (tension), My = 3.34 kNm, Mz = 0.34 kNm  
section class Y : 3, section class Z : 3  
A = 10.45 cm<sup>2</sup>, Wely = 47.0 cm<sup>3</sup>, Welz = 17.5 cm<sup>3</sup>  
alfaY = 0.34, alfaZ = 0.34, lambdaSY = 0.35, lambdaSZ = 1.05, chiY = 0.95, chiZ = 0.57  
muy = -0.63, ky = 1.00, muz = -1.88, kz = 0.98  
Npl.Rd = 318.98 kN, Mely.rd = 15.17 kNm, Melz.rd = 5.65 kNm

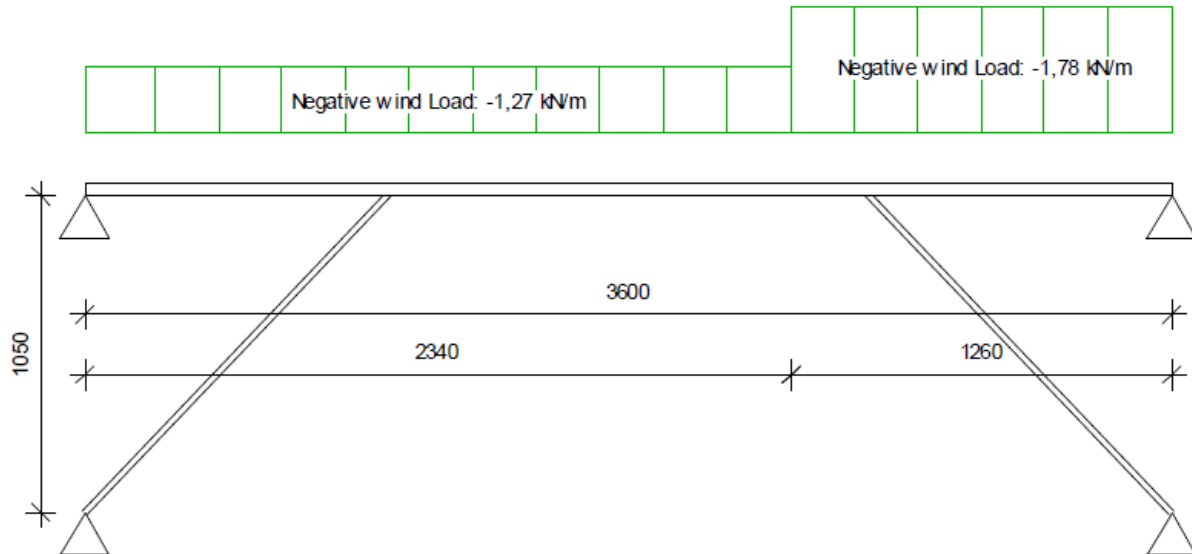
**detail design check : normal force and moment, lateral torsional buckling**

distance from node 4 : 80 cm  
for combination ULS FC 25  
N = 0.95 kN (tension), My = 3.72 kNm, Mz = 0.17 kNm  
section class Y : 3, section class Z : 3  
A = 10.45 cm<sup>2</sup>, Wely = 47.0 cm<sup>3</sup>, Welz = 17.5 cm<sup>3</sup>  
C1 = 1.28, Mcr = 13.24 kNm, lambdaLTS = 1.12, sigmaLT = 0.49  
alfaY = 0.34, alfaZ = 0.34, lambdaSY = 0.35, lambdaSZ = 1.05, chiLT = 0.47, chiZ = 0.57  
kLT = 1.00, muz = -1.88, kz = 0.99  
Npl.Rd = 318.98 kN, Mely.rd = 7.17 kNm, Melz.rd = 5.65 kNm

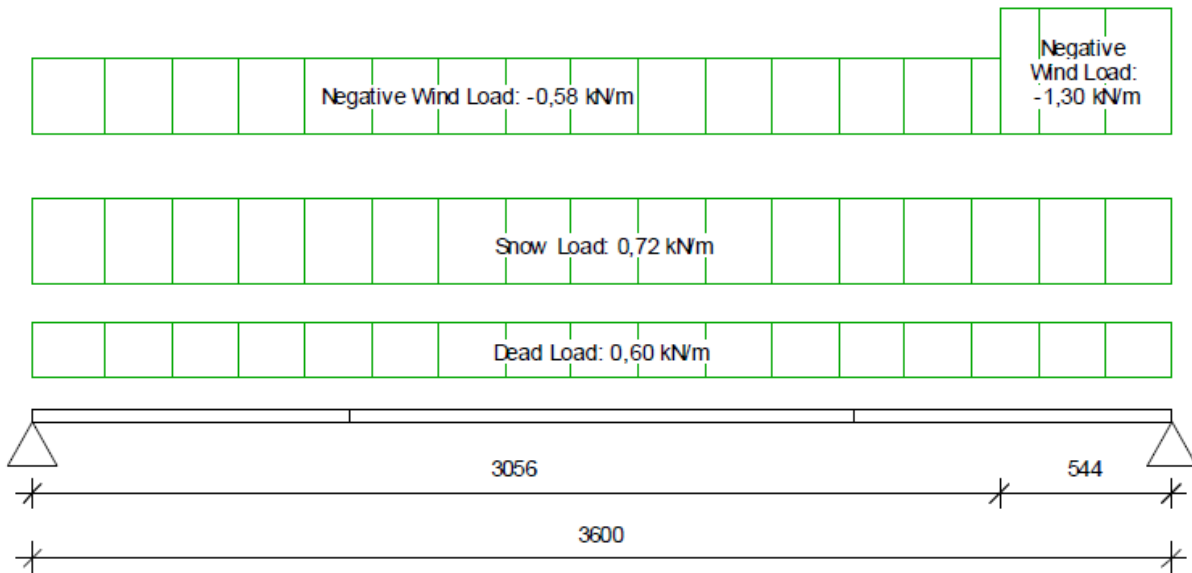
### 5.8.3.2.3 East Wind

#### 5.8.3.2.3.1 System and Loads

Horizontal loads:

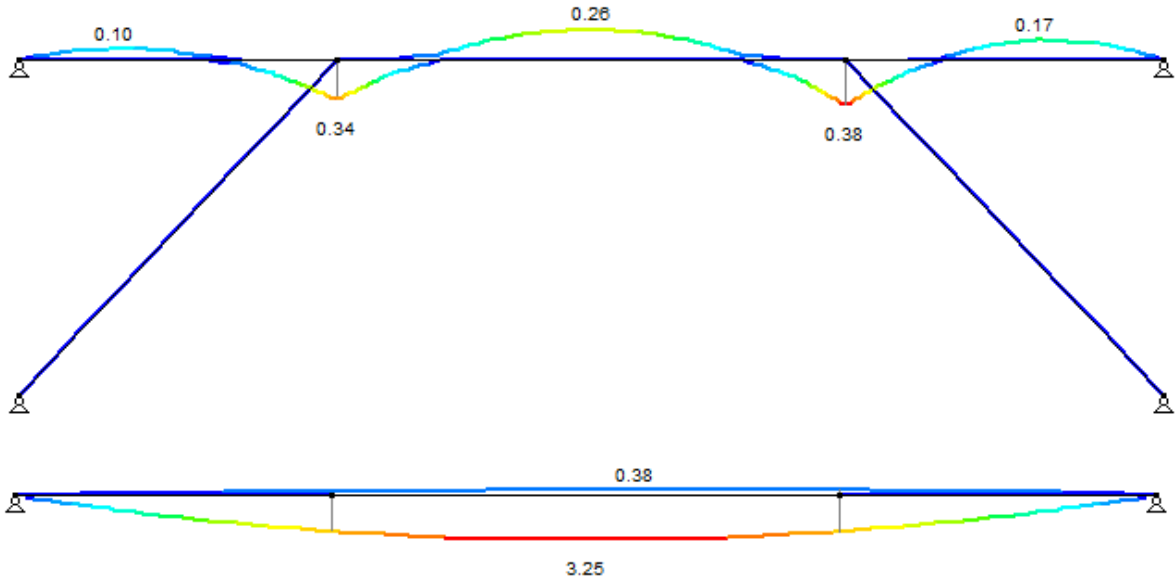


Vertical loads:

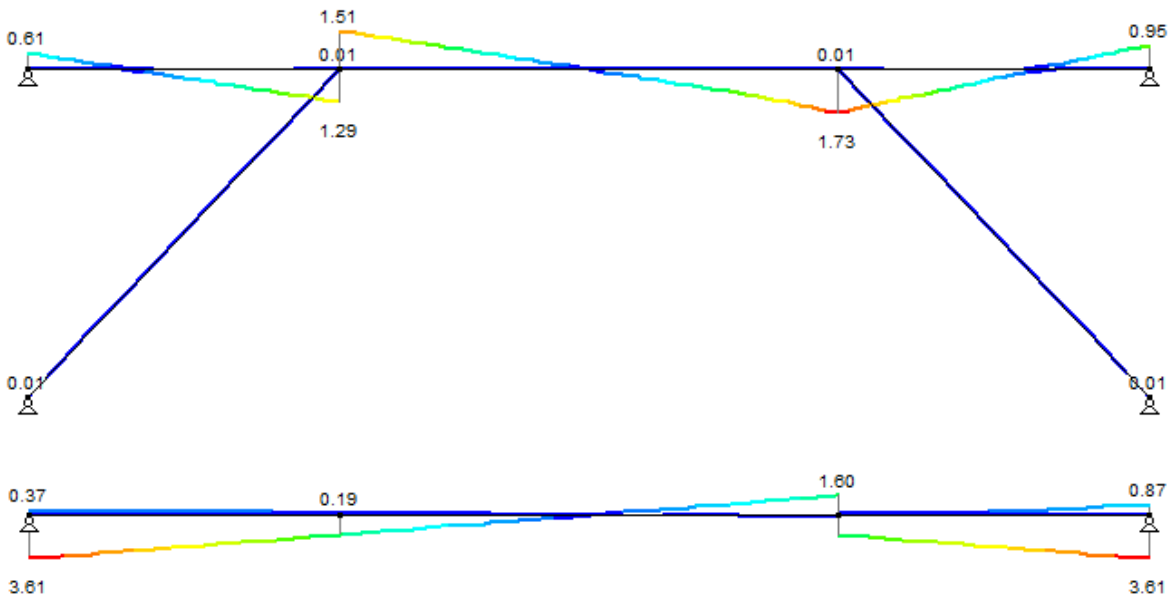


#### 5.8.3.2.3.2 Results

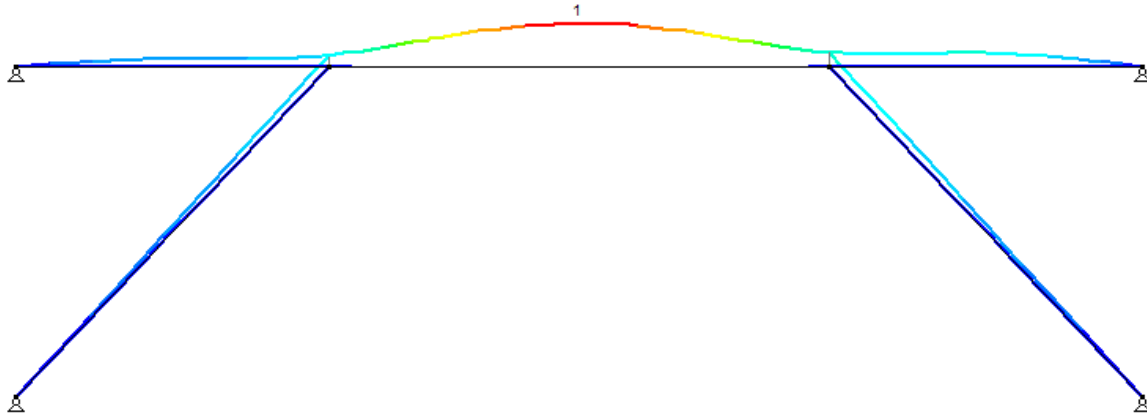
Bending moments [kNm]



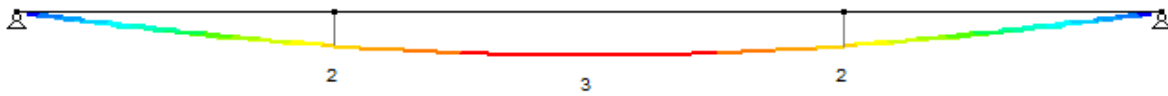
Shear forces [kN]



Horizontal deflections due to variable loads [mm] (=total deflection)

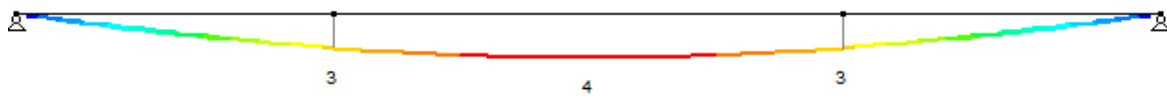


Vertical deflections due to variable loads [mm]



$$3 \text{ mm} < \frac{L}{500} = 8 \text{ mm} \quad \text{OK}$$

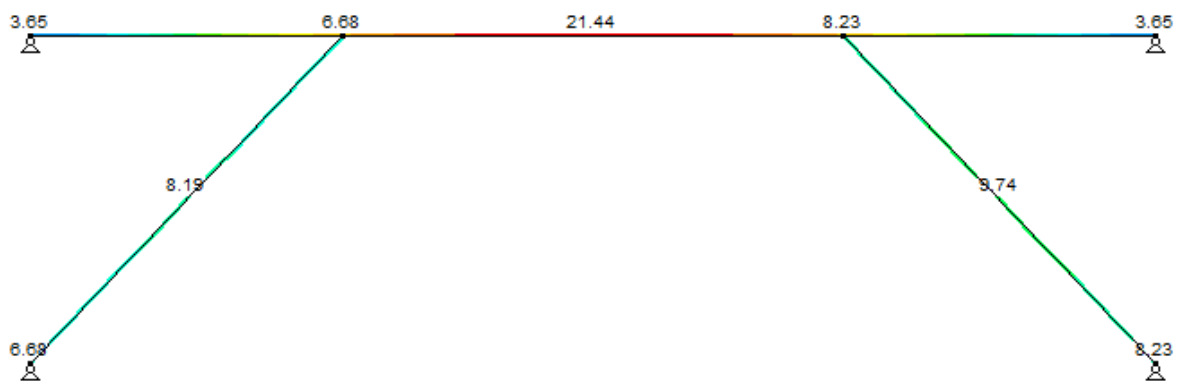
Total deflections [mm]



$$4 \text{ mm} < \frac{L}{300} = 13,3 \text{ mm} \quad \text{OK}$$

#### 5.8.3.2.3.3 Cross section resistance and buckling check

The cross-section resistance of the elements is checked:



The buckling resistance of the elements is checked:



The cross-section and buckling resistance is less critical than in south or north condition. Further details of this calculation are not required.

### 5.8.3.3 Critical element no. 3

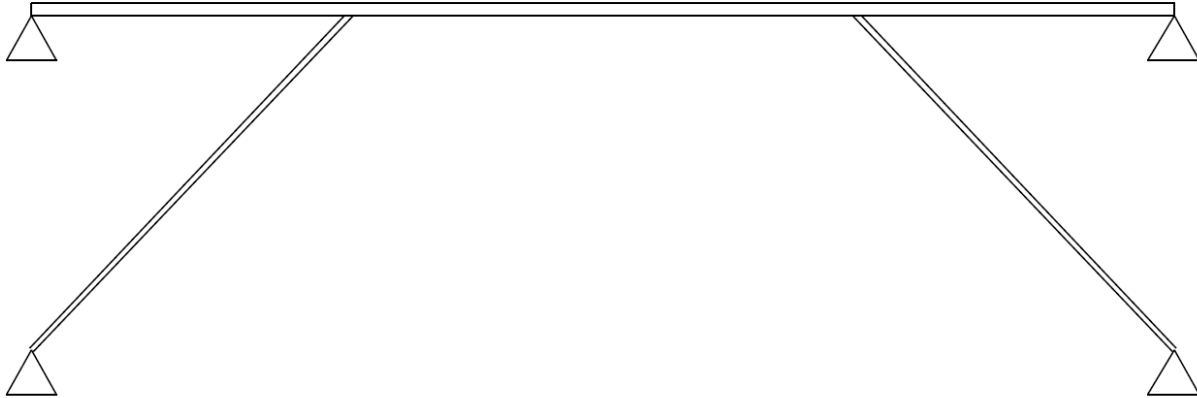
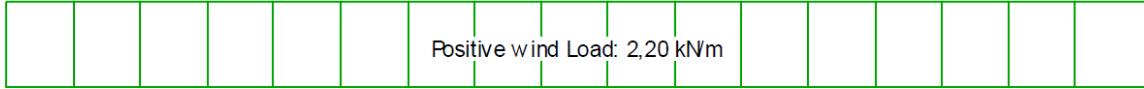
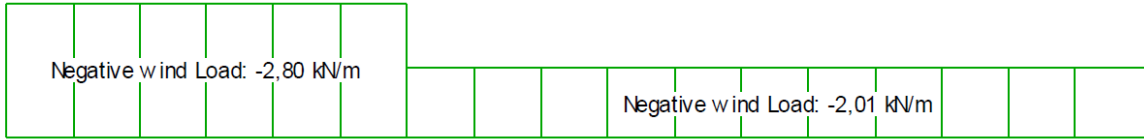
#### 5.8.3.3.1 System and Loads

The joist is lateral supported with diagonal bars to minimize the horizontal displacements. The diagonal bar is considered as hinged. We consider both the extreme positive and negative wind loads. The joist is loaded in vertical (floor load) and horizontal (wind load) direction. The results are given for both directions.

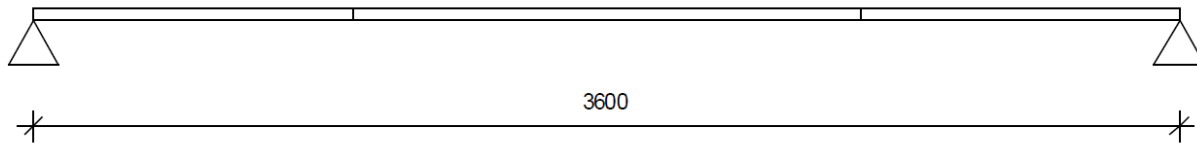
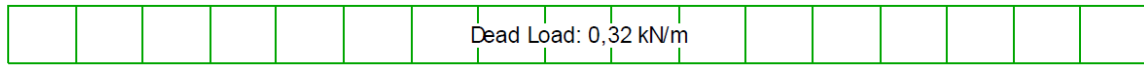
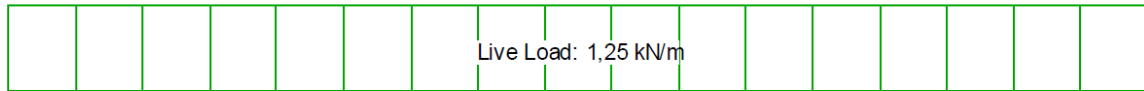
The reference width of this beam is 1,05 m for the vertical loads on the first floor. The reference width for the wind loads equals 2,34 m.

Horizontal loads: two possibilities of wind loads considered, wind pressure (south wind) and suction (east wind).



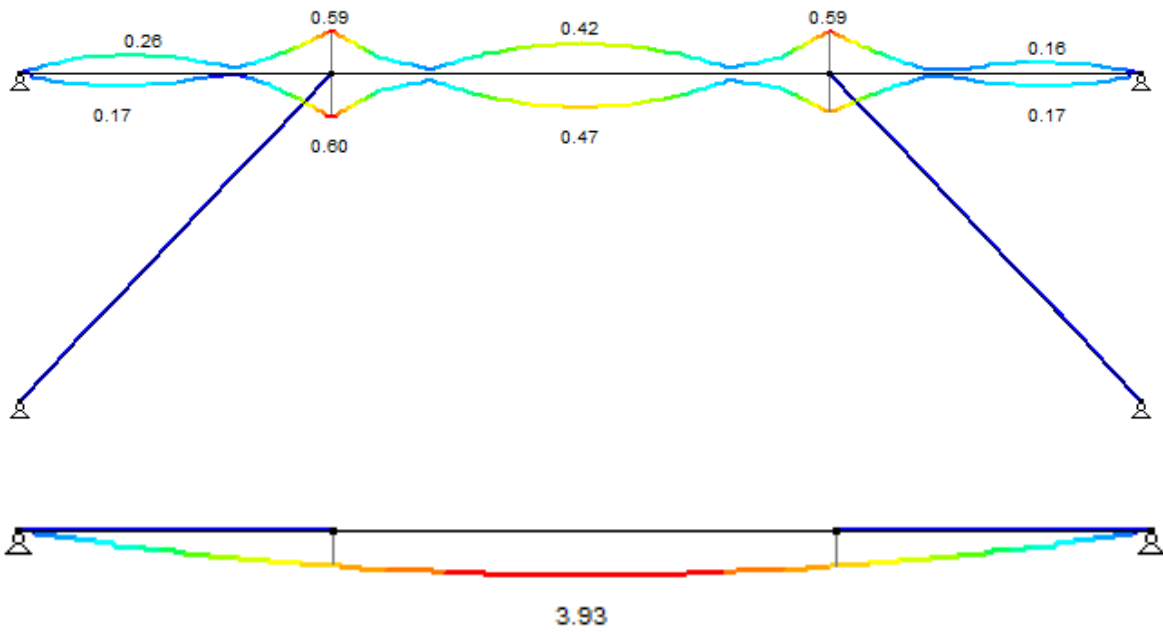


Vertical loads:

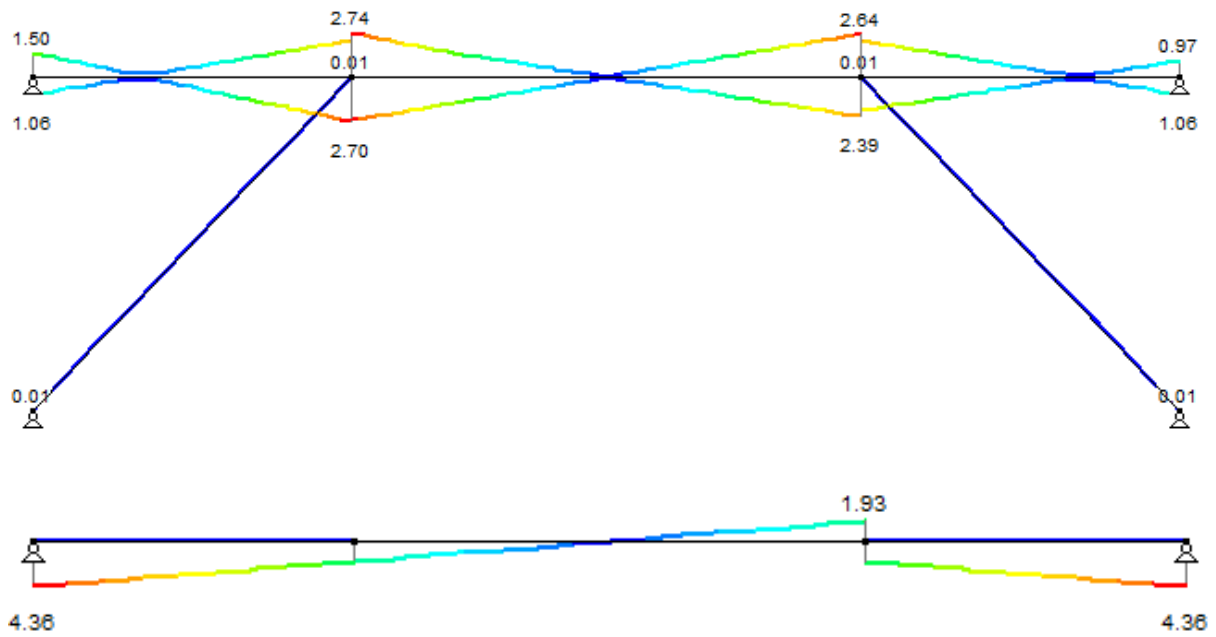


### 5.8.3.3.2 Results

Bending moments [kNm]



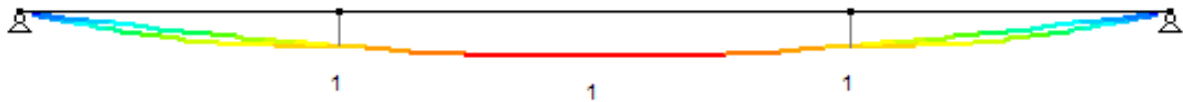
Shear forces [kN]



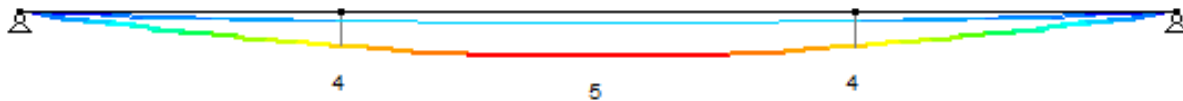
Horizontal deflections due to variable loads [mm] (=total deflection)



Vertical deflections due to variable loads [mm]



$$1 \text{ mm} < \frac{L}{500} = 8 \text{ mm} \quad \text{OK}$$



$$5 \text{ mm} < \frac{L}{400} = 9 \text{ mm} \quad \text{OK}$$

### 5.8.3.3.3 Cross-section resistance and buckling check

The cross-section resistance of the elements is checked:



The buckling resistance of the elements is checked:



The most critical elements to buckling are the diagonal bracers. Details of the cross section and buckling resistance for this element is given:

Results - Cross-section resistance check EC3 bar 1

cross-section : @S@-Diagonaal      orientation : 90.00 °       $f_y$  : 355.00 N/mm<sup>2</sup>

tensile force	12.97 %	
compressive force	11.62 %	
moment My'	0.00 %	
moment Mz'	1.51 %	
shear force Vz'	0.00 %	
shear force Vy'	0.09 %	
moment My' + shear force Vz'	0.00 %	
moment Mz' + shear force Vy'	0.00 %	
☐ <b>moment My' and Mz' + normal force</b>	<b>14.48 %</b>	
moment My' and Mz' + shear force Vz' and Vy' + normal force	0.00 %	

**detail design check : tensile force**

maximum at node 3  
 for combination ULS FC 26  
 N = 7.51 kN  
 A = 1.80 cm<sup>2</sup>  
 Npl.Rd = 57.93 kN

**detail design check : compressive force**

maximum at node 4  
 for combination ULS FC 48  
 N = 6.73 kN  
 section class : 3  
 A = 1.80 cm<sup>2</sup>  
 Npl.Rd = 57.93 kN

**detail design check : moment My'**

bar is not subjected to bending My'

**detail design check : moment  $Mz'$** 

distance from node 3 : 72 cm

for combination ULS FC 47

 $Mz = 0.00$  kNm

section class : 3

 $W_{elz} = 1.0$  cm<sup>3</sup> $M_{elz.Rd} = 0.32$  kNm**detail design check : shear force  $Vz'$** bar is not subjected to shear force  $Vz'$ **detail design check : shear force  $Vy'$** 

maximum at node 4

for combination ULS FC 49

 $Vy = 0.01$  kN $A_{vy} = 0.80$  cm<sup>2</sup> $V_{y.Rd} = 14.88$  kN**detail design check : moment  $My'$  + shear force  $Vz'$** contribution of shear force  $Vz'$  is negligible**detail design check : moment  $Mz'$  + shear force  $Vy'$** contribution of shear force  $Vy'$  is negligible**detail design check : moment  $My'$  and  $Mz'$  + normal force**

distance from node 3 : 72 cm

for combination ULS FC 35

 $N = 7.51$  kN (tension),  $My = 0.00$  kNm,  $Mz = 0.00$  kNm

section class Y : 3, section class Z : 3

 $A = 1.80$  cm<sup>2</sup>,  $W_{ely} = 1.9$  cm<sup>3</sup>,  $W_{elz} = 1.0$  cm<sup>3</sup> $N_{pl.Rd} = 57.93$  kN,  $M_{ely.Rd} = 0.61$  kNm,  $M_{elz.Rd} = 0.32$  kNm**detail design check : moment  $My'$  and  $Mz'$  + shear force  $Vz'$  and  $Vy'$  + normal force**

contribution of shear force is negligible

**detail design check : torsion**

bar is not subjected to torsion

## Results - Buckling check EC3 bar 1

cross-section : @S@-Diagonaal      length: 145 cm      orientation : 90.00 °       $f_y : 355.00$  N/mm<sup>2</sup>

buckling length in-plane = 145 cm      buckling length out-of-plane = 145 cm

Lat. torsional buckl. length( $z' > 0$ ) : 145      ( $k = 1.00$ ,  $k_w = 1.00$ )Lat. torsional buckl. length( $z' < 0$ ) : 145      ( $k = 1.00$ ,  $k_w = 1.00$ )normal force, buckling in  $y'$ -plane      33.06 %normal force, buckling in  $z'$ -plane      64.12 %

lateral torsional buckling 0.00 %  
▣ **normal force and moment, buckling** 66.39 %  
normal force and moment, lateral torsional buckling 66.39 %

**detail design check : normal force, buckling in y'-plane**

maximum at node 4  
for combination ULS FC 48  
N = 6.73 kN  
section class : 3  
A = 1.80 cm<sup>2</sup>  
alfa = 0.49, lambdaS = 1.39, chi = 0.35  
Nb.Rd = 20.37 kN

**detail design check : normal force, buckling in z'-plane**

maximum at node 4  
for combination ULS FC 48  
N = 6.73 kN  
section class : 3  
A = 1.80 cm<sup>2</sup>  
alfa = 0.49, lambdaS = 2.09, chi = 0.18  
Nb.Rd = 10.50 kN

**detail design check : lateral torsional buckling**

no risk for lateral torsional buckling  
lambdaLTS <= 0.40

**detail design check : normal force and moment, buckling**

distance from node 3 : 72 cm  
for combination ULS FC 47  
N = 6.73 kN (compression), My = 0.00 kNm, Mz = 0.00 kNm  
section class Y : 3, section class Z : 3  
A = 1.80 cm<sup>2</sup>, Wely = 1.9 cm<sup>3</sup>, Welz = 1.0 cm<sup>3</sup>  
alfaY = 0.49, alfaZ = 0.49, lambdaSY = 1.39, lambdaSZ = 2.09, chiY = 0.35, chiZ = 0.18  
muy = -2.51, ky = 1.50, muz = -3.77, kz = 1.50  
Npl.Rd = 10.50 kN, Mely.rd = 0.61 kNm, Melz.rd = 0.32 kNm

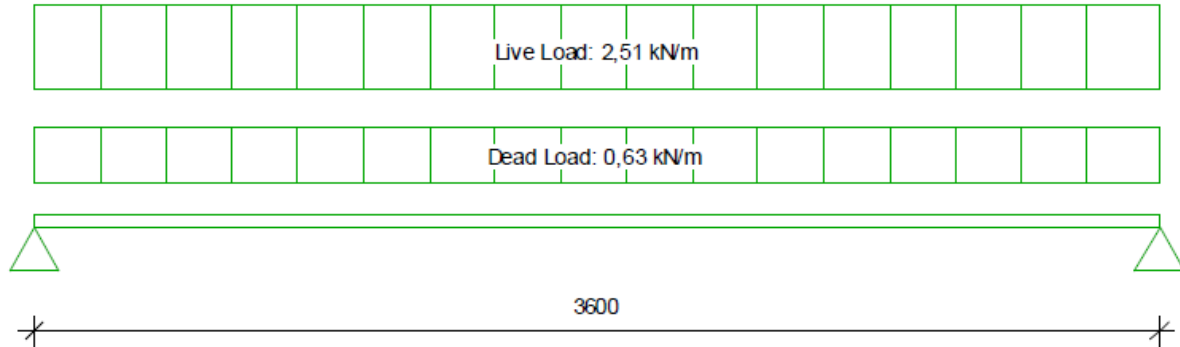
**detail design check : normal force and moment, lateral torsional buckling**

distance from node 3 : 72 cm  
for combination ULS FC 47  
N = 6.73 kN (compression), My = 0.00 kNm, Mz = 0.00 kNm  
section class Y : 3, section class Z : 3  
A = 1.80 cm<sup>2</sup>, Wely = 1.9 cm<sup>3</sup>, Welz = 1.0 cm<sup>3</sup>  
C1 = 1.13, Mcr = 0.91 kNm, lambdaLTS = 0.86, sigmaLT = 0.21  
alfaY = 0.49, alfaZ = 0.49, lambdaSY = 1.39, lambdaSZ = 2.09, chiLT = 0.76, chiZ = 0.18  
kLT = 1.00, muz = -3.77, kz = 1.50  
Npl.Rd = 10.50 kN, Mely.rd = 0.47 kNm, Melz.rd = 0.32 kNm

### 5.8.3.4 Critical element no. 4

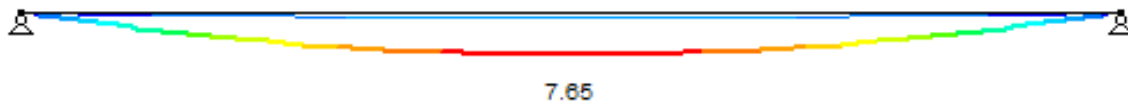
#### 5.8.3.4.1 System and Loads

The reference width of this beam is 1,05 m. The corresponding line loads on this beam are:



#### 5.8.3.4.2 Results

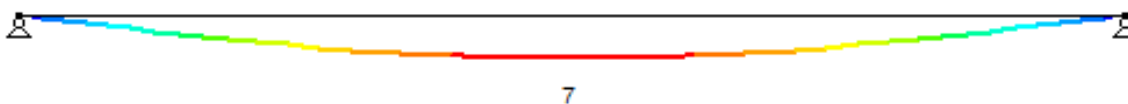
Bending moments [kNm]



Shear forces [kN]

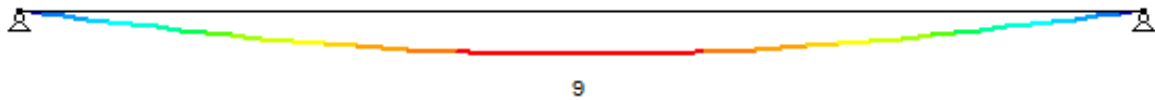


Deflection due to variable loads [mm]



$$7 \text{ mm} < \frac{L}{500} = 7,2 \text{ mm} \quad \text{More detailed calculations recommended}$$

Total deflection [mm]:



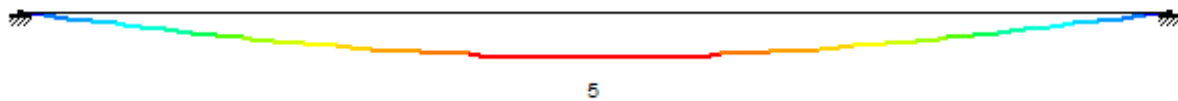
$$9 \text{ mm} < \frac{L}{400} = 9 \text{ mm} \quad \text{More detailed calculations recommended}$$

To make sure that the vertical deflections should not exceed the limits more detailed calculations are made using the type of connection to the PLU16 uprights. The connection can be modeled as an elastic hinge, specified by the manufacturer  $K_m$  is equal to:

$$K_m = 166,32 \text{ kNm/rad}$$

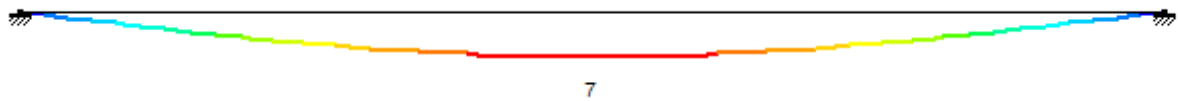
Using this value the deflections are:

Deflection due to variable loads [mm]



$$5 \text{ mm} < \frac{L}{500} = 7,2 \text{ mm} \quad \text{Ok}$$

Total deflection [mm]:



$$7 \text{ mm} < \frac{L}{400} = 9 \text{ mm} \quad \text{Ok}$$

#### 5.8.3.4.3 Cross-section resistance and buckling check

The detailed model was used to check the cross-section and buckling resistance.

#### Results - Cross-section resistance check EC3 bar 1

cross-section : @S@-PNB0436      orientation : 0.00 °       $f_y$  : 355.00 N/mm<sup>2</sup>

tensile force	0.00 %
compressive force	0.00 %
▣ <b>moment My'</b>	<b>41.19 %</b>
moment Mz'	0.00 %
shear force Vz'	8.59 %



shear force $V_{y'}$	0.00 %	
moment $M_{y'}$ + shear force $V_{z'}$	0.00 %	
moment $M_{z'}$ + shear force $V_{y'}$	0.00 %	
moment $M_{y'}$ and $M_{z'}$ + normal force	41.19 %	
moment $M_{y'}$ and $M_{z'}$ + shear force $V_{z'}$ and $V_{y'}$ + normal force		0.00 %

**detail design check : tensile force**

bar is not subjected to tension

**detail design check : compressive force**

bar is not subjected to compression

**detail design check : moment  $M_{y'}$**

distance from node 1 : 180 cm

for combination ULS FC 1

$M_y = 6.25$  kNm

section class : 3

$W_{ely} = 47.0$  cm<sup>3</sup>

$M_{y,Rd} = 15.17$  kNm

**detail design check : moment  $M_{z'}$**

bar is not subjected to bending  $M_{z'}$

**detail design check : shear force  $V_{z'}$**

maximum at node 1

for combination ULS FC 1

$V_z = 8.50$  kN

$A_{vz} = 5.31$  cm<sup>2</sup>

$V_{z,Rd} = 98.94$  kN

**detail design check : shear force  $V_{y'}$**

bar is not subjected to shear force  $V_{y'}$

**detail design check : moment  $M_{y'}$  + shear force  $V_{z'}$**

contribution of shear force  $V_{z'}$  is negligible

**detail design check : moment  $M_{z'}$  + shear force  $V_{y'}$**

contribution of shear force  $V_{y'}$  is negligible

**detail design check : moment  $M_{y'}$  and  $M_{z'}$  + normal force**

distance from node 1 : 180 cm

for combination ULS FC 1

$N = 0.00$  kN (tension),  $M_y = 6.25$  kNm,  $M_z = 0.00$  kNm

section class Y : 3, section class Z : 3

$A = 10.45$  cm<sup>2</sup>,  $W_{ely} = 47.0$  cm<sup>3</sup>,  $W_{elz} = 17.5$  cm<sup>3</sup>

$N_{pl,Rd} = 337.25$  kN,  $M_{y,Rd} = 15.17$  kNm,  $M_{z,Rd} = 5.65$  kNm

**detail design check : moment  $M_{y'}$  and  $M_{z'}$  + shear force  $V_{z'}$  and  $V_{y'}$  + normal force**

contribution of shear force is negligible

**detail design check : torsion**

bar is not subjected to torsion

Results - Buckling check EC3 bar 1
------------------------------------

cross-section : @S@-PNB0436      length: 360 cm      orientation : 0.00 °       $f_y : 355.00 \text{ N/mm}^2$   
buckling length in-plane = 360 cm      buckling length out-of-plane = 360 cm  
Lat. torsional buckl. length( $z' > 0$ ) : 180      ( $k = 0.50, k_w = 1.00$ )  
Lat. torsional buckl. length( $z' < 0$ ) : 360      ( $k = 0.50, k_w = 1.00$ )

normal force, buckling in $y'$ -plane	0.00 %
normal force, buckling in $z'$ -plane	0.00 %
<b>lateral torsional buckling</b>	<b>87.99 %</b>
normal force and moment, buckling	0.00 %
normal force and moment, lateral torsional buckling	0.00 %

**detail design check : normal force, buckling in  $y'$ -plane**

bar is not subjected to compression

**detail design check : normal force, buckling in  $z'$ -plane**

bar is not subjected to compression

**detail design check : lateral torsional buckling**

distance from node 1 : 180 cm  
for combination ULS FC 1  
 $M_y = 6.25 \text{ kNm}$   
section class : 3  
 $W_{ely} = 47.0 \text{ cm}^3$   
 $C_1 = 0.71, M_{cr} = 13.05 \text{ kNm}$   
 $\lambda_{bLT} = 1.13, \sigma_{LT} = 0.49, \chi_{LT} = 0.47$   
 $M_{b,Rd} = 7.10 \text{ kNm}$

**detail design check : normal force and moment, buckling**

bar is not subjected to compression nor bending

**detail design check : normal force and moment, lateral torsional buckling**

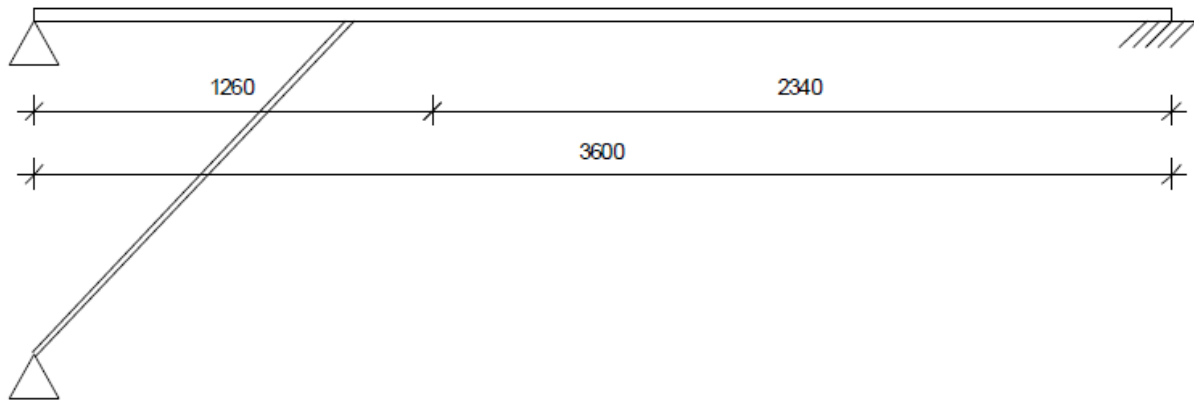
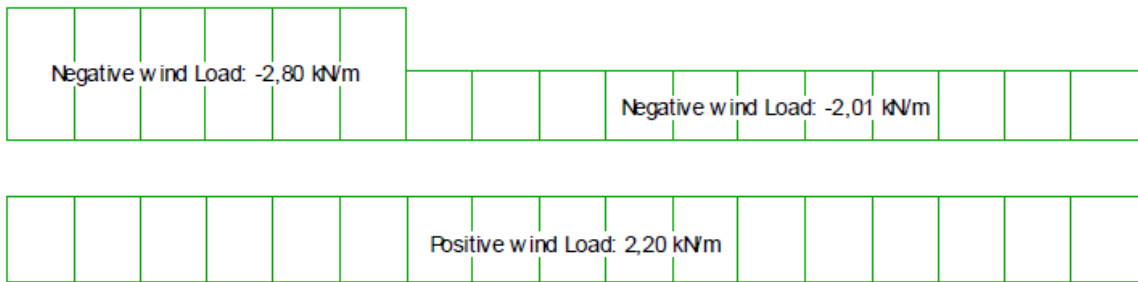
no risk for lateral torsional buckling  
 $\lambda_{bLT} \leq 0.40$

**5.8.3.5 Critical element no. 5**

This joists is not braced on both sides because were the second bar would be there is a stairway placed. If we don't take additional measures the joists horizontal displacements would be unacceptably high. Therefore we make sure that the stairway is rigid and connected at the top to the joist, so we can assume that on that side the joist is clamped.

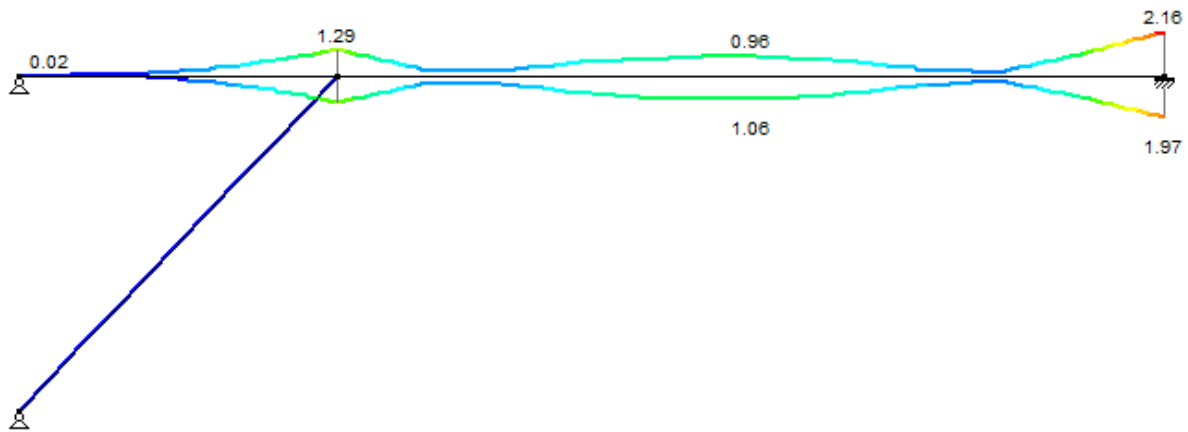
The reference width for the wind loads is 2,34 m. There are no vertical loads on this joist.

### 5.8.3.5.1 System and Loads

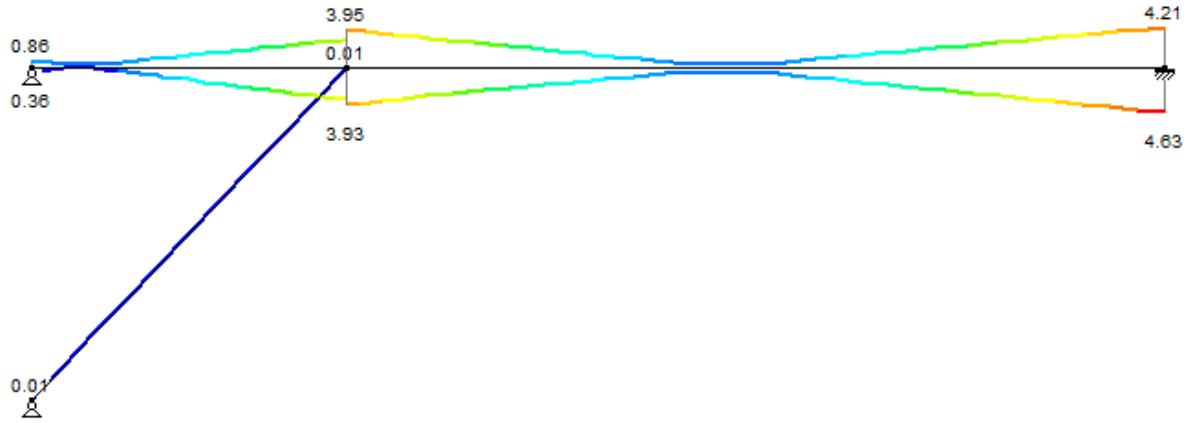


### 5.8.3.5.2 Results

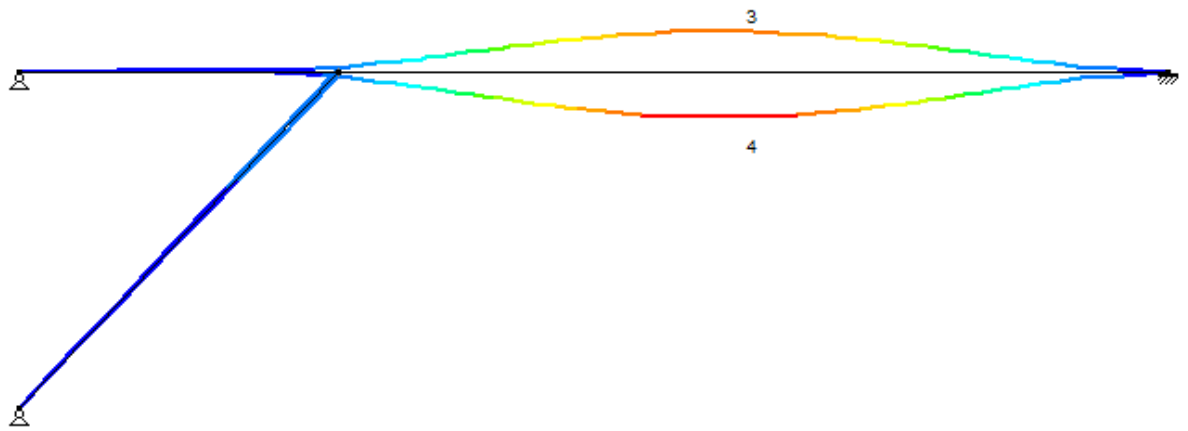
Bending moments [kNm]



Shear forces [kN]

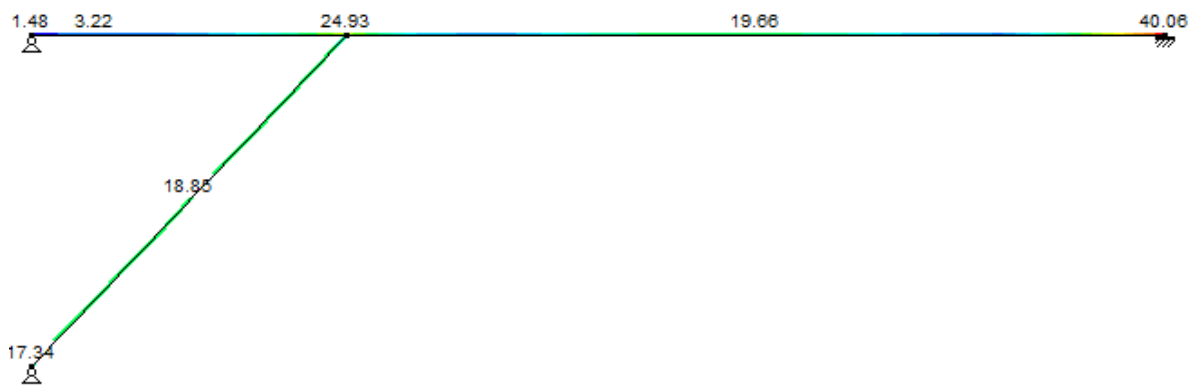


Deflection due to variable loads [mm] (= total deflection)

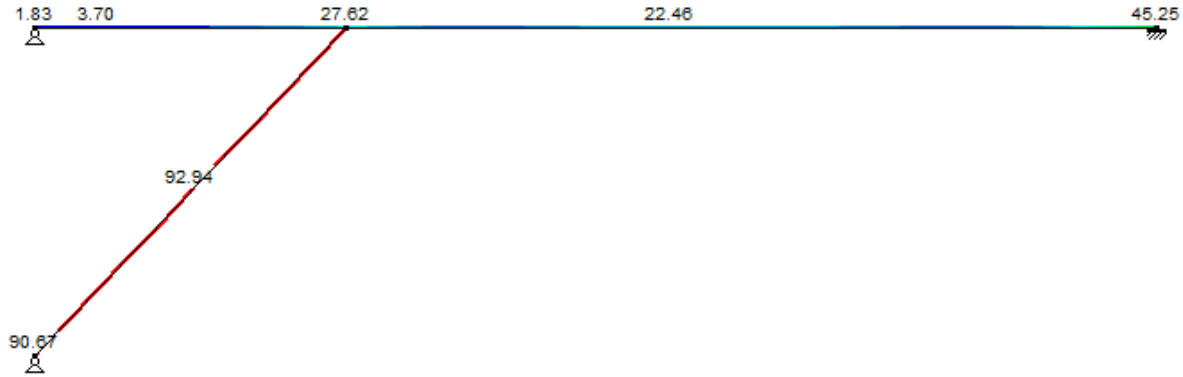


### 5.8.3.5.3 Cross-section resistance and buckling check

The cross-section resistance of the elements is checked:



The buckling resistance of the elements is checked:



The most critical element to buckling is the diagonal bracer. Details of the cross section and buckling resistance for this element is given:

Results - Cross-section resistance check EC3 bar 1

cross-section : @S@-Diagonaal      orientation : 90.00 °       $f_y : 355.00 \text{ N/mm}^2$

tensile force	17.34 %	
compressive force	16.44 %	
moment $M_{y'}$	0.00 %	
moment $M_{z'}$	1.51 %	
shear force $V_{z'}$	0.00 %	
shear force $V_{y'}$	0.09 %	
moment $M_{y'}$ + shear force $V_{z'}$	0.00 %	
moment $M_{z'}$ + shear force $V_{y'}$	0.00 %	
▣ <b>moment <math>M_{y'}</math> and <math>M_{z'}</math> + normal force</b>	<b>18.85 %</b>	
moment $M_{y'}$ and $M_{z'}$ + shear force $V_{z'}$ and $V_{y'}$ + normal force		0.00 %

**detail design check : tensile force**

maximum at node 3  
 for combination ULS FC 7  
 $N = 10.05 \text{ kN}$   
 $A = 1.80 \text{ cm}^2$   
 $N_{pl.Rd} = 57.93 \text{ kN}$

**detail design check : compressive force**

maximum at node 3  
 for combination ULS FC 9  
 $N = 9.52 \text{ kN}$   
 section class : 3  
 $A = 1.80 \text{ cm}^2$   
 $N_{pl.Rd} = 57.93 \text{ kN}$

**detail design check : moment  $M_{y'}$**

bar is not subjected to bending  $M_{y'}$

**detail design check : moment  $Mz'$**

distance from node 3 : 72 cm

for combination ULS FC 1

$Mz = 0.00$  kNm

section class : 3

$W_{elz} = 1.0$  cm<sup>3</sup>

$M_{elz.Rd} = 0.32$  kNm

**detail design check : shear force  $Vz'$**

bar is not subjected to shear force  $Vz'$

**detail design check : shear force  $Vy'$**

maximum at node 4

for combination ULS FC 9

$Vy = 0.01$  kN

$A_{vy} = 0.80$  cm<sup>2</sup>

$Vy.Rd = 14.88$  kN

**detail design check : moment  $My'$  + shear force  $Vz'$**

contribution of shear force  $Vz'$  is negligible

**detail design check : moment  $Mz'$  + shear force  $Vy'$**

contribution of shear force  $Vy'$  is negligible

**detail design check : moment  $My'$  and  $Mz'$  + normal force**

distance from node 3 : 72 cm

for combination ULS FC 7

$N = 10.05$  kN (tension),  $My = 0.00$  kNm,  $Mz = 0.00$  kNm

section class Y : 3, section class Z : 3

$A = 1.80$  cm<sup>2</sup>,  $W_{ely} = 1.9$  cm<sup>3</sup>,  $W_{elz} = 1.0$  cm<sup>3</sup>

$N_{pl.Rd} = 57.93$  kN,  $M_{ely.Rd} = 0.61$  kNm,  $M_{elz.Rd} = 0.32$  kNm

**detail design check : moment  $My'$  and  $Mz'$  + shear force  $Vz'$  and  $Vy'$  + normal force**

contribution of shear force is negligible

**detail design check : torsion**

bar is not subjected to torsion

Results - Buckling check EC3 bar 1

cross-section : @S@-Diagonaal      length: 145 cm      orientation : 90.00 °       $f_y : 355.00$  N/mm<sup>2</sup>

buckling length in-plane = 145 cm      buckling length out-of-plane = 145 cm

Lat. torsional buckl. length( $z' > 0$ ) : 145      ( $k = 1.00$ ,  $k_w = 1.00$ )

Lat. torsional buckl. length( $z' < 0$ ) : 145      ( $k = 1.00$ ,  $k_w = 1.00$ )

normal force, buckling in  $y'$ -plane      46.74 %

normal force, buckling in z'-plane	90.67 %
lateral torsional buckling	0.00 %
<b>▣ normal force and moment, buckling</b>	<b>92.94 %</b>
normal force and moment, lateral torsional buckling	92.94 %

**detail design check : normal force, buckling in y'-plane**

maximum at node 4  
for combination ULS FC 10  
N = 9.52 kN  
section class : 3  
A = 1.80 cm<sup>2</sup>  
alfa = 0.49, lambdaS = 1.39, chi = 0.35  
Nb.Rd = 20.37 kN

**detail design check : normal force, buckling in z'-plane**

maximum at node 4  
for combination ULS FC 10  
N = 9.52 kN  
section class : 3  
A = 1.80 cm<sup>2</sup>  
alfa = 0.49, lambdaS = 2.09, chi = 0.18  
Nb.Rd = 10.50 kN

**detail design check : lateral torsional buckling**

no risk for lateral torsional buckling  
lambdaLTS <= 0.40

**detail design check : normal force and moment, buckling**

distance from node 3 : 72 cm  
for combination ULS FC 9  
N = 9.52 kN (compression), My = 0.00 kNm, Mz = 0.00 kNm  
section class Y : 3, section class Z : 3  
A = 1.80 cm<sup>2</sup>, Wely = 1.9 cm<sup>3</sup>, Welz = 1.0 cm<sup>3</sup>  
alfaY = 0.49, alfaZ = 0.49, lambdaSY = 1.39, lambdaSZ = 2.09, chiY = 0.35, chiZ = 0.18  
muy = -2.51, ky = 1.50, muz = -3.77, kz = 1.50  
Npl.Rd = 10.50 kN, Mely.rd = 0.61 kNm, Melz.rd = 0.32 kNm

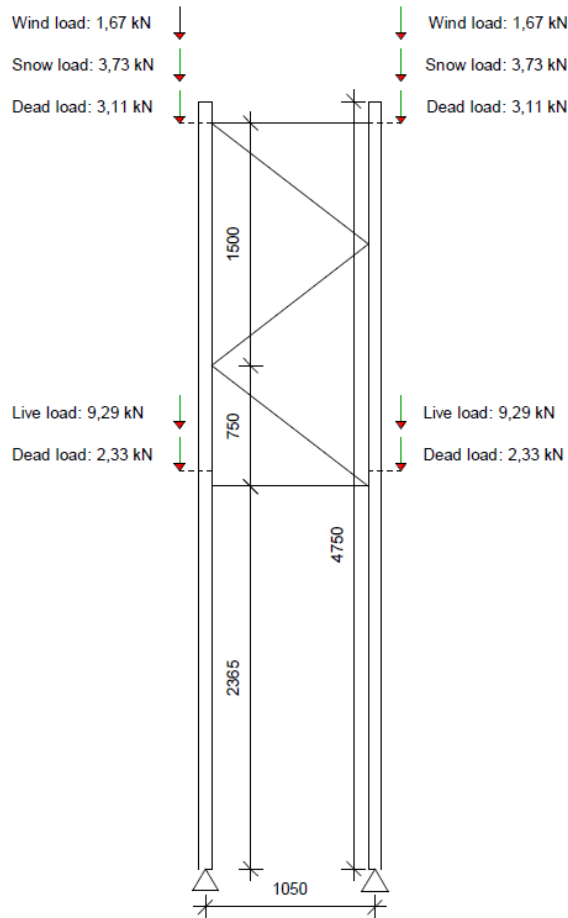
**detail design check : normal force and moment, lateral torsional buckling**

distance from node 3 : 72 cm  
for combination ULS FC 9  
N = 9.52 kN (compression), My = 0.00 kNm, Mz = 0.00 kNm  
section class Y : 3, section class Z : 3  
A = 1.80 cm<sup>2</sup>, Wely = 1.9 cm<sup>3</sup>, Welz = 1.0 cm<sup>3</sup>  
C1 = 1.13, Mcr = 0.91 kNm, lambdaLTS = 0.86, sigmaLT = 0.21  
alfaY = 0.49, alfaZ = 0.49, lambdaSY = 1.39, lambdaSZ = 2.09, chiLT = 0.76, chiZ = 0.18  
kLT = 1.00, muz = -3.77, kz = 1.50  
Npl.Rd = 10.50 kN, Mely.rd = 0.47 kNm, Melz.rd = 0.32 kNm

### 5.8.3.6 Critical element no. 6

This PLU frame is braced only at the upper half of the frame. The loads are applied as point loads where the joists are fastened to the frame. At this connections no lateral movements of the frame are allowed. The effective area for one upright for vertical loads is  $1,05 \times 3,70 \text{m} = 3,89 \text{m}^2$ .

#### 5.8.3.6.1 System and Loads

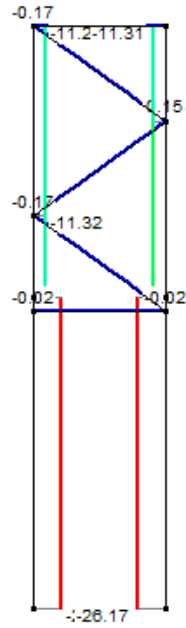


#### 5.8.3.6.2 Results

The bending moments, shear forces and deflections of this element are negligible. The uprights are mainly subjected to axial compression.

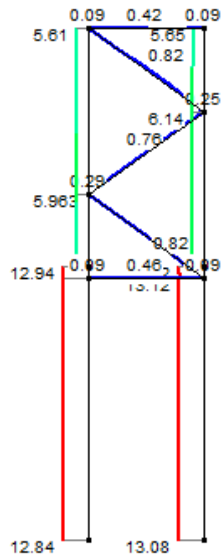
The normal forces are [kN]:





### 5.8.3.6.3 Cross-section resistance and buckling check

The buckling resistance of the elements is checked:	The cross-section resistance of the elements is checked:
---	--



For an upright details of the cross-section and buckling resistance is given:

Results - Cross-section resistance check EC3 bar 2
--

cross-section : @S@-Kolom 100 STOW orientation : 0.00 ° fy : 355.00 N/mm<sup>2</sup>

tensile force	0.00 %	
compressive force	13.08 %	
moment $M_{y'}$	0.13 %	
moment $M_{z'}$	0.00 %	
shear force $V_{z'}$	0.00 %	
shear force $V_{y'}$	0.00 %	
moment $M_{y'}$ + shear force $V_{z'}$	0.00 %	
moment $M_{z'}$ + shear force $V_{y'}$	0.00 %	
▣ <b>moment <math>M_{y'}</math> and <math>M_{z'}</math> + normal force</b>	<b>13.12 %</b>	
moment $M_{y'}$ and $M_{z'}$ + shear force $V_{z'}$ and $V_{y'}$ + normal force		0.00 %

**detail design check : tensile force**

bar is not subjected to tension

**detail design check : compressive force**

maximum at node 5

for combination ULS FC 8

$N = 26.17 \text{ kN}$

section class : 3

$A = 6.20 \text{ cm}^2$

$N_{pl.Rd} = 200.09 \text{ kN}$

**detail design check : moment  $M_{y'}$**

maximum at node 6

for combination ULS FC 9

$M_y = 0.00 \text{ kNm}$

section class : 3

$W_{ely} = 8.4 \text{ cm}^3$

$M_{ely.Rd} = 2.71 \text{ kNm}$

**detail design check : moment  $M_{z'}$**

bar is not subjected to bending  $M_{z'}$

**detail design check : shear force  $V_{z'}$**

bar is not subjected to shear force  $V_{z'}$

**detail design check : shear force  $V_{y'}$**

bar is not subjected to shear force  $V_{y'}$

**detail design check : moment  $M_{y'}$  + shear force  $V_{z'}$**

contribution of shear force  $V_{z'}$  is negligible

**detail design check : moment  $M_{z'}$  + shear force  $V_{y'}$**

contribution of shear force  $V_{y'}$  is negligible

**detail design check : moment  $M_{y'}$  and  $M_{z'}$  + normal force**

maximum at node 6

for combination ULS FC 8

N = 26.02 kN (compression), My = 0.00 kNm, Mz = 0.00 kNm  
 section class Y : 3, section class Z : 3  
 A = 6.20 cm<sup>2</sup>, Wely = 8.4 cm<sup>3</sup>, Welz = 18.5 cm<sup>3</sup>  
 Npl.Rd = 200.09 kN, Mely.rd = 2.71 kNm, Melz.rd = 5.97 kNm

**detail design check : moment My' and Mz' + shear force Vz' and Vy' + normal force**  
 contribution of shear force is negligible

**detail design check : torsion**  
 bar is not subjected to torsion

Results - Buckling check EC3 bar 2

cross-section : @S@-Kolom 100 STOW length: 236 cm orientation : 0.00 ° fy :  
 355.00 N/mm<sup>2</sup>  
 buckling length in-plane = 169 cm buckling length out-of-plane = 138 cm  
 Lat. torsional buckl. length(z'>0) : 236 (k = 1.00, kw = 1.00)  
 Lat. torsional buckl. length(z'<0) : 236 (k = 1.00, kw = 1.00)

▣ <b>normal force, buckling in y'-plane</b>	<b>24.37 %</b>
normal force, buckling in z'-plane	15.39 %
lateral torsional buckling	0.15 %
normal force and moment, buckling	24.36 %
normal force and moment, lateral torsional buckling	15.43 %

**detail design check : normal force, buckling in y'-plane**  
 maximum at node 5  
 for combination ULS FC 8  
 N = 26.17 kN  
 section class : 3  
 A = 6.20 cm<sup>2</sup>  
 alfa = 0.49, lambdaS = 1.01, chi = 0.54  
 Nb.Rd = 107.40 kN

**detail design check : normal force, buckling in z'-plane**  
 maximum at node 5  
 for combination ULS FC 8  
 N = 26.17 kN  
 section class : 3  
 A = 6.20 cm<sup>2</sup>  
 alfa = 0.49, lambdaS = 0.49, chi = 0.85  
 Nb.Rd = 169.99 kN

**detail design check : lateral torsional buckling**  
 maximum at node 6  
 for combination ULS FC 9  
 My = 0.00 kNm

section class : 3  
 $W_{ely} = 8.4 \text{ cm}^3$   
 $C1 = 1.13$ ,  $M_{cr} = 7.59 \text{ kNm}$   
 $\lambda_{bLTS} = 0.63$ ,  $\sigma_{LT} = 0.21$ ,  $\chi_{LT} = 0.88$   
 $M_{b,Rd} = 2.38 \text{ kNm}$

**detail design check : normal force and moment, buckling**

distance from node 5 : 24 cm  
 for combination ULS FC 8  
 $N = 26.15 \text{ kN}$  (compression),  $M_y = 0.00 \text{ kNm}$ ,  $M_z = 0.00 \text{ kNm}$   
 section class Y : 3, section class Z : 3  
 $A = 6.20 \text{ cm}^2$ ,  $W_{ely} = 8.4 \text{ cm}^3$ ,  $W_{elz} = 18.5 \text{ cm}^3$   
 $\alpha_Y = 0.49$ ,  $\alpha_Z = 0.49$ ,  $\lambda_{bSY} = 1.01$ ,  $\lambda_{bSZ} = 0.49$ ,  $\chi_Y = 0.54$ ,  $\chi_Z = 0.85$   
 $\mu_y = -0.40$ ,  $\mu_z = 1.09$ ,  $\mu_z = -0.88$ ,  $k_z = 1.12$   
 $N_{pl,Rd} = 107.40 \text{ kN}$ ,  $M_{ely,Rd} = 2.71 \text{ kNm}$ ,  $M_{elz,Rd} = 5.97 \text{ kNm}$

**detail design check : normal force and moment, lateral torsional buckling**

maximum at node 6  
 for combination ULS FC 8  
 $N = 26.02 \text{ kN}$  (compression),  $M_y = 0.00 \text{ kNm}$ ,  $M_z = 0.00 \text{ kNm}$   
 section class Y : 3, section class Z : 3  
 $A = 6.20 \text{ cm}^2$ ,  $W_{ely} = 8.4 \text{ cm}^3$ ,  $W_{elz} = 18.5 \text{ cm}^3$   
 $C1 = 1.13$ ,  $M_{cr} = 7.59 \text{ kNm}$ ,  $\lambda_{bLTS} = 0.63$ ,  $\sigma_{LT} = 0.21$   
 $\alpha_Y = 0.49$ ,  $\alpha_Z = 0.49$ ,  $\lambda_{bSY} = 1.01$ ,  $\lambda_{bSZ} = 0.49$ ,  $\chi_{LT} = 0.88$ ,  $\chi_Z = 0.85$   
 $k_{LT} = 1.00$ ,  $\mu_z = -0.88$ ,  $k_z = 1.12$   
 $N_{pl,Rd} = 107.40 \text{ kN}$ ,  $M_{ely,Rd} = 2.38 \text{ kNm}$ ,  $M_{elz,Rd} = 5.97 \text{ kNm}$

**5.8.4 Point load connections**

**5.8.4.1 Fastening of the vertical wind bracings**

The vertical wind bracings are bolted to joists PNB 0436/2. The maximal axial force in ULS equals (see part 13.3.3.2)

$$F_{v,Sd} = 28,68 \text{ kN}$$

If we use bolts M14 6.8 the shear resistance of the bolt is calculated:

$$F_{v,Rd} = \frac{0,6 f_{ub} A_s}{\gamma_{Mb}} = \frac{0,6 \cdot 600 \cdot 115}{1,25} = 33120 \text{ N} = 33,12 \text{ kN}$$

The expression for the resistance of bolts if  $F_{t,Sd} = 0$  (do not overtighten the bolt) equals

$$\frac{28,68}{33,12} = 0,87 \leq 1,0 \quad Ok$$

#### 5.8.4.2 Fastening of the horizontal wind bracings

The horizontal wind bracings are bolted to a clamp which is fastened to a joist PNB 0436/2. The maximal axial force equals (see part 13.3.3.1)

$$F_{v,Sd} = 5,48 \text{ kN}$$

If we use bolts M10 5.8 the shear resistance of the bolt is calculated:

$$F_{v,Rd} = \frac{0,6f_{ub}A_s}{\gamma_{Mb}} = \frac{0,6 \cdot 500 \cdot 58}{1,25} = 13920 \text{ N} = 13,92 \text{ kN}$$

The expression for the resistance of bolts if  $F_{t,Sd} = 0$  (do not overtighten the bolt) equals

$$\frac{5,48}{13,92} = 0,41 \leq 1,0 \quad \text{Ok}$$

#### 5.8.4.3 Fastening of the solar panels

In this design stage the solar panels are not yet specified, in a later version of the project manual the fastening of these panels will be determined.

### 5.9 Roof panels

The roof will consist of sandwich panels perpendicular to the direction of the STOW joists. A sandwich panel consist of stiff PU-insulation squeezed between two plywood panels. On the sides there are wooden stiffening beams. The sandwich panels will be fabricated by "Unilin".

### 5.10 Wall panels

The walls will consist of sandwich panels, a standard panel will be 1,05m wide and 2,37m height (two panels will be placed on top of each other). The panels support on the floor panels, for lateral stability they will be connected to the STOW frames PLU16 or joists PNB0436/2. These sandwich panels will be fabricated by "Unilin".

### 5.11 Ground floor panels

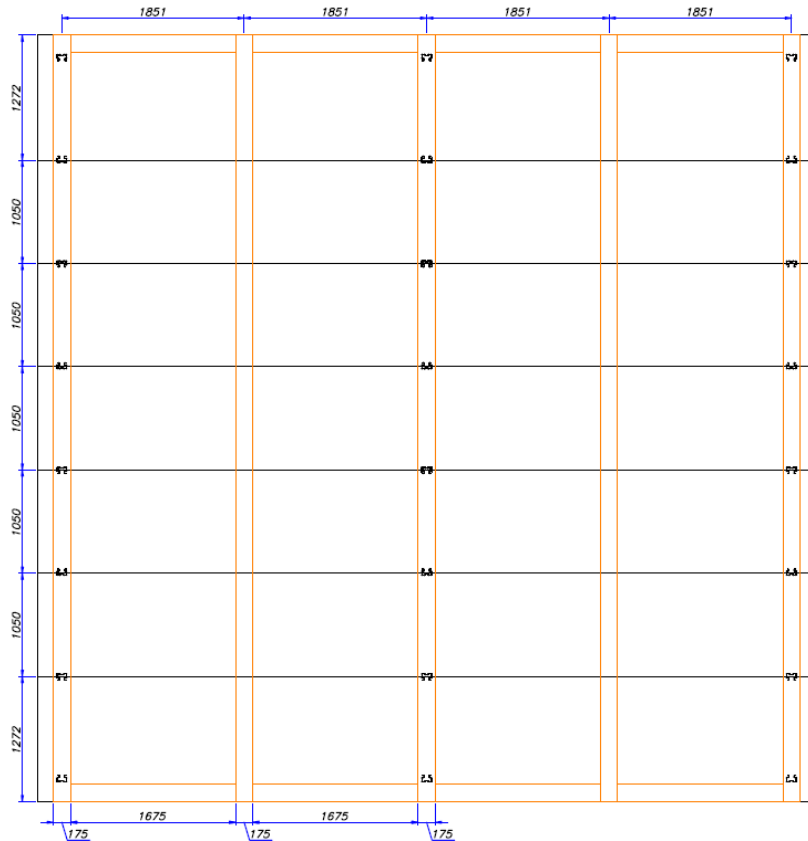
The floor sandwich panels are 1,05m wide and approximately 3,9m long. They and will be places in the same direction as the STOW joists PNB0436/2. It's likely that an intermediate support will be needed for the 3,60m span of one panel.

The Floor panels will support the whole structure above, local reinforcement of the panels directly underneath the STOW uprights may be required.

These sandwich panels will also be fabricated by "Unilin".

### 5.12 Foundations

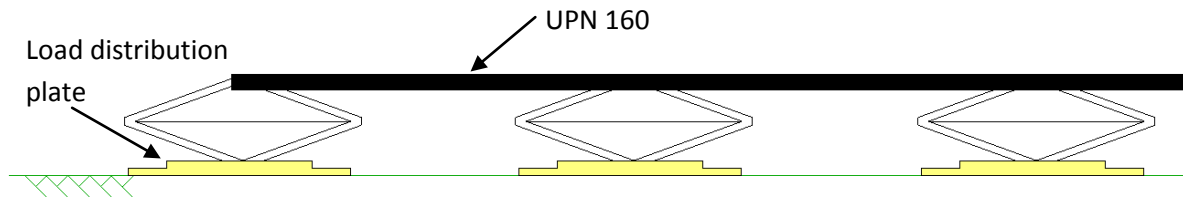
The whole STOW structure (including roof, wall and first floor panels) are placed on the ground floor panels. These panels are supported by steel UPN 160 beams as shown by the drawings below.



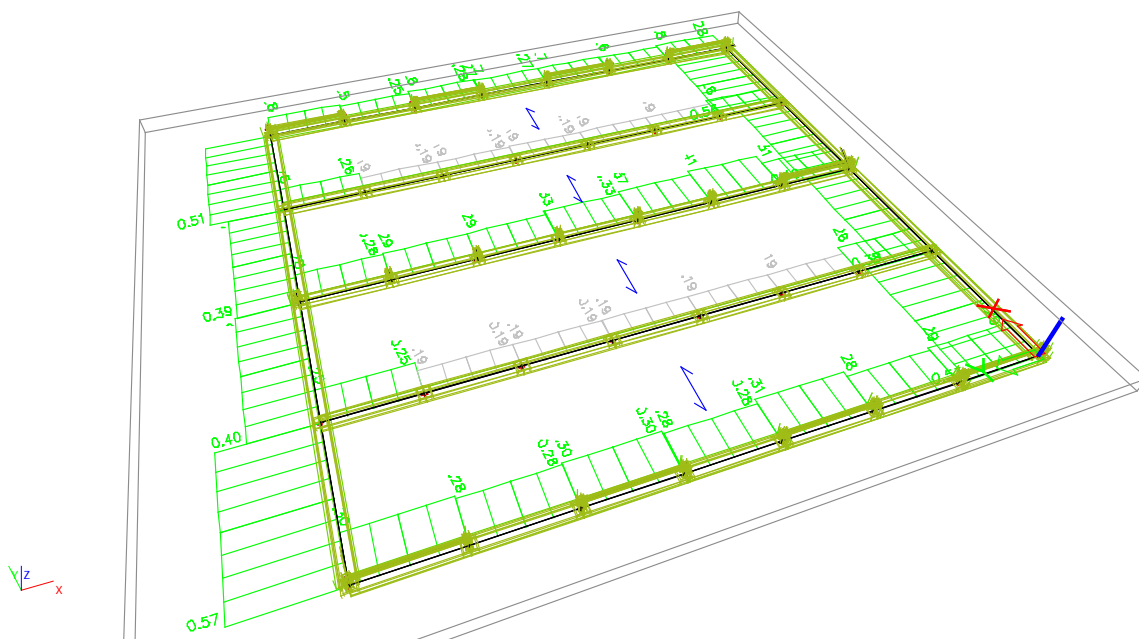
The UAP beams are supported by scissor jacks which can be adjusted to the desired height. The load bearing capacity of one jack is 3000 kg (6614 lb).



The top plate of each jack is bolted on two points to the UPN beams so that we can assume lateral stability in one direction. The bottom plates are bolted to the distribution plate, this connection provides lateral stability in the other direction.

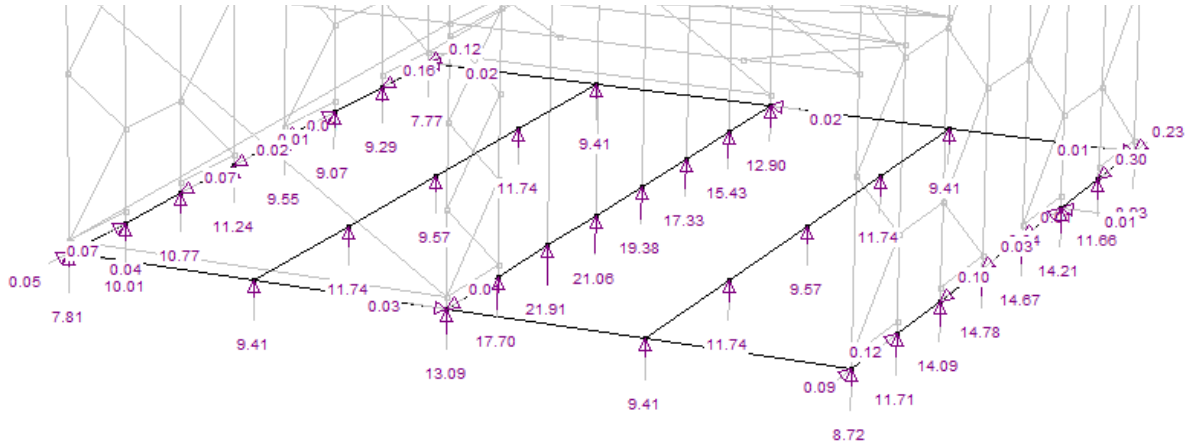


The jacks are placed directly under the STOW uprights. The results of the cross-section resistance of the UPN beams are given [0-1, failure above 1.00].



Detailed specifications of an UPN 160 cross-section are given in Annex C.

The loads on the ground floor panels may be adjusted due to the dead weight of technical installations, water tanks used as thermal mass, etc. Furthermore the dead weight of the sandwich panels is probably overestimated which is a save approach for structural calculations of elements. At this design stage we make an estimation, with the information available, of the maximum loads on the footings are [kN].

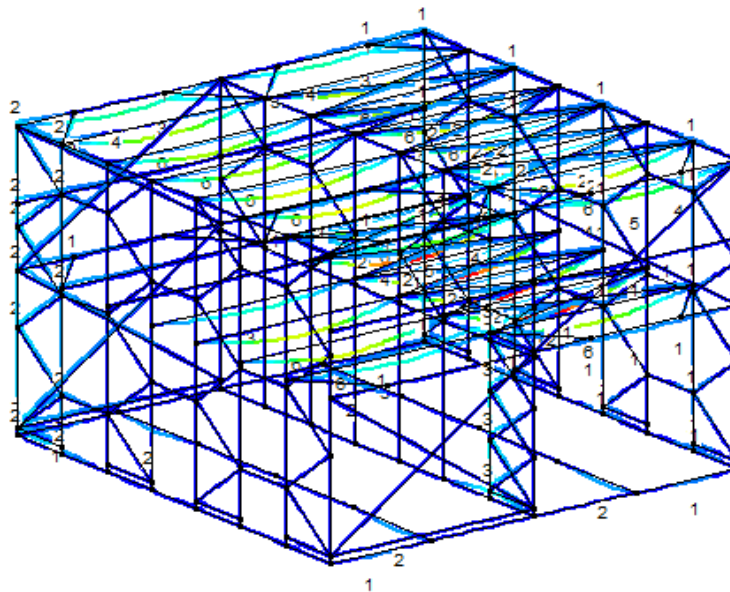


The dimensions of a load distribution plate are determined by the maximum load 21,91 kN. The maximum  $71,8 \text{ kN/m}^2$ . This gives us a minimum surface of  $0,30\text{m}^2$  for one footplate. For example stiff square footplates of  $0,6\text{m}$  by  $0,6\text{m}$  can be used to spread out the loads. Probably in future the size of the footplates can be reduced because of the conservative estimations made earlier.

## 5.13 Overall stability

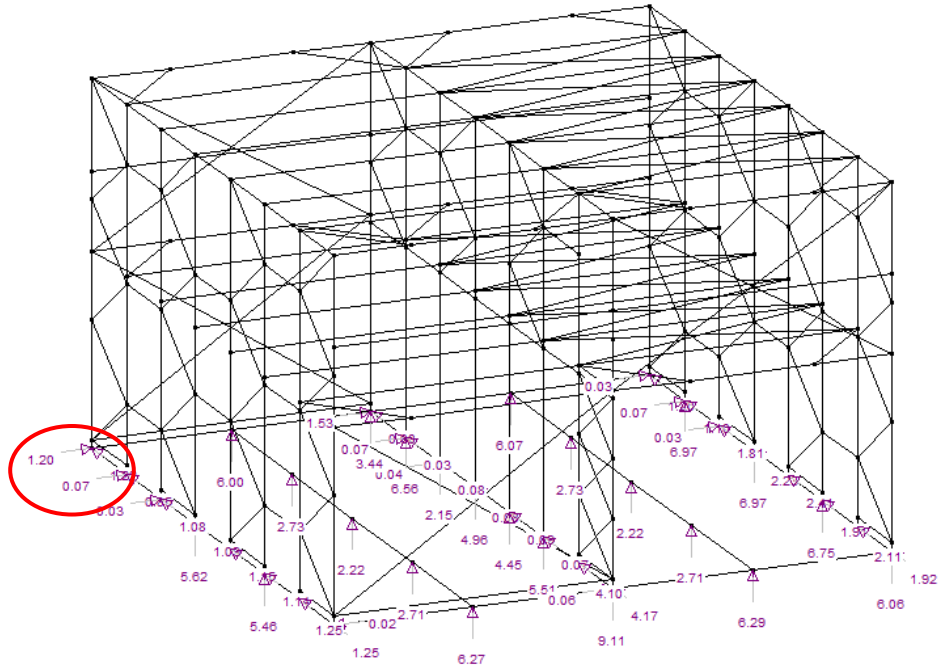
### 5.13.1 Uplift

The whole structure is subjected to the most negative combination of loads which results in the peak uplift condition. The footings can only support downwards forces. The deflections of the structure for the most negative uplift condition are [mm]:

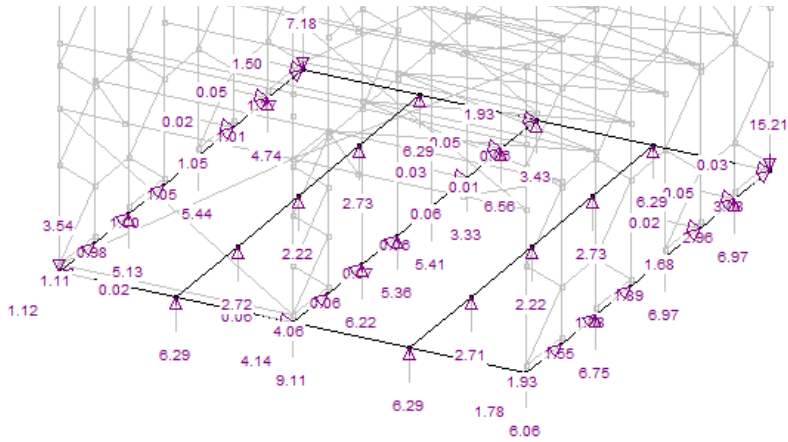


The structure is locally distorted upwards, further more minimal the forces (most negative uplift condition) on the footings are given [kN]:

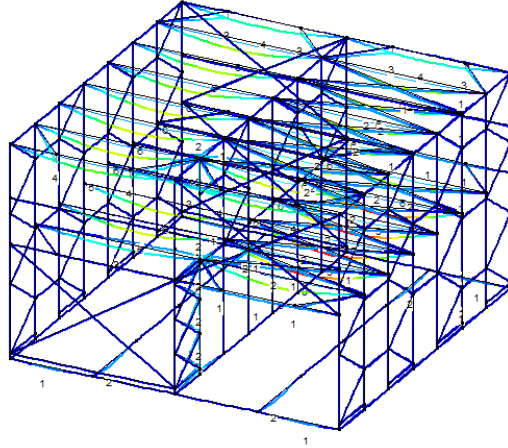




For the highlighted footing the vertical force equals zero. Thus we will need tie downs on the corner of the structure to prevent local uplift. The vertical forces (most severe uplift condition) on the footings when using tie downs at the corners of the structure are [kN]

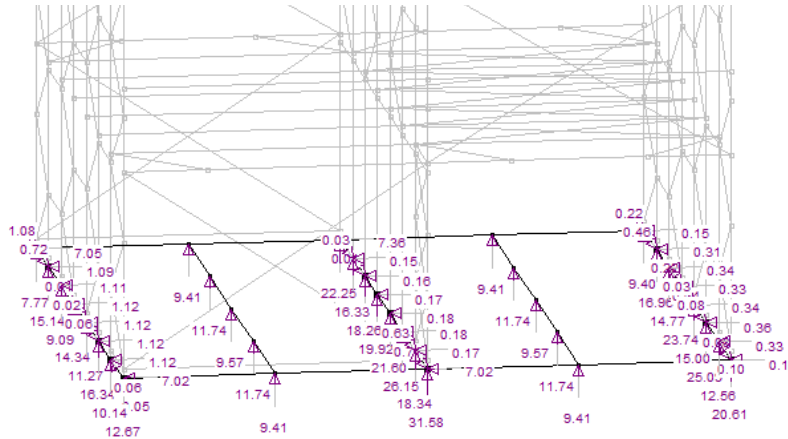


The vertical deflections are [mm]:



### 5.13.2 Sliding

There is friction of the load distribution plates on the ground and the tie-downs can be placed at an angle to be able to take horizontal loads. The horizontal load are given [kN]:



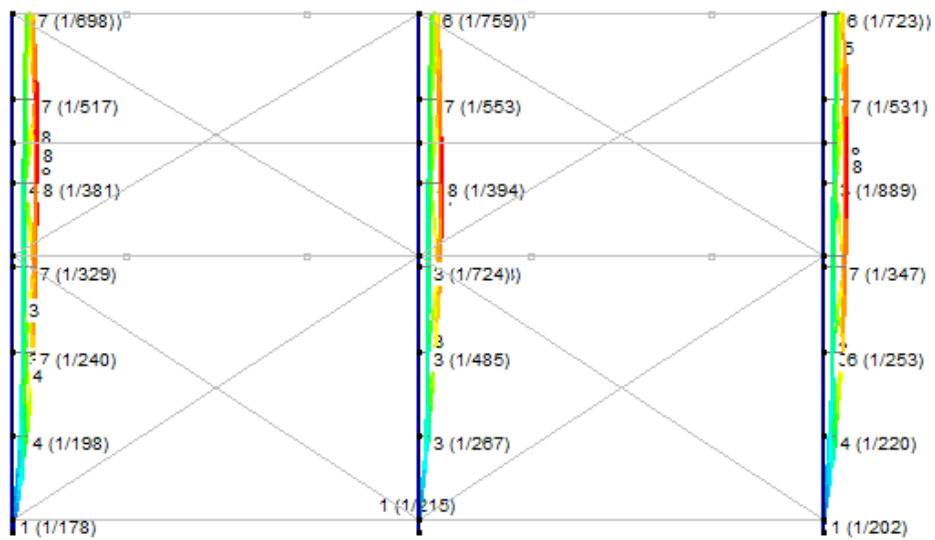
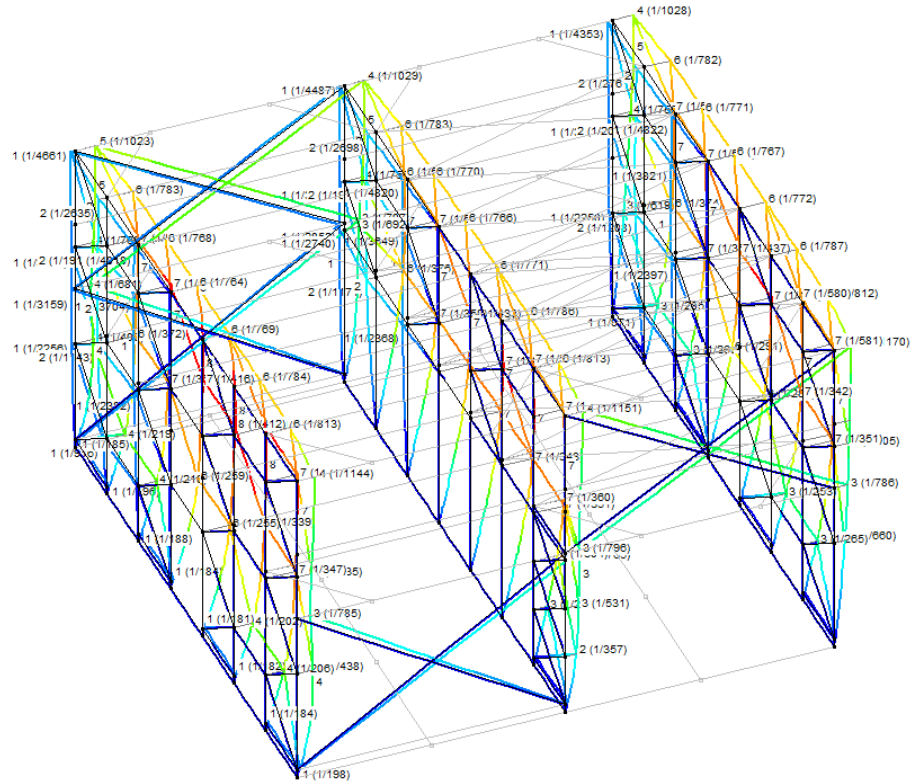
The horizontal forces are acceptable to be taken by the tie downs. Furthermore there are a lot of footplates which take the horizontal loads by friction. No additional measures have to be taken regarding sliding of the structure.

### 5.13.3 Lateral stability

The deflections in the x and z direction are checked. Furthermore the resistance of the wind bracing elements is checked.

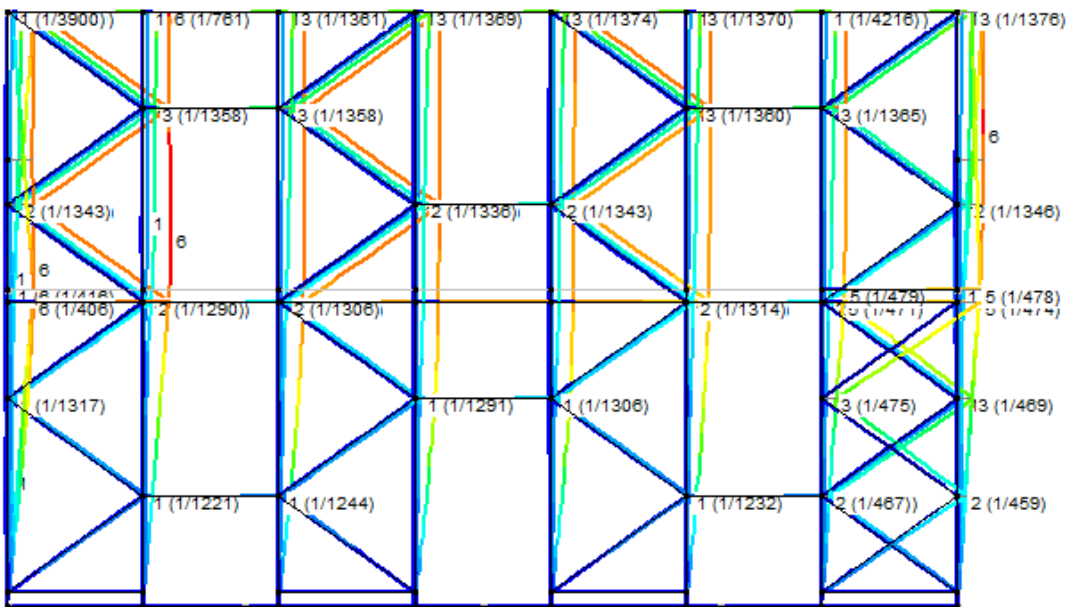
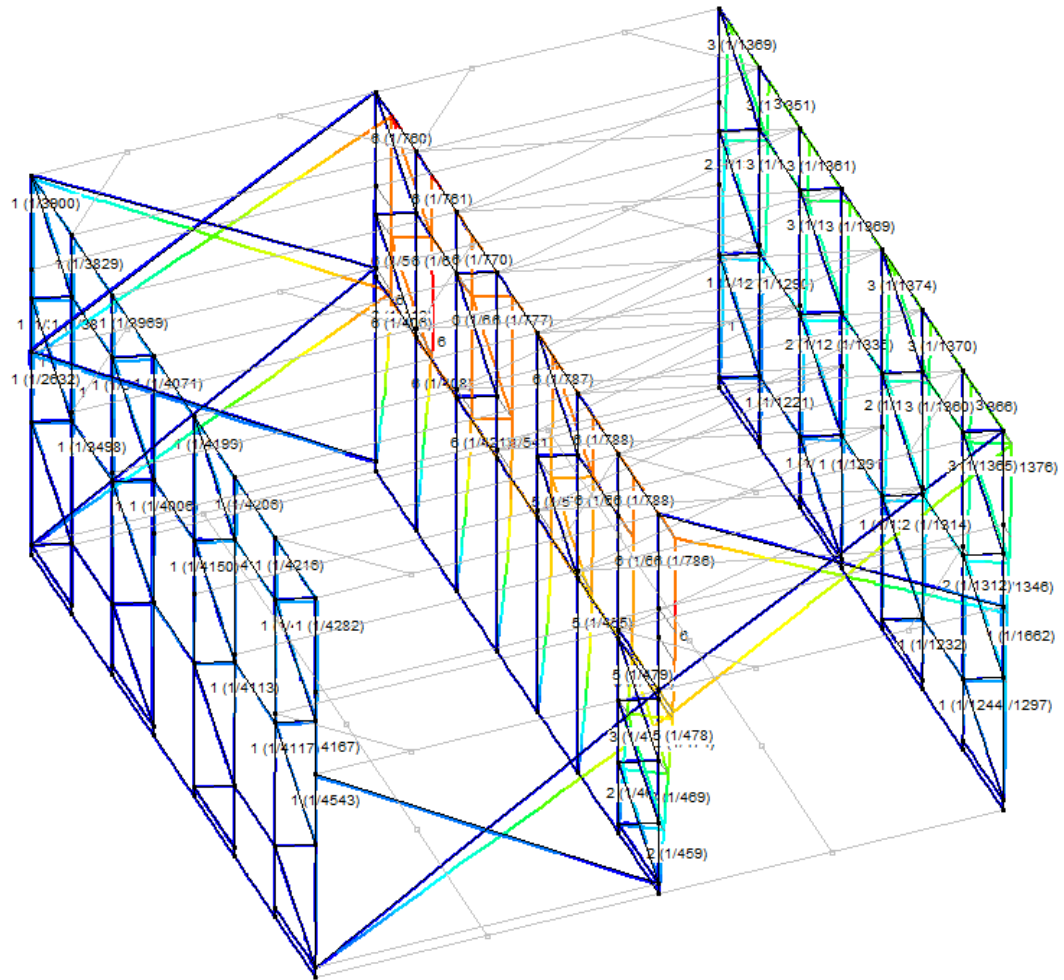
#### 5.13.3.1 Deflections in the z-direction

Deflections [mm]



$$\delta_{h1} = 7 \leq \frac{h_i}{300} = 7,8 \text{ mm} \quad \text{and} \quad \delta_h = 7 \leq \frac{h_c}{500} = 9,5 \text{ mm} \quad \text{Ok}$$

### 5.13.3.2 Deflections in the x-direction



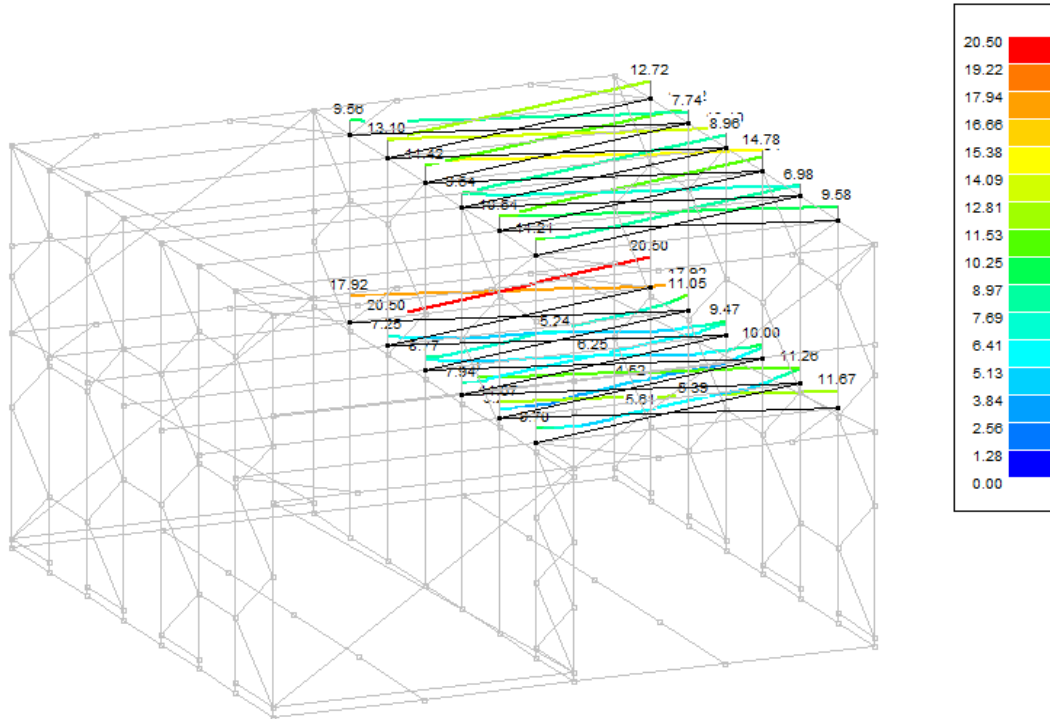
$$\delta_{h1} = 2 \leq \frac{h_i}{300} = 7,8 \text{ mm} \quad \text{and} \quad \delta_h = 3 \leq \frac{h_t}{500} = 9,5 \text{ mm} \quad \text{Ok}$$

### 5.13.3.3 Resistance of the wind bracing elements

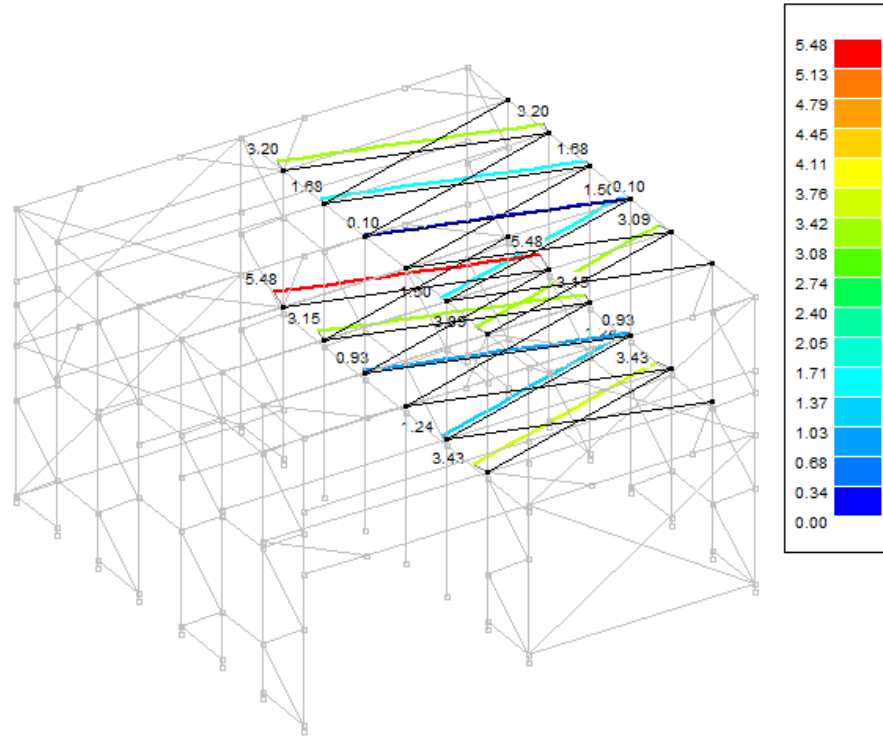
The cross-section resistance of these elements will be checked. These elements are modeled as tie rods so no buckling resistance check is required.

#### 5.13.3.3.1 Cross-section resistance of the horizontal wind bracings

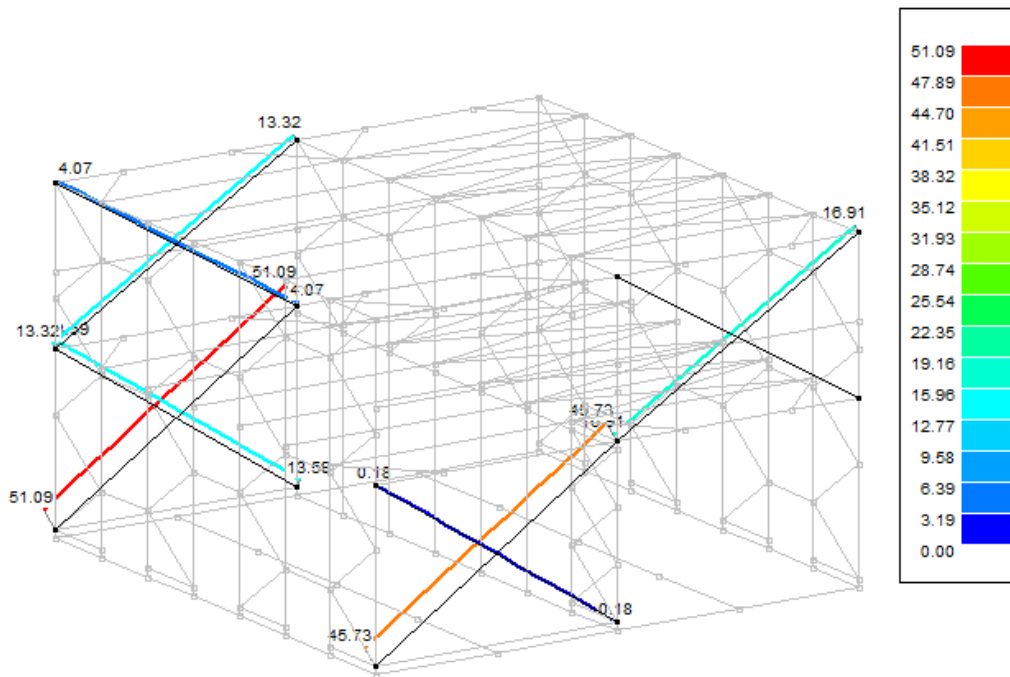
Values in % (100%=failure)



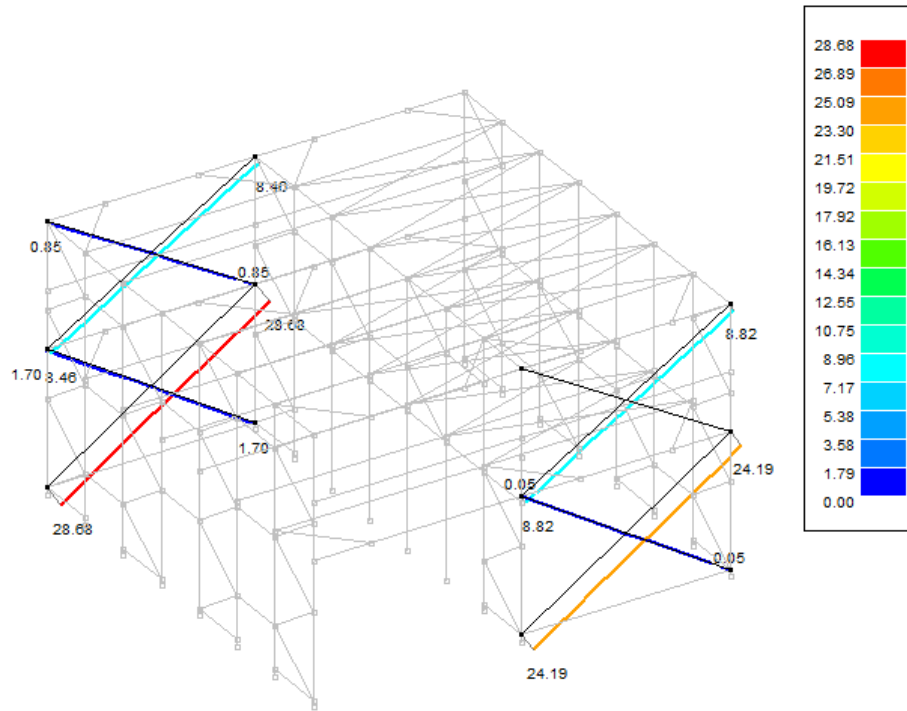
For the calculations of the bolted connections the axial forces are given [kN]



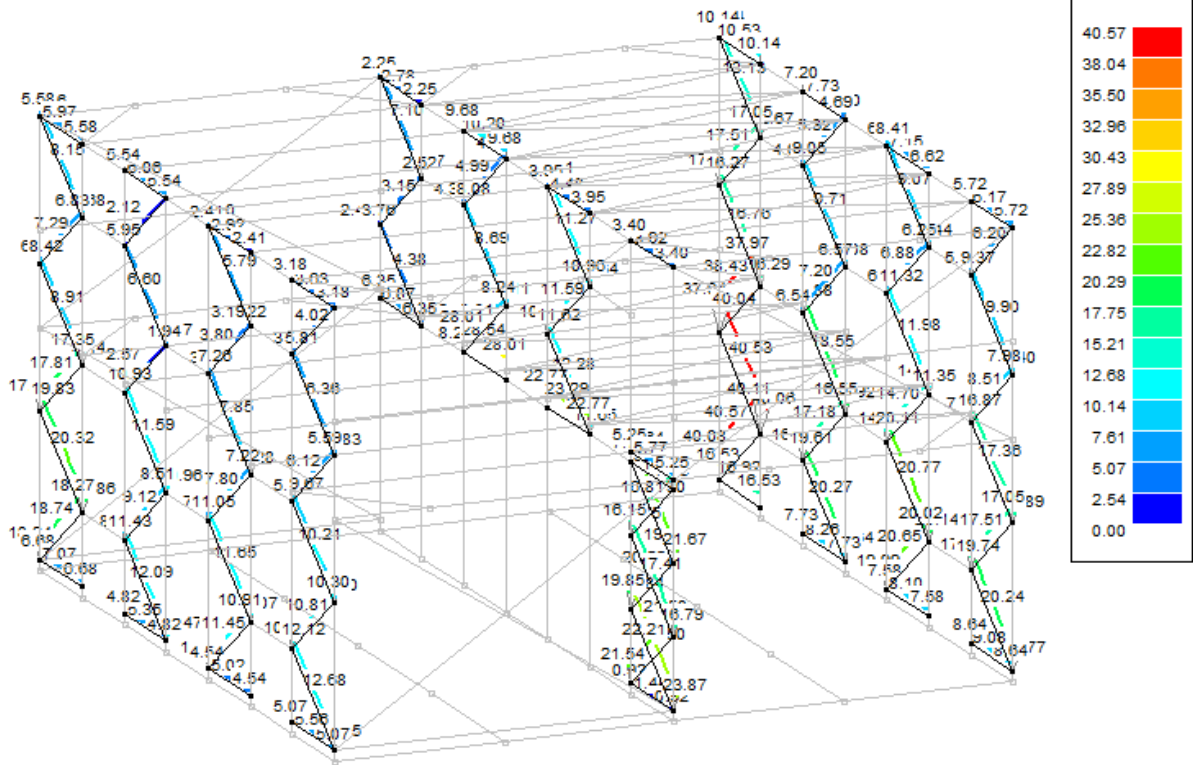
5.13.3.3.2 Cross-section resistance of the vertical wind bracings  
 Values in % (100%=failure)



For the calculations of the bolted connections the axial forces are given [kN]

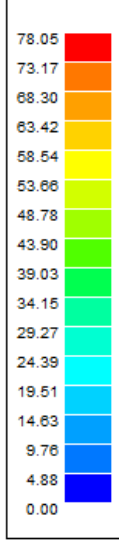
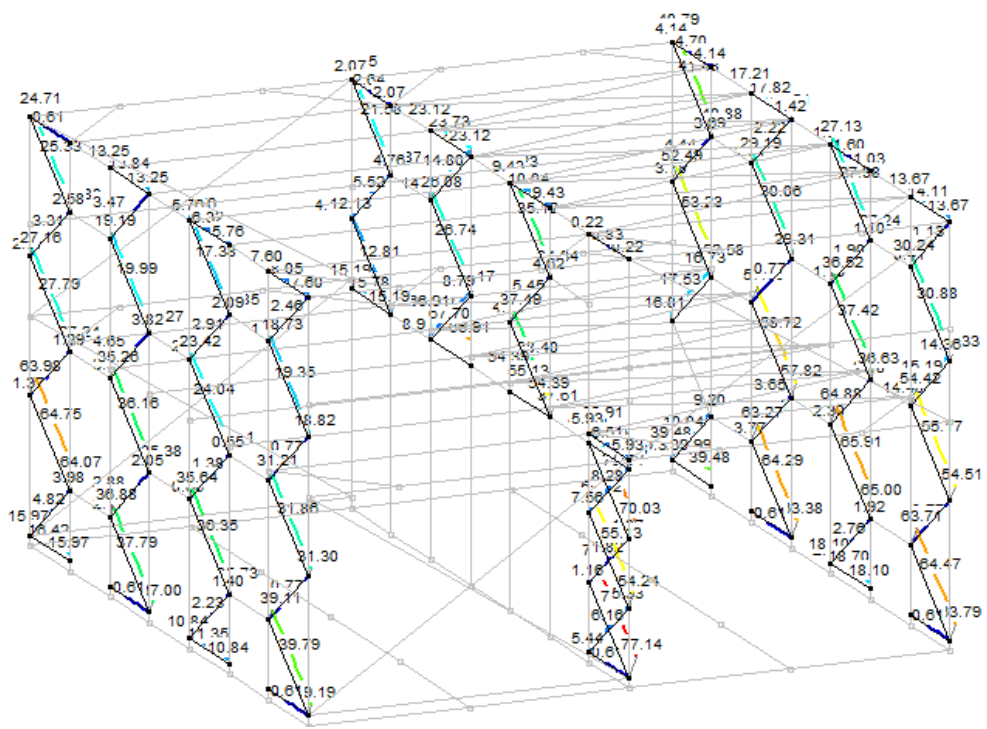


5.13.3.3.3 Cross-section resistance of the frame diagonals  
 Values in % (100%=failure)

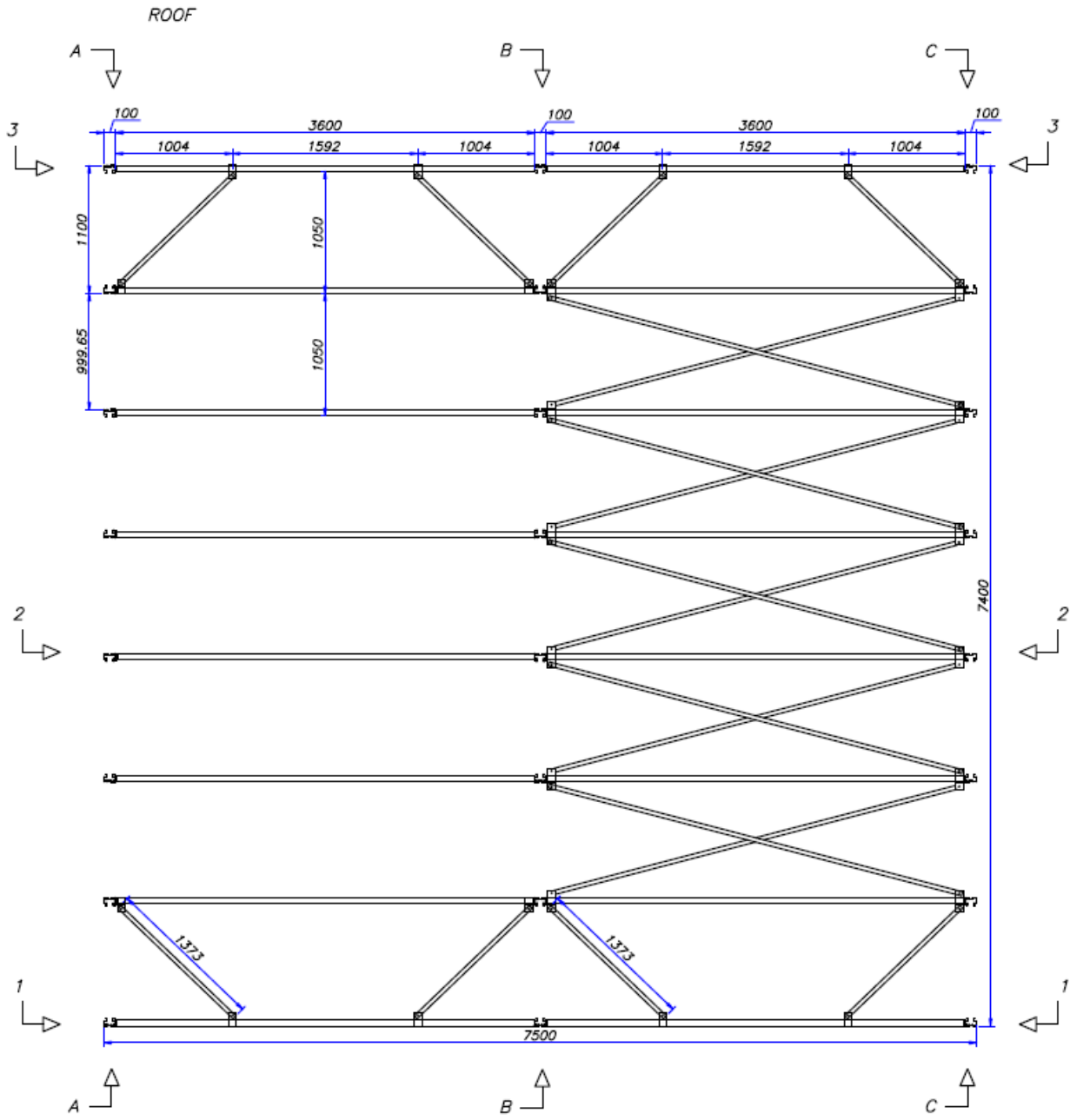


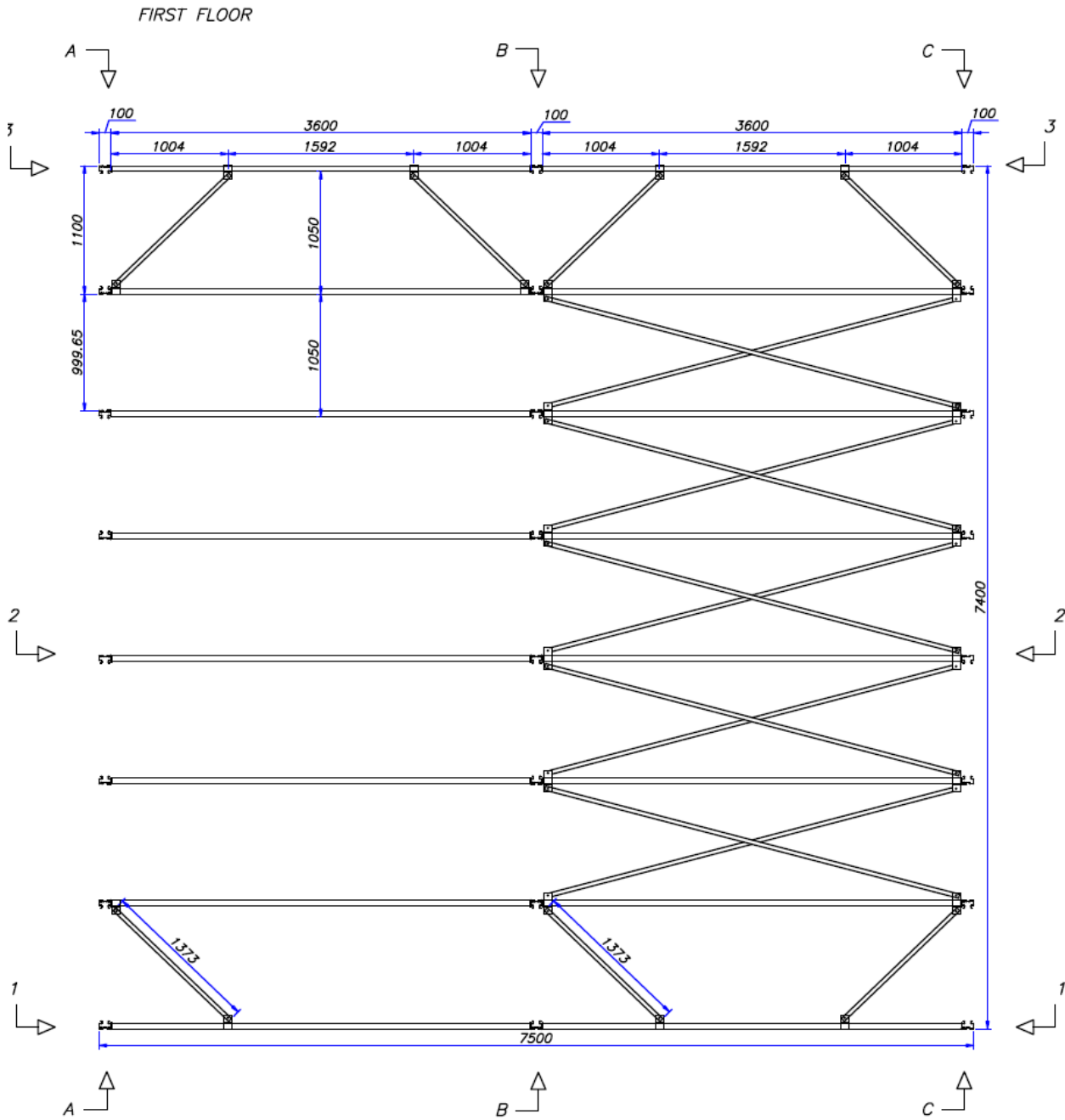
5.13.3.3.4 Buckling resistance of the frame diagonals  
 Values in % (100%=failure)





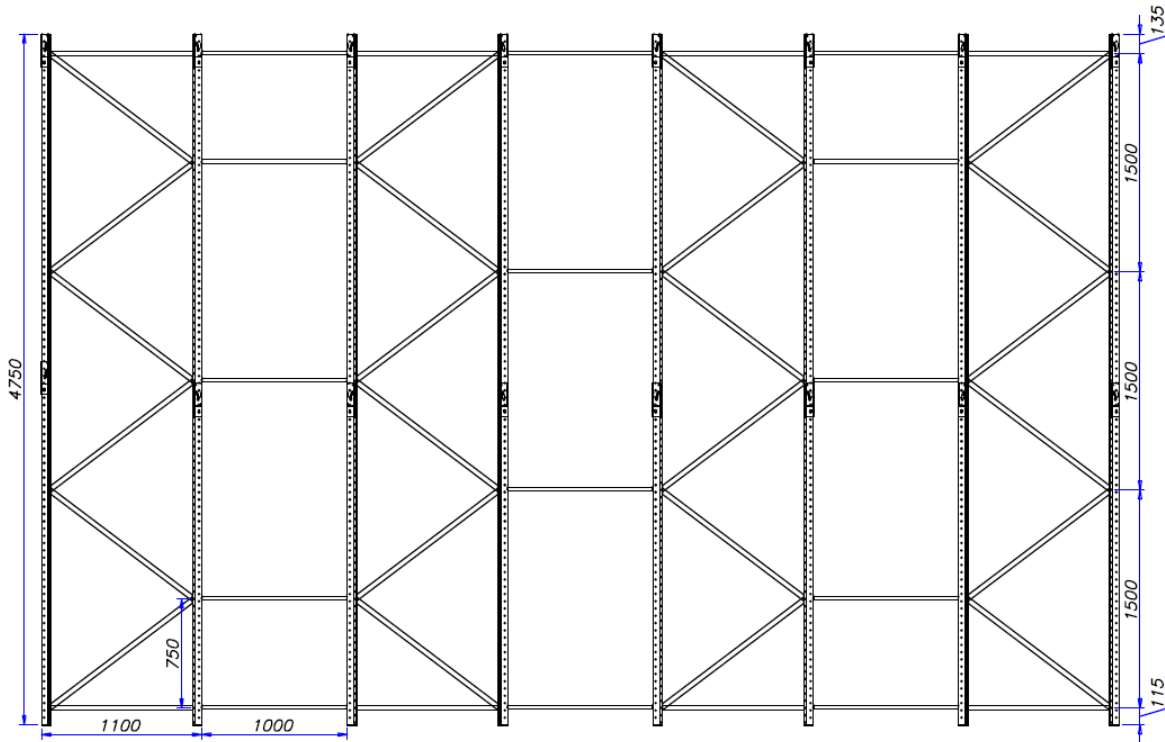
# Annex A: Structural drawings





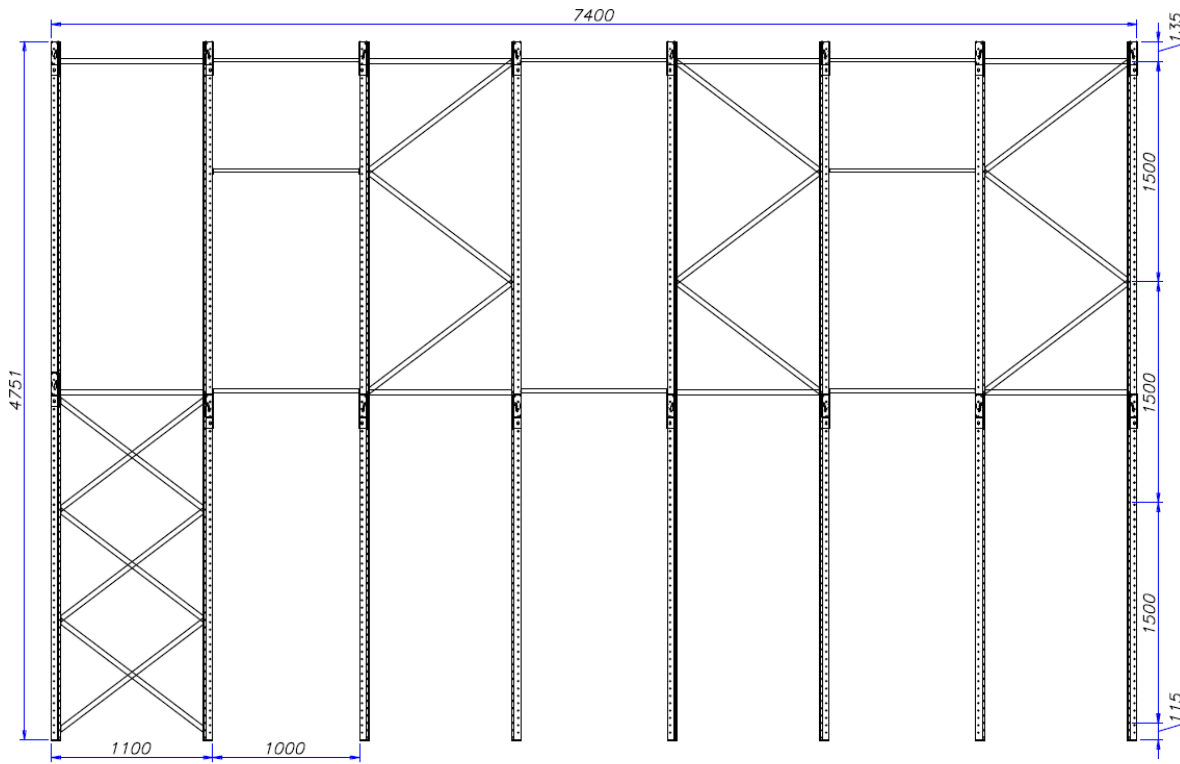


SECTION A



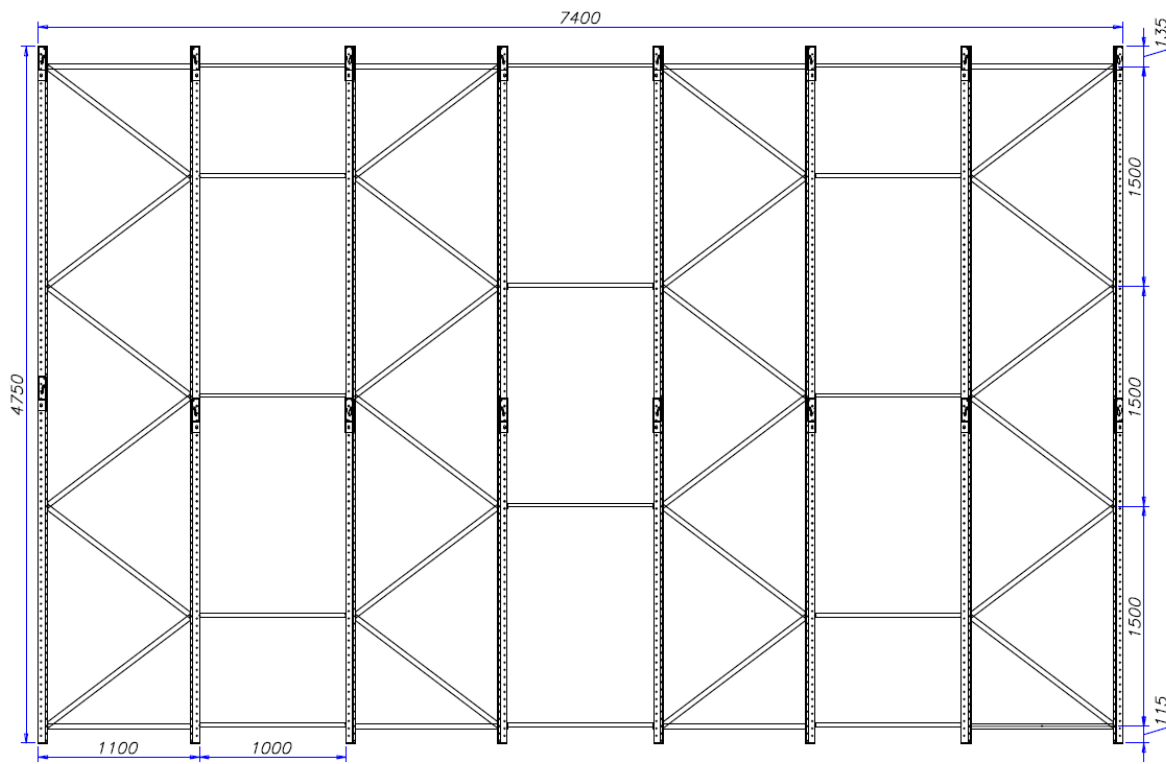


SECTION B



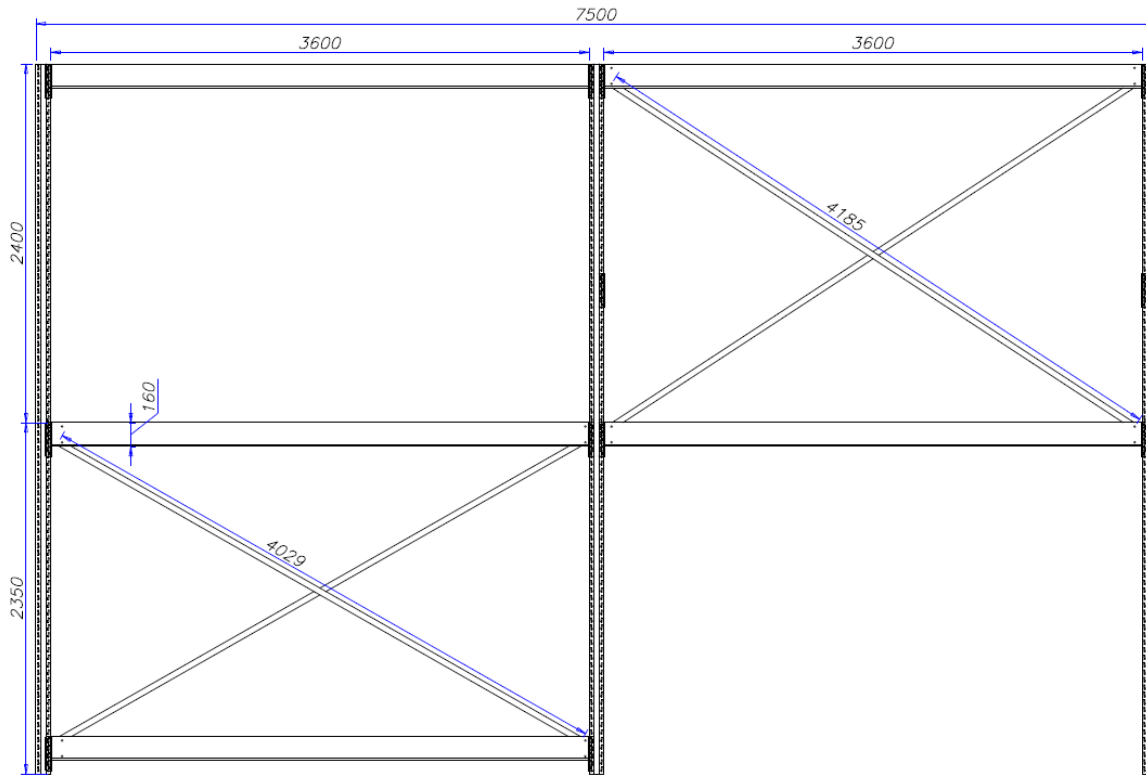


SECTION C



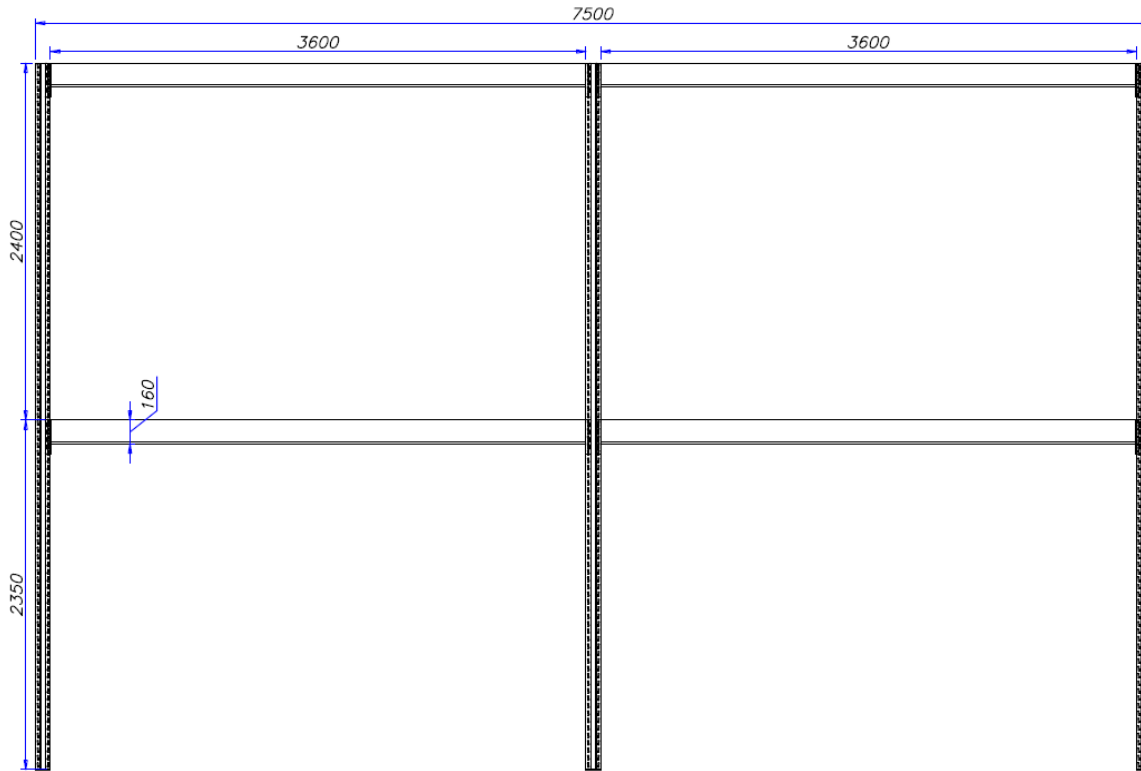


SECTION 1





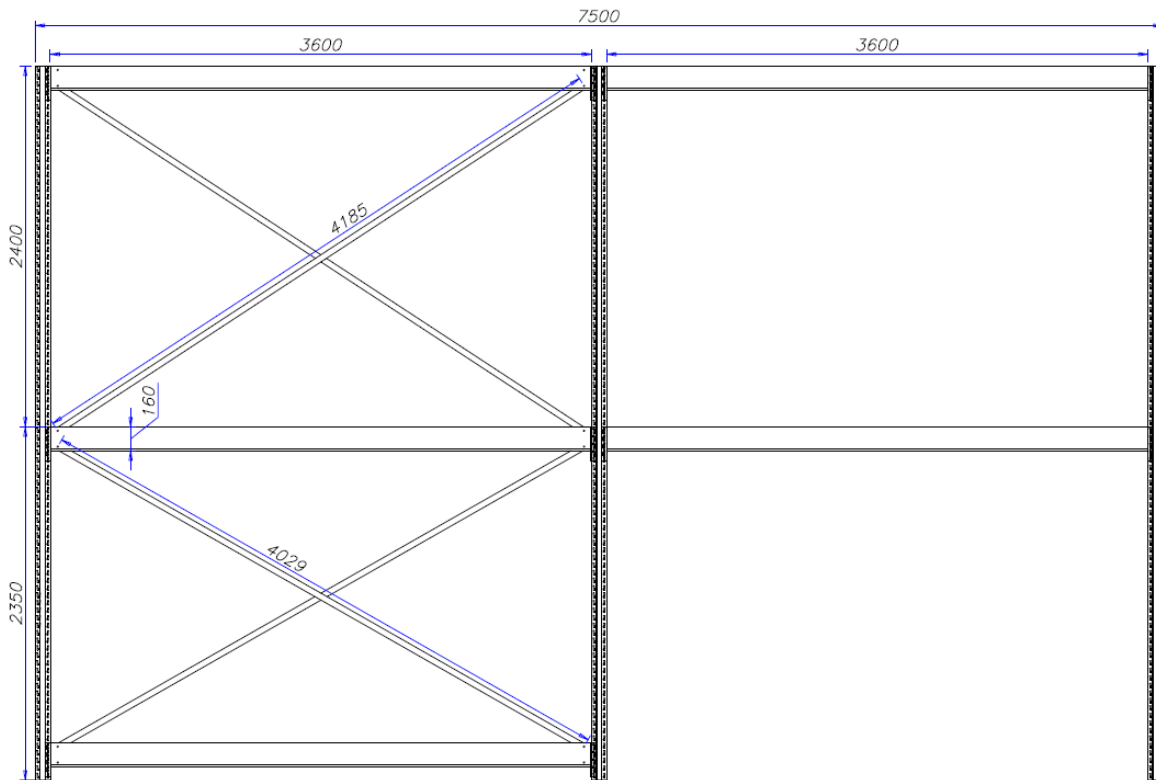
SECTION 2







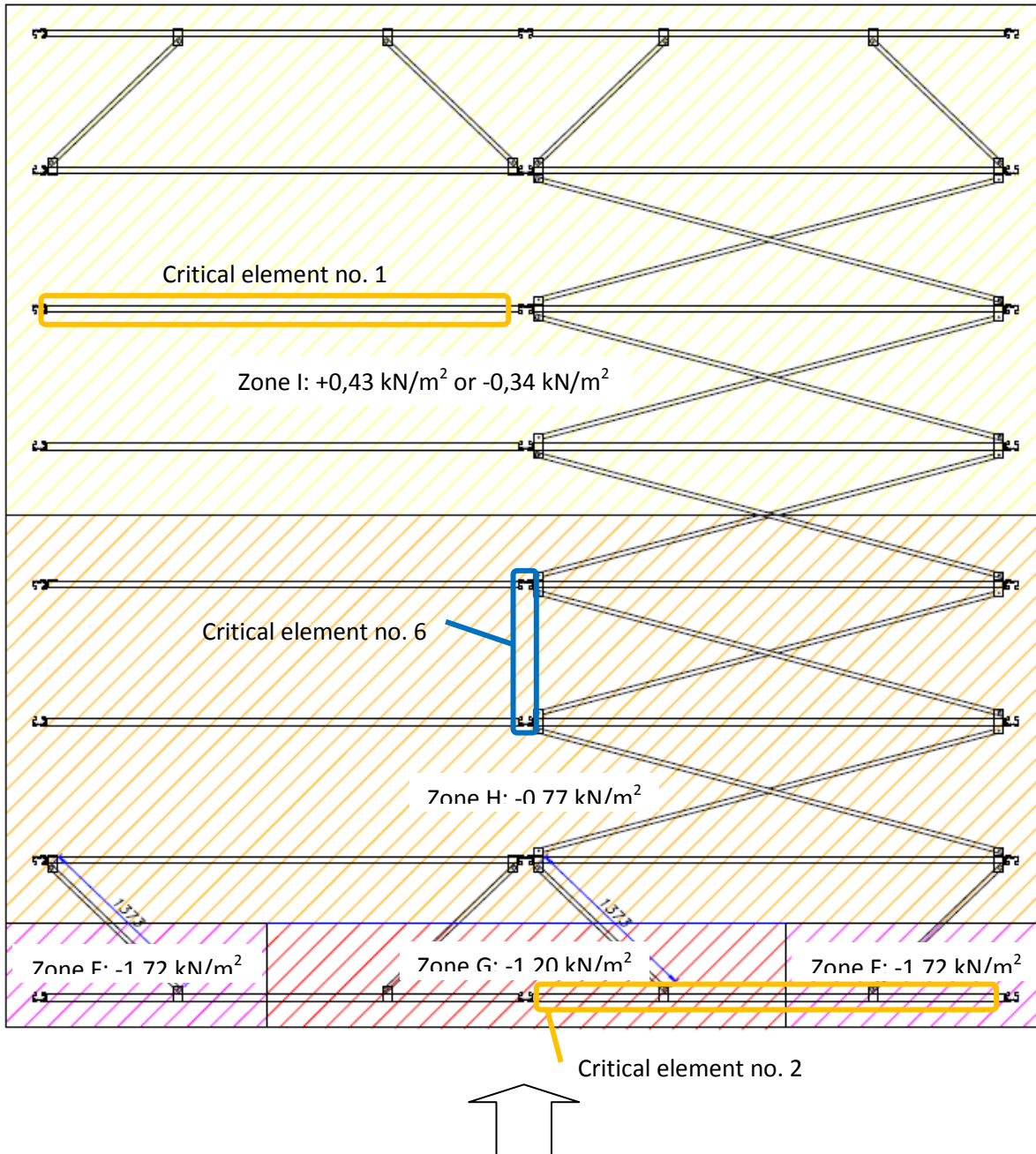
SECTION 3





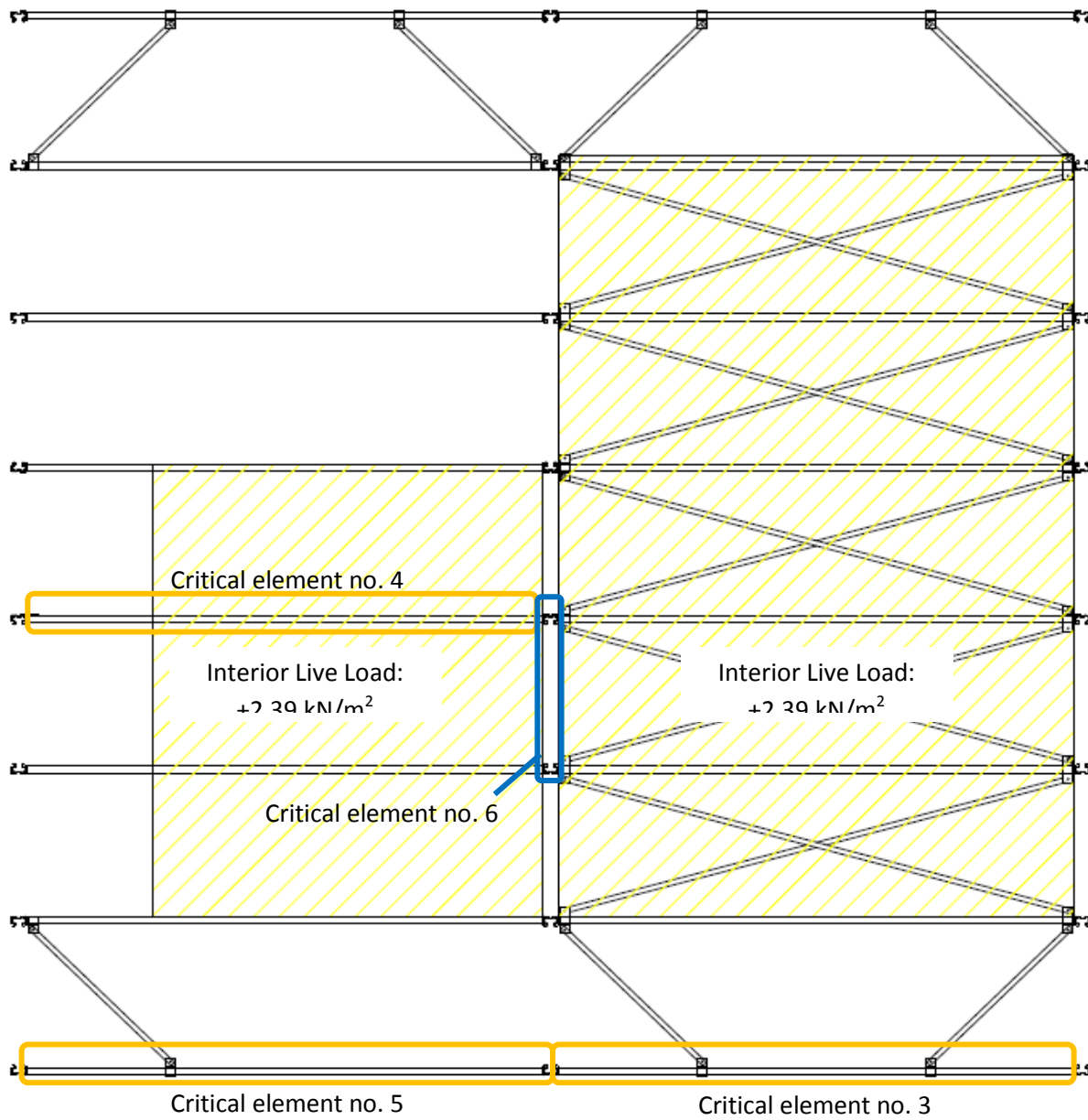
## Annex B: Most critical elements & Loads

### Roof: South Wind



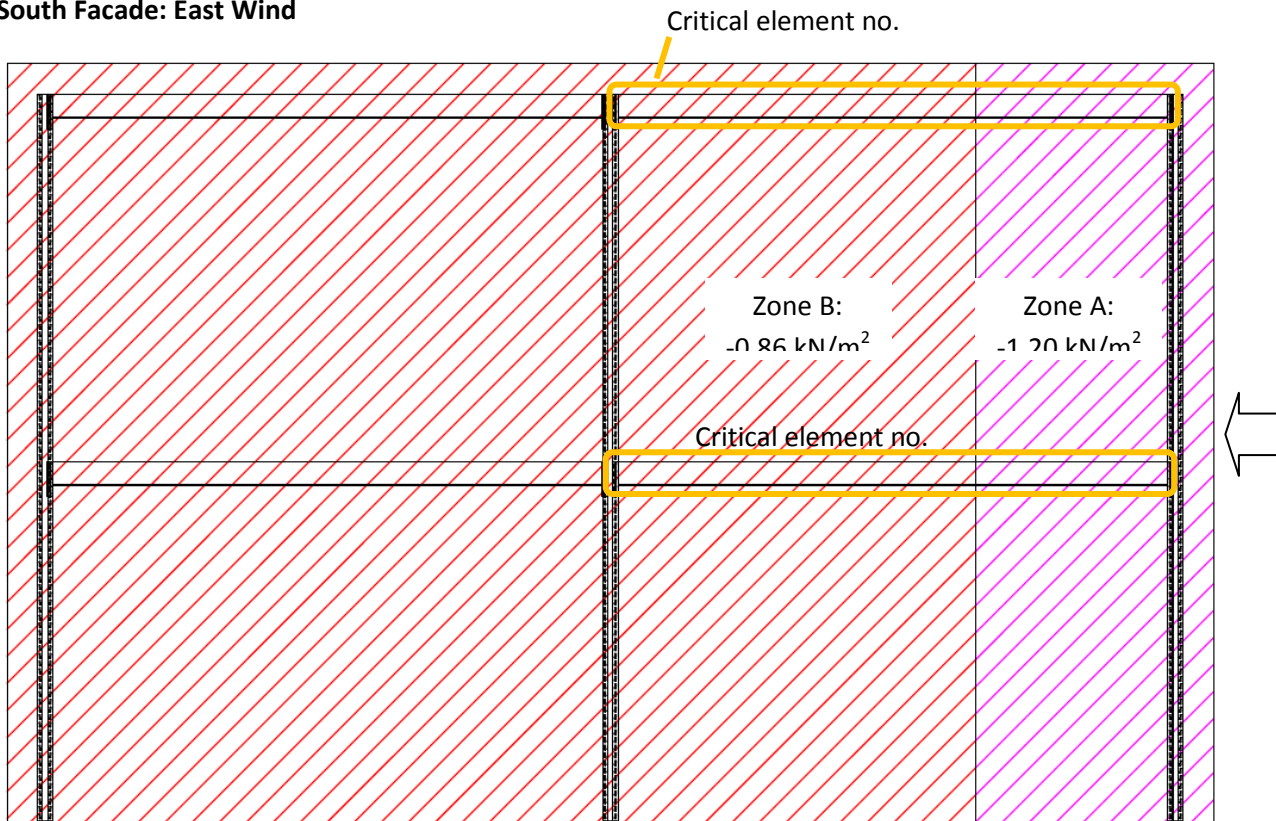


### 1st floor: Liveloads

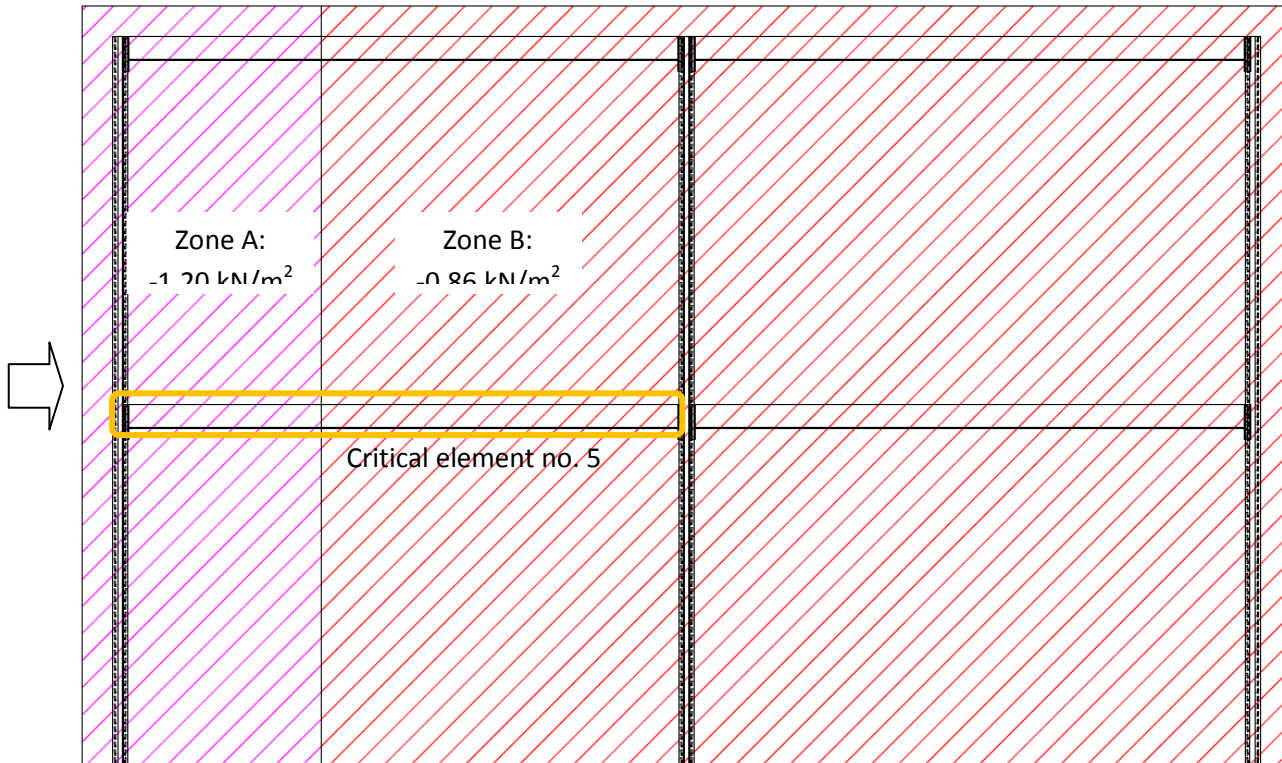




**South Facade: East Wind**

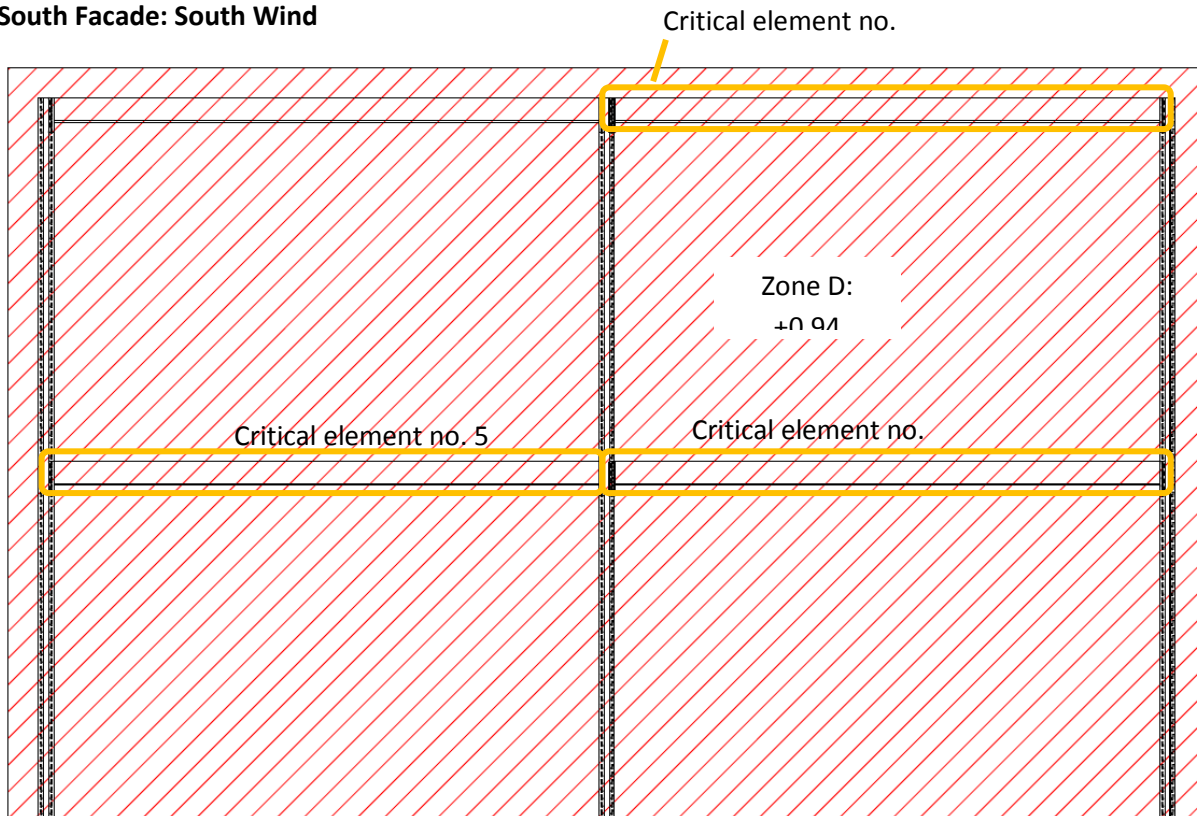


**South Facade: West Wind**

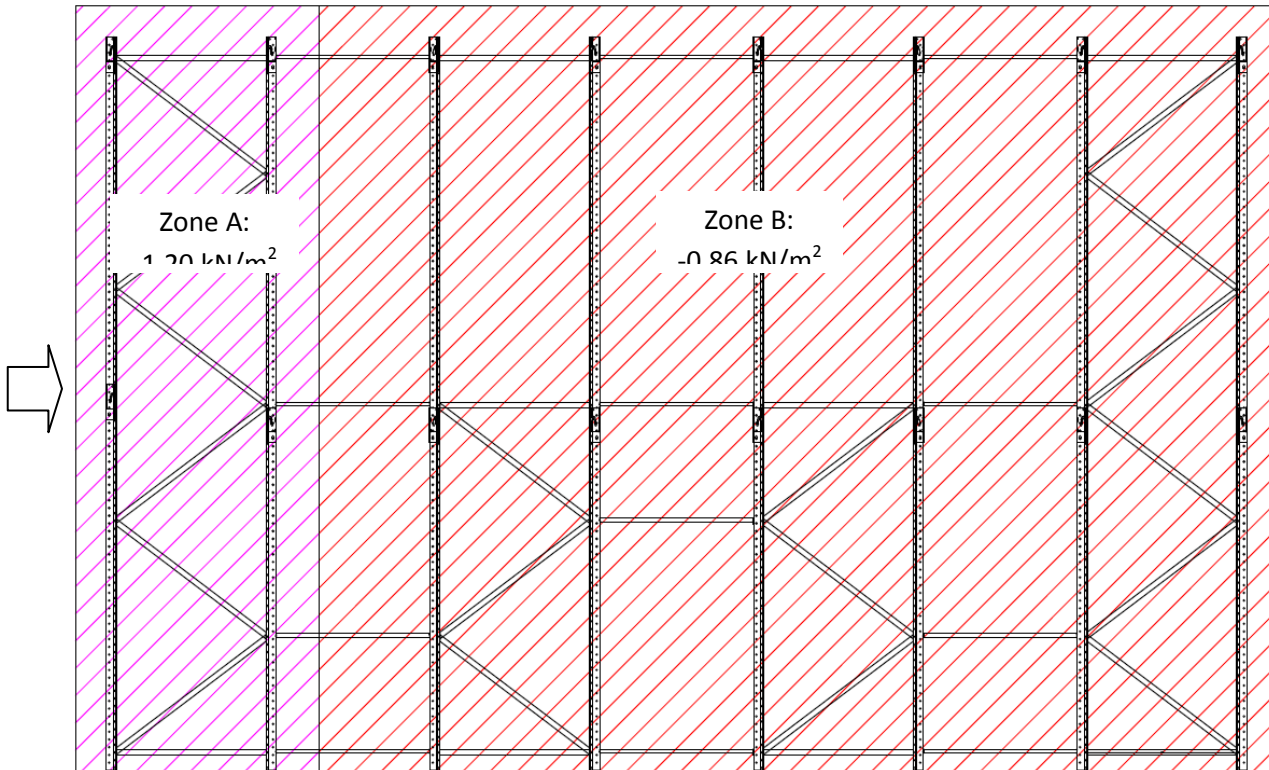




**South Facade: South Wind**



**East Facade: South Wind**

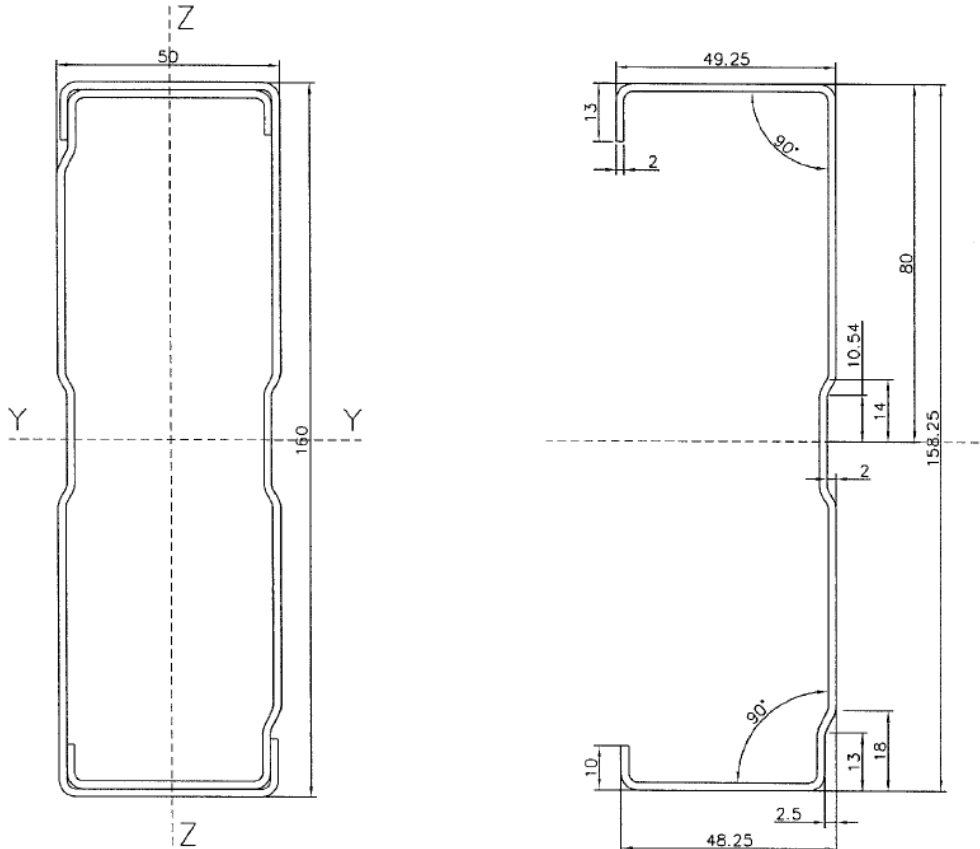




## Annex C: Specifications of Elements

### Joist PNB 0436/2

#### PNB 0436/2



$A =$	10,45 cm <sup>2</sup>
$I_y =$	375,62 cm <sup>4</sup>
$I_z =$	43,63 cm <sup>4</sup>
$W_y =$	46,95 cm <sup>3</sup>
$W_z =$	17,45 cm <sup>3</sup>
$i_y =$	6,00 cm
$i_z =$	2,04 cm
$W_{pl,y} =$	57.2 cm <sup>3</sup>
$W_{pl,z} =$	20.0 cm <sup>3</sup>
$Av_z =$	5.31 cm <sup>2</sup>
$Av_y =$	3.43 cm <sup>2</sup>
$f_y =$	355 N/mm <sup>2</sup>
$E =$	210 GPa





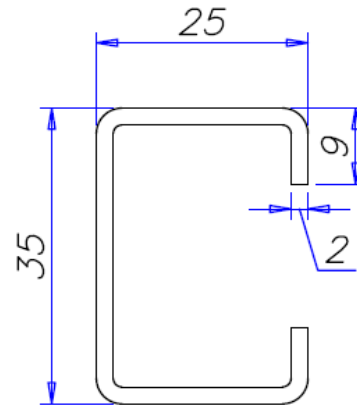
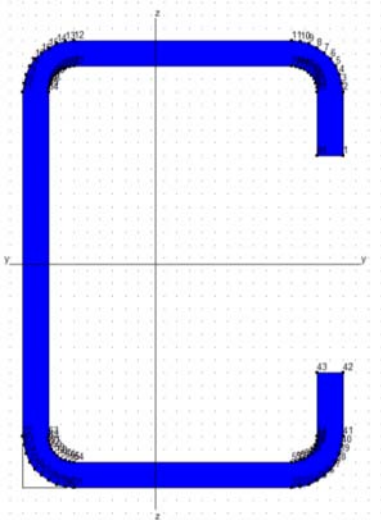


$i_y =$	3,6	cm
$i_z =$	2,2	cm
$W_{pl,y} =$	23,0	cm <sup>3</sup>
$W_{pl,z} =$	13,4	cm <sup>3</sup>
$Av_z =$	1,88	cm <sup>2</sup>
$Av_y =$	2,27	cm <sup>2</sup>
$f_y =$	355	N/mm <sup>2</sup>
$E =$	210	GPa
$G =$	5.3	kg/m

Section Class 3 according to Eurocode 3. "When all the compression elements of a cross-section are Class 3, its resistance may be based on an elastic distribution of stresses across the cross-section, limited to the yield strength at the extreme fibres."



## Diagonal for frame bracing



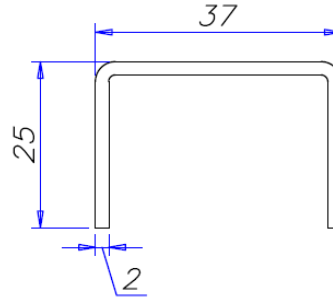
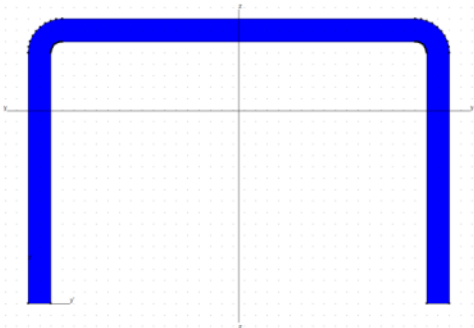
A =	1.80	cm <sup>2</sup>
I <sub>y</sub> =	3.3	cm <sup>4</sup>
I <sub>z</sub> =	1.5	cm <sup>4</sup>
W <sub>y</sub> =	1.9	cm <sup>3</sup>
W <sub>z</sub> =	1.0	cm <sup>3</sup>
i <sub>y</sub> =	1.4	cm
i <sub>z</sub> =	0.9	cm
W <sub>pl,y</sub> =	2.3	cm <sup>3</sup>
W <sub>pl,z</sub> =	1.5	cm <sup>3</sup>
Av <sub>z</sub> =	0.58	cm <sup>2</sup>
Av <sub>y</sub> =	0.80	cm <sup>2</sup>
f <sub>y</sub> =	355	N/mm <sup>2</sup>
E =	210	GPa
G =	1.4	kg/m

Section Class 3 according to Eurocode 3. "When all the compression elements of a cross-section are Class 3, its resistance may be based on an elastic distribution of stresses across the cross-section, limited to the yield strength at the extreme fibres."

These bars are also used as horizontal wind bracings.



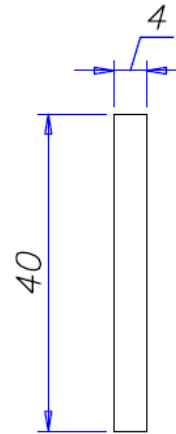
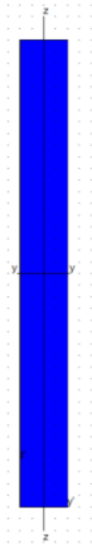
## Spacer PNAG 0482



$A =$	1.63	$\text{cm}^2$
$I_y =$	1.0	$\text{cm}^4$
$I_z =$	3.6	$\text{cm}^4$
$W_y =$	0.6	$\text{cm}^3$
$W_z =$	1.9	$\text{cm}^3$
$i_y =$	0.8	$\text{cm}$
$i_z =$	1.5	$\text{cm}$
$W_{pl,y} =$	1.1	$\text{cm}^3$
$W_{pl,z} =$	2.2	$\text{cm}^3$
$Av_z =$	0.72	$\text{cm}^2$
$Av_y =$	0.64	$\text{cm}^2$
$f_y =$	355	$\text{N/mm}^2$
$E =$	210	$\text{GPa}$
$G =$	1.3	$\text{kg/m}$



## Diagonal for vertical wind bracing



$A =$	1.60	$\text{cm}^2$
$I_y =$	2.1	$\text{cm}^4$
$I_z =$	0.0	$\text{cm}^4$
$W_y =$	1.1	$\text{cm}^3$
$W_z =$	0.1	$\text{cm}^3$
$i_y =$	1.2	$\text{cm}$
$i_z =$	0.1	$\text{cm}$
$W_{pl,y} =$	1.6	$\text{cm}^3$
$W_{pl,z} =$	0.2	$\text{cm}^3$
$Av_z =$	1.60	$\text{cm}^2$
$Av_y =$	1.60	$\text{cm}^2$
$f_y =$	355	$\text{N/mm}^2$
$E =$	210	$\text{GPa}$
$G =$	1.3	$\text{kg/m}$

This bars are used as vertical wind bracings. They are subjected to axial tension only because they are considered as tie rods.



## Beam UPN 160

### Fers U normaux européens

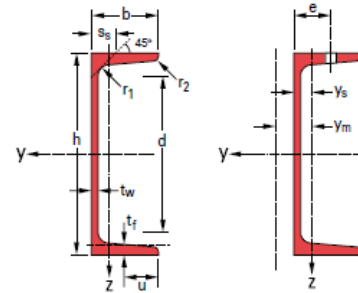
conformes à DIN 1026-1: 2000, NF A 45-202 (1983)

### European standard channels

in accordance with DIN 1026-1: 2000, NF A 45-202 (1983)

### Europäische U-Stahl-Normalprofile

gemäß DIN 1026-1: 2000, NF A 45-202 (1983)



Designation Designation Bezeichnung	Dimensions Abmessungen							Dimensions de construction Dimensions for detailing Konstruktionsmaße					Surface Oberfläche	
	G kg/m	h mm	b mm	t <sub>w</sub> mm	t <sub>f</sub> mm	r <sub>1</sub> mm	r <sub>2</sub> mm	A cm <sup>2</sup>	d mm	∅	e <sub>min</sub> mm	e <sub>max</sub> mm	A <sub>L</sub> m <sup>2</sup> /m	A <sub>G</sub> m <sup>2</sup> /t
UPN 100	10.6	100	50	6	8.5	8.5	4.5	13.5	64	-	-	-	0.372	35.1
UPN 120	13.4	120	55	7	9	9	4.5	17.0	82	-	-	-	0.434	32.52
UPN 140	16.0	140	60	7	10	10	5	20.4	98	M12	33	37	0.489	30.54
UPN 160	18.8	160	65	7.5	10.5	10.5	5.5	24.0	115	M12	34	42	0.546	28.98
UPN 180	22.0	180	70	8	11	11	5.5	28.0	133	M16	38	41	0.611	27.8
UPN 200	25.3	200	75	8.5	11.5	11.5	6	32.2	151	M16	39	46	0.661	26.15
UPN 220	29.4	220	80	9	12.5	12.5	6.5	37.4	167	M16	40	51	0.718	24.46
UPN 240	33.2	240	85	9.5	13	13	6.5	42.3	184	M20	46	50	0.775	23.34
UPN 260	37.9	260	90	10	14	14	7	48.3	200	M22	50	52	0.834	22
UPN 280	41.8	280	95	10	15	15	7.5	53.3	216	M22	52	57	0.89	21.27
UPN 300	46.2	300	100	10	16	16	8	58.8	232	M24	55	59	0.95	20.58
UPN 320	59.5	320	100	14	17.5	17.5	8.75	75.8	246	M22	58	62	0.982	16.5
UPN 350	60.6	350	100	14	16	16	8	77.3	282	M22	56	62	1.047	17.25
UPN 380	63.1	380	102	13.5	16	16	8	80.4	313	M24	59	60	1.11	17.59
UPN 400	71.8	400	110	14	18	18	9	91.5	324	M27	61	62	1.182	16.46



## 6 Detailed Water Budget

FUNCTION	WATER USE (LITERS)	CALCULATION		NOTES
		LITER	EVENTS	
Hot water	999,7	62,48	16	10% above 56,8 liter limit
Cooking	9,1	2,271	4	Vaporize 2,268 kg, starting with 2,721 kg
Dishwasher	75,0	15	5	15 liter/use
Clothes Washer	400,0	50	8	50 liter/use
Vegetation	180,0	15	12	15 liter from water delivery - disassembly
Sprinklers	75,0	5	15	estimated 5 liters - for 15 sprinklers
Boiler	500,0	500	1	500 liter boiler
Initial System Fill	60,0	60	1	estimated 60 liters to fill pipes
Solar Thermal Collectors	4,2	2,1	2	2 collectors of each 2,1 liters
HVAC				
Safety Factor	230,3			10 % of all water required
<b>WATER REQUIRED</b>	<b>2533,3</b>	liters		



## 7 Summary of Unlisted Electrical Components

According to the different Standards in America and Belgium, many of our products will not have UL-Certification. All non-listed components will comply with European regulations.





## 8 Summary of Reconfigurable Features

We don't have any plans to include reconfigurable features in our design.



## 9 Interconnection Application Form

Team Belgium – Ghent University  
Lot Number: 116

### PV Systems

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
Sanyo HIP-215NKHA5	4 arrays, of 9 modules in series, in parallel	36 x 215 Wp = 7740 Wp

Total DC power of all arrays is **7.740** kWp

### INVERTERS

Inverter Manufacturer	Model Number	Voltage	Rating (kVA or KW)	Quantity
SMA	Sunny Boy 4000 US	600 V	4 kW @ 240 V AC output	2

Total AC power of all inverters is **8** kW.

The following information must be included in the project manual or construction documents. If located in the construction documents, list the drawing locations in this section of the project manual.

1. One-Line Electrical schematic – the loads do not have to be detailed. (BIM-model drawing E-601)
2. Calculations of service/feeder net computer load and neutral load (NEC 220) (BIM-model drawing E-103)
3. Plan view of the lot showing the house, decks, ramps, tour paths, the service point and the distribution panel or load center. (BIM-model drawing L-101)

Provide the Team’s “Electrical Engineer (Thomas Delameillieure)” contact in the “Team Officer Contact Info” database on the Yahoo Group as required per Rule 3-2.

Please see the “SD2011\_Microgrid\_Interconnection\_Process\_v1” file located the Files/Rules/Team Interconnection Process section of the Yahoo Group for more details on the interconnection process. Please see the “Grid Interconnection Process for Teams” file on the Yahoo Group for more details on the interconnection process and the Terminal Box Mounting Panel.



## 10 Energy Analysis Results and Discussion

### 10.1 General design approach

In order to come to an energy efficient design, we have used an iterative design process to minimize the anticipated energy demand for team Belgium’s 2011 Solar decathlon house. During this process, a balance is sought between often conflicting requirements such as the need to conserve energy for heating and cooling purposes, the need to optimize solar gains, the need to optimize passive cooling, and other needs such as the desire to provide ample visual access to the surrounding environment. During the conceptual design phase we have adopted the following initial design options:

- ° the passive house design standard, which stipulates overall energy consumption standards as well as the performance of individual components and assemblies (thermal insulation performance, air tightness, ...).
- ° a compact building volume to minimize envelope energy losses or gains,
- ° a two story house with open floor plan and open section in order to improve cross ventilation and maximize the thermal mass.

Rather than to use these criteria as rigid design requirements, we have used an iterative design process to check their validity and relative importance. The primary energy demand for space heating and cooling was determined by means of an iterative design process whereby critical design parameters were changed and evaluated. To date, this process was completed with the help of two different simulation software packages (EPB, PHPP and TRNSys).

#### 10.1.1 EPB

	EPB	PHPP	Trnsys
Heating	x	x	x
Overheating Indicator	x	x	x
Official demands	x	x	
Summer comfort			x
Climate variations		x	x
Sanitary hot water	x		
Technical Installations	x		x
Dynamic simulations			x

The EPB-software (offered by the Flemish Energy Agency - VEA) proves that the house is compatible with the current energy performance rules. The house has a high performance concerning:

- energy performance level (E-level, maximum for a private building: E80) Thanks to solar panels, a zero-energy



building is obtained.

- insulation level (maximum for a private building: K45, and Umax). The level depends on a high performance envelope (usage of optimale insulation, PIR) and building-compactness (a cube has a compactness = 1)
- indoor climate (ventilation and overheating).

n (1/h)	1
Heating demand (kWh/m <sup>2</sup> )	13,21
Cooling demand (kWh/m <sup>2</sup> )	35,32
Average U-value	0,23
Insulation level	21
Energy performance level	-30
Energy performance level without solar panels	31

The design sees to the passive house standard as the heating demand is concerned: < 15kWh/m<sup>2</sup> for n50 = 1/h, what is a realistically achievable value.

	Solar shading not in plane	Fixed solar shading	Movable solar shading in the plane
Overheating indicator (Kh)	26 197	32 078	16 393

Out of this analysis one can conclude that solar shading in the plane, witch is applied in the E-cube, is the best choice to decrease the cooling demand and the overheating (maximum 17500 Kh).

	-2½ N-windows	-2½ N-windows - 2 O-windows	-2½ N-windows -2 O-windows -1 Z-windows
Heating demand (kWh/m <sup>2</sup> )	12,77	12,22	12,32
Cooling demand (kWh/m <sup>2</sup> )	25,97	19,02	15,23
Average U-value	0,22	0,21	0,21
Insulation level	21	20	19
Energy performance level	-34	-38	-40
Energy performance level without solar panels	27	23	21
Overheating indicator (Kh)	16 081	14 744	13 904

The modular envelope panels allow to compose the envelope to compound according specific needs and preferences. Likewise, one can choose the performance level of the building. Out of this analysis we can conclude that solar shading in the plane is the best choice to decrease the cooling demand and the overheating.



### 10.1.2 PHPH

The PHPP-software (Passive House Planning Package) approves that the building is compatible with the current energy performance rules on the passive house standard. Crucial are:

- air tightness: 0,6/h
- heating and cooling demand < 15 kWh/m<sup>2</sup>

In several other climate zones (Washington, Las Vegas, North-Canada), the house copes with the passive standards, thanks to the modular construction that allow a reconfiguration of wall and glass panels without attacking the concept of the Ecube.

### 10.1.3 Analysis with TRNSys

To make valid choices at every step of the process the simulation program TRNSys was used to study the impact of various design decisions on the total energy demand (heating and cooling loads).

In the conceptual design phase the building geometry has been implemented in the simulation software to determine a suitable geometry and placement of openings. For example the schematic design included a skylight that covered a large section of the roof, simulations showed however that this resulted in too much internal solar heat gains, after which it was decided to omit this design feature. Also, several parameters were adjusted to look for passive cooling techniques. We saw we could drop the total cool loads without using active techniques.

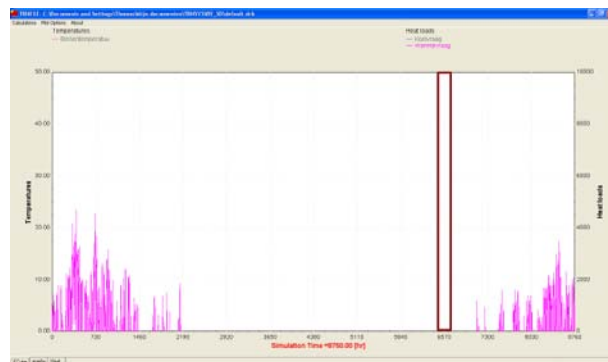
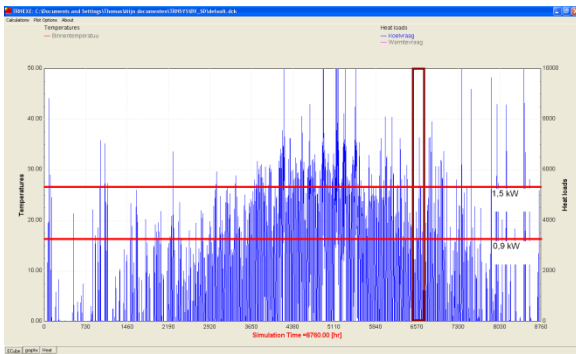
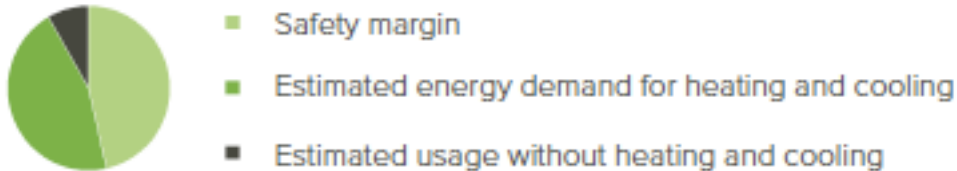


Fig. 1: Cool and Heat loads

TRNSys was also used to dimension the HVAC system. Different options were evaluated for example, we compared an air-based system (air – to – air heat pump) with a water- based system ( sun collector with an air to water heat pump). We have seen that this last option is the most efficient .

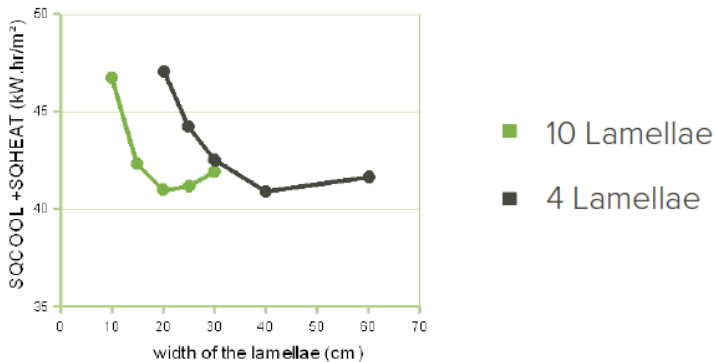


The energy needed to provide the E-cube in thermal comfort will reach of 45% of the total energy consumption. Using Trnsys simulations in several climate zones (Ukkel, Washington, Las Vegas and North-Canada), an analysis was made to explore how this consumption can be optimised.

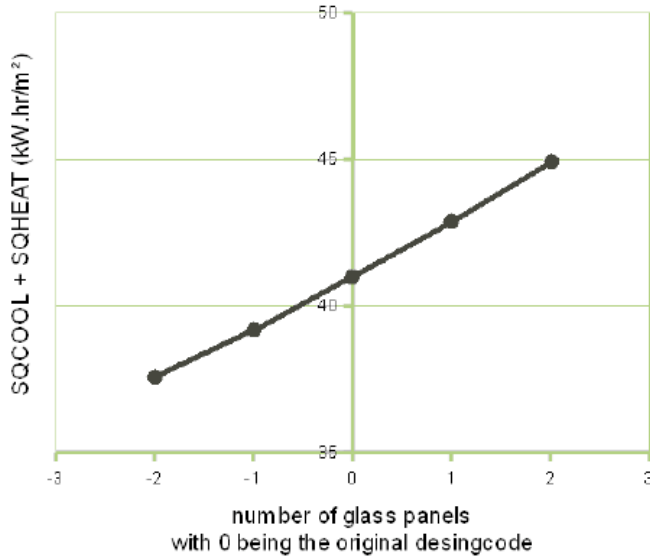


#### Types of blinds:

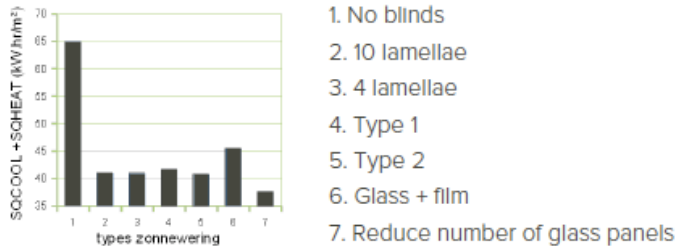
Lamellae obstruct accession of the sun in summer and let them pass in winter, witch results in a reduction of cooling demand in the first and heat demand in the second situation. The optimum of energy demand and the dimensions of the lamellae change when the distance between them varie.



Two types of automatic blinds, both controlled by an analysis of the total amount of sunlight that is recieved by the glass surface, are simulated. Type 2 contains an extra temperature regulation. Useful solar heat gains are utilized, and have a major influence by minor setpoints of the amount of sunlight on the glass surface. Glass supplemented with a film reduces accession of the sun. As a result there are limited solar gains. The cooling demand will decrease in summer, but the heating demand will rise in winter. The energy requirement can be reduced by a variation in the number of wall and glass panels, thanks to the modular construction of the E-cube.



The total energy demand can be reduced by nearly 1/3 by using one of upper systems. Automatical solar blinds of type 2 will result in the highest effectiveness. Lamellae are the second best. These have these have the advantage that they do not need energy.



## Discussion, Preliminary Conclusions, and Next Phase

In the conceptual design phase the building geometry has been implemented in the simulation software to determine a suitable geometry and placement of openings. Changes were made when initial design features were deemed to energy intensive or too expensive, or a combination thereof. For example the schematic design included an operable skylight that covered a large section of the roof. Simulations indicated however that this design feature resulted in much unwanted internal solar heat gains and that the feature would require extensive shading devices to counteract this effect. Subsequently, it was decided to omit this design feature as it would have increased the cost of the house too much, thus not yet fitting the overall criteria of affordability. Also,



several parameters were adjusted to look for passive cooling techniques, such as implementing thermal mass in the top of the E-cube and using night ventilation.

When selecting an appropriate heating and cooling approach, we have made a trade-off between energy efficiency and affordability (which included ease of installation on the National Mall). An air- to-air heat pump system was adopted with convection heating and cooling units. TRNSys was used to dimension the HVAC system.

Other building related energy demands (cooking, warm water,...) were simply calculated.

Finally, the overall energy demand for the building was calculated by simply adding the various energy expenditures. This initial energy balance represents a conservative estimate of all energy expenditures by simply adding them together, assuming a worst case scenario where all energy events occur simultaneously. This estimate resulted in required PV size of approximately 7kWp in order to accomplish a zero-energy design.

In the next phase we will take into account the probability that various energy loads occur simultaneously and develop controls or guidelines to prevent some simultaneously energy events from happening. This will accommodate a leaner overall design and allow the use of a smaller PV system that is more affordable.





## 11 Construction Specifications

### 11.1.1 00 01 01 Project Title Page

**Title:** Team Belgium Solar Decathlon 2011  
Universiteit Gent

**Date:** April 2010 - October 2011

**Construction Site:** Technicum - Universiteit Gent  
Sint-Pietersnieuwstraat 41  
9000, Gent  
Belgium

#### Core Student Team:

**Project manager:** Michael Arens  
**Project Architects:** Toon Vermeir  
Pieter Jan De Loof  
Ruben Rottiers  
Dietwin van de Walle  
Thomas Delameillieure  
**Sponsoring and Events:** Charlotte Vyncke  
**Structural Design:** Wieland Wuyts

#### Advisors:

**General:** Steven Van Dessel  
Arnold Janssens  
**Technical Installations:** Michel De Paepe  
Donald Desmet  
**Building envelope:** Marc De Kooning  
Stéfanie Mangé  
**Interior design:** Bert Gellynck  
Lionel Devlieger  
**Structural design:** Rolf Van Steenwegen  
Klaas De Rijcke  
**Environmental Analysis:** Jelle Laverge  
Marc Delghust

**Team Belgium Website:** <http://www.solardecathlon.ugent.be/>  
**Team Belgium Contact:** [teambelgium.sd2011@gmail.com](mailto:teambelgium.sd2011@gmail.com)



## 11.2 DIVISION 01 – GENERAL REQUIREMENTS

### 11.2.1 01 10 00 Summary

### 11.2.2 01 50 00 Temporary Facilities and Controls

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 01 54 26 Temporary scaffolding and platforms

##### 1.2. SUBMITTALS

- A. custom made by team Belgium page according to document page 466

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. custom made by team Belgium

##### 2.2. PRODUCTS

- A. multiplex temporary platform



## 11.3 DIVISION 05 – METALS

### 11.3.1 05 05 00 Common Work Results for Metals

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 05 05 23 Metal Fastenings

##### 1.2. SUBMITTALS

- A. <http://www.stow-group.com/VL/producten/gepalletiseerde-goederen-2507.aspx>

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. STOW International nv  
Industriepark 6 B  
8587 Spiere-Helkijn  
Belgium  
[www.stow-group.com](http://www.stow-group.com)

##### 2.2. PRODUCTS

- A. Bolts, washers, and nuts (zinc plated)



## 11.3.2 05 12 00 Structural steel framing

### Part 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. 05 12 13 Architecturally-exposed structural Steel Framing
- B. 05 12 23 Structural Steel for Buildings

#### 1.2 SUBMITTALS

- A. see datasheet 05 12 13 page 179
- B. No datasheet available, custom made by team Belgium and professional metalwork according to construction document C101, S101 S 102

### Part 2 PRODUCTS

#### 2.1 MANUFACTURER

- A. STOW International nv  
Industriepark 6 B  
8587 Spiere-Helkijn  
Belgium  
[www.stow-group.com](http://www.stow-group.com)
- B. VERCO Metaal BVBA  
Wissenstraat 10  
9200 Sint-Gillis-Bij-Dendermonde  
Belgium  
T: +32 (0)52 21 90 15  
[info@vercometaal.be](mailto:info@vercometaal.be)

#### 2.2 PRODUCTS

- A.
  - Upright PLU16
  - Diagonals for frame bracing
  - Joists PNB 0436/2
  - Spacer PNAG 0482
  - Horizontal wind bracings
  - Vertical wind bracings



## B. UPN 160 profile

### 11.3.3 05 50 00 Metal Fabrications

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 05 51 00 Metal Stairs
- A. 05 51 00 Metal Pan Stairs
- B. 05 53 00 Metal Gratings Stairs
- C. 05 52 00 Metal Railings

##### 1.2. SUBMITTALS

A./B./C. [www.echelle-europeenne.be/nl/trappen/treden-en-roosters/kant-en-klaar-trap](http://www.echelle-europeenne.be/nl/trappen/treden-en-roosters/kant-en-klaar-trap)

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

A./B./C l'Echelle Europeenne Gent  
New Orleansstraat 16B  
9000 Gent  
Belgium  
+32( 0)3/830.35.57  
[echelle.gent@telenet.be](mailto:echelle.gent@telenet.be)  
[www.echelle-europeenne.be](http://www.echelle-europeenne.be)

##### 2.2. PRODUCTS

- A. Prefabricated metal staircase
- B. Metal railings staircase
- C. Metal gratings stairs



### 11.3.4 05 59 00 Metal Specialties

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 05 59 00 Adjustable Metal Foundation Support

##### 1.2. SUBMITTALS

- A. <http://www.gereedschapbestellen.nl/vmchk/-/hand-werkplaatsgereedschap/hijs-hefmiddelen/schaarkrik-3-ton>

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Handelonderneming van Rossum  
Koperslagerstraat 23  
5405 BS Uden  
Netherlands.  
[info@gereeddscapbesteelen.nl](mailto:info@gereeddscapbesteelen.nl)  
[www.gerredscapbestellen.nl](http://www.gerredscapbestellen.nl)

##### 2.2. PRODUCTS

- A. Standard Scaffolding Jack 3 ton



## 11.4 DIVISION 06 – WOODS, PLASTICS, and COMPOSITES

### 11.4.1 06 12 00 Structural Panels

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 06 12 16 Structural Insulated Panels

##### 1.2. SUBMITTALS

- A. No data sheet available, custom made by team Belgium and UNILIN according to document A 111, A113, A312, A 322

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

A/B/C Unilin bvba - division Systems  
Waregemstraat 112  
B-8792 Waregem  
Belgium  
[Sales\\_Systems@unilin-systems.com](mailto:Sales_Systems@unilin-systems.com)  
Tel. +32(0)56 73.50.91  
[www.unilin-systems.com](http://www.unilin-systems.com)

##### 2.2. PRODUCTS

- A. Thermally Insulated and finished Structural Panels for Floor  
Thermally Insulated and finished Structural Panels for Wall  
Thermally Insulated and finished Structural Panels for Roof



## 11.4.2 06 40 00 Architectural Woodwork

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 06 42 00 Wood Paneling

#### 1.2. SUBMITTALS

- A. No datasheet available, custom made by team Belgium and UNILIN according to document A 111

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Unilin bvba - division Systems  
Waregemstraat 112  
B-8792 Waregem  
Belgium  
[Sales\\_Systems@unilin-systems.com](mailto:Sales_Systems@unilin-systems.com)  
Tel. +32(0)56 73.50.91  
[www.unilin-systems.com](http://www.unilin-systems.com)

#### 2.2. PRODUCTS

- A. Interior wood partitions panels





### 11.4.3 07 50 00 Membrane Roofing

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 07 53 23 EPDM Roofing

##### 1.2. SUBMITTALS

- A. <http://www.irs-europe.be/nlProfDakEpdmEVA.html>

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. I.R.S nv  
Europalaan 73  
9800 Deinze  
België  
Tel. 09 321 99 21  
Fax 09 371 97 61  
E-mail : info@waterdicht.be  
[www.irs-europe.be](http://www.irs-europe.be)  
[www.waterdicht.be](http://www.waterdicht.be)

##### 2.2. PRODUCTS

- A. I.R.S.-EPDM Roofing Membrane EVALASTIC: color white



#### 11.4.4 07 70 00 Roof and Wall Specialties and Accessories

##### Part 1 – GENERAL

###### 1.1. SECTION INCLUDES

- A. 07 71 23 Manufactured Gutters and Downspout

###### 1.2. SUBMITTALS

- A. tbd

##### Part 2 - PRODUCTS

###### 2.1. MANUFACTURER

- A. I.R.S nv  
Europalaan 73  
9800 Deinze  
België  
Tel. 09 321 99 21  
Fax 09 371 97 61  
E-mail : info@waterdicht.be

###### 2.2. PRODUCTS

- A. Manufactured Roof downspout in EPDM



## 11.5 DIVISION 08 – OPENINGS

### 11.5.1 08 10 00 Doors and Frames

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 08 11 16 Aluminum Doors and Frames

##### 1.2. SUBMITTALS

- A. see datasheets 08 10 00 page 188

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Reynaers Aluminium  
Oude Liersebaan 266  
B-2570 Duffel  
Belgium  
T. +32 (0)15 30 85 00  
F. +32 (0)15 30 86 00  
[info@reynaers.com](mailto:info@reynaers.com)

##### 2.2. PRODUCTS

- A. Thermally insulated aluminum door CS 104 profile



## 11.5.2 08 14 00 wood doors

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 08 14 73 sliding wood doors

#### 1.2. SUBMITTALS

- A. -sliding system:  
see datasheet 08 14 73 page 189
- sliding doors:  
No datasheet available, custom made by team Belgium according to document A581

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. -sliding system:  
ROB NV Louage & Wisselinck  
Stationsstraat 221  
8850 Aardooie  
Belgium  
T:+32(0)51744801  
[info@rob.be](mailto:info@rob.be)  
[www.rob.be](http://www.rob.be)
- sliding doors: made by team Belgium

#### 2.2. PRODUCTS

- A. -Sliding system: single roll sliding system with stops
- Sliding doors



### 11.5.3 08 50 00 Windows

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 08 51 13 Aluminum Windows

##### 1.2. SUBMITTALS

- A. see datasheet 08 50 00 page 194

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Reynaers Aluminium  
Oude Liersebaan 266  
B-2570 Duffel  
Belgium  
T. +32 (0)15 30 85 00  
F. +32 (0)15 30 86 00  
[info@reynaers.com](mailto:info@reynaers.com)

##### 2.2. PRODUCTS

- A. Thermally insulated aluminum windows CS 104 profile



## 11.5.4 08 80 00 Glazing

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 08 81 00 Glass Glazing

#### 1.2. SUBMITTALS

- A. See datasheets 08 80 00 page 196

#### 1.3. RELATED SECTIONS

- 08 11 16 Aluminum Doors and Frames
- 08 51 13 Aluminum Windows

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Saint-Gobain-Glass Benelux.  
Rue des Glaces Nationales  
5060 Sambreville  
Belgium  
[glassinfo.fr@saint-gobain-glass.com](mailto:glassinfo.fr@saint-gobain-glass.com)  
[www.saint-gobain-glass.com](http://www.saint-gobain-glass.com)

#### 2.2. PRODUCTS

- A. Triple glazing CLIMATOP MAX



## 11.6 DIVISION 09 – FINISHES

### 11.6.1 09 60 00 Flooring

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 09 62 00 Specialty Flooring

##### 1.2. SUBMITTALS

- A. <http://www.echelle-europeenne.be/nl/trappen/treden-en-roosters/maasroosters>  
See drawing A102

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. l'Echelle Europeenne Gent  
New Orleansstraat 16B  
9000 Gent  
Belgium  
+32( 0)3/830.35.57  
[echelle.gent@telenet.be](mailto:echelle.gent@telenet.be)  
[www.echelle-europeenne.be](http://www.echelle-europeenne.be)

##### 2.2. PRODUCTS

- A. flooring second floor hallway: industrial metal gratings



## 11.6.2 09 90 00 Painting and Coating

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 09 91 23 Interior Painting

#### 1.2. SUBMITTALS

- A. see datasheet 09 91 23 page 198

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A./B. Tintelijn  
verkortingstraat 53  
9040 Gent ( St.-Amandsberg)  
Belgium  
[info@tintelijn.be](mailto:info@tintelijn.be)  
[www.tintelijn.be](http://www.tintelijn.be)

#### 2.2. PRODUCTS

- A. Ecotec paint / Ecotec Pro aqua lak





## 11.7 DIVISION 10 – SPECIALTIES

### 11.7.1 10 28 00 Toilet, Bath, and Laundry Accessories

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 10 28 16.13 residential Bath Accessories

##### 1.2. SUBMITTALS

- A. see datasheet 10 28 00 page 201

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. FACQ N.V.  
Industrieweg 12  
9032 Wondelgem  
Belgium  
T +32 (0)9 396 31 02  
[www.facq.be](http://www.facq.be)  
[sales@facq.be](mailto:sales@facq.be)

##### 2.2. PRODUCTS

- A. Towel bar 50 cm 296247  
Toilet paper dispenser 296261  
Towel hook 296261



## 11.7.2 10 57 00 Wardrobe and Closet Specialties

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 10 57 23 Closet and Utility Shelving

#### 1.2. SUBMITTALS

- A. -shelving: see datasheet 10 30 00 page 208  
-wheels: [www.doehetzelfdepot.be/wieltje-nl-2-3.html](http://www.doehetzelfdepot.be/wieltje-nl-2-3.html)

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. -shelving:  
AVASCO INDUSTRIES N.V.  
Cardijnlaan 6  
8600 Diksmuide  
Belgium  
Tel. +32(0)51 50 08 11  
  
-wheels:  
hout- & bouwcenter Van den nest  
Doorsteeklaan 1  
9308 Hofstade  
T: +32 (0)35/21 58 43  
[info@vandennest.be](mailto:info@vandennest.be)  
[www.vandennest.be](http://www.vandennest.be)

#### 2.2. PRODUCTS

- A. -shelving: AVASCO CLICKER  
- wheels: PVC wheels ( 40 kg)



### 11.7.3 10 70 00 Exterior Specialties

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 10 71 13 Exterior Sun Control Devices

##### 1.2. SUBMITTALS

- A. see datasheet 10 70 00 page 202

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Helioscreen N.V.  
Dijkstraat 26 B  
9160 Lokeren  
Belgium  
Tel +32 (0)93489000  
[info@helioscreen.be](mailto:info@helioscreen.be)  
[www.helioscreen.be](http://www.helioscreen.be)

##### 2.2. PRODUCTS

- A. external fibre solar shading , electrical operated Smartscreen EVE 063 105 TPC



## 11.8 DIVISION 11 – EQUIPMENT

### 11.8.1 11 30 00 Residential Equipment

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 11 31 13 Residential Kitchen Appliances
- B. 11 31 23 Residential Laundry Appliances

##### 1.2. SUBMITTALS

- A. - Cook Top Induction :  
[www.whirlpool.be:80/app.cnt/whr/nl\\_BE/pageid/pgwpproddtI001/catid/1/subcatid/3/prodid/33](http://www.whirlpool.be:80/app.cnt/whr/nl_BE/pageid/pgwpproddtI001/catid/1/subcatid/3/prodid/33)

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- Combi Microwave/oven:

see datasheet 11 30 00 page 204

- Refrigerator:

see datasheet 11 30 00 page 204

- Dishwasher:

see datasheet 11 30 00 page 204

- Deco Hood

see datasheet 11 30 00 page 204

- Coffee machine:

[http://www.whirlpool.be:80/app.cnt/whr/nl\\_BE/pageid/pgwpproddtI001/catid/1/subcatid/19/prodid/35](http://www.whirlpool.be:80/app.cnt/whr/nl_BE/pageid/pgwpproddtI001/catid/1/subcatid/19/prodid/35)

340

- B. - Cloth Washer:



- Cloth Drier:
- see datasheet 11 30 00 page 204

## Part 2 - PRODUCTS

### 2.1. MANUFACTURER

A./B. Whirlpool Benelux NV  
Nijverheidslaang 3/1  
1853 Stroombeek-Bever  
Belgium  
T:+32 (0)2 263 32 42  
[www.whirlpool.com](http://www.whirlpool.com)

### 2.2. PRODUCTS

- A. Cook top Induction hob : ACM 754 LX  
Speed over + microwave function: AMW 593 IX  
Full door dish: ADG 9643 TR  
Coffee machine: ACE 010 IX  
Deco Hood AKR 016 IX  
Combi freezer refrigerator: WBE 34132 A++S
- B. Cloth Washer                      product number: PURE 1485  
Cloth Drier                            product number: AZA 1485



## 11.9 DIVISION 12 – FURNISHINGS

### 11.9.1 12 30 00 Casework

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 12 35 30.13 Kitchen Casework
- B. 12 35 30.23 Bathroom Casework
- C. 12 36 19 Wood Countertops

##### 1.2. SUBMITTALS

- A. see datasheet 12 30 00 page 208
- B. No datasheet available, custom made by team Belgium according to document A 305  
product: melamine chipboard  
<http://www.hanssenshout.be/plaatmateriaal/melamineplaten>
- C. design by team Belgium  
product: betonplex  
<http://www.hanssenshout.be/plaatmateriaal/betonplex>

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. AVASCO INDUSTRIES N.V.  
Cardijnlaan 6  
8600 Diksmuide  
Belgium  
Tel. +32(0)51 50 08 11  
[www.avasco.be](http://www.avasco.be)
- B. /C. wood products:  
HANSENS HOUT N.V.  
Port Arthurlaan 90



Team Belgium – Ghent University  
Teambelgium.sd2011@gmail.com

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9000 Gent  
Belgium  
Tel. +32(0)92509650  
[www.hanssenshout.be](http://www.hanssenshout.be)  
[info@hanssenshout.be](mailto:info@hanssenshout.be)

## 2.2. PRODUCTS

- A. Avasco clicker
- B. bathroom furniture in melamine chipboard
- C. betonplex kitchentop



## 11.9.2 12 40 00 Furnishings and Accessories

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 12 40 00 Table Accessories
- B. 12 43 00 Portable lamps
- C. 12 45 00 Bedroom Furnishings

#### 1.2. SUBMITTALS

- A. Product datasheets
- B. Product datasheets
- C. Product datasheets

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. t.b.d
- B. t.b.d
- C. t.b.d

#### 2.2. PRODUCTS

- A. t.b.d
- B. t.b.d
- C. t.b.d





### 11.9.3 12 50 00 Furniture

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 12 58 00 residential Furniture

##### 1.2. SUBMITTALS

- A. t.b.d

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. second hand shop

##### 2.2. PRODUCTS

- A. dining table+ chairs  
2 sofa's  
living table  
book shelves  
masterbed  
bunkbed  
desk



## 11.10 DIVISION 21 – FIRE SUPPRESSION

### 11.10.1 21 10 00 Water Based Fire-Suppression Systems

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 21 11 00 Facility Fire-Suppression Water-Service Piping
- B. 21 13 00 Fire Suppression Sprinkler Systems

##### 1.2. SUBMITTALS

- A. see datasheet 21 11 00 page 210
- B: see datasheets 21 13 00 page **Error! Bookmark not defined.**

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A./B. Tyco Fire Protection Products  
E19 Business Park - Battelsesteenweg 455 - Gebouw D,  
2800 Mechelen  
Belgium  
Tel: +32 (0) 15285555  
mvandaele@tyco-bspd.com  
www.tyco-fsbp.com

##### 2.2. PRODUCTS

- A. G-press piping system, stainless steel
- B. residential sprinklers , quick response  
TFP 400/ TFP 415/ TFP 450 / Riser Manifold



## 11.10.2 21 40 00 Fire-Suppression Water Storage

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 21 41 16 Elevated Storage Tanks for Fire-Suppression Water

#### 1.2. SUBMITTALS

- A. No datasheet available, custom made by Sioen according to document L107  
  
see datasheets 21 40 00 page 252 for more information about the fabric of the container

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Sioen Industries NV  
Fabriekstraat 23  
8850 Ardoorie  
Belgium  
T + 32 51 74 09 00  
[corporate@sioen.be](mailto:corporate@sioen.be)  
[www.sioen.com](http://www.sioen.com)

#### 2.2. PRODUCTS

- A. flexible container: B6000 PVC coated PES fabric bag



## 11.11 DIVISION 22 – PLUMBING

### 11.11.1 22 10 00 Plumbing Piping and Pumps

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 22 11 16 Domestic Water Piping
- B. 22 11 23 Domestic Water Pumps
- C. 22 12 00 Facility Potable-Water Storage Tanks
- D. 22 13 13 Facility Sanitary Sewers

##### 1.2. SUBMITTALS

- A. see datasheets 22 11 16 page 253
- B. see datasheets 22 11 23 page 322
- C. No datasheet available, custom made by Sioen according to document L107  
see datasheets 22 12 00 page 330 for more information about the fabric of the container
- D. see datasheets 22 13 13 page 332

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Henco NV  
Toekomstlaan 27  
2200 Herentals  
Belgium  
T: +32 14 28 56 60  
[www.henco.be](http://www.henco.be)  
[info@henco.be](mailto:info@henco.be)  
  
VSH Fittings B.V.  
Oude Amersfoortseweg 99  
1212 Hilversum  
Nederland  
T:+31 (0)35 6884211  
[info@vsh-fittings.com](mailto:info@vsh-fittings.com)  
[www.vsh-fittings.com](http://www.vsh-fittings.com)



- B. NV GRUNDFOS BELLUX SA  
Boomsesteenweg 81-83  
B-2630 AARTSELAAR  
Belgium  
Tel 0032 3 870 73 00  
Fax 0032 3 870 73 01  
E-mail: [infobellux@grundfos.com](mailto:infobellux@grundfos.com)
  
- C. Sioen Industries NV  
Fabriekstraat 23  
8850 Ardoie  
Belgium  
T + 32 51 74 09 00  
[corporate@sioen.be](mailto:corporate@sioen.be)  
[www.sioen.com](http://www.sioen.com)
  
- D. FACQ N.V.  
Industrieweg 12  
9032 Wondelgem  
Belgium  
T +32 (0)9 396 31 02  
[www.facq.be](http://www.facq.be)  
[sales@facq.be](mailto:sales@facq.be)

## 2.2. PRODUCTS

- A. Henco multilayer piping system + VSH flow control system
- B. CMBE 3-3 pump  
Liftaway system grundfos KP pump  
Alpha 2 25 60 circulation pump
- C. flexible containerbag : B 6303 PVC coated PES fabric bag  
Waste water flexible containerbag: B 6000 PVC coated PES fabric bag
- D. PVC sanitary piping system



## 11.11.2 22 40 00 Plumbing Fixtures

### 22 41 00 Residential Plumbing Fixtures

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 22 41 13 Residential Water Closets, Urinals, and Bidets
- B. 22 41 16 Residential Lavatories and Sinks
- C. 22 41 23 Residential Shower Receptors and Basins
- D. 22 41 39 Residential Faucets, Supplies and Trim

##### 1.2. SUBMITTALS

- A./B./D. see datasheet 22 41 00 page 155
- C. no datasheet available, Custom made by team Belgium and I.R.S according to document A 582

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A./B./D. FACQ N.V.  
Industrieweg 12  
9032 Wondelgem  
Belgium  
T +32 (0)9 396 31 02  
[www.facq.be](http://www.facq.be)  
[sales@facq.be](mailto:sales@facq.be)
  
- C. I.R.S. NV  
Europalaan 73  
9800 Deinze  
Belgium  
T +32(0)9 321 99 21  
[www.waterdicht.be](http://www.waterdicht.be)  
[info@waterdicht.be](mailto:info@waterdicht.be)



## 2.2. PRODUCTS

- A. residential water closet: gelux 317040
- B. residential lavatory: Floronde rond 243440  
Residential sink: KUBUS KBX 210 530
- C. EPDM shower bag /basin
- D. faucet shower: Tempesta duo 377  
Faucet Lavatory : 295647  
Faucet kitchen: ACTIVE 311729  
Shower thermostat: 29568  
Shower hoseGROHFLEX 226730



## 11.12 DIVISION 23 – HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

### 11.12.1 23 09 00 Instrumentation and Control for HVAC

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 23 09 33 Electric and Electronic Control System for HVAC

##### 1.2. SUBMITTALS

- A. see datasheets 23 09 00 page 355

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

A/B/C/D	Niko NV Industriepark West 40 9100 Sint-Niklaas Belgium <a href="http://www.niko.be">www.niko.be</a> T: +32 37789000 Karin.mussche@nikoprojects.be
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##### 2.2. PRODUCTS

- A. Niko Home Control system





## 11.12.2 23 30 00 HVAC Air Distribution

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 23 31 00 HVAC Ducts and Casings
- B. 23 37 00 Air Outlets and Inlets

#### 1.2. SUBMITTALS

- A. See datasheets 23 31 00 page 369
- B. See datasheets 23 37 00 page 379

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A./B. Lindab NV  
Zeeschipstraat 149  
9000 Gent  
Belgium  
T:+32 9 385 50 11  
[info@lindab.be](mailto:info@lindab.be)  
[www.lindab.be](http://www.lindab.be)

#### 2.2. PRODUCTS

- A. air Duct Safe Sytem: round ventilation ducts
- B. displacement diffuser: Theater diffuser



### 11.12.3 23 50 00 Central Heating Equipment

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 23 50 00 Central Heating Equipment
- B. 23 56 00 Solar Energy Heating Equipment

##### 1.2. SUBMITTALS

- A. See datasheet 23 50 00 page 380
- B. See datasheet 23 56 00 page 400

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A./B. Daikin Europe N.V.  
Zandvoordestraat 300  
BE-8400 Oostende  
Belgium  
T.: +32 59 55 81 11  
F.: +32 59 55 88 99  
[www.daikin.be](http://www.daikin.be)  
  
Bulex

##### 2.2. PRODUCTS

- A. Daikin Altherma Heatpump  
Inside Unit: Daikin Altherma EKHBX008BA6WN  
Outside Unit: Daikin Altherma ERLQ008BV3  
Boiler Bulex RS 100
- B. Solar Collectors Heating EKHTS 260 AC



## 11.12.4 23 60 00 Central Cooling Equipment

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 23 60 00 Central Cooling Equipment

#### 1.2. SUBMITTALS

- A. See datasheet 23 50 00 page 380

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A Daikin Europe N.V.  
Zandvoordestraat 300  
BE-8400 Oostende  
Belgium  
T.: +32 59 55 81 11  
F.: +32 59 55 88 99  
[www.daikin.be](http://www.daikin.be)

#### 2.2. PRODUCTS

- A. Daikin Altherma Heatpump  
Inside Unit: Daikin Altherma EKHBX008BA6WN  
Outside Unit: Daikin Altherma ERLQ008BV3



## 11.12.5 23 70 00 Central HVAC Equipment

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 23 72 00 Air-to-Air Energy Recovery Equipment

#### 1.2. SUBMITTALS

- A. see datasheets 23 72 00 page 390

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Daikin Europe N.V.  
Zandvoordestraat 300  
BE-8400 Oostende  
Belgium  
T.: +32 59 55 81 11  
F.: +32 59 55 88 99  
[www.daikin.be](http://www.daikin.be)

#### 2.2. PRODUCTS

- A. Daikin Heat Recovery VAM250FA8VE



## 11.12.6 23 80 00 Decentralised HVAC Equipment

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 23 82 00 convection heating and cooling units

#### 1.2. SUBMITTALS

- A. see datasheets 23 82 00 page 409

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Daikin Europe N.V.  
Zandvoordestraat 300  
BE-8400 Oostende  
Belgium  
T.: +32 59 55 81 11  
F.: +32 59 55 88 99  
[www.daikin.be](http://www.daikin.be)

#### 2.2. PRODUCTS

- A. Daikin fancoil unit FWM08CTN



## 11.13 DIVISION 26 – ELECTRICAL

### 11.13.1 26 05 00 Common Work Results for Electrical Distribution

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 26 05 19 Low-Voltage Electrical Power Conductors and Cables
- B. Branch Circuit Load Calculation / Feeder and Service Load Calculation

##### 1.2. SUBMITTALS

- A. see datasheet 26 05 00 page 417
- B. see calculations page 431

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Wieland Benelux  
Bosstraat 22  
1050 Brussel  
Belgium  
+32 (0) 2 640 80 40  
[www.aecinfo.be](http://www.aecinfo.be)

Kabelwerk Eupen AG  
Malmedyer Strasse 9  
4700 Eupen  
Belgium  
+32/ 87/597-000  
[www.eupen.be](http://www.eupen.be)  
info@eupen.com

##### 2.2. PRODUCTS

- A. DISTRIBUTOR: GST18I3V 3PI V SW  
GESIS KNX ( USB INTEFACE)



GESIS EIB-V ENOCEAN GATEWAY

GESIS RCSWITCH 2 CH

CONNECTORS WITH CABLE

INSTALLATION CABLE F2 3G1,5mm2 XVB3G1.5 R 100 100m 0,4978

INSTALLATION CABLE F2 3G2,5mm2 XVB3G2.5 R 100 250m 0,7157

INSTALLATION CABLE F2 3G6mm2 XVB3G6 R 50 50m 2,0287

HARMONIZED CABLE H07 VKT BLAUW EUPEN 2,5mm2 V0BST2,5B R 100

HARMONIZED CABLE H07VKT ZWART EUPEN 2,5mm2 V0BST2,5N R 100

HARMONIZED CABLE H07VKT BLAUW EUPEN 10mm2 V0BST10B R 100

HARMONIZED CABLE H07VKT ZWART EUPEN 10mm2 V0BST10N R 100



## 11.13.2 26 20 00 Low-Voltage Electrical Distribution

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 26 24 00 Switchboards and Panelboards

#### 1.2. SUBMITTALS

- A. see datasheets 26 20 00 page 439

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Schneider electric  
Dieweg 3  
1180 Ukkel  
Belgium  
+ 32 (0) 2 373 75 02  
[www.schneider-electric.be](http://www.schneider-electric.be)

#### 2.2. PRODUCTS

- A. Cupboard pragma plus Box plus 24510  
Door BOXPLUS 245010  
Differential release FREEDIS 40 A, 300 mA  
Differential release FREEDIS 40 A, 30 mA  
Automat FREEDIS 10 A  
Automat FREEDIS 16 A  
Automat FREEDIS 20 A  
Automat FREEDIS 32 A  
Magnetic Switch CT





### 11.13.3 26 70 00 Low-Voltage Distribution equipment

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 26 27 19 Multi – Outlet assemblies
- B. 26 27 26 Wiring Devices

##### 1.2. SUBMITTALS

- A. see datsheet 26 70 00 page 447

##### 1.3. RELATED SECTIONS

- A. 23 09 00

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Niko NV  
Industriepark West 40  
9100 Sint-Niklaas  
Belgium  
[www.niko.be](http://www.niko.be)  
T: +32 37789000  
[Karin.mussche@nikoprojects.be](mailto:Karin.mussche@nikoprojects.be)

b+b Automations- und Steuerungstechnik GmbH  
Klingenweg 17  
64385 Reichelsheim  
Germany  
[www.bb-steuerungstechnik.de](http://www.bb-steuerungstechnik.de)



T: + 49 6164/ 912057  
support@bb-steuerungstechnik.de

B.           Wieland Belelux  
Bosstraat 22  
1050 Brussel  
Belgium  
+32 (0) 2 640 80 40  
[www.aecinfo.be](http://www.aecinfo.be)

ERIKS nv  
Boombekelaan 3,  
B-2660 Hoboken,  
Belgium  
T: +(32) 3-829 26 11  
[www.eriks.be](http://www.eriks.be)  
e-mail: info@eriks.be

## 2.2. PRODUCTS

A.           NIKO OUTLET  
              ENOCEAN IP-GATEWAY

B.           RC SWITCH 4CH  
              RC SWITCH 2CH  
              FRAME  
              FRAME 2 FOLD  
              PROTECTOR PROFILE



## 11.13.4 26 30 00 Facility Electrical Power Generating and Storage Equipment

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 26 31 00 Photovoltaic Collectors (roof)

#### 1.2. SUBMITTALS

- A. see datasheet 26 31 00 page 456

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Sanyo Benelux  
Antwerpsesteenweg 491A  
2500 Lier  
Belgium  
Tel : ++32/3.451.21.50  
Fax : ++32/3.451.21.55  
[sales@sanyo.be](mailto:sales@sanyo.be)

#### 2.2. PRODUCTS

- A. Sanyo HIP-215NKHA5



## 11.13.5 26 50 00 Lighting

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

- A. 26 51 13 Interior Lighting Fixtures, Lamps, and Ballasts
- B. 26 56 29 Site Lighting

#### 1.2. SUBMITTALS

- A. see datasheet 26 50 00 page 465
- B. <http://www.dewalt.be/nl/powertools/productdetails/catno/DC019/>  
[http://www.stanleyworks.be/product\\_detail/Klemzaklamp/SkuDetail.ctlg?ObjectID=95-891](http://www.stanleyworks.be/product_detail/Klemzaklamp/SkuDetail.ctlg?ObjectID=95-891)

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

- A. Delta Ligth NV  
Muizelstraat 2  
8560 Wevelgem  
Belgium  
+ 32 56 435 735  
[info@deltalight.com](mailto:info@deltalight.com)  
[www.deltalight.com](http://www.deltalight.com)
- B. De Walt  
Nieuwlandlaan 7  
Industriezone Aarschot B156  
3200 Aarschot  
Tel: 070 / 220 063  
[info@dewalt.be](mailto:info@dewalt.be)



## 2.2. PRODUCTS

- A. microline 30 modules T16 down compressed MIC – PC SBL PROFILE
- B. Heavy-Duty werkplaatsverlichting op accu of netstroom  
Klemzaklamp - 95-891



## 11.14 DIVISION 27 – COMMUNICATIONS

### 11.14.1 27 20 00 Data Communications

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

A. 27 41 19 Portable Audio-Video Equipment

A. 27 41 00 Audio-Video Systems

##### 1.2. SUBMITTALS

A. <http://www.sony.be/lang/nl/product/hcs-home-cinema-projectors/vpl-vw85>

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

A. Sony Belgium  
Da Vincilaan 7 D1  
19935 Zaventem  
Belgium  
+32 (0)70 222 130  
[www.sony.be](http://www.sony.be)

##### 2.2. PRODUCTS

A. home cinema projector VPL-VW85



## 11.14.2 27 40 00 Audio Video Communications

### Part 1 – GENERAL

#### 1.1. SECTION INCLUDES

A. 27 41 19 Portable Audio-Video Equipment

A. 27 41 00 Audio-Video Systems

#### 1.2. SUBMITTALS

A. <http://www.sony.be/lang/nl/product/hcs-home-cinema-projectors/vpl-vw85>

### Part 2 - PRODUCTS

#### 2.1. MANUFACTURER

A. Sony Belgium  
Da Vincilaan 7 D1  
19935 Zaventem  
Belgium  
+32 (0)70 222 130  
[www.sony.be](http://www.sony.be)

#### 2.2. PRODUCTS

A. home cinema projector VPL-VW85



## 11.15 DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

### 11.15.1 28 30 00 Electronic Detection and Alarm

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 28 31 00 Fire Alarm

##### 1.2. SUBMITTALS

- A. [www.tyco-fire.com/TFP\\_translate/TFP922\\_NL.pdf](http://www.tyco-fire.com/TFP_translate/TFP922_NL.pdf)

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Tyco Fire Protection Products  
E19 Business Park - Battelsesteenweg 455 - Gebouw D,  
2800 Mechelen  
Belgium  
Tel: +32 (0) 15285555  
[mvandaele@tyco-bspd.com](mailto:mvandaele@tyco-bspd.com)  
[www.tyco-fsbp.com](http://www.tyco-fsbp.com)

##### 2.2. PRODUCTS

- A. fire alarm





## 11.16 DIVISION 32 – EXTERIOR IMPROVEMENTS

### 11.16.1 32 10 00 Bases, Ballast, and Paving

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 32 14 26 Wood paving

##### 1.2. SUBMITTALS

- A. Custom made by team Belgium

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. custom made by team Belgium according to document page 466

##### 2.2. PRODUCTS

- A. multiplex flooring for walkways and terraces(reused temporary flooring from build up)



## 11.17 DIVISION 41 – MATERIAL PROCESSING AND HANDLING EQUIPMENT

### 11.17.1 41 60 00 Facility Mobile Plant Equipment

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 41 62 23 Forklift trucks
- B. 41 65 16 Mobile Generators

##### 1.2. SUBMITTALS

- A.  
[www.toyotaforklifts.nl/SiteCollectionDocuments/Lokale%20documenten%20TMHNL/PDF%20files/7FG-D+2007297+english.pdf](http://www.toyotaforklifts.nl/SiteCollectionDocuments/Lokale%20documenten%20TMHNL/PDF%20files/7FG-D+2007297+english.pdf)
- B. <http://www.jushonda.co.uk/pages/HondaEU30is.htm>

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Toyota material handling Belgium  
Fotografielaan 47-49  
B - 2610 Wilrijk  
T +32 (0)3 820 76 31  
F +32 (0)3 830 17 99  
M +32 (0)476 471 103  
[www.toyota-forklifts.be](http://www.toyota-forklifts.be)
- B. Honda Belgium NV  
Doornveld 180-184 Sphere Business park, Zoning 3  
1731 Zellik  
Belgium  
[cco@honda-eu.com](mailto:cco@honda-eu.com)  
[www.fl.honda.be](http://www.fl.honda.be)  
+32 2/620 11 34

##### 2.2. PRODUCTS

- A.forklift Toyota diesel 7FD35 (3,5 ton reach 5,5m)



Team Belgium – Ghent University  
Teambelgium.sd2011@gmail.com

---

B. portable Honda generator: EU 30 iS (49dB(a) at 7m @ 1/4 load)



## 11.18 DIVISION 42 – PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

### 11.18.1 42 31 16 Dessicant Equipment

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. Dehumidifier

##### 1.2. SUBMITTALS

- A. see datasheet 42 31 16 page 467

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Munters Belgium SA  
Rue du Progrés 5  
4821 Dison  
Belgium  
[info@muntersbelgium.be](mailto:info@muntersbelgium.be)  
[www.muntersnv.be](http://www.muntersnv.be)

##### 2.2. PRODUCTS

- A. portable dehumidifier: MCS 300



## 11.19 DIVISION 48 – ELECTRIC POWER GENERATION

### 11.19.1 48 10 00 Electrical power Generation Equipment

#### Part 1 – GENERAL

##### 1.1. SECTION INCLUDES

- A. 48 19 16 Electrical Power Generation Inverters

##### 1.2. SUBMITTALS

- A. see datasheet 48 10 00 page 469

#### Part 2 - PRODUCTS

##### 2.1. MANUFACTURER

- A. Linea Trovata  
Zelebaan 124  
9160 Lokeren  
tel +32 9 336 53 64  
[www.lineatrovata.com](http://www.lineatrovata.com)

##### 2.2. PRODUCTS

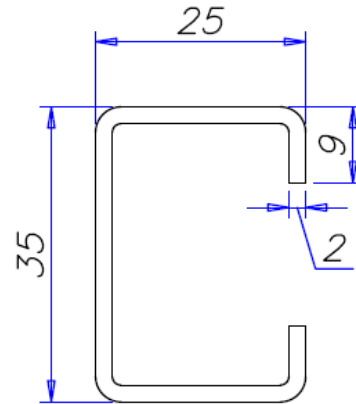
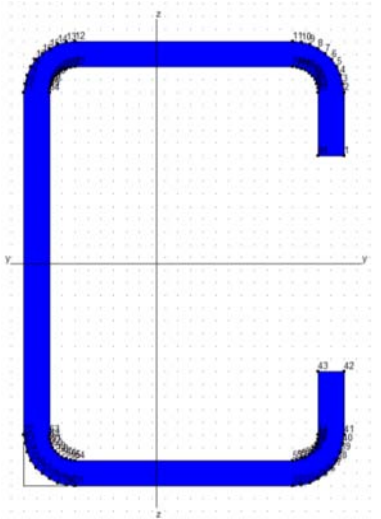
- A. Sunny Boy 700 US





$E = 210 \text{ GPa}$   
 $G = 5.3 \text{ kg/m}$

### Diagonal for frame bracing



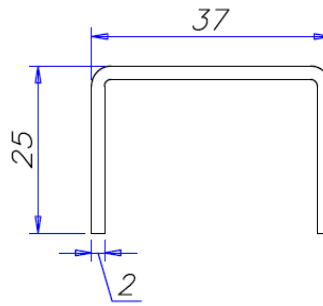
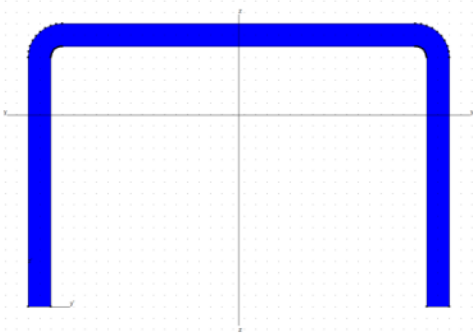
$A = 1.80 \text{ cm}^2$   
 $I_y = 3.3 \text{ cm}^4$   
 $I_z = 1.5 \text{ cm}^4$   
 $W_y = 1.9 \text{ cm}^3$   
 $W_z = 1.0 \text{ cm}^3$   
 $i_y = 1.4 \text{ cm}$   
 $i_z = 0.9 \text{ cm}$   
 $W_{pl,y} = 2.3 \text{ cm}^3$   
 $W_{pl,z} = 1.5 \text{ cm}^3$   
 $Av_z = 0.58 \text{ cm}^2$   
 $Av_y = 0.80 \text{ cm}^2$   
 $f_y = 355 \text{ N/mm}^2$   
 $E = 210 \text{ GPa}$   
 $G = 1.4 \text{ kg/m}$

Section Class 3 according to Eurocode 3. "When all the compression elements of a cross-section are Class 3, its resistance may be based on an elastic distribution of stresses across the cross-section, limited to the yield strength at the extreme fibres."

These bars are also used as horizontal wind bracings.



Spacer PNAG 0482

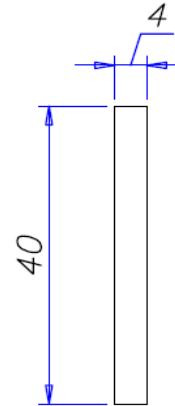
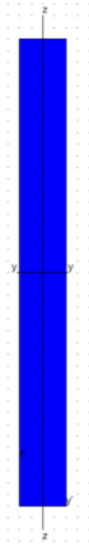


$A =$	1.63	$\text{cm}^2$
$I_y =$	1.0	$\text{cm}^4$
$I_z =$	3.6	$\text{cm}^4$
$W_y =$	0.6	$\text{cm}^3$
$W_z =$	1.9	$\text{cm}^3$
$i_y =$	0.8	$\text{cm}$
$i_z =$	1.5	$\text{cm}$
$W_{pl,y} =$	1.1	$\text{cm}^3$
$W_{pl,z} =$	2.2	$\text{cm}^3$
$Av_z =$	0.72	$\text{cm}^2$
$Av_y =$	0.64	$\text{cm}^2$
$f_y =$	355	$\text{N/mm}^2$
$E =$	210	$\text{GPa}$
$G =$	1.3	$\text{kg/m}$



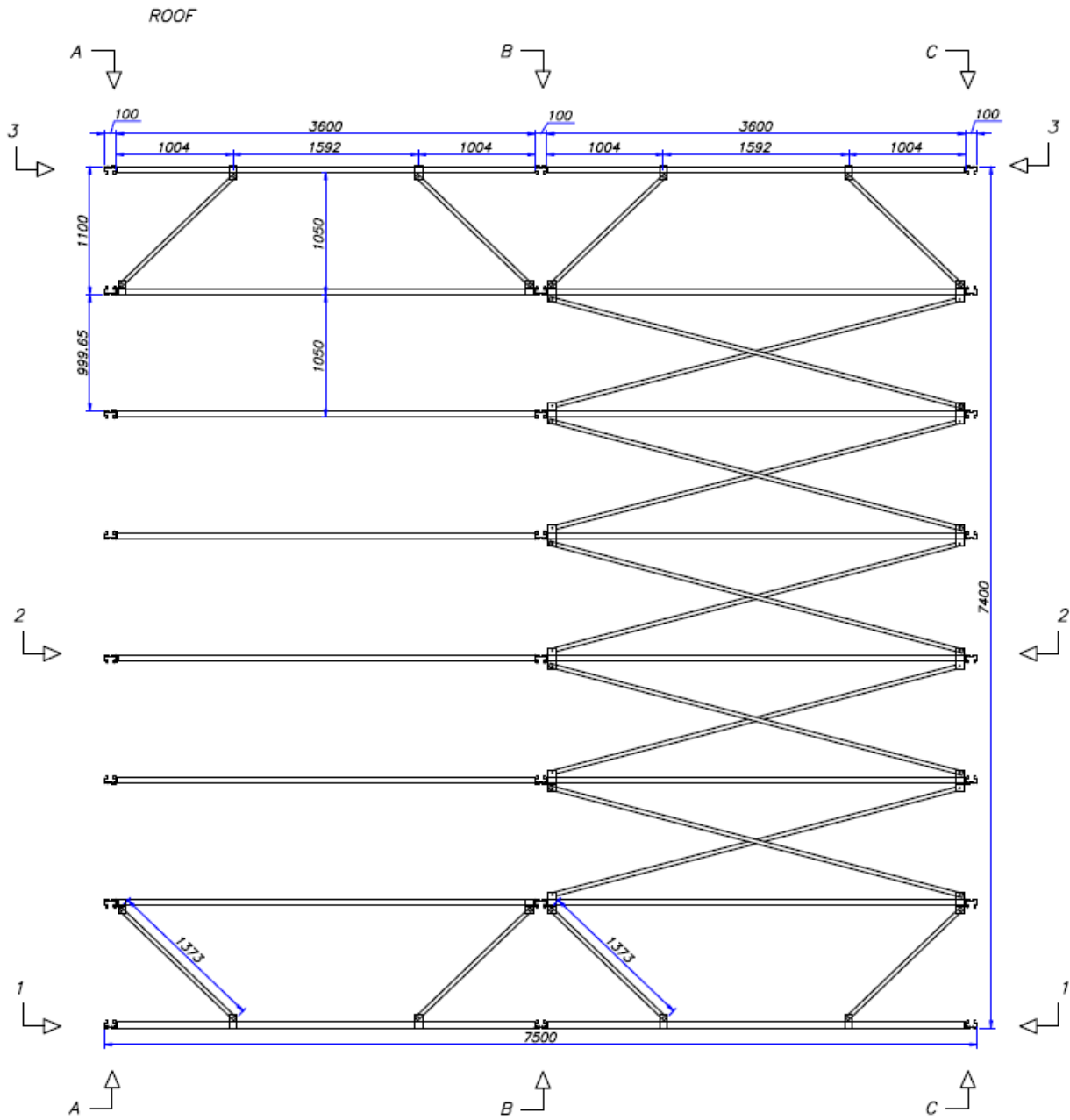


### Diagonal for vertical wind bracing



$A =$	1.60	$\text{cm}^2$
$I_y =$	2.1	$\text{cm}^4$
$I_z =$	0.0	$\text{cm}^4$
$W_y =$	1.1	$\text{cm}^3$
$W_z =$	0.1	$\text{cm}^3$
$i_y =$	1.2	$\text{cm}$
$i_z =$	0.1	$\text{cm}$
$W_{pl,y} =$	1.6	$\text{cm}^3$
$W_{pl,z} =$	0.2	$\text{cm}^3$
$Av_z =$	1.60	$\text{cm}^2$
$Av_y =$	1.60	$\text{cm}^2$
$f_y =$	355	$\text{N/mm}^2$
$E =$	210	$\text{GPa}$
$G =$	1.3	$\text{kg/m}$

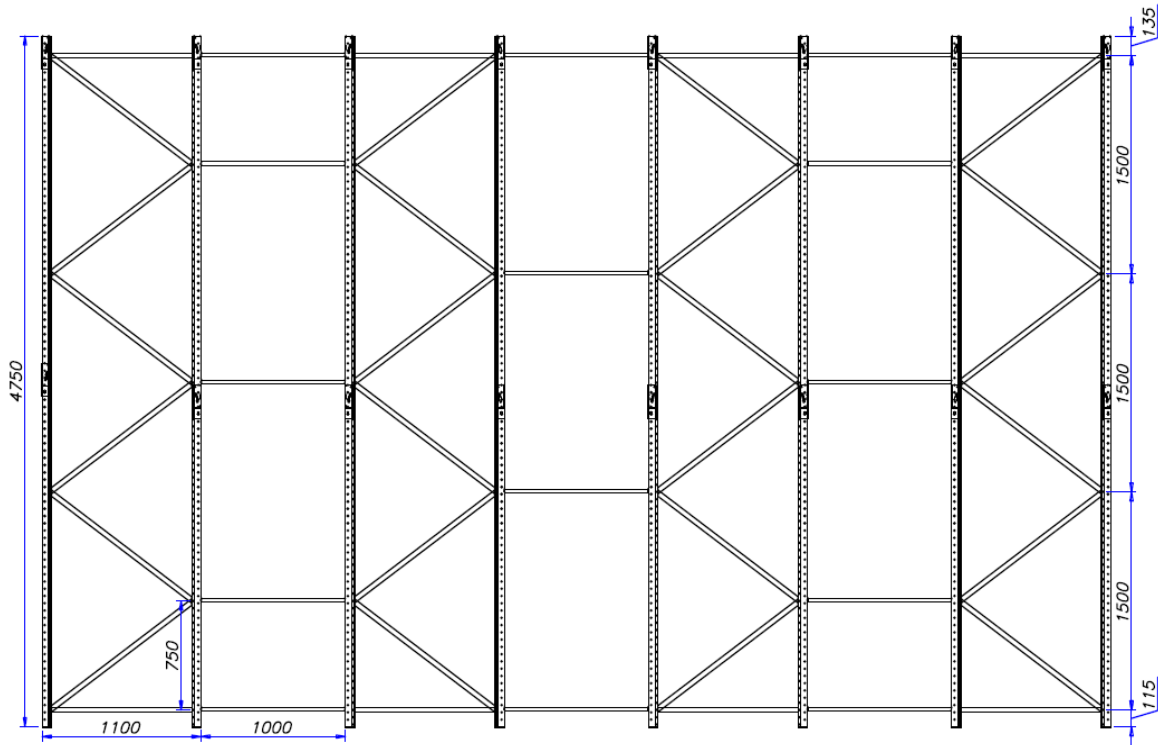
This bars are used as vertical wind bracings. They are subjected to axial tension only because they are considered as tie rods.





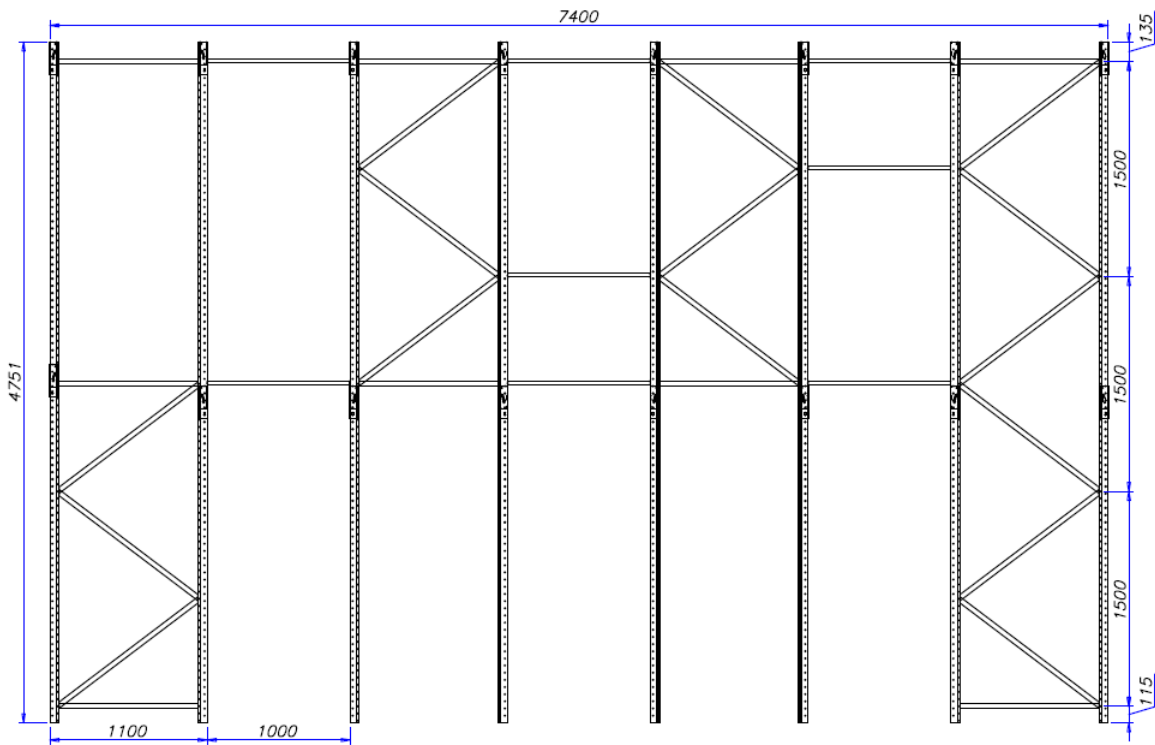


SECTION A

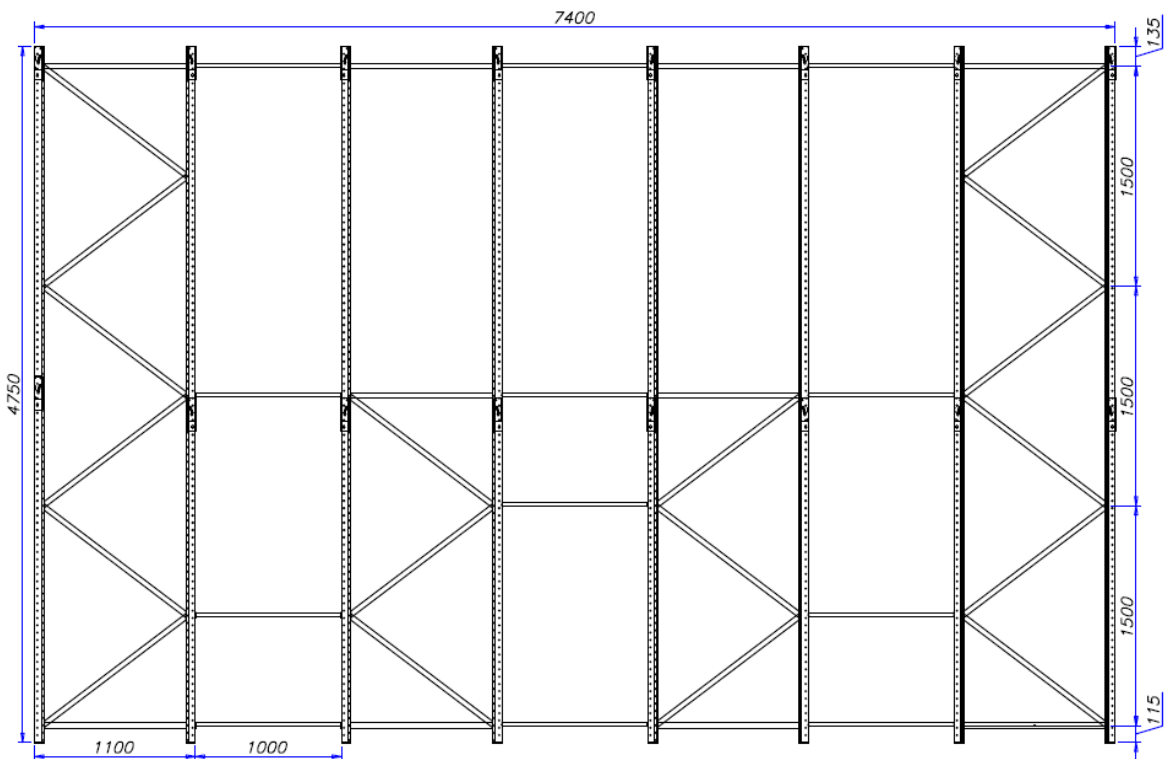




SECTION B

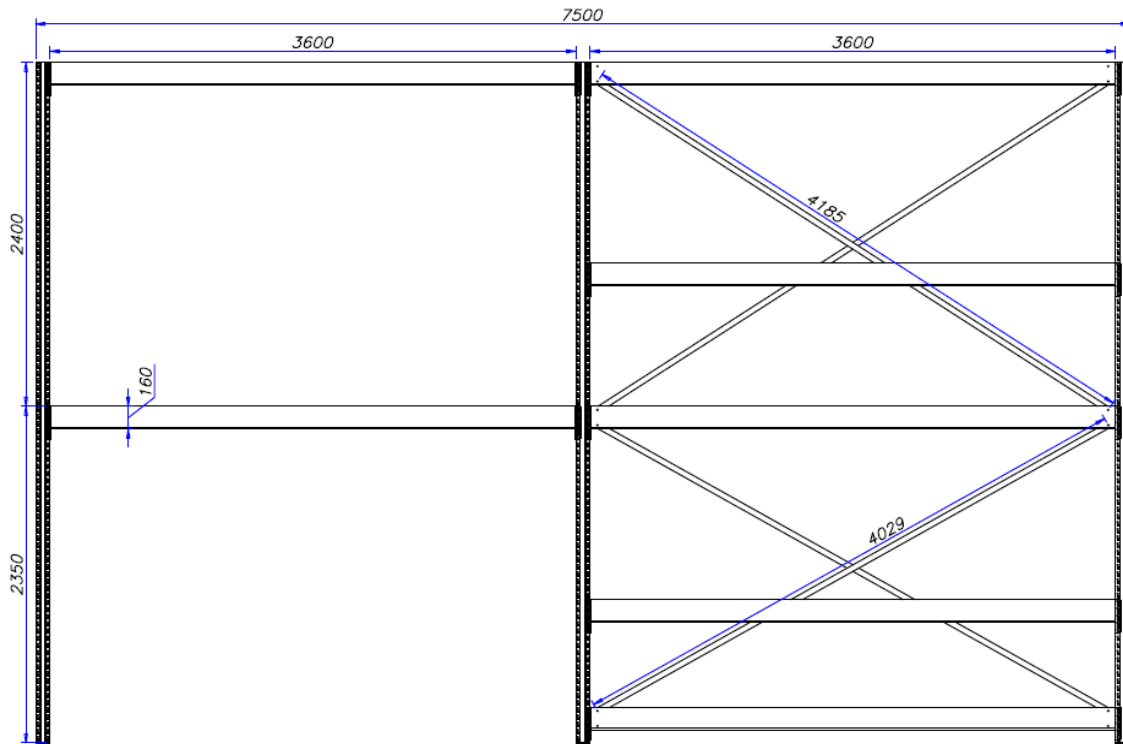


SECTION C





SECTION 1





## 08 10 00 Doors and Frames



# CS 104

Ramen en deuren



## CS 104, het raam van de toekomst

**Reynaers Aluminium biedt totaal-aluminiumoplossing aan voor de duurzame woning van morgen**

Passief- en lage energiehuizen zijn de toekomst van de bouwsector. Met het CS 104 profiel realiseert men passieve constructies met isolatiewaarden tot Uf 0,88 W/m<sup>2</sup>K, door het gebruik van een gepatenteerde isolatietechnologie. De stegen zijn uitgerust met een geïntegreerde PUR foam waardoor er geen afzonderlijke assemblage van de strips meer dient te gebeuren. Speciaal ontwikkelde rubbers garanderen een perfecte wind- en waterdichtheid en zorgen zo voor een optimale energie efficiëntie.

De inbouwdiepte van de profielen draagt bovendien bij tot de stevigheid en stabiliteit van het CS 104 systeem. Dat geeft de architect en constructeur de ontwerpvrijheid van grote overspanningen met driedubbele beglazing, met een innovatieve, energie efficiënte en duurzame oplossing als resultaat.






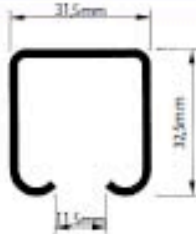







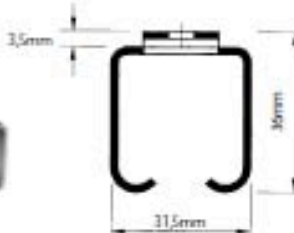
**LOOPPROFIELEN**





Het profiel (32,5 x 31,5 x 1,5 mm) wordt gelemd in versnakte uitvoering, productie serie 110.000





Het profiel ref. 110.200 is het profiel ref. 110.000 met daaronder plafondplaatjes. Via deze plaatjes wordt het profiel rechtstreeks aan het plafond vastgeschroefd. Door deze doornetting kunnen de vlijppinnen de loop van de rollen nauw hielden. Wanneer toch muurbevestiging gewenst wordt, kunnen de haakjes ref. 111.170 in de gleuf tussen profiel en plafondplaat worden ingedrukt.

LEVERBARE LENGTEN 110.000 en 110.200:

1,20m - 1,50m - 1,80m - 2,10m - 2,40m - 2,70m - 3,00m  
 3,30m - 3,60m - 3,90m - 4,20m - 4,50m - 4,80m - 5,10m  
 5,40m - 5,70m - 6,00m - 6,30m - 6,60m - 6,90m - 7,20m  
 7,50m - 7,80m - 8,10m

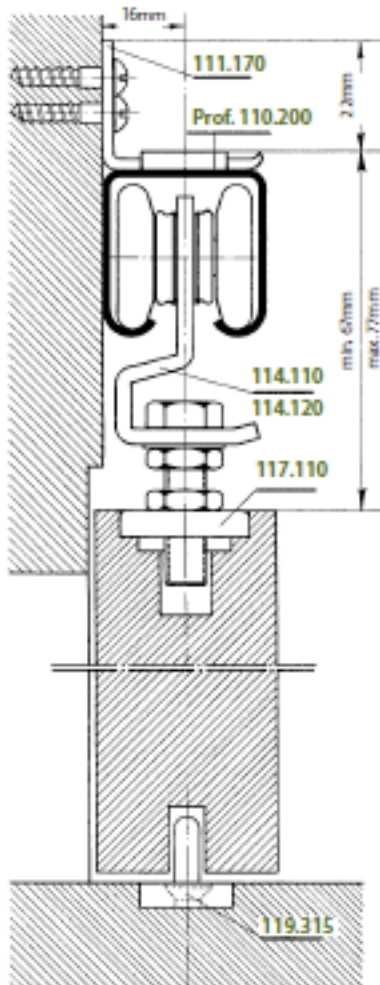
**ONDERDELEN**

 111.130	 111.140	 111.170	 119.610	 111.230	 111.240
 114.110	 114.120	 114.110.1	 114.120.1		
 117.250	 119.315			 117.110	
 118.250	 100.110.2	 100.150.2		 118.110	



## SERIE 110.000

MAX. 60 KG PER VI EUGEL (GEGALVANISEERD)



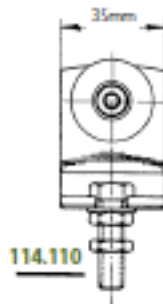
### Ref. 100.100 Garnituren enkele rollen MAX. DEURGEWICHT 40kg

Een garnituur 100.100,  
verpakt in een plastic zakje, bevat:

- 8 hoeken 111.170
- 2 enkele rollen 114.110
- 2 oplegplaten 117.110
- 2 eindstoppers 119.610
- 1 geleider 119.315
- de bijhorende vijzen

#### VERPAKKING:

Per 6 garnituren in kartonnen doos.  
Gewicht per doos: 3,750kg



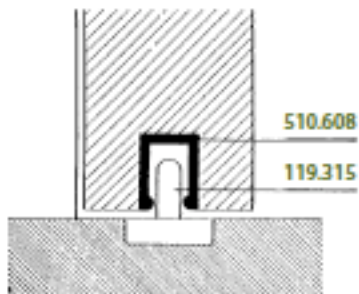
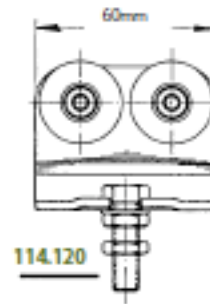
### Ref. 100.600 Garnituren dubbele rollen MAX. DEURGEWICHT 60kg

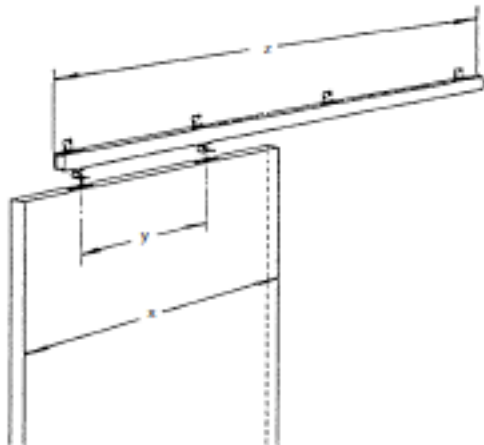
Een garnituur 100.600,  
verpakt in een plastic zakje, bevat:

- 8 hoeken 111.170
- 2 enkele rollen 114.120
- 2 oplegplaten 117.110
- 2 eindstoppers 119.610
- 1 geleider 119.315
- de bijhorende vijzen

#### VERPAKKING:

Per 6 garnituren in kartonnen doos.  
Gewicht per doos: 4,500kg





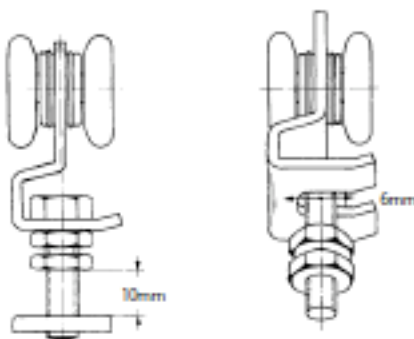
Elke voorverpakte standaardgarnituur bevat alle onderdelen met de nodige vijzen en is klaar voor plaatsing.  
Een aangepaste documentatie, met aanduidingen als deurbreedte, maximum deurgewicht en aanduiding van de nodige ruimte voor plaatsing, is bij elke verpakking ingesloten.

**GARNITUREN MET ENKELE ROLLEN**  
Toegelaten deurgewicht: max. 40kg.

Alle rollen zijn voorzien van kunststof loopschijven, uitgerust met naaldlagers. Deze uitvoering waarborgt aan de deur een soepele en geruisloze loop.  
De speciale constructie van de rollen biedt de mogelijkheid op eenvoudige wijze de deur aan de rollen te bevestigen of vrij te maken zonder de rollen uit het profiel te moeten halen. Na plaatsing kan de deur afgeregeld worden zowel in horizontale als in verticale richting.

Nr	X deurbreedte	Y afstand tussen rollen	Z lengte profiel	Gewicht
100.110	51 à 70cm	35cm	1,20m	2,000kg
100.120	71 à 90cm	45cm	1,50m	2,400kg
100.130	91 à 110cm	55cm	1,80m	2,800kg
100.140	111 à 130cm	65cm	2,10m	3,160kg
100.150	131 à 150cm	75cm	2,40m	3,560kg
100.160	151 à 170cm	85cm	2,70m	4,000kg
100.170	171 à 190cm	95cm	3,00m	4,400kg

**GARNITUREN MET DUBBELE ROLLEN**  
Toegelaten deurgewicht: max. 60kg.



Nr	X deurbreedte	Y afstand tussen rollen	Z lengte profiel	Gewicht
100.610	51 à 70cm	35cm	1,20m	2,220kg
100.620	71 à 90cm	45cm	1,50m	2,600kg
100.630	91 à 110cm	55cm	1,80m	2,940kg
100.640	111 à 130cm	65cm	2,10m	3,360kg
100.650	131 à 150cm	75cm	2,40m	3,940kg
100.660	151 à 170cm	85cm	2,70m	4,320kg
100.670	171 à 190cm	95cm	3,00m	4,700kg



## 08 50 00 Windows



### CS 104

Ramen en deuren



## CS 104, het raam van de toekomst

**Reynaers Aluminium biedt totaal-aluminiumoplossing aan voor de duurzame woning van morgen**

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De inbouwlepte van de profielen draagt bovendien bij tot de stevigheid en stabiliteit van het CS 104 systeem. Dat geeft de architect en constructeur de ontwerpvrijheid van grote overspanningen met driedubbele beglazing, met een innovatieve, energie efficiënte en duurzame oplossing als resultaat.





**TECHNISCHE PRESTATIES**

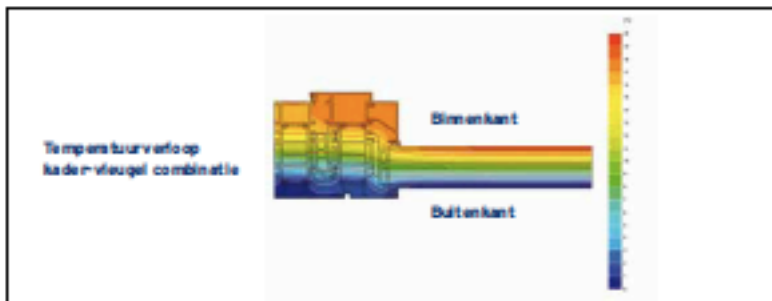


		Ramen	Deuren
Min. aandichtbreedte binnenzijde	kader	69 mm	82 mm
	vleugel	48 mm	71 mm
Min. aandichtbreedte buitenzijde	kader	-	46 mm
	vleugel	-	107 mm
Min. aandichtbreedte T-profiel		99 mm	99 mm
Inbouwdiepte	kader	95 mm	95 mm
	vleugel	104 mm	95 mm
Spouwinghoogte		25 + 30 mm	25 mm
Glasdikte		24 + 65 mm	24 + 65 mm
Beglazing		Droge beglazing met EPDM of neopreen afdichting	
Thermische isolatie (1) in functie van kader/vleugel combinatie (2)		Uf waarde tussen 0,88 en 1,06 W/m²K	Uf waarde 1,06 W/m²K

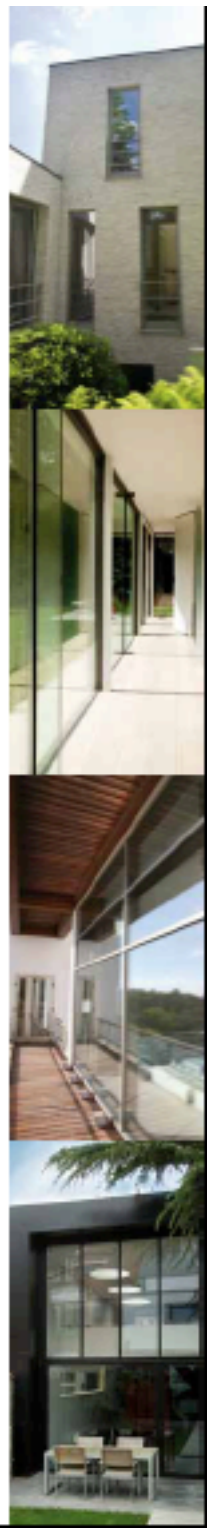
**PRESTATIES**

Comfort	Ramen	Deuren
Luchtdichtheid (max. bestdruk) EN 1026; EN 12207 (3)	4 (600 Pa)	4 (600 Pa)
Waterdichtheid (max. bestdruk) EN 1027; EN 12208 (4)	E900 (900 Pa)	TA (000 Pa)
Weerstand tegen windbelasting, EN 12211; EN 12210 (5)	5	2
Weerstand tegen windbelasting, (relatieve doorbuiging) EN 12211; EN 12210 (5)	C (1/300)	C (1/300)

- (1) Dit is de waarde die overeenkomstig de EN 12207 is vastgesteld voor een Uf-waarde van 1,06 W/m²K.
- (2) De Uf-waarde is de waarde die overeenkomstig de EN 12207 is vastgesteld voor een Uf-waarde van 1,06 W/m²K. Het is de waarde die overeenkomstig de EN 12207 is vastgesteld voor een Uf-waarde van 1,06 W/m²K.
- (3) De waarde is de waarde die overeenkomstig de EN 1026 is vastgesteld voor een bestdruk van 600 Pa.
- (4) De waarde is de waarde die overeenkomstig de EN 1027 is vastgesteld voor een bestdruk van 900 Pa.
- (5) De waarde is de waarde die overeenkomstig de EN 12211 is vastgesteld voor een bestdruk van 500 Pa.



REYNACRS ALUMINIUM NV/SA • www.reynacrs.be • info@reynacrs.be  
B-2030 - DAKENING - VLA G. Dupuis, 10 de Lieve Heer 266, 80 870 Duffel





08 81 00 Glass Glazing

The advertisement is a vertical rectangular panel. At the top center is the Saint-Gobain logo, which consists of a stylized roofline above the text 'SAINT-GOBAIN' and 'GLASS' below it. Below the logo, the left side of the panel shows a window with a dark frame. The window is divided into two panes. The upper pane shows a view of trees and a sky, with the text 'SGG CLIMATOP® ULTRA N' and 'SGG CLIMATOP® MAX' overlaid in white. The lower pane shows a view of a garden with a table and chairs. The right side of the panel is a solid blue background with a faint, dark, abstract pattern. At the bottom right of the blue background, there is a small orange rectangle with the text 'SAINT-GOBAIN GLASS COMFORT' in white.

SAINT-GOBAIN  
GLASS

SGG CLIMATOP® ULTRA N  
SGG CLIMATOP® MAX

*Drievoudige beglazing met  
SGG PLANITHERM ULTRA N  
en SGG PLANITHERM MAX*

SAINT-GOBAIN GLASS COMFORT



SAINT-GOBAIN GLASS COMFORT *Drievoudig glas*

# SGG CLIMATOP® ULTRA N

# SGG CLIMATOP® MAX\*

*Drievoudige beglazing met SGG PLANITHERM ULTRA N en SGG PLANITHERM MAX*

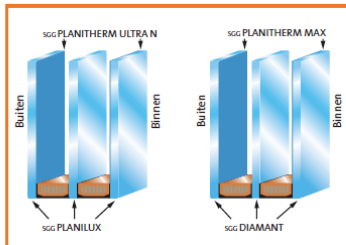
## Omschrijving

Drievoudige beglazing met SGG PLANITHERM ULTRA N bestaat uit drie blanke SGG PLANILUX-glasbladen met:

- op zijden 2 en 5 een SGG PLANITHERM ULTRA N coating met lage emissiviteit;
- twee spouwen, gevuld met argon.

Drievoudige beglazing met SGG PLANITHERM MAX bestaat uit drie extra blanke SGG DIAMANT-glasbladen met:

- op zijden 2 en 5 een SGG PLANITHERM MAX\*-coating;
- twee spouwen, gevuld met argon of krypton.



## Toepassingen

Lage energie- of passiefgebouwen, zowel bij:

- nieuwbouw als renovatie;
- woningbouw als utiliteitsbouw.

## Voordelen

### Besparingen

Vermindering van de verwarmingskosten, zelfs bij grote glasoppervlakken

### Comfort

- Koude zone aan het raam optimaal beperkt
- Zeer aangenaam binnenklimaat
- Hoge lichttransmissie

### Milieu

- Laag verbruik van fossiele brandstoffen
- Vermindering van de CO<sub>2</sub>-uitstoot

## Gamma

### SGG CLIMATOP ULTRA N

Effectieve milieubescherming, lager energieverbruik, lagere CO<sub>2</sub>-uitstoot.

### SGG CLIMATOP MAX

Voor passiefgebouwen optimaal genieten van de gratis zonne-energie door een zonnefactor g van 0,60.

Warm-edge afstandhouders :  
gelieve ons te raadplegen

## Prestaties

	SGG CLIMATOP ULTRA N			SGG CLIMATOP MAX*	
Glasblad 1 (buiten)	SGG PLANITHERM ULTRA N			SGG PLANITHERM MAX*	
Glasblad 2 (midden)	SGG PLANILUX			SGG DIAMANT	
Glasblad 3 (binnen)	SGG PLANITHERM ULTRA N			SGG PLANITHERM MAX*	
Samenstelling	4/x/4/x/4			4/x/4/x/4	
Spouwbreedte x mm gevuld met argon	9	10	12	12 ar	12 kr
Coatingzijde	zijde 2 en 5			zijde 2 en 5	
T <sub>L</sub> Lichttransmissie in % volgens EN 410	71			74	
R <sub>g</sub> Lichtreflectie van buiten in % volgens EN 410	14			15	
g-waarde, zonnefactor volgens EN 410	0,50			0,60	
U <sub>g</sub> -waarde, warmtedoorgangcoëfficiënt in W/m <sup>2</sup> K volgens EN 673	0,9	0,8	0,7	0,7	0,5

\*geen standaard product, wordt steeds op extra klaar glas SGG DIAMANT geproduceerd.

SGG CLIMATOP MAX, SGG CLIMATOP ULTRA N, SGG DIAMANT, SGG PLANILUX, SGG PLANITHERM MAX en SGG PLANITHERM ULTRA N zijn gedeponeerde merken.

SAINT-GOBAIN GLASS BENELUX 02-09/01-04 - Onder voorbehoud van wijzigingen.



SAINT-GOBAIN GLASS BENELUX N.V.  
Rue des Glaces Nationales 169  
5060 Sambreville



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RPM/RPR Namen  
BTW BE 0402.733.607

Verdeler





# ECOTEC Natuurverven

## Dispersieverf

2-120

### **1. Beschrijving:**

Witte, oplosmiddelvrij, elastische muur- en plafondverf voor binnen. Natuurdispersieverf is vochtregulerend en ademt. Op deze manier zorgt zij voor een gezonde leefruimte. Deze verf is antistatisch. Door het hoge gehalte aan vaste deeltjes (gewicht 1.7) bezit deze verf een uitstekend dekvermogen. Ze is bijna helemaal drupvrij.

### **2. Inhoud:**

2,5L - 5L - 10L Art. Nr. 2-1200/1201/1202

### **3. Verbruik:**

100-140 ml/m<sup>2</sup>, 7-10 m<sup>2</sup>/l naar gelang de ondergrond. 1<sup>ste</sup> verflaag steeds tot max. 10% met water verdunnen. Bij het aanbrengen van een tweede verflaag wordt er een dikte van ca. 120 µm bekomen.

### **4. Kleur:**

Wit; Op aanvraag kunnen bijna alle NCS of RAL kleuren aangemaakt worden. Inkleurbaar met natuurlijke pigmenten (zie verder).

### **5. Verdunningsmiddel:**

Kan individueel, naar behoefte, tot max. 10% met water verdund worden.

### **6. Droogtijd:**

Naar gelang de temperatuur en de luchtvochtigheid na 6 -12u overschilderbaar. Volledig droog na 10 dagen.

### **7. Waar:**

Hoogdekkende binnenmuurverf voor alle minerale ondergronden zoals beton, metselwerk en bepleistering. Evenals voor organische, droge, absorberende en vetvrije ondergronden zoals behang, hout, giproplaten en stofbespanning.

### **8. Eigenschappen:**

#### **8.1 Technische eigenschappen :**

Afwasbaar volgens EN13 300. Bijna pasteus, goed drogend, hoog dek- en vulvermogen, dampdoorlatend. Met water te verdunnen en met pigmenten in te kleuren. Zeer goed te verwerken. Bijna helemaal drupvrij.

#### **8.2 Biologische eigenschappen:**

De natuurdispersieverf wordt op basis van niet-giftige en natuurlijke basisstoffen milieu en water vriendelijk gefabriceerd. Ze is antistatisch. Door de samenstelling van de natuurdispersieverf en het juiste gebruik is ze onschadelijk voor mens en milieu.

### **9. Verwerking**

#### **9.1 Voorbereiding**

Oude wateroplosbare lijm- of kalkverfwerken dienen verwijderd te worden. Oud glad lak- olie- of acrylverfwerk dient opgeruimd te worden. Losse verfresten wegborstelen. Bij zandige of sterk zuigende ondergronden dient men een met 10% verdunde grondlaag aan te brengen. Water-, nicotine-, en roestvlekken dienen met Ecotec isolerende grondlaag voorbehandeld te worden.

#### **9.2 Verwerking**

De ondergrond moet proper, droog en vetvrij zijn. Gladde ondergronden opruwen. Bij een goede verwerking is normaal gezien slechts 1 verflaag nodig. Moest de dekkraft na de

eerste verflaag niet voldoende zijn, komt dit door een sterk absorberende ondergrond en dient er dan een tweede laag geplaatst te worden. Voor de eerste laag dient men de verf te verdunnen met water; max. 10%! Verdunnen na het inkleuren met natuurlijk pigment (zie verder).

### **9.3 Andere verwerkingen**

Inkleuren met pigmenten:

Indien de natuurdispersieverf met pigmenten wordt ingekleurd, moeten deze pigmenten meerdere uren in water weken. De geweekte en meermaals opgeschudde pigmenten kunnen nu in de verf geroerd worden, en dienen zeer goed en lang gemixt te worden met een verfmixer (minimum 20 min) tot men een egale kleur bekomt. Voor de eerste laag dient men de verf te verdunnen met water; max. 10%! Verdunnen na het inkleuren met natuurlijk pigment, aangezien deze pigmenten voor het toevoegen aan de verf, opgelost dienen te worden in water. (Dus verkrijgt je reeds een verdunde verfmassa na toevoeging.) Bij zeer intensieve kleuren zoals ultramarijn blauw, -violet en ijzeroxyd rood kan er zich streepvorming voordoen. Om een zo goed mogelijk resultaat te bekomen gebruikt men best niet meer dan 5-8% pigmenten.

### **10. Materiaal**

Goede verwerking met rol of kwast. Bij gebruik van een spuitpistool dient de verf verdund te worden. Na gebruik met lauw water en zeep reinigen.

### **11. Stockering**

Koel en droog maar wel vorstvrij. Reeds geopende emmers zeer goed sluiten. Ongeopend minstens 9 maanden houdbaar.

### **12. Samenstelling**

Water, krijt, marmersmeel, azijnzure ester, cellulose, titandioxyde (witpigment), fosfaat, natriumzout en 0,1% synth. Conserveringsmiddel.

#### **Technische gegevens**

Gewicht: ca. 1,7g/ml  
vast-dichtheid: ca. 60 gew. %  
Viscositeit (bij 20°C): pasteus.  
Dekkracht (k-waarde): >99,8% - wit: 89%

### **13. Gevaarklasse**

Niet van toepassing

### **14. Veiligheidsvoorschriften**

Ook niet giftige verven dienen voor kinderen onbereikbaar te zijn.

### **15. VOC Wetgeving:**

VOC gehalte :0,05 gr./L ; Cat h-Wb  
Grenswaarden VOC vanaf 01-01-2007 50 gr/L  
Vanaf 01-01-2010 : 30Gr./L

De gegevens van deze Technische Fiche dienen als hulpmiddel voor handelaars en gebruikers. De gebruiker dient steeds na te gaan of het product gepast kan gebruikt worden op de betreffende doel of ondergrond. De Ecotec verven worden geproduceerd door Ecotec Naturfarben GmbH en worden verdeeld in de Benelux door:

Ecotec Natuurverven  
Zuidweg 23-27 M8  
2660 Hoboken

tel. 03/322 94 14  
Fax. 03/322 94 17  
ecotec-natuurverven@telenet.be

versie 1-2007



Team Belgium – Ghent University  
Teambelgium.sd2011@gmail.com

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# ECOTEC Natuurverven

2-379

## ProAqua Lak - zijdeglanzend

### **1. Beschrijving:**

Oplosmiddelvrije, waterverdunbare, druipvrije blijvend-elastische witte lak voor binnen en buiten. Kan dmv mixstelsel ingekleurd worden in pastel of diepe kleuren.

### **2. Inhoud & kleur:**

Standaard	Mixkleur:
0,125L	
0,75L	>0,68L
2,5 L	>2,25L
10L	>9,0L

Volumes van mixkleuren zijn afhankelijk van gebruikte hoeveelheid pigmenten.

### **3. Verbruik:**

Ca. 70 – 90ml/m<sup>2</sup>, 12-15m<sup>2</sup>/L naargelang receptuur en ondergrond.

### **4. Kleur:**

Wit, Bijna alle intense of pasteleuren kunnen bij benadering van NCS Standaard aangemaakt worden.

### **5. Verdunningsmiddel:**

Water. (maximaal 5 -10%)

### **6. Droogtijd - Verwerkingstijd:**

Naar gelang de temperatuur en de luchtvochtigheid: stofdroog na 15-30 minuten; opschuren na 45 minuten en overschilderbaar na 2u.

Niet onder 8°C toepassen.

### **7. Waar gebruiken:**

Ecotec ProAqua is een weersbestendige witte lak voor het behandelen van houten delen en dit zowel binnen als buitenshuis. Ecotec ProAqua is zowel toe te passen op maathoudend elementen zoals vensters en deuren als voor niet maathoudend houtwerk zoals panelen of houten bekledingen.

### **8. Eigenschappen:**

#### **Technisch :**

Gemakkelijk verwerkbaar, quasi druipvrij en zeer goed bestand tegen wisselende weers- omstandigheden. Sterk hechtend en snel drogend. Ecotec ProAqua lak is vrij van vluchtige organische verbindingen.

#### **Biologisch:**

Wordt op basis van niet-giftige en natuurlijke grondstoffen en dit met respect voor de natuur vervaardigd. Is volledig oplosmiddelvrij en veroorzaakt geen electrostatische opladingen. Bij correct gebruik is

de ProAqua lak onschadelijk voor mens en natuur.

### **9. Toepassing:**

#### **9.1 Voorbereiding**

Gelachtige structuur, voor gebruik goed oproeren.

De ondergrond moet proper, droog en vetvrij zijn. Oude loszittende verflagen dienen verwijderd te worden. Vastzittende verflagen goed opschuren. Olieën of harshoudend hout moet ontharst worden.

#### **9.2 Verwerking**

Als grondlaag wordt 1 laag Ecotec ProAqua lak , verdund met 5 – 10% water aangebracht. Afwerking gebeurt met 2 tot 3 lagen onverdunde lak. Tussen de verschillende lagen opschuren met schuurpapier K 180-240. De lak dun aanbrengen.

#### **Opmerking :**

Wij adviseren om jaarlijks een controle uit te voeren en kleine beschadigingen onmiddellijk bij te werken.

### **10. Materiaal:**

Goede verwerking met kwast, rol of spuitpistool. (vb. Airless of Aircoat) Materiaal na gebruik met lauwater en zeep reinigen.

### **11. Stockering:**

Koel en droog maar wel vorstvrij. Reeds geopende emmers zeer goed sluiten. Ongeopend min. 1 jaar houdbaar.

### **12. Samenstelling**

Water, kizelzuur, azijnzuurester, tenside, TiO<sub>2</sub>, conserveringsmiddel.

Dichtheid ca. 1,05g/cm<sup>3</sup> Viscositeit : thixotroop.

### **13. Gevaarklasse:**

Niet van toepassing

### **14 Veiligheidsvoorschriften:**

Ook niet giftige verven dienen voor kinderen onbereikbaar te zijn. Tijdens de werkzaamheden steeds goed verluchten.

### **15. Voorschriften VOC verordening:**

VOC gehalte : 0gr./L

Cat: d-Wb

Grenswaarden : vanaf 01-01-2007 150gr./L -/- vanaf 01-01-2010 : 130 gr./L



10 28 00 Toilet, Bath, and Laundry Accessories

Linea 1700  
= inda



 <b>Glashouder</b> 296243 • verchromd 64,41 €	 <b>Tablet 60 cm</b> 296242 • verchromd 84,11 €	 <b>Dubbele handdoekhouder</b> 296249 • 65 cm 92,11 €	 <b>Papierhouder met deksel</b> 296262 • verchromd 60,90 €
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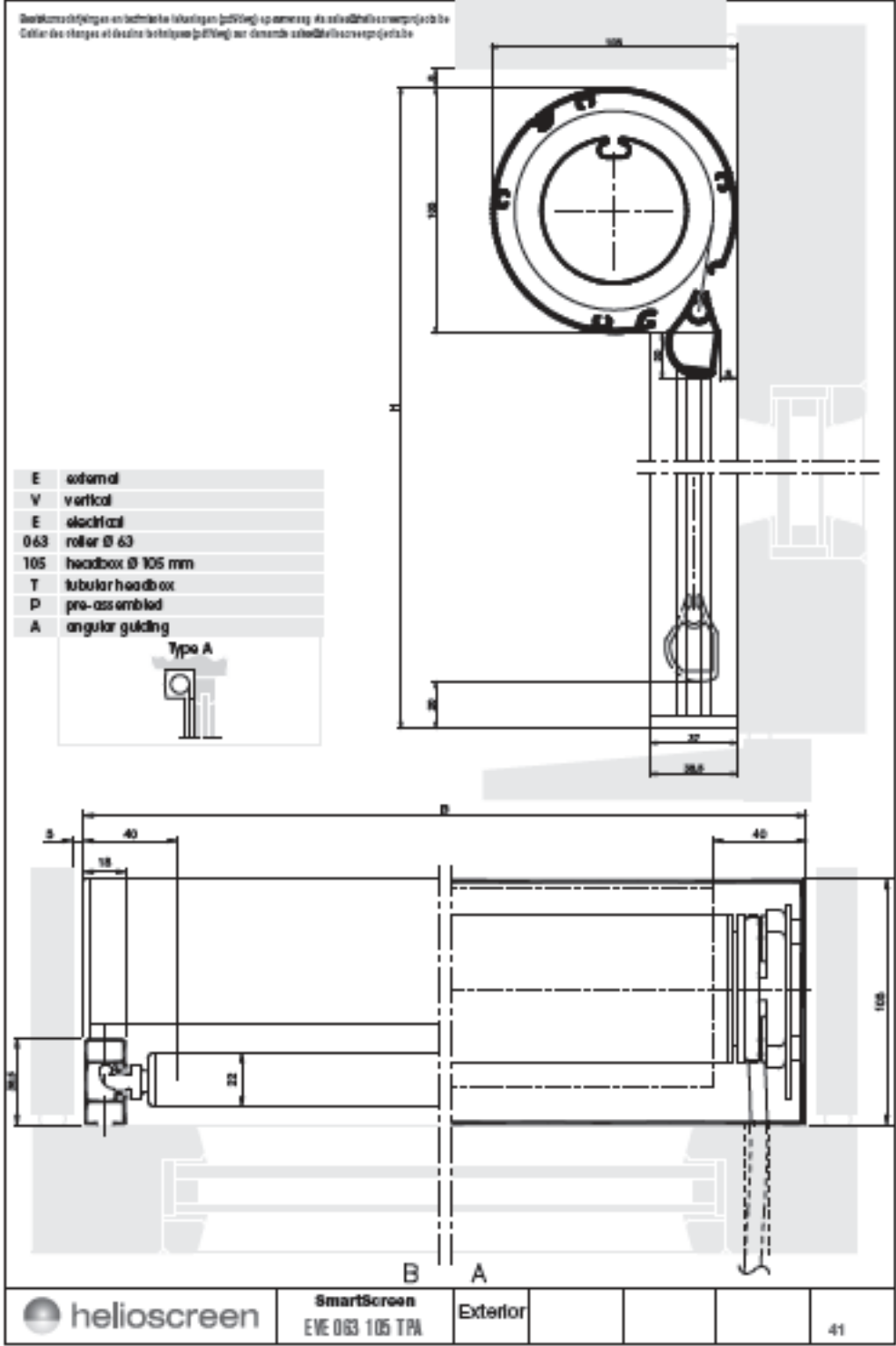


TOERECHTINGEN

Dateldje.code = produkt in voorraad in onze depots en snel leverbaar - indicatieve prijzen 21% BTW inbegrepen.



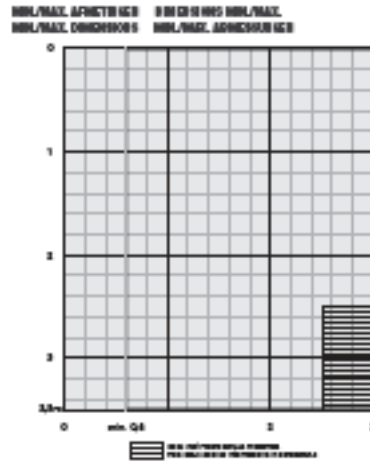
10 70 00 Exterior Specialties





**AnemoScreen**  
vrijstaand

**EVE 063 100 AWA**



**NEDERLANDS**

**Technische**

- Schermopening verticaal.
- Rols over de volledige hoogte van het raam.
- Uitsluiting in een raam met vierkante kast 100/100 mm.
- Uitsluiting met op rolbuis Ø63 mm of Ø 70 mm.
- Uitsluiting met rolbuis en dials 22 x 40 mm, compact en gemakkelijk te openen en te sluiten. (patenttype)
- Uitsluiting met compacte geleider 33x37 mm.
- Frontale montage met clips. (patenttype)
- Afrotling draaibaar of langs het raam (type A) of van het raam weg (type B)
- Eenvoudige montage en reverseerbaarheid van de bediening ongeacht type afrotling.
- Onafhankelijk in de draai- en de kast.
- Toegang tot de kast steeds mogelijk. (in de kast uit)
- Uitsluiting kast en geleiders in aluminium, kleur naar keuze.
- Specificaties van de motoren en bedieningen op aanvraag beschikbaar.
- Voor koppeling contacteer ons.

**Français**

**Appelation:**

- Protection solaire extérieure, pose verticale.
- Zip sur toute la hauteur de la toile.
- Solution sur le châssis avec caisson carré 100/100 mm.
- Solution avec tube Ø63 mm ou Ø70 mm.
- Solution avec barre de charge 22x40 mm, compacte et facile à ouvrir ou fermer. (patent)
- Solution avec guidage compacte 33x37 mm.
- Montage frontale avec clips. (patent)
- Déroulement de la toile contre le châssis (type A) ou l'écarté du châssis. (type B)
- Assemblage simple et réversible de la commande, indépendamment du type de déroulement.
- La barre de charge est facilement dans le caisson.
- Caisson toujours accessible. (patent)
- Solution caisson et guide en aluminium, couleur selon choix.
- Spécifications des moteurs et systèmes de commande disponibles sur demande.
- Veuillez nous contacter au sujet d'accouplage.

**English**

**Appelation:**

- External solar shading, vertical installation.
- Zip on the complete height of the cover.
- Tube installed against the window frame with square headcase 100/100 mm.
- Roller tube Ø63 mm or Ø70 mm.
- Square bar 22x40 mm, compact and easy to open and close. (patent)
- Compact guiding 33x37 mm.
- Frontal installation with clips. (patent)
- Cover rolls down towards the window (type A) or away from the window (type B).
- Easy assembly and reversibility of the drive whatever the type of the roll down direction may be.
- Accessible to all disengageably in the cover.
- Always easy access to headcase. (patent)
- Headcase and guides in aluminium, colour by choice.
- Specifications of motors and control available on demand.
- Please contact us for coupling.

**Deutsch**

**Appelation:**

- Außen Sonnenschutz, Senkrechte Montage.
- Zip auf die volle Höhe der Tuches.
- Montage an dem Fenster, Ausführung mit rechteckigen Kästen 100/100 mm.
- Ausführung mit Rolloben Ø63 mm oder Ø70 mm.
- Ausführung mit rechteckige Unterleiste 22 x 40 mm, kompakt und einfach zu öffnen und schließen. (patent)
- Ausführung mit kompakten Seitenführung 33x37 mm.
- Frontale Montage mit clips. (patent)
- Rolle Abrotlung zum Fenster hin (Type A) oder vom Fenster entfernt (Type B).
- Montage ist einfach und reverseerbar die Steuerung möglich wie auch immer die Abrotlung.
- Die Unterleiste ist immer das in den Kästen hin ein.
- Immer Zugang zum Kästen. (patent)
- Ausführung Kästen und Seitenführung in aluminium, Farbe zu wählen.
- Einzelheiten der Motoren und der Steuerung auf Anfrage.
- Für Kuppelung, bitte kontaktieren Sie uns.



## 11 30 00 Residential appliances

### AMW 593 IX

Multifunctionele compacte oven met microgolffunctie



#### Belangrijkste kenmerken

- ◆ 17 kookfuncties
- ◆ Boven- en onderwarme gecombineerd met microgolven
- ◆ Elektronische timer met LCD display
- ◆ 50 voorgeprogrammeerde recepten

**AMW 593 IX**  
EAN 80 03437 39227 6

#### Type apparaat

- Design: Genesis Line
- Inbouwbaar in een kolomkast met breedte 60 cm

#### Kookmethodes

- 4 kookmethodes: boven- en onderwarme, microgolven, grill en turbo hete lucht
- 17 kookfuncties
- Microgolven 90 - 850 W
- Grill 1600 W
- Regelbare temperatuur tot 250°C
- Turbo hete lucht gecombineerd met microgolven
- Turbo grill (grill + ventilator)
- Turbo grill gecombineerd (grill + ventilator + microgolven)
- Auto Reheat
- Grill gecombineerd (grill + microgolven)

#### Functies

- Auto defrost
- Boven- en onderwarme
- Boven- en onderwarme gecombineerd met microgolven
- Bakken (onderwarme + ventilator)
- Booster
- Hete lucht
- Hete lucht gecombineerd met microgolven
- Turbo hete lucht
- Warmhoudfunctie (60°C)
- Lage temperatuur/Deeg rijzen (35°C)

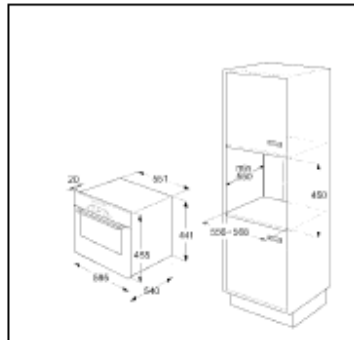
#### Uitvoering

- Ovenverlichting
- Verwijderbare deur
- Energieklasse A
- 2 verzinkbare bedieningsknoppen

- Deur met spiegelglas
- Elektronische bediening
- Inhoud ovenruimte: 40 liter
- Vergrendelen bedieningspaneel
- Elektronische timer
- Bediening bovenaan
- Elektronische timer met LCD display en groene tekst
- 24-uursklok
- Materiaal ovenruimte: geëmailleerd
- 8 vermogens
- Neerklapbare deur
- 50 voorgeprogrammeerde recepten
- Bereiding mogelijk op 3 verschillende niveaus

#### Technische gegevens

- Afmetingen apparaat (HxBxD): 455 x 595 x 560 mm
- Afmetingen verpakt apparaat (HxBxD): 560 x 707 x 707 mm
- Nisafmetingen (HxBxD): 450 x 560 x 550 mm
- Aansluitwaarde 2800 W
- Zekering 16 A
- Frequentie 50 Hz
- Spanning 230 V
- Gewicht apparaat 35 kg
- Gewicht verpakt apparaat 43,8 kg
- Accessoires
- Geëmailleerde bakplaat
- Rooster



Voor technische informatie verwijzen we u naar de 00-productinformatie. Productnamen en prijzen onder voorbehoud van wijzigingen en drukfouten. Teksten en/of afbeeldingen mogen niet gebruikt/publiceerd worden in andere media zonder voorafgaande toestemming. Stand 01.02.2011



SENSING THE DIFFERENCE



## ADG 9643 TR

6th Sense® Full door vaatwasser met Space+



### Belangrijkste kenmerken

- ◆ 6th Sense® Max AquaSteam
- ◆ Space+, een besteklade op het derde niveau voor meer flexibiliteit!
- ◆ A+
- ◆ Warmwateraansluiting

ADG 9643 TR  
EAN 80 03437 58061 1

### Type apparaat

- Volledig integreerbare vaatwasser
- 60 cm breed

### Uitvoering

- Bedieningspaneel: Symbolen + display
- 13 bestekken
- **6th Sense® technologie**
- Startuistel 1-24u
- 3 sproeiarmen
- Akoestisch signaal bij programma-einde
- Statisch droogsysteem
- **Light Control**, geeft feedback over de programmastatus van de vaatwasser
- Elektronische indicator voor glansmiddel
- Elektronische indicator voor zoutnavulling
- Automatische deurbalans
- 5 sproeiniveaus
- Inox kuip
- Zelfreinigend filtersysteem
- Elektrisch weergave programma-verloop
- Aqua Control waterbeveiliging

### Programma's

- 6 programma's
- Voorspoelen, koud
- Programma **6th Sense® Max AquaSteam** (40°-70°C)
- Eco 50°C
- Express 45°C

- Daily Fast 60°C
- Intensief 70°C

### Functies

- Optie All-in-1
- Optie Halve lading Multizone
- Indicatie resterende tijd
- Antibacterie

### Korven

- In hoogte verstelbare bovenkorf, zelfs volgeladen, bovenkorf verwijderbaar
- Space+, besteklade 3de niveau

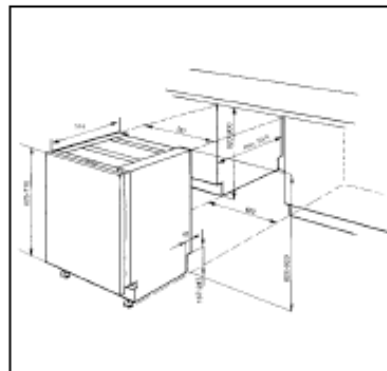
### Verbruikswaarden

- Energieklasse A+
- Afwasresultaat A
- Droogresultaat A
- Programmaduur 170 min
- Waterverbruik per cyclus: 11 liter
- Energieverbruik per cyclus: 0,98 kWh (standaardprogramma)
- Waterverbruik: 3080 liter per jaar
- Energieverbruik: 293 kWh per jaar

### Technische gegevens

- Laag geluidsniveau 42 dB(A) - IEC 704
- Spanning 220-230 V
- Zekering 10 A
- Aansluitwaarde: 2200 W
- **Warmwateraansluiting tot 60°C mogelijk**
- Lengte aansluitkabel 160 cm
- Frequentie: 50 Hz
- Diepte met open deur 1150 mm
- Gewicht apparaat 50 kg

- Gewicht verpakt apparaat 51,9 kg
- 3 voetjes in hoogte verstelbaar vanaf de voorzijde
- Hoogte apparaat verstelbaar van 820 mm tot 900 mm
- Nisafmetingen (HxBxD): 820-900 x 600 x 570 mm
- Afmetingen apparaat (HxBxD): 820 x 597 x 555 mm
- Afmetingen verpakt apparaat (HxBxD): 845 x 640 x 660 mm



Voor technische informatie verwijzen we u naar de EU-productinformatie. Productkenmerken en prijzen onder voorbehoud van wijzigingen en drukfouten. Teksten en/of afbeeldingen mogen niet gebruikt/publiceerd worden in andere media zonder voorafgaandelijke toestemming. Stand 15.02.2011



SENSING THE DIFFERENCE





## HOTTE - AKR 016 IX

**PROVISOIRE**

23/3/2011



Existe en Blanc	*
Existe en Noir	*
Existe en Inox	AKR 016 IX
Existe en Métal peint	*

### TYPE DE HOTTE

Largeur (en cm)	90
Design	Box

### MOTEUR

Débit d'air maximum (m <sup>3</sup> /h)**	782
Débit d'air minimum (m <sup>3</sup> /h)**	226
Niveau sonore en dB(A)*	
positions en mode évacuation	46-55-61-67-69-71

### BANDEAU DE COMMANDE

Sélecteur électronique/mécanique	Electronique 6th Sense
Nombre de vitesses d'aspiration	5+1 intensive
Type de commande	Touches sensibles
Temporisation	*
Affichage des vitesses par témoins lumineux	Oui
Indicateur de saturation du filtre graisse	Oui
Indicateur de saturation du filtre à charbon	Oui
Bandeau de commande	En façade

### ÉCLAIRAGE DU PLAN DE CUISSON

Eclairage commandé par un interrupteur indépendant de celui de l'aspiration Lampes	Oui
Type de lampes	LED 2 x 3 w

### EQUIPEMENT

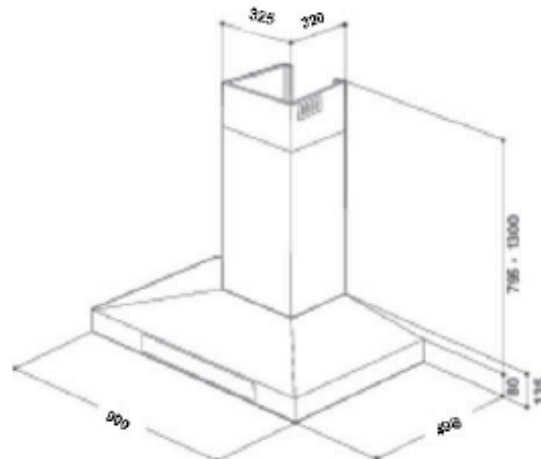
Evacuation/recyclage	Oui/Oui
Version livrée en :	Evacuation
Filtre à graisse métallique, permanent lavable au lave-vaisselle	3 "cassette"
Filtre clipsé (nettoyage plus facile)	Oui
Filtre à charbon	Option 1 AMC027
Clapet anti-retour	Non

### DIMENSIONS (HxLxP) en cm

du produit	79,5 à 130x90x49,8
avec emballage	68,5x91x61,5
Poids net/avec emballage (en kg)	24/30
Puissance moteur en watts	170
Alimentation électrique 220-230V/50Hz - 10 A	Oui
Diamètre extérieur pour la gaine d'évacuation	15

AKR 016 IX EAN : 8003437976216 • 12NC : 857801 601000

Filtre à charbon  
Référence : AMC027  
EAN : 8015250037449 • 12NC : 481248048217





## WBE 34132 A++S

Koel/vriescombinatie



### Belangrijkste kenmerken

- ◆ Extra energiezuinig: klasse A++
- ◆ Antibacteriële filter: bescherming van uw voedsel
- ◆ MAX Space diepvrieslade

WBE 34132 A++S  
EAN 80 03437 89280 6

### Design

- Type deur: rond
- Kleur: Zilver

### Comfort

- Energieklasse A++
- Netto inhoud totaal: 341 liter
- Mechanisch bedieningspaneel
- Type handgreep: Extern

### Koelgedeelte

- Antibacteriële filter
- Aantal groentebakken: 1
- 4 verstelbare deurvakken
- 4 legplaten (incl. afdekplaat groentebak)
- 3 in hoogte verstelbare legplaten van veiligheidsglas
- Ventilator

### Vriesgedeelte

- Manuele ontdooiing van het vriesgedeelte
- 1 MAX Space diepvrieslade(n)
- Aantal diepvriesladen: 3, waarvan 1 Max Space
- Netto inhoud diepvriesgedeelte: 116 liter
- Invriesvermogen: 4,5 kg in 24 uur
- Max. bewaartijd diepvriesgedeelte bij stroomuitval 24 uur
- Stereanduiding vriesgedeelte: 4

### Technische gegevens

- Energieverbruik per jaar 222 kWh
  - Afmetingen (HxBxD): 189,5x59,5x64 cm
  - Lengte aansluitkabel: 170 cm
  - Aansluitwaarde: 150 W
  - Zekering: 16 A
  - Frequentie: 50 Hz
  - Spanning: 220-240 V
  - Geluidsniveau: 39 dBA
  - Gewicht apparaat: 63 kg
  - Gewicht verpakt apparaat: 65 kg
  - Energieverbruik per dag: 0,61 kWh
  - Bruto inhoud totaal: 352 liter
  - Netto inhoud koelgedeelte: 225 liter
  - Bruto inhoud vriesgedeelte: 125 liter
  - Bruto inhoud koelgedeelte: 227 liter
  - Draairichting deuren verwisselbaar
- ### Uitvoering
- Koel/vriescombinatie
  - Vrijstaand
- ### Technologie
- Voor gebruik in omgevingstemperatuur (°C): +16/+43 (N-T)
  - Aantal thermostaten: 1
  - Aantal compressors: 1



Voor technische informatie verwijzen we u naar de EU-productinformatie. Productnamen en prijzen onder voorbehoud van wijzigingen en drukfouten. Teksten en/of afbeeldingen mogen niet gebruikt/publiceerd worden in andere media zonder voorafgaande toestemming. ©2011 25.04.2011



SENSING THE DIFFERENCE



12 30 00 Casework

ISO 9001  
BUREAU VERITAS  
Certification



AVASCO

GARANTIE  
3 ANS  
3 YEARS WARRANTY

**CLICKER** 

50 - 70 - 85 - 100 - OFFICE



# 50 CLICKER 50

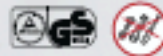


### AFMETINGEN / DIMENSIONS

EAN	I <sub>tot</sub>	H <sub>tot</sub>	α <sub>tot</sub>	QUANTITEIT		✓	🏠	kg
				IN BALDEN	PER PALLET			
CLICKER 50 385142	150	75	30	4	8	☐		50 kg
CLICKER 50 385234	150	75	30	4	8	■		50 kg
CLICKER 50 385005	150	75	30	4	8	■		50 kg



# 70 CLICKER 70



### AFMETINGEN / DIMENSIONS

EAN	I <sub>tot</sub>	H <sub>tot</sub>	α <sub>tot</sub>	QUANTITEIT		✓	🏠	kg
				IN BALDEN	PER PALLET			
CLICKER 70 384149	180	90	30	4	8	☐		70 kg
CLICKER 70 384231	180	90	30	4	8	■		70 kg
CLICKER 70 384002	180	90	30	4	8	■		70 kg
CLICKER 70 384354	180	90	30	4	8	■		70 kg
CLICKER 70 385146	180	90	30	5	8	☐		70 kg
CLICKER 70 385238	180	90	30	5	8	■		70 kg
CLICKER 70 385009	180	90	30	5	8	■		70 kg
CLICKER 70 385351	180	90	30	5	8	■		70 kg



# 85 CLICKER 85



### AFMETINGEN / DIMENSIONS





EAN	I <sub>tot</sub>	H <sub>tot</sub>	α <sub>tot</sub>	QUANTITEIT		✓	🏠	kg
				IN BALDEN	PER PALLET			
CLICKER 85 385143	180	90	40	4	8	☐		85 kg
CLICKER 85 385235	180	90	40	4	8	■		85 kg
CLICKER 85 385006	180	90	40	4	8	■		85 kg
CLICKER 85 385356	180	90	40	4	8	■		85 kg
CLICKER 85 387140	180	90	40	5	8	☐		85 kg
CLICKER 85 387232	180	90	40	5	8	■		85 kg
CLICKER 85 387003	180	90	40	5	8	■		85 kg
CLICKER 85 387355	180	90	40	5	8	■		85 kg







## 21 10 00 Water Based Fire-Suppression Systems

### General, G-Press Piping System, the Approvals

- D** Allgemeines, G-Press-Rohrsystem, Zulassungen
- F** Généralités, système de tuyaux G-Press, homologations

Carbon Steel				
Size mm	 VdS* Dry System	 VdS* Wet System	 FM Dry System	 FM Wet System
22	not approved	16.0 bar / 230 psi	not approved	12.5 bar / 175 psi
28	not approved	16.0 bar / 230 psi	not approved	12.5 bar / 175 psi
35	not approved	16.0 bar / 230 psi	not approved	12.5 bar / 175 psi
42	not approved	16.0 bar / 230 psi	not approved	12.5 bar / 175 psi
54	not approved	16.0 bar / 230 psi	not approved	12.5 bar / 175 psi

\*Approved for up to and including ordinary hazard class 3 (OH3) and partially including hazard class 4 (OH4, concert, exhibition halls, theatres incl. movie theatres).

Stainless Steel				
Size mm	 VdS* Dry System	 VdS* Wet System	 FM Dry System	 FM Wet System
22	16.0 bar / 230 psi	16.0 bar / 230 psi	12.5 bar / 175 psi	12.5 bar / 175 psi
28	16.0 bar / 230 psi	16.0 bar / 230 psi	12.5 bar / 175 psi	12.5 bar / 175 psi
35	16.0 bar / 230 psi	16.0 bar / 230 psi	12.5 bar / 175 psi	12.5 bar / 175 psi
42	16.0 bar / 230 psi	16.0 bar / 230 psi	12.5 bar / 175 psi	12.5 bar / 175 psi
54	16.0 bar / 230 psi	16.0 bar / 230 psi	12.5 bar / 175 psi	12.5 bar / 175 psi
76.1	16.0 bar / 230 psi	16.0 bar / 230 psi	Available soon	Available soon
88.9	12.5 bar / 175 psi	12.5 bar / 175 psi	Available soon	Available soon
108.0	10.0 bar / 150 psi	10.0 bar / 150 psi	Available soon	Available soon

\*Approved for up to and including ordinary hazard class 3 (OH3) and partially including hazard class 4 (OH4, concert, exhibition halls, theatres incl. movie theatres).

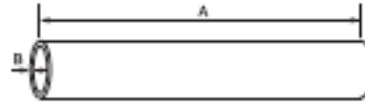
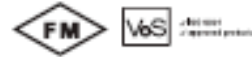


## G-Press Sprinkler Tube

- 🔊 G-Press Sprinklerrohr
- 🔊 Tuyau de sprinkleur G-Press



SPRINKLER TUBE



### Galvanized Carbon Steel <FM> VdS approved

Art. Nr.	Outside Ø mm	Pipe Thickness (B)	Length (A) mm	W <sub>net</sub> /mtr
PIPE22CS	22.0	1.5	6000	0.624
PIPE28CS	28.0	1.5	6000	0.790
PIPE35CS	35.0	1.5	6000	1.240
PIPE42CS	42.0	1.5	6000	1.503
PIPE54CS	54.0	1.5	6000	1.972

Note: Galvanized carbon steel press tube can be recognized by a transparent plastic cover cap

### Stainless Steel 1.4401 <FM> VdS approved

Art. Nr.	Outside Ø mm	Pipe Thickness (B)	Length (A) mm	W <sub>net</sub> /mtr
PIPE22SS1	22.0	1.2	6000	0.302
PIPE28SS1	28.0	1.2	6000	1.052
PIPE35SS1	35.0	1.5	6000	1.320
PIPE42SS1	42.0	1.5	6000	1.620
PIPE54SS1	54.0	1.5	6000	2.098
PIPE76SS1	76.1	2.0	6000	3.710
PIPE89SS1	88.9	2.0	6000	4.480
PIPE108SS1	108.0	2.0	6000	5.310

### Stainless Steel 1.4520 <FM> approved

Art. Nr.	Outside Ø mm	Pipe Thickness (B)	Length (A) mm	W <sub>net</sub> /mtr
PIPE22SS2	22.0	1.2	6000	0.302
PIPE28SS2	28.0	1.2	6000	1.052
PIPE35SS2	35.0	1.5	6000	1.320
PIPE42SS2	42.0	1.5	6000	1.620
PIPE54SS2	54.0	1.5	6000	2.098

### Stainless Steel 1.4521 <FM> approved

Art. Nr.	Outside Ø mm	Pipe Thickness (B)	Length (A) mm	W <sub>net</sub> /mtr
PIPE22SS3	22.0	1.2	6000	0.302
PIPE28SS3	28.0	1.2	6000	1.052
PIPE35SS3	35.0	1.5	6000	1.320
PIPE42SS3	42.0	1.5	6000	1.620
PIPE54SS3	54.0	1.5	6000	2.098

Note: Stainless steel press tube can be recognized by a green plastic cover cap

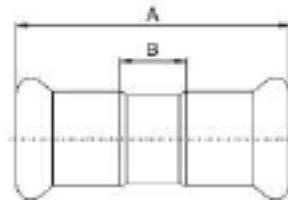
For further information see G-Press catalogue reference 'TYCENPRESS'.

General notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions. Never remove any piping components nor correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified with the gasket recommendation listing for the specific application.



## G-Press G05 Straight coupling (2x press)

- 🔊 G-Press G05 Gerade Kupplung (2x Press)
- 🔊 Raccord droit G-Press G05 (2 x femelle)



Galvanized Carbon Steel				
Art. Nr.	Dimensions mm	A mm	B mm	kg
G05221	22x22	55.0	13.0	0.067
G05281	28x28	59.0	13.0	0.075
G05351	35x35	65.0	13.0	0.123
G05421	42x42	76.0	16.0	0.148
G05541	54x54	86.0	16.0	0.200

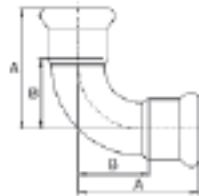
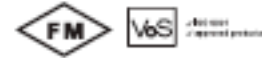
Stainless Steel 316L / 1.4404				
Art. Nr.	Dimensions mm	A mm	B mm	kg
G05224	22x22	52.0	10.0	0.056
G05284	28x28	56.2	10.2	0.075
G05354	35x35	62.3	10.3	0.123
G05424	42x42	73.3	13.3	0.154
G05544	54x54	83.0	13.0	0.221
G05764	76x76	142.0	32.0	0.604
G05894	89x89	163.0	37.0	0.837
G051084	108x108	192.0	38.0	1.193

For further information see G-Press catalogue reference 'TYCENPRESS'.



## G-Press G15 Elbow 90° (2x press)

- G-Press G15 90° Bogen (2 x Press)
- Coude 90° G-Press G15 (2 x femelle)



### Galvanized Carbon Steel

Art. Nr.	Dimensions mm	A mm	B mm	Kg
G15221	22x22	51.0	30.0	0.100
G15281	28x28	60.0	37.0	0.157
G15351	35x35	71.0	45.0	0.215
G15421	42x42	86.0	58.0	0.329
G15541	54x54	105.0	70.0	0.489

### Stainless Steel 316L / 1.4404

Art. Nr.	Dimensions mm	A mm	B mm	Kg
G15224	22x22	51.0	30.0	0.109
G15284	28x28	60.1	37.1	0.165
G15354	35x35	71.1	45.1	0.312
G15424	42x42	86.1	58.1	0.103
G15544	54x54	105.0	70.0	0.220
G15764	76x76	150.0	95.0	0.977
G15894	89x89	175.0	112.0	1.325
G151084	108x108	214.0	136.0	2.091

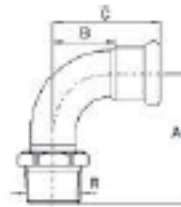
For further information see G-Press catalogue reference 'TYCENPRESS'.





## G-Press G17 Elbow 90° (press x male thread)

- G-Press G17 90° Bogen (Press x Aussengewinde)
- Coude 90° G-Press G17 (femelle x filetage mâle)



### Galvanized Carbon Steel

Art. Nr.	Dimensions mm	A mm	B mm	C mm	kg
G1722TC1	22xR3/4	61.5	30.0	51.0	0.162
G1728TD1	28xR1	73.5	37.0	60.0	0.234
G1735TE1	35xR1.1/4	85.5	45.0	71.0	0.376
G1742TF1	42xR1.1/2	95.5	56.0	86.0	0.486
G1754TG1	54xR2	115.5	70.0	105.0	0.724

### Stainless Steel 316L / 1.4404

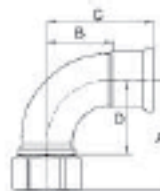
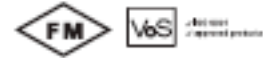
Art. Nr.	Dimensions mm	A mm	B mm	C mm	kg
G1722TC4	22xR3/4	48.5	27.5	38.5	0.274
G1728TD4	28xR1	53.0	30.0	46.0	0.230
G1735TE4	35xR1.1/4	60.0	34.0	52.0	0.368
G1742TF4	42xR1.1/2	69.0	39.0	58.0	0.502
G1754TG4	54xR2	82.0	47.0	68.0	0.839

For further information see G-Press catalogue reference 'TYCENPRESS'.



## G-Press G18 Elbow 90° (press x female thread)

- G-Press G18 90° Bogen (Press x Innengewinde)
- Coude 90° G-Press G18 (femelle x filetage femelle)



Galvanized Carbon Steel						
Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	kg
G1822TB1	22xRp1/2	59.0	30.0	51.0	43.0	0.155
G1822TC1	22xRp3/4	59.0	30.0	51.0	43.0	0.154
G1828TB1	28xRp1/2	65.0	37.0	60.0	46.0	0.198
G1828TC1	28xRp3/4	65.0	37.0	60.0	46.0	0.175
G1828TD1	28xRp1	69.5	37.0	60.0	50.5	0.175
G1835TB1	35xRp1/2	74.5	45.0	71.0	54.0	0.352
G1835TC1	35xRp3/4	74.5	45.0	71.0	54.0	0.322
G1835TD1	35xRp1	74.5	45.0	71.0	54.0	0.323
G1842TB1	42xRp1/2	soon available				
G1842TC1	42xRp3/4	soon available				
G1842TD1	42xRp1	soon available				
G1854TB1	54xRp1/2	soon available				
G1854TC1	54xRp3/4	soon available				
G1854TD1	54xRp1	soon available				

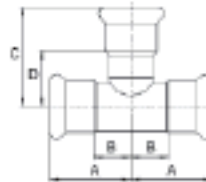
Stainless Steel 316L / 1.4404						
Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	kg
G1822TB4	22xRp1/2	31.0	24.0	45.0	16.0	0.285
G1822TC4	22xRp3/4	33.0	27.5	48.5	16.7	0.262
G1828TB4	28xRp1/2	35.0	24.5	47.5	16.0	0.320
G1828TC4	28xRp3/4	35.0	27.5	50.5	18.5	0.295
G1828TD4	28xRp1	37.0	31.5	54.5	17.5	0.260
G1835TB4	35xRp1/2	35.0	30.0	56.0	20.0	0.477
G1835TC4	35xRp3/4	37.0	31.5	57.5	21.0	0.452
G1835TD4	35xRp1	40.5	32.0	58.0	21.0	0.417

For further information see G-Press catalogue reference 'TYCENPRESS'.



## G-Press G35 Tee equal (3 x press)

- ▶ G-Press G30 Gleiches T-Stück (3 x Press)
- ▶ Tè égal G-Press G35 (3 x femelle)



Galvanized Carbon Steel						
Art. No.	Dimensions mm	A mm	B mm	C mm	D mm	$\alpha$ Kg
G35221	22x22x22	39.5	18.5	48.5	27.5	0.108
G35281	28x28x28	44.5	21.5	53.5	30.5	0.150
G35351	35x35x35	51.0	25.0	60.0	34.0	0.210
G35421	42x42x42	60.0	30.0	68.5	36.5	0.294
G35541	54x54x54	71.0	36.0	77.5	42.5	0.431

Stainless Steel 316L / 1.4404						
Art. No.	Dimensions mm	A mm	B mm	C mm	D mm	$\alpha$ Kg
G35224	22x22x22	39.5	18.5	43.5	22.5	0.108
G35284	28x28x28	44.5	21.5	48.5	25.5	0.150
G35354	35x35x35	51.0	25.0	55.0	29.0	0.210
G35424	42x42x42	60.0	30.0	61.5	31.5	0.294
G35544	54x54x54	71.0	36.0	72.5	37.5	0.430
G35784	76x76x76	116.0	61.0	115.0	60.0	1.192
G35894	89x89x89	131.0	68.0	127.0	64.0	1.617
G351084	108x108x108	156.0	79.0	155.0	78.0	2.450

For further information see G-Press catalogue reference 'TYCENPRESS'.

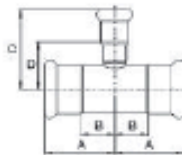


## G-Press G36 Tee reduced (3 x press)

- G-Press G36 Reduzier-T-Stück (3 x Press)
- Tê de redução G-Press G36 (3 x femelle)



G36



### Galvanized Carbon Steel

Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	kg
G362228221	22x28x22	39.5	18.5	52.0	29.0	0.122
G362822281	28x22x28	44.5	21.5	51.5	30.5	0.139
G362835281	28x35x28	soon available				
G363522351	35x22x35	51.0	25.0	55.0	34.0	0.183
G363528351	35x28x35	51.0	25.0	57.0	34.0	0.193
G363542351	35x42x35	soon available				
G364222421	42x22x42	60.0	30.0	57.5	36.5	0.245
G364228421	42x28x42	60.0	30.0	59.5	36.5	0.255
G364235421	42x35x42	60.0	30.0	62.5	36.5	0.269
G364254421	42x54x42	soon available				
G365422541	54x22x54	71.0	36.0	63.5	42.5	0.350
G365428541	54x28x54	71.0	36.0	65.5	42.5	0.360
G365435541	54x35x54	71.0	36.0	68.5	42.5	0.375
G365442541	54x42x54	71.0	36.0	72.5	42.5	0.393

### Stainless Steel 316L / 1.4404

Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	kg
G362822284	28x22x28	44.5	21.5	48.5	25.5	0.139
G362835284	28x35x28	soon available				
G363522354	35x22x35	51.0	25.0	50.0	29.0	0.183
G363528354	35x28x35	51.0	25.0	52.0	29.0	0.193
G363542354	35x42x35	soon available				
G364222424	42x22x42	60.0	30.0	52.5	31.5	0.244
G364228424	42x28x42	60.0	30.0	54.5	31.5	0.254
G364235424	42x35x42	60.0	30.0	57.5	31.5	0.269
G364254424	42x54x42	soon available				
G365422544	54x22x54	71.0	36.0	58.5	37.5	0.350
G365428544	54x28x54	71.0	36.0	60.5	37.5	0.360
G365435544	54x35x54	71.0	36.0	63.5	37.5	0.374
G365442544	54x42x54	71.0	36.0	67.5	37.5	0.393
G367622764	76x22x76	116.0	61.0	88.0	45.0	0.942
G367628764	76x28x76	116.0	61.0	71.0	47.0	0.956
G367635764	76x35x76	116.0	61.0	75.0	48.0	0.968
G367642764	76x42x76	116.0	61.0	79.0	47.0	0.981
G367654764	76x54x76	116.0	61.0	80.0	43.0	1.067
G368922894	89x22x89	131.0	68.0	76.0	53.0	1.256
G368928894	89x28x89	131.0	68.0	76.0	52.0	1.244
G368935894	89x35x89	131.0	68.0	83.0	56.0	1.267
G368942894	89x42x89	131.0	68.0	85.0	53.0	1.271
G368954894	89x54x89	131.0	68.0	93.0	56.0	1.271
G368976894	89x76x89	131.0	68.0	116.0	61.0	1.297
G369822084	108x22x108	156.0	79.0	85.0	62.0	1.479
G369828084	108x28x108	156.0	79.0	88.0	64.0	1.919
G369835084	108x35x108	156.0	79.0	94.0	67.0	1.939
G369842084	108x42x108	156.0	79.0	96.0	64.0	1.955
G369854084	108x54x108	156.0	79.0	102.0	65.0	1.967
G369876084	108x76x108	156.0	79.0	125.0	70.0	2.147
G369889084	108x89x108	156.0	79.0	135.0	72.0	2.255

General notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions. Never remove any piping components nor correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified with the gasket recommendation listing for the specific application.

For further information see G-Press catalogue reference 'TYCENPRESS'.

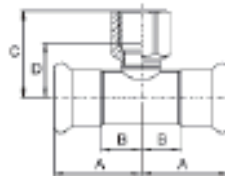
TYCENPRESS 1010 Tyco reserves the right to change the contents without notice

5.053



## G-Press G37 Tee threaded (press x female thread x press)

- G-Press G37 T-Stück Gewinde (Press x Innengewinde x Press)
- Té fileté G-Press G37 (femelle x filetage femelle x femelle)



Galvanized Carbon Steel						
Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	$\alpha_{kg}$
G3722TB221	22xRp1/2x22	39.5	18.5	39.0	24.0	0.113
G3722TC221	22xRp3/4x22	39.5	18.5	41.0	24.7	0.135
G3728TB281	28xRp1/2x28	44.5	21.5	42.0	27.0	0.145
G3728TC281	28xRp3/4x28	44.5	21.5	44.0	27.7	0.165
G3728TD281	28xRp1x28	44.5	21.5	48.0	29.0	0.251
G3735TB351	35xRp1/2x35	51.0	25.0	45.5	30.5	0.189
G3735TC351	35xRp3/4x35	51.0	25.0	47.5	31.2	0.209
G3735TD351	35xRp1x35	51.0	25.0	51.5	32.5	0.295
G3742TB421	42xRp1/2x42	60.0	30.0	48.0	33.0	0.248
G3742TC421	42xRp3/4x42	60.0	30.0	50.0	33.7	0.271
G3742TD421	42xRp1x42	60.0	30.0	54.0	35.0	0.357
G3754TB541	54xRp1/2x54	71.0	36.0	54.0	39.0	0.357
G3754TC541	54xRp3/4x54	71.0	36.0	56.0	39.7	0.377
G3754TD541	54xRp1x54	71.0	36.0	60.0	41.0	0.462

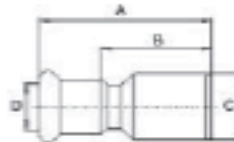
Stainless Steel 316L / 1.4404						
Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	$\alpha_{kg}$
G3722TB224	22xRp1/2x22	39.5	18.5	37.0	22.0	0.128
G3722TC224	22xRp3/4x22	39.5	18.5	39.0	23.0	0.140
G3728TB284	28xRp1/2x28	44.5	21.5	40.0	25.0	0.158
G3728TC284	28xRp3/4x28	44.5	21.5	42.0	26.0	0.170
G3728TD284	28xRp1x28	44.5	21.5	46.0	27.5	0.212
G3735TB354	35xRp1/2x35	51.0	25.0	43.5	28.5	0.203
G3735TC354	35xRp3/4x35	51.0	25.0	45.5	29.5	0.215
G3735TD354	35xRp1x35	51.0	25.0	50.0	31.0	0.254
G3742TB424	42xRp1/2x42	60.0	30.0	46.0	31.0	0.261
G3742TC424	42xRp3/4x42	60.0	30.0	48.0	32.0	0.276
G3742TD424	42xRp1x42	60.0	30.0	52.5	33.5	0.310
G3754TB544	54xRp1/2x54	71.0	36.0	52.0	37.0	0.370
G3754TC544	54xRp3/4x54	71.0	36.0	54.0	38.0	0.382
G3754TD544	54xRp1x54	71.0	36.0	58.0	39.0	0.673
G3778TC764	76xRp3/4x76	116.0	61.0	68.0	55.0	1.009
G3789TC894	89xRp3/4x89	131.0	68.0	87.0	74.0	1.210
G3708TC084	108xRp3/4x108	156.0	79.0	86.0	73.0	1.956

For further information see G-Press catalogue reference 'TYCENPRESS'.



## G-Press G40 Reducer (press x male)

- G-Press G40 Reduktionsstück (Press x Einschub)
- Réducteur G-Press G40 (compression x mâle)



Galvanized Carbon Steel						
Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	kg
G4028221	28x22	63.0	42.0	28.0	22.0	0.064
G4035221	35x22	68.0	42.0	35.0	22.0	0.080
G4035281	35x28	69.0	46.0	35.0	28.0	0.087
G4042221	42x22	80.0	59.0	42.0	22.0	0.077
G4042281	42x28	79.0	56.0	42.0	28.0	0.101
G4042351	42x35	76.0	50.0	42.0	35.0	0.127
G4054221	54x22	89.0	68.0	54.0	22.0	0.200
G4054281	54x28	87.0	64.0	54.0	28.0	0.123
G4054351	54x35	89.0	63.0	54.0	35.0	0.141
G4054421	54x42	91.0	61.0	54.0	42.0	0.183

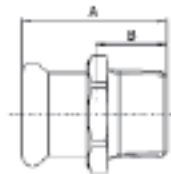
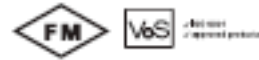
Stainless Steel 316L / 1.4404						
Art. Nr.	Dimensions mm	A mm	B mm	C mm	D mm	kg
G4028224	28x22	61.2	40.2	28.0	22.0	0.062
G4035224	35x22	69.0	48.0	35.0	22.0	0.077
G4035284	35x28	68.1	45.1	35.0	28.0	0.084
G4042224	42x22	84.5	63.5	42.0	22.0	0.137
G4042284	42x28	77.9	54.9	42.0	28.0	0.114
G4042354	42x35	77.6	51.6	42.0	35.0	0.120
G4054224	54x22	96.5	75.5	54.0	22.0	0.203
G4054284	54x28	95.5	72.5	54.0	28.0	0.197
G4054354	54x35	94.6	68.6	54.0	35.0	0.242
G4054424	54x42	95.1	65.1	54.0	42.0	0.173
G4076424	76x42	151.0	119.0	76.1	42.0	0.425
G4076544	76x54	140.0	103.0	76.1	54.0	0.451
G4089544	89x54	156.0	119.0	88.9	54.0	0.586
G4089764	89x76	156.0	101.0	88.9	76.1	0.653
G40108544	108x54	204.0	167.0	108.0	54.0	0.880
G40108764	108x76	196.0	141.0	108.0	76.1	0.978
G40108894	108x89	196.0	127.0	108.0	88.9	0.992

For further information see G-Press catalogue reference 'TYCENPRESS'.



## G-Press G45 Straight connector (press x male thread)

- G-Press G45 Gerades Verbindungsstück (Press x Aussengewinde)
- Adaptateur G-Press G45 (femelle x filetage mâle)



### Galvanized Carbon Steel

Art. Nr.	Dimensions mm	A mm	B mm	K <sub>t</sub>
G4522TB1	22xR1/2	43.0	22.0	0.074
G4522TC1	22xR3/4	44.0	23.0	0.081
G4522TD1	22xR1	50.0	29.0	0.095
G4528TC1	28xR3/4	46.0	23.0	0.101
G4528TD1	28xR1	48.0	25.0	0.131
G4535TE1	35xR1.1/4	55.0	29.0	0.190
G4542TF1	42xR1.1/2	59.0	29.0	0.242
G4554TG1	54xR2	69.0	34.0	0.381

### Stainless Steel 316L / 1.4404

Art. Nr.	Dimensions mm	A mm	B mm	K <sub>t</sub>
G4522TB4	22xR1/2	42.0	21.0	0.133
G4522TC4	22xR3/4	43.3	22.3	0.083
G4522TD4	22xR1	48.5	27.5	0.149
G4528TC4	28xR3/4	45.2	22.2	0.172
G4528TD4	28xR1	48.0	25.0	0.133
G4528TE4	28xR1.1/4	51.5	28.5	0.198
G4535TD4	35xR1	52.7	26.7	0.210
G4535TE4	35xR1.1/4	55.0	29.0	0.194
G4535TF4	35xR1.1/2	56.0	30.0	0.224
G4542TE4	42xR1.1/4	59.0	29.0	0.274
G4542TF4	42xR1.1/2	59.0	29.0	0.249
G4554TF4	54xR1.1/2	64.7	29.7	0.549
G4554TG4	54xR2	69.0	34.0	0.394
G4578TH4	78xR2.1/2	125.0	70.0	0.820
G4589TH4	89xR3	138.0	75.0	1.158

For further information see G-Press catalogue reference 'TYCENPRESS'.



## G-Press G46 Straight connector (press x female thread)

- G-Press G46 Gerades Verbindungsstück (Press x Innengewinde)
- Adaptateur G-Press G46 (femelle x filetage femelle)



### Galvanized Carbon Steel

Art. Nr.	Dimensions mm	A mm	B mm	Kg
G4622TC1	22xRp3/4	43.0	5.7	0.086
G4628TB1	28xRp1/2	38.0	2.0	0.157
G4628TC1	28xRp3/4	40.5	1.0	0.107
G4628TD1	28xRp1	49.0	7.0	0.157
G4635TE1	35xRp1.1/4	50.0	2.3	0.100

### Stainless Steel 316L / 1.4404

Art. Nr.	Dimensions mm	A mm	B mm	Kg
G4622TC4	22xRp3/4	39.5	7.5	0.088
G4622TD4	22xRp1	43.6	9.6	0.118
G4628TC4	28xRp3/4	40.0	6.0	0.189
G4628TD4	28xRp1	44.6	8.6	0.160
G4628TE4	28xRp1.1/4	47.0	9.0	0.170
G4635TD4	35xRp1	46.0	7.0	0.154
G4635TE4	35xRp1.1/4	50.0	9.0	0.212
G4635TF4	35xRp1.1/2	50.0	10.0	0.196
G4642TE4	42xRp1.1/4	52.0	3.0	0.285
G4642TF4	42xRp1.1/2	54.0	10.0	0.278
G4654TF4	54xRp1.1/2	58.0	9.0	0.496
G4654TG4	54xRp2	63.0	10.0	0.491

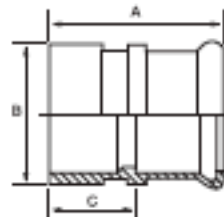
For further information see G-Press catalogue reference 'TYCENPRESS'.





## G-Press G48 Transition for grooved couplings (press x groove)

- G-Press G48 Übergang für geriefte Anschlüsse (Press x Riefe)
- Adaptateur G-Press G48 (femelle x rainure)



### Galvanized Carbon Steel

Art. Nr.	Dimensions mm	A mm	B mm	C mm	kg
G4828TD1	28x33.7	72.5	33.7	26.5	0.140
G4835TE1	35x42.4	78.0	42.4	26.0	0.199
G4842TF1	42x48.3	85.0	48.3	25.0	0.241
G4854TG1	54x60.3	96.5	60.3	26.5	0.318

### Stainless Steel 316L / 1.4404

Art. Nr.	Dimensions mm	A mm	B mm	C mm	kg
G4828TD4	28x33.7	72.5	33.7	26.5	0.140
G4835TE4	35x42.4	78.0	42.4	26.0	0.199
G4842TF4	42x48.3	85.0	48.3	25.0	0.241
G4854TG4	54x60.3	96.5	60.3	26.5	0.318



Note: Recommended to use figure G48 with Grinnel® Grooved Couplings.

Important note for FM approved installations:

When connecting the G-press system to a grooved system it is mandatory to use the G48 transition coupling

For further information see G-PRESS catalogue reference 'TYCENPRESS'.



## Couplings, Stainless Steel Coupling, Flexible

- Edelstahlkupplungen, leichte flexible Kupplung
- Raccords en acier inoxydable, raccords flexibles



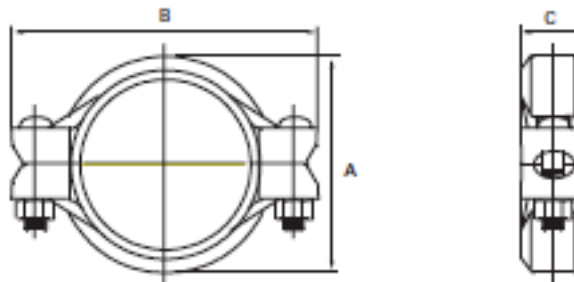
by First Five Swasticon & dentha products



FIG. 405



ACS WRAS ARPA



Art. Nr.	Nominal Size	Pipe OD	Max. Wk. Pressure t	Max. End Load t	Range of Pipe End Separation t	Deflection	Coupling Dimensions			Coupling Bolts		Approx Weight	
	mm ["]	mm	Bar [Psi]	kN	mm	Abweichung/Deflection	A	B	C	Qty	Size		
	mm ["]	mm	Bar [Psi]	kN	mm	Per Coupling	mm	mm	mm	mm	mm	Kg	
405MD00344	25 [1]	33.7	34.5 [500]	3.02	0-3.3	5°26'	95.1	56	97	46	2	M10 x 57	0.6
405MD00424	32 [1.1/4]	42.4	34.5 [500]	4.88	0-3.3	4°19'	75.0	65	106	46	2	M10 x 57	0.7
405MD00484	40 [1.1/2]	48.3	34.5 [500]	6.30	0-3.3	3°46'	65.8	70	113	46	2	M10 x 57	0.7
405MD00804	50 [2]	60.3	34.5 [500]	9.85	0-3.3	3°01'	52.5	83	124	48	2	M10 x 57	0.8
405MD00734	65 [2.1/2]	73.0	34.5 [500]	14.43	0-3.3	2°29'	43.3	94	140	48	2	M10 x 57	0.9
405MD00764	65 [2.1/2]	76.1	34.5 [500]	15.71	0-3.3	2°23'	41.7	102	146	48	2	M12 x 76	1.4
405MD00894	80 [3]	88.9	34.5 [500]	21.38	0-3.3	2°03'	35.8	111	165	48	2	M12 x 76	1.4
405MD01044	100 [4]	114.3	22.4 [325]	21.21	0-6.4	3°11'	55.8	145	197	52	2	M12 x 76	1.8
405MD01394	125 [5]	139.7	13.8 [200]	31.67	0-6.4	2°36'	45.5	173	248	52	2	M16 x 83	3.3
405MD01414	125 [5]	141.3	13.8 [200]	32.42	0-6.4	2°35'	45.0	175	248	52	2	M16 x 83	3.2
405MD01654	150 [6]	165.1	13.8 [200]	44.24	0-6.4	2°12'	38.3	197	272	52	2	M16 x 83	3.2
405MD01664	150 [6]	168.3	13.8 [200]	45.98	0-6.4	2°10'	37.5	202	271	52	2	M16 x 83	3.2
405MD02194	200 [8]	219.1	13.8 [200]	72.92	0-6.4	1°40'	29.2	250	344	64	2	M20 x 121	6.6



### Residential Sprinklers, Quick Response, Pendent Concealed

- 🇩🇪 Wohnraum Sprinkler, Schnell Ansprechend, Hängend Verdeckt
- 🇪🇫 Sprinkleurs Residentiels, Réponse Rapide, Pendant Caché



LFI



TFP 440 / TFP 442 [K=71]

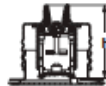


0.240 kg



Art. Nr. 560001265, W-Type 18

(p.1.116)



K=60[4.2] • 1/2" NPT • SINTY2596 • H=47.6 mm ±3.2 [1-7/8±1/8"]

Art. Nr.	T °C [°F]	F	≡
511223160	71 [160]	3	✓
511224160	71 [160]	4	✓
511229160	71 [160]	9	✓

K=71[4.9] • 1/2" NPT • SINTY3596 • H=47.6 mm ±3.2 [1-7/8±1/8"]

Art. Nr.	T °C [°F]	F	UL
51123160	71 [160]	3	✓
51124160	71 [160]	4	✓
51129160	71 [160]	9	✓

### Residential Sprinklers, Domed Plate, Pendent Concealed

- 🇩🇪 Wohnraum Sprinkler, Domed Plate, Hängend Verdeckt
- 🇪🇫 Sprinkleurs Residentiels, Cache Bombé, Pendant Caché



LFI



TFP 450 / TFP 408 [K=100]



0.240 kg



Art. Nr. 568504001

(p.1.116)



K=70[4.9] • 1/2" NPT • SINTY2234 • H=54.0 mm ±6.4 [2.2/16±1/4"]

Art. Nr.	T °C [°F]	F	≡
518733155	68 [155]	3	✓
518734155	68 [155]	4	✓
518739155	68 [155]	9	✓

K=100[6.9] • 3/4" NPT • SINTY4234 • H=54.0 mm ±6.4 [2.2/16±1/4"]

Art. Nr.	T °C [°F]	F	≡
510883155	68 [155]	3	✓
510884155	68 [155]	4	✓
510889155	68 [155]	9	✓



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 Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500



## Series LFII Residential Concealed Pendent Sprinklers, Flat Plate 4.2 K-factor

### General Description

The Tyco® Rapid Response™ Series LFII (TY2596) Residential Concealed Pendent Sprinklers are decorative, fast response, fusible solder sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels.

The cover plate assembly conceals the sprinkler operating components above the ceiling. The flat profile of the cover plate provides the optimum aesthetically appealing sprinkler design. In addition, the concealed design of the Series LFII (TY2596) provides 1/2 inch (12,7 mm) vertical adjustment. This adjustment provides a measure of flexibility with regard to which the length of fixed pipe drops to the sprinklers must be cut.

The Series LFII are to be used in wet pipe residential sprinkler systems for one- and two-family dwellings and mobile homes per NFPA 13D; wet pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R; or, wet pipe sprinkler systems for the residential portions of any occupancy per NFPA 13.

The Series LFII (TY2596) has a 4.2

(60,5) K-factor that provides the required residential flow rates at reduced pressures, enabling smaller pipe sizes and water supply requirements.

The Series LFII (TY2596) has been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

The Series LFII (TY2596) Residential Concealed Pendent Sprinklers are shipped with a Disposable Protective Cap. The Protective Cap is temporarily removed for installation, and then it can be replaced to help protect the sprinkler while the ceiling is being installed or finished. The tip of the Protective Cap can also be used to mark the center of the ceiling hole into plaster board, ceiling tiles, etc. by gently pushing the ceiling product against the Protective Cap. When the ceiling installation is complete the Protective Cap is removed and the Cover Plate Assembly installed.

#### NOTICE

*The Series LFII (TY2596) Residential Concealed Pendent Sprinklers described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.*

*The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.*



### Sprinkler/Model Identification Number

SIN TY2596

#### IMPORTANT

*Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.*



## Operation

The glass Bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass Bulb allowing the sprinkler to activate and flow water.

## Design Criteria

The Series LFII (TY3334) Residential Horizontal Sidewall Sprinklers are UL and C-UL Listed for installation in accordance with the following criteria.

### NOTE

*When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the local Authority Having Jurisdiction.*

**System Type.** Only wet pipe systems may be utilized.

**Hydraulic Design.** The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Table A and B as a function of temperature rating and the maximum allowable coverage areas. The sprinkler flow rate is the minimum required discharge from each of the total number of "design sprinklers" as specified in NFPA 13D or NFPA 13R.

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Tables A and B for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 gpm/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for the actual coverage areas being protected by the four sprinklers.

**Obstruction To Water Distribution.** Locations of sprinklers are to be in accordance with the obstruction rules of NFPA 13 for residential sprinklers.

**Operational Sensitivity.** The sprinklers are to be installed with an end-of-deflector-boss to wall distance of 1-3/8 to 6 inches or in the recessed position using only the Style 20 Recessed Escutcheon as shown in Figure 2.

In addition the top-of-deflector-to-ceiling distance is to be within the range (Ref. Table A or B) being hydraulically calculated.

**Sprinkler Spacing.** The minimum spacing between sprinklers is 8 feet (2,4 m) when installed with a top-of-deflector-to-ceiling distance of 4 to 6 inches (100 to 150 mm). The minimum spacing between sprinklers is 9 feet (2,7 m) when installed with a top-of-deflector-to-ceiling distance of 6 to 12 inches (150 to 300 mm). The maximum spacing between sprinklers cannot exceed the width of the coverage area (Ref. Table A) being hydraulically calculated (e.g., maximum 12 feet for a 12 ft. x 12 ft. coverage area, or 16 feet for a 16 ft. x 20 ft. coverage area).

## Installation

The Series LFII (TY3334) must be installed in accordance with the following instructions:

### NOTES

*Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm).*

*A leak tight 1/2 inch NPT sprinkler joint should be obtained with a torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). A maximum of 21 ft.lbs. (28,5 Nm) of torque is to be used to install sprinklers. Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.*

*Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under- or over-tightening the Sprinkler. Readjust the position of the sprinkler fitting to suit.*

**The Series LFII Horizontal Sidewall Sprinklers** must be installed in accordance with the following instructions.

**Step 1.** Horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word "TOP" on the Deflector is to face towards the ceiling with the front edge of the Deflector parallel to the ceiling.

**Step 2.** With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

**Step 3.** Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Ref. Figure 3). With reference to Figure 1, the W-Type

6 Sprinkler Wrench is to be applied to the wrench flats.

The **Series LFII Recessed Horizontal Sidewall Sprinklers** must be installed in accordance with the following instructions.

**Step A.** Recessed horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word "TOP" on the Deflector is to face towards the ceiling.

**Step B.** After installing the Style 20 Mounting Plate over the sprinkler threads and with pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

**Step C.** Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Ref. Figure 4). With reference to Figure 1, the W-Type 7 Recessed Sprinkler Wrench is to be applied to the sprinkler wrench flats.

**Step C.** After the wall has been installed or the finish coat has been applied, slide on the Style 20 Closure over the Series LFII Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the wall.

## Care and Maintenance

The Series LFII (TY3334) must be maintained and serviced in accordance with the following instructions:

### NOTES

*Absence of an Escutcheon Plate may delay the sprinkler operation in a fire situation.*

*Before closing a fire protection system main control valve for maintenance work on the fire protection system which it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.*

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned

(Continued on Page 6)



ELEVATION

Maximum Coverage Area <sup>(a)</sup> Width x Length <sup>(b)</sup> Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow <sup>(c)</sup> and Residual Pressure			
		Top-Of-Deflector- To- Ceiling: 4 to 6 Inches (100 to 150 mm)		Top-Of-Deflector- To- Ceiling: 6 to 12 Inches (150 to 300 mm)	
		155°F/68°C	175°F/79°C	155°F/68°C	175°F/79°C
12 x 12 (3,7 x 3,7)	12 (3,7)	17 GPM (64,3 LPM) 9.2 psi (0,63 bar)	17 GPM (64,3 LPM) 9.2 psi (0,63 bar)	20 GPM (75,7 LPM) 12.8 psi (0,88 bar)	20 GPM (75,7 LPM) 12.8 psi (0,88 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	19 GPM (71,9 LPM) 11.5 psi (0,79 bar)	19 GPM (71,9 LPM) 11.5 psi (0,79 bar)	22 GPM (83,3 LPM) 15.4 psi (1,06 bar)	22 GPM (83,3 LPM) 15.4 psi (1,06 bar)
16 x 14 (4,9 x 4,3)	16 (4,9)	20 GPM (75,7 LPM) 12.8 psi (0,88 bar)	20 GPM (75,7 LPM) 12.8 psi (0,88 bar)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)	28 GPM (106,0 LPM) 25.0 psi (1,72 bar)	28 GPM (106,0 LPM) 25.0 psi (1,72 bar)
16 x 18 (4,9 x 5,5)	16 (4,9)	26 GPM (98,4 LPM) 21.6 psi (1,49 bar)	26 GPM (98,4 LPM) 21.6 psi (1,49 bar)	31 GPM (117,3 LPM) 30.6 psi (2,11 bar)	31 GPM (117,3 LPM) 30.6 psi (2,11 bar)
16 x 20 (4,9 x 6,1)	16 (4,9)	29 GPM (109,8 LPM) 26.8 psi (1,85 bar)	29 GPM (109,8 LPM) 26.8 psi (1,85 bar)	37 GPM (140,0 LPM) 43.7 psi (3,01 bar)	37 GPM (140,0 LPM) 43.7 psi (3,01 bar)

(a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

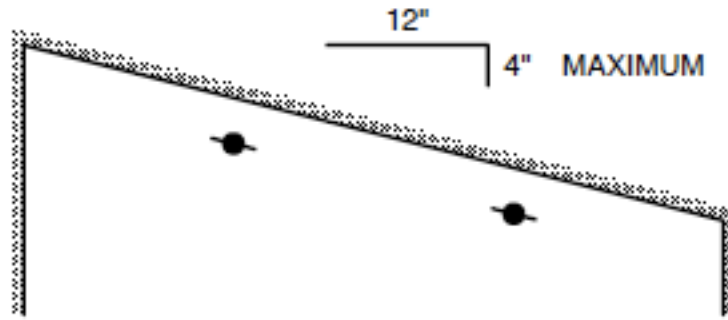
(b) Width (backwall where sprinkler is located) x Length (horizontal throw of sprinkler).

(c) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details.

(d) Sidewall sprinklers, where installed under a ceiling with a slope greater than 0 inch rise for a 12 inch run to a slope up to 2 inch rise for 12 inch run, must be located per one of the following:

- Locate the sprinklers at the high point of the slope and positioned to discharge down the slope.
- Locate the sprinklers along the slope and positioned to discharge across the slope.

**TABLE A**  
**NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA**  
**FOR THE SERIES LFI (TY3334)**  
**RESIDENTIAL HORIZONTAL SIDEWALL AND RECESSED HORIZONTAL SIDEWALL SPRINKLERS**  
**FOR HORIZONTAL CEILING (Maximum 2 Inch Rise for 12 Inch Run)**



ELEVATION

Maximum Coverage Area <sup>(a)</sup> Width x Length <sup>(b)</sup> Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow <sup>(c)</sup> and Residual Pressure Two sprinkler design with the sprinklers located along the slope and positioned to discharge across the slope.			
		Top-Of-Deflector- To- Ceiling: 4 to 6 Inches (100 to 150 mm)		Top-Of-Deflector- To- Ceiling: 6 to 12 Inches (150 to 300 mm)	
		155°F/68°C	175°F/79°C	155°F/68°C	175°F/79°C
16 x 16 (4,9 x 4,9)	16 (4,9)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)	24 GPM (90,8 LPM) 18.4 psi (1,27 bar)

- (a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.
- (b) Width (backwall where sprinkler is located) x Length (horizontal throw of sprinkler).
- (c) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details.

**TABLE B**  
**NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA**  
**FOR THE SERIES LFII (TY3334)**  
**RESIDENTIAL HORIZONTAL SIDEWALL AND RECESSED HORIZONTAL SIDEWALL SPRINKLERS**  
**FOR SPRINKLERS LOCATED ALONG A SLOPE AND DISCHARGING ACROSS THE SLOPE**  
*(Greater Than 2 Inch Rise for 12 Inch Run Up To 4 Inch Rise for 12 Inch Run)*





by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

**NOTE**

*The owner must assure that the sprinklers are not used for hanging of any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.*

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national code.

**Limited Warranty**

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

**Ordering Procedure**

When placing an order, indicate the full product name. Contact your local distributor for availability..

**Sprinkler Assembly:**

Series LFII (TY3334), K=5.6, Residential Horizontal Sidewall Sprinkler with (specify) temperature rating and (specify) finish, P/N (specify).

**155°F/68°C**

Chrome Plated .....	P/N 51-524-9-155
White Coated .....	P/N 51-524-4-155
White (RAL9010)* .....	P/N 51-524-3-155
Natural Brass .....	P/N 51-524-1-155

**175°F/79°C**

Chrome Plated .....	P/N 51-524-9-175
White Coated .....	P/N 51-524-4-175
White (RAL9010)* .....	P/N 51-524-3-175
Natural Brass .....	P/N 51-524-1-175

\* Eastern Hemisphere sales only.

**Recessed Escutcheon:**

Specify: Style 20 Recessed Escutcheon with (specify\*) finish, P/N (specify\*).

\* Refer to Technical Data Sheet TFP770.

**Sprinkler Wrench:**

Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.



## Residential Sprinklers, Quick Response, Pendent Concealed

- Wohnraum Sprinkler, Schnell Ansprechend, Hängend Verdeckt
- Sprinkleurs Residentiels, Réponse Rapide, Pendant Caché



TFP 440 / TFP 442 [K-71]



0.240 kg



Art. Nr. 560001265, W-Type 18

[p.1.116]



K-60[4.2] • 1/2" NPT • SINTY2596 • H=476 mm ±3.2 [1-7/8±1/8"]

Art. Nr.	T °C [°F]	F	≡
511223100	71 [160]	3	✓
511224100	71 [160]	4	✓
511229100	71 [160]	9	✓

K-71[4.9] • 1/2" NPT • SINTY2596 • H=476 mm ±3.2 [1-7/8±1/8"]

Art. Nr.	T °C [°F]	F	≡
511123100	71 [160]	3	✓
511124100	71 [160]	4	✓
511129100	71 [160]	9	✓

## Residential Sprinklers, Domed Plate, Pendent Concealed

- Wohnraum Sprinkler, Domed Plate, Hängend Verdeckt
- Sprinkleurs Residentiels, Cache Bombé, Pendant Caché



TFP 450 / TFP 40s [K-100]



0.240 kg



Art. Nr. 568504001

[p.1.116]



K-70[4.9] • 1/2" NPT • SINTY2234 • H=54.0 mm ±5.4 [2.2/16±1/4"]

Art. Nr.	T °C [°F]	F	≡
518730155	68 [155]	3	✓
518734155	68 [155]	4	✓
518739155	68 [155]	9	✓

K-100[6.9] • 3/4" NPT • SINTY4234 • H=54.0 mm ±5.4 [2.2/16±1/4"]

Art. Nr.	T °C [°F]	F	≡
510683155	68 [155]	3	✓
510684155	68 [155]	4	✓
510689155	68 [155]	9	✓



Maximum Coverage Area <sup>(a)</sup> Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow <sup>(b)</sup> and Residual Pressure For Horizontal Ceiling (Max. 2 Inch Rise for 12 Inch Run)	Minimum Flow <sup>(b)</sup> and Residual Pressure For Sloped Ceiling (Greater Than 2 Inch Rise Up To Max. 4 Inch Rise for 12 Inch Run)	Minimum Flow <sup>(b)</sup> and Residual Pressure For Sloped Ceiling (Greater Than 4 Inch Rise Up To Max. 8 Inch Rise for 12 Inch Run)
		160°F/71°C Sprinkler	160°F/71°C Sprinkler	160°F/71°C Sprinkler
12 x 12 (3,7 x 3,7)	12 (3,7)	13 GPM (49,2 LPM) 9,6 psi (0,66 bar)	18 GPM (68,1 LPM) 18,4 psi (1,27 bar)	18 GPM (68,1 LPM) 18,4 psi (1,27 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	14 GPM (53,0 LPM) 11,1 psi (0,77 bar)	18 GPM (68,1 LPM) 18,4 psi (1,27 bar)	18 GPM (68,1 LPM) 18,4 psi (1,27 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	16 GPM (60,6 LPM) 14,5 psi (1,00 bar)	18 GPM (68,1 LPM) 18,4 psi (1,27 bar)	18 GPM (68,1 LPM) 18,4 psi (1,27 bar)
18 x 18 (5,5 x 5,5)	18 (5,5)	20 GPM (75,7 LPM) 22,7 psi (1,57 bar)	20 GPM (75,7 LPM) 22,7 psi (1,57 bar)	N/A
20 x 20 (6,1 x 6,1)	20 (6,1)	24 GPM (90,8 LPM) 32,7 psi (2,25 bar)	26 GPM (98,4 LPM) 36,3 psi (2,54 bar)	N/A

(a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details.

**TABLE A**  
**NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA**  
**FOR THE SERIES LFII (TY2596) RESIDENTIAL CONCEALED PENDENT SPRINKLER**

## Technical Data

### Approvals:

UL and C-UL Listed, NYC Approved under MEA 44-03-E.

The Series LFII Concealed Pendent Sprinklers are only listed and approved with the Series LFII Concealed Cover Plates having a factory applied finish.

**Maximum Working Pressure:**  
175 psi (12,1 bar)

**Discharge Coefficient:**  
K=4.2 GPM/psi<sup>1/2</sup> (60,5 LPM/bar<sup>1/2</sup>)

**Temperature Rating:**  
160°F/71°C Sprinkler with  
139°F/59°C Cover Plate

**Vertical Adjustment:**  
1/2 inch (12,7 mm)

### Finishes:

Refer to Ordering Procedure section.

### Physical Characteristics:

Body	Brass
Cap	Bronze
Saddle	Brass
Sealing Assembly	
Beryllium Nickel w/ Teflon <sup>†</sup>	
Soldered Link Halves	Nickel
Lever	Bronze
Compression Screw	Brass
Deflector	Copper
Guide Pin Housing	Bronze
Guide Pins	Stainless Steel
Support Cup	Steel
Cover Plate	Copper

Retainer ..... Brass  
 Cover Plate Ejection Spring .....  
 ..... Stainless Steel

<sup>†</sup>DuPont Registered Trademark

## Operation

When exposed to heat from a fire, the Cover Plate, which is normally soldered to the Support Cup at three points, falls away to expose the Sprinkler Assembly. At this point the Deflector supported by the Arms drops down to its operated position. The fusible link of the Sprinkler Assembly is comprised of two link halves that are soldered together with a thin layer of solder. When the rated temperature is reached, the solder melts and the two link halves separate allowing the sprinkler to activate and flow water.

## Design Criteria

The Tyco<sup>®</sup> Rapid Response™ Series LFII (TY2596) Residential Concealed Pendent Sprinklers are UL and C-UL Listed for installation in accordance with the following criteria.

**Note:** When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the Authority Having Jurisdiction.

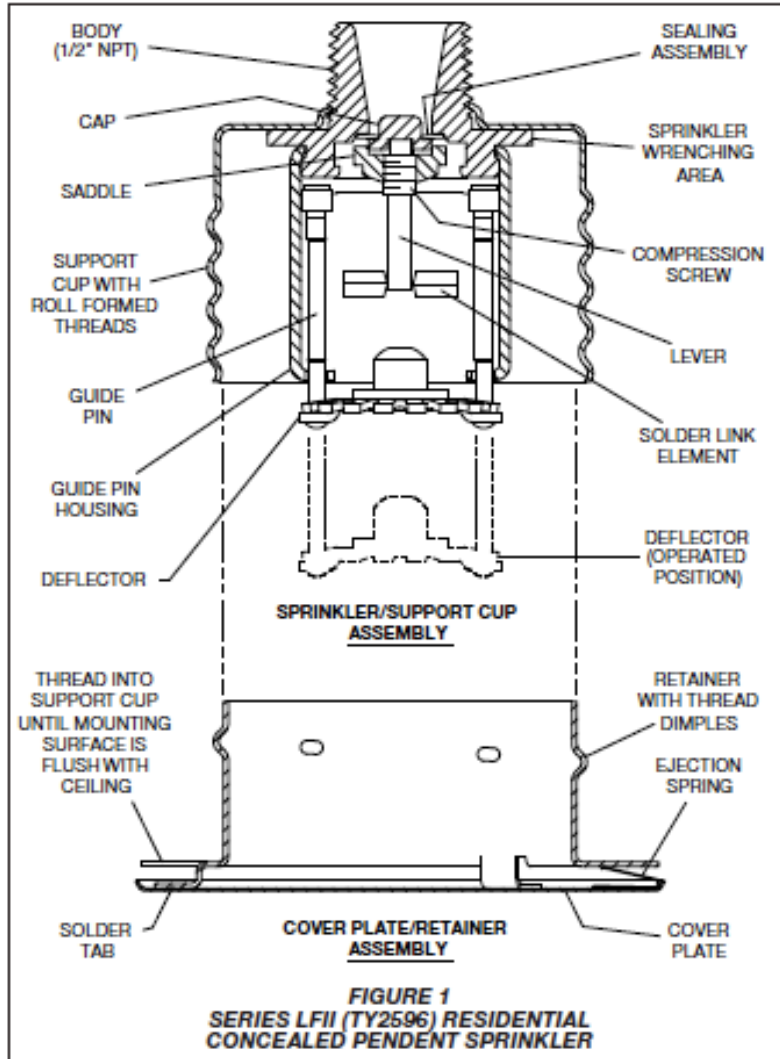
**System Type.** Only wet pipe systems may be utilized.

**Hydraulic Design.** The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Table A as a function of temperature rating and the maximum allowable coverage areas. The sprinkler flow rate is the minimum required discharge from each of the total number of "design sprinklers" as specified in NFPA 13D or NFPA 13R.

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Table A for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 gpm/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for the actual coverage areas being protected by the four sprinklers.

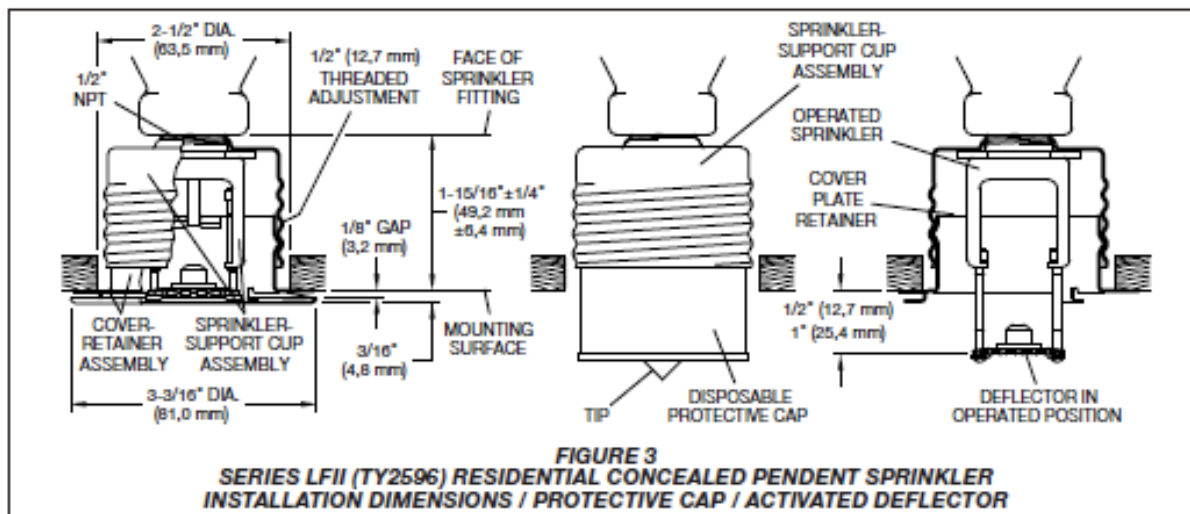
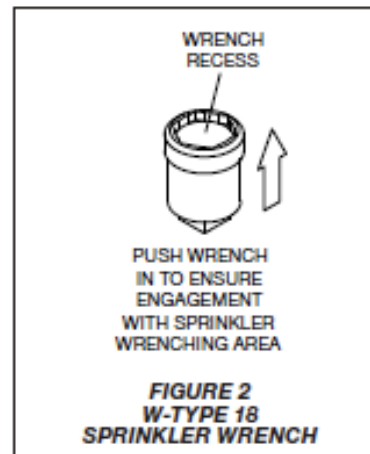
**Obstruction To Water Distribution.** Locations of sprinklers are to be in accordance with the obstruction rules of NFPA 13 for residential sprinklers.



**Operational Sensitivity.** The sprinklers are to be installed relative to the ceiling mounting surface as shown in Figure 3.

**Sprinkler Spacing.** The minimum spacing between sprinklers is 8 feet (2,4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area (Ref. Table A) being hydraulically calculated (e.g., maximum 12 feet for a 12 ft. x 12 ft. coverage area, or 20 feet for a 20 ft. x 20 ft. coverage area).

**The Series LFII must not be used in applications where the air pressure above the ceiling is greater than that below. Down drafts through the Support Cup could delay sprinkler operation in a fire situation.**





## Installation

The Series LFII (TY2596) must be installed in accordance with the following instructions:

### NOTICE

*Damage to the fusible Link Assembly during installation can be avoided by handling the sprinkler by the support cup only (i.e., do not apply pressure to the fusible link Assembly).*

*A 1/2 inch NPT sprinkler joint should be obtained with a minimum to maximum torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.*

*Do not attempt to compensate for insufficient adjustment in the Cover Plate/Retainer Assembly by under- or over-tightening the Sprinkler. Readjust the position of the sprinkler fitting to suit.*

**Step 1.** The sprinkler must only be installed in the pendent position and with the centerline of the sprinkler perpendicular to the mounting surface.

**Step 2.** Remove the Protective Cap.

**Step 3.** With pipe thread sealant applied to the pipe threads, and using the W-Type 18 Wrench shown in Figure 2, install and tighten the Sprinkler/Support Cup Assembly into the fitting. The W-Type 18 Wrench will accept a 1/2 inch ratchet drive.

**Step 4.** Replace the Protective Cap by pushing it upwards until it bottoms out against the Support Cup. The Protective Cap helps prevent damage to the Deflector and Guide Pins during ceiling installation and/or during application of the finish coating of the ceiling. It may also be used to locate the center of the clearance hole by gently pushing the ceiling material against the center point of the Cap.

### NOTICE

*As long as the protective Cap remains in place, the system is considered to be "Out Of Service".*

**Step 5.** After the ceiling has been completed with the 2-1/2 inch (63 mm) diameter clearance hole and in preparation for installing the Cover Plate Assembly, remove and discard the Protective Cap, and verify that the Deflector moves up and down freely.

If the Sprinkler has been damaged and the Deflector does not move up and down freely, replace the entire Sprinkler assembly. Do not attempt to modify or repair a damaged sprinkler.

**Step 6.** Screw on the Cover Plate Assembly until its flange comes in contact with the ceiling.

Do not continue to screw on the Cover Plate Assembly such that it lifts a ceiling panel out of its normal position.

If the Cover Plate Assembly cannot be engaged with the Mounting Cup or the Cover Plate Assembly cannot be engaged sufficiently to contact the ceiling, the Sprinkler Fitting must be repositioned.

## Care and Maintenance

The Tyco® Rapid Response™ Series LFII (TY2596) must be maintained and serviced in accordance with the following instructions:

### NOTICE

*Absence of a Cover Plate may delay the sprinkler operation in a fire situation.*

*When properly installed, there is a nominal 1/8 inch (3,2 mm) air gap between the lip of the Cover Plate and the ceiling, as shown in Figure 3. This air gap is necessary for proper operation of the sprinkler by allowing heat flow from a fire to pass below and above the Cover Plate to help assure appropriate release of the Cover Plate in a fire situation. If the ceiling is to be repainted after the installation of the Sprinkler, care must be exercised to ensure that the new paint does NOT seal off any of the air gap.*

*Factory painted Cover Plates MUST NOT be repainted. They should be replaced, if necessary, by factory painted units. Non-factory applied paint may adversely delay or prevent sprinkler operation in the event of a fire.*

*Do not pull the Cover Plate relative to the Enclosure. Separation may result.*

*Before closing a fire protection system main control valve for maintenance work on the fire protection system which it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.*

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified or over heated sprinklers must be replaced.

Care must be exercised to avoid damage -before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

### NOTICE

*The owner must assure that the sprinklers are not used for hanging of any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.*

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.



## Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

## Ordering Procedure

When placing an order, indicate the full product name. Contact your local distributor for availability.

### Sprinkler Assembly:

Series LFII (TY2596), K=4.2, Residential Concealed Pendent Sprinkler without Cover Plate Assembly, P/N 51-122-1-160.

### Cover Plate Assembly:

Cover Plate Assembly having a (specify) finish for the Series LFII (TY2596), K=4.2, Residential Concealed Pendent Sprinkler, P/N (specify).

Chrome.....	P/N 56-122-9-135
Signal White (a) (RAL 9003).....	P/N 56-122-4-135
Pure White (b) (RAL 9010).....	P/N 56-122-3-135
Custom .....	P/N 56-122-X-135

- (a) Previously known as Bright White.
- (b) Eastern Hemisphere sales only.

### Sprinkler Wrench:

Specify: W-Type 18 Sprinkler Wrench, P/N 56-000-1-265.



## Residential Sprinklers, Quick Response, [Recessed] Pendant

- D** Wohnraum Sprinkler, Schnell Ansprechend, [Versenkt] Hängend
- F** Sprinkleurs Residentiels, Réponse Rapide, Pendant [Encastré]



TFP 400 / TFP 408 [K=100] / TFP402 [K=43]



0.150 kg



[P.L116]

Art. Nr. 560006387, W-Type 6  
568504001, W-Type 7



[P.L109]

Style 20 / style 30 [K=100]



**K=70 [4.9] • 1/2" NPT • SINTY2234 • H=572 mm [2-1/4"]**

Art. Nr.	T °C [°F]	F	UL
512011155	68 [155]	1	✓
512011175	79 [175]	1	✓
512013155	68 [155]	3	✓
512013175	79 [175]	3	✓
512019155	68 [155]	9	✓
512019175	79 [175]	9	✓

**K=100 [6.9] • 3/4" NPT • SINTY4234 • H=572 mm [2-1/4"]**

Art. Nr.	T °C [°F]	F	UL
510691155	68 [155]	1	✓
510691175	79 [175]	1	✓
510693155	68 [155]	3	✓
510693175	79 [175]	3	✓
510699155	68 [155]	9	✓
510699175	79 [175]	9	✓

**K=43 [3.0] • 1/2" NPT • SINTY1234 • H=55.6 mm [2-3/16"]**

Art. Nr.	T °C [°F]	F	UL
510101155	68 [155]	1	✓
510101175	79 [175]	1	✓
510104155	68 [155]	4	✓
510104175	79 [175]	4	✓
510109155	68 [155]	9	✓
510109175	79 [175]	9	✓



## tyco Fire Suppression & Building Products

Technical Services 800-381-9312 | +1-401-781-8220  
www.tyco-fire.com



### Series LFII Residential Sprinklers 4.9 K-Factor Pendent and Recessed Pendent Wet Pipe and Dry Pipe Systems

#### General Description

The TYCO RAPID RESPONSE Series LFII Residential Pendent and Recessed Pendent Sprinklers (TY2234) are decorative, fast response, frangible bulb sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels. When aesthetics and optimized flow characteristics are the major consideration, the Series LFII Residential Sprinklers should be the first choice.

The Series LFII Residential Sprinklers are intended for use in the following scenarios:

- wet and dry pipe residential sprinkler systems for one- and two-family dwellings and mobile homes per NFPA 13D
- wet and dry pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R
- wet and dry pipe sprinkler systems for the residential portions of any occupancy per NFPA 13

Historically residential sprinklers, based on their Listing, have been limited to wet pipe sprinkler systems to assure speed of water delivery for a given prescribed design area (number of design sprinklers).

#### IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

The Listing for the Series LFII Residential Pendent and Recessed Pendent Sprinklers now offers the laboratory approved option of designing dry pipe residential sprinkler systems.

Through extensive testing, it has been determined that the number of design sprinklers (hydraulic design area) for the Series LFII Residential Pendent and Recessed Pendent Sprinklers (TY2234) need not be increased over the number of design sprinklers (hydraulic design area) as specified for wet pipe sprinkler systems, as is accustomed for density/area sprinkler systems designed per NFPA 13.

Consequently, the Series LFII Residential Sprinklers offer the features of non-water filled pipe in addition to not having to increase the number of design sprinklers (hydraulic design area) for systems designed to NFPA 13, 13D, or 13R. Non-water filled pipe will permit options for areas sensitive to freezing.

These Sprinklers have a 4.9 (70,6) K-Factor that provides the required residential flow rates at reduced pressures, enabling smaller pipe sizes and water supply requirements.

The recessed version of the Series LFII Residential Sprinklers is intended for use in areas with finished ceilings. It employs a two-piece Style 20 Recessed Escutcheon.

The Recessed Escutcheon provides 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush ceiling position. The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the pipe nipples to the sprinklers must be cut.

The Series LFII Residential Pendent and Recessed Pendent Sprinklers have been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.



#### NOTICE

The Series LFII Residential Pendent and Recessed Pendent Sprinklers (TY2234) described herein must be installed and maintained in compliance with this document and the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

Owners are responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.





Maximum Coverage Area <sup>(a)</sup> Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	WET PIPE SYSTEM Minimum Flow <sup>(b)</sup> and Residual Pressure				
		For Horizontal Ceiling (Maximum 2-Inch Rise for 12-Inch Run)	For Sloped Ceiling (Greater than 2-Inch Rise up to Maximum 4-Inch Rise for 12-Inch Run)		For Sloped Ceiling (Greater than 4-Inch Rise up to Maximum 8-Inch Rise for 12-Inch Run)	
			155°F (68°C) or 175°F (79°C)	155°F (68°C)	175°F (79°C)	155°F (68°C)
12 x 12 (3,7 x 3,7)	12 (3,7)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
18 x 18 (5,5 x 5,5)	18 (5,5)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
20 x 20 (6,1 x 6,1)	20 (6,1)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)	21 GPM (79,5 LPM) 18.4 psi (1,27 bar)	22 GPM (83,3 LPM) 20.2 psi (1,39 bar)

(a) For coverage area dimensions less than or between those indicated, use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) The Minimum Flow requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-Factor. Refer to Hydraulic Design under the Design Criteria section.

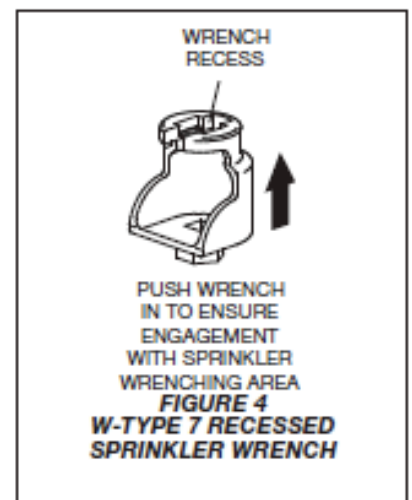
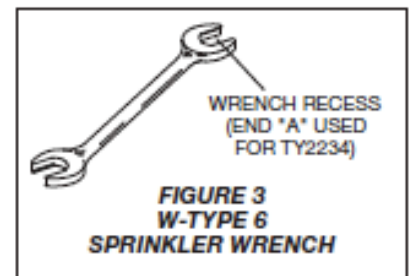
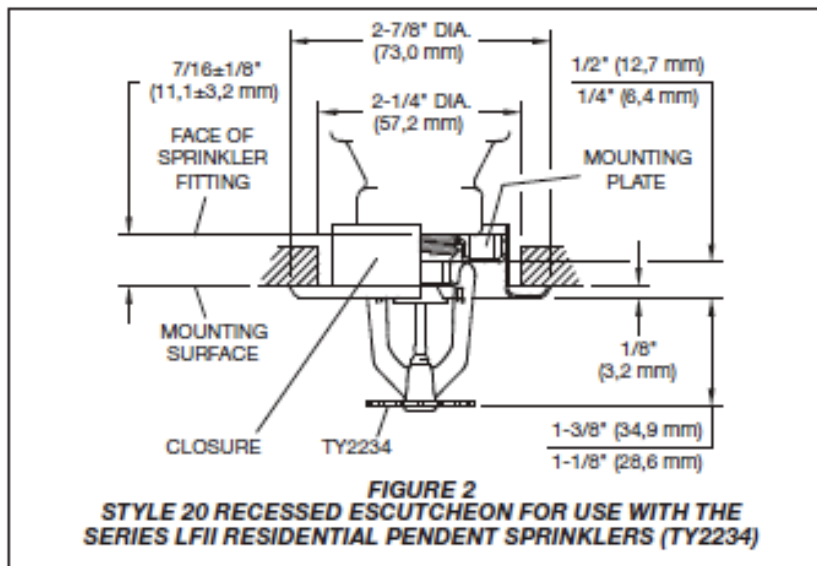
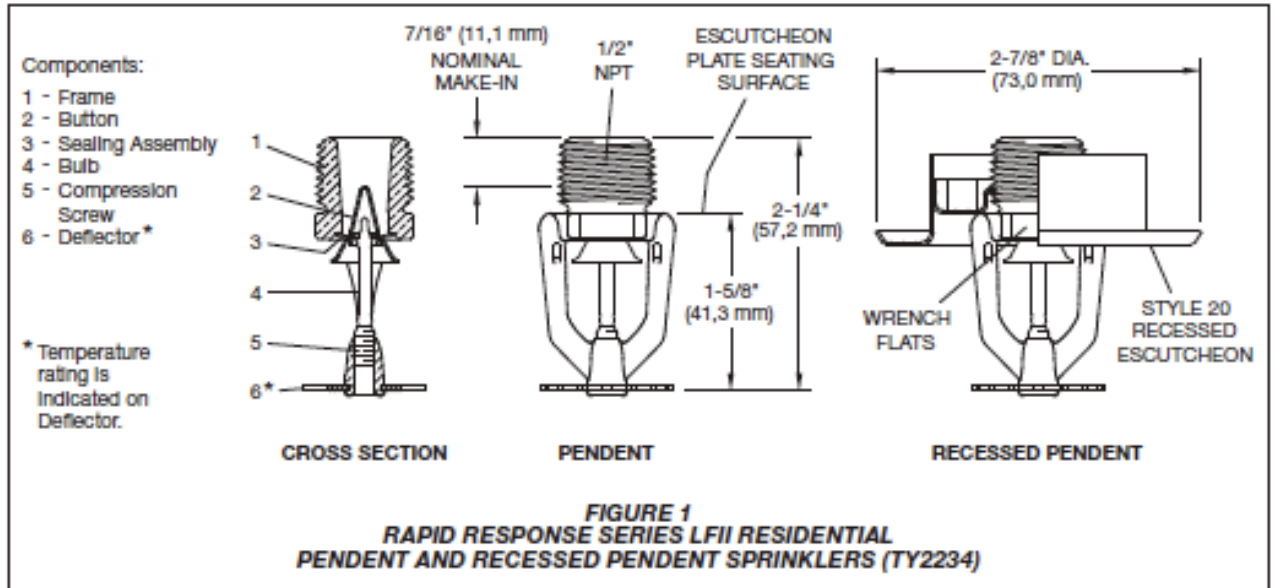
**TABLE A**  
**SERIES LFII RESIDENTIAL PENDENT AND RECESSED PENDENT SPRINKLERS (TY2234)**  
**NFPA 13D AND 13R HYDRAULIC DESIGN CRITERIA**  
**WET PIPE SYSTEMS**

Maximum Coverage Area <sup>(a)</sup> Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	DRY PIPE SYSTEM Minimum Flow <sup>(b)</sup> and Residual Pressure	
		For Horizontal Ceiling (Maximum 2-Inch Rise for 12-Inch Run)	
		155°F (68°C)	175°F (79°C)
12 x 12 (3,7 x 3,7)	12 (3,7)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	14 GPM (53,0 LPM) 8.2 psi (0,57 bar)	14 GPM (53,0 LPM) 8.2 psi (0,57 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	15 GPM (56,8 LPM) 9.4 psi (0,65 bar)	15 GPM (56,8 LPM) 9.4 psi (0,65 bar)
18 x 18 (5,5 x 5,5)	18 (5,5)	18 GPM (68,1 LPM) 13.5 psi (0,93 bar)	18 GPM (68,1 LPM) 13.5 psi (0,93 bar)
20 x 20 (6,1 x 6,1)	20 (6,1)	21 GPM (79,5 LPM) 18.4 psi (1,27 bar)	21 GPM (79,5 LPM) 18.4 psi (1,27 bar)

(a) For coverage area dimensions less than or between those indicated, use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) The Minimum Flow requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-Factor. Refer to Hydraulic Design under the Design Criteria section.

**TABLE B**  
**SERIES LFII RESIDENTIAL PENDENT AND RECESSED PENDENT SPRINKLERS (TY2234)**  
**NFPA 13D HYDRAULIC DESIGN CRITERIA**  
**DRY PIPE SYSTEMS**





TFP400  
Page 4 of 8

## Model/Sprinkler Identification Number (SIN)

TY2234

## Technical Data

### Approvals

- UL Listed for use with wet pipe and dry pipe systems
- C-UL Listed for use only with wet pipe systems
- NYC Approved under MEA 44-03-E

For details on these approvals, refer to the Design Criteria section.

**Maximum Working Pressure**  
175 psi (12,1 bar)

**Discharge Coefficient**  
 $K=4.9 \text{ GPM/psi}^{1/2}$  (70,6 LPM/bar<sup>1/2</sup>)

**Temperature Rating**  
155°F (68°C) or 175°F (79°C)

### Finishes

- White Polyester
- Chrome Plated
- Natural Brass

### Physical Characteristics

Frame .....	Brass
Button .....	Bronze
Sealing Assembly .....	Beryllium Nickel w/Teflon*
Bulb (3 mm) .....	Glass
Compression Screw .....	Bronze
Deflector .....	Bronze
Ejection Spring .....	Stainless Steel

## Operation

The glass Bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass Bulb, allowing the sprinkler to activate and flow water.

## Design Criteria

The RAPID RESPONSE Series LFI Residential Pendant and Recessed Pendant Sprinklers (TY2234) are UL and C-UL Listed for installation in accordance with the following criteria.

**Note:** When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the local authority having jurisdiction.

### System Types

Per the UL Listing, wet pipe and dry pipe systems may be utilized. Per the C-UL Listing, only wet pipe systems may be utilized.

- For dry systems corrosion-resistant or internally galvanized pipe shall be utilized with the sprinklers described in this data sheet.
- For dry systems not using CPVC, pendent sprinklers shall be installed on return bends, where the sprinklers, return bends, and branch line piping (that is, potential areas for trapped water) are in areas at or above 40°F (4°C).

Refer to technical data sheet TFP485 about the use of Residential Sprinklers in residential dry pipe systems.

### NOTICE

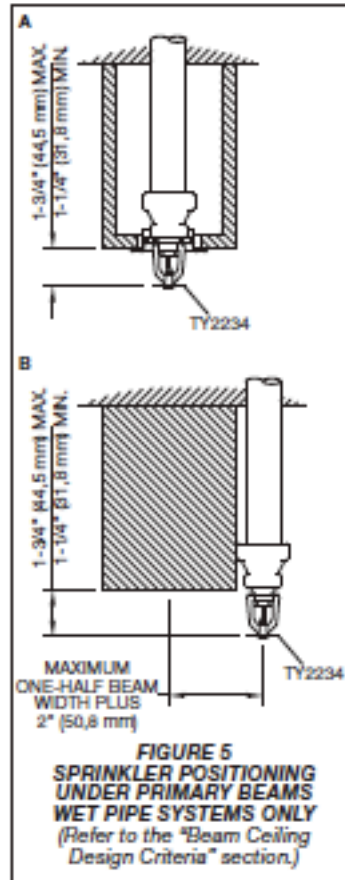
When corrosion-resistant or internally galvanized pipe and fittings with a potable water supply is utilized, return bends need not be installed. However, any portion of the piping that has the potential to trap water must be maintained at or above 40°F (4°C) unless provision to drain such areas is provided and maintained dry.

### Water Delivery

When using the Series LFI Residential Pendant and Recessed Pendant Sprinklers (TY2234) in dry pipe sprinkler systems, the requirements for "Dry System Water Delivery" per Section 8.3.4.3 of the 2010 edition of NFPA 13D apply. For a residential hazard, in no case shall the time of water delivery exceed 15 seconds for the most remote operating sprinkler.

### Hydraulic Design (NFPA 13D and 13R)

The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Tables A and B as a function of temperature rating and the maximum allowable coverage areas. The sprinkler flow rate is the minimum required discharge from each of the total number of "design sprinklers" as specified in NFPA 13D or NFPA 13R.



**FIGURE 5**  
**SPRINKLER POSITIONING UNDER PRIMARY BEAMS WET PIPE SYSTEMS ONLY**  
(Refer to the "Beam Ceiling Design Criteria" section.)

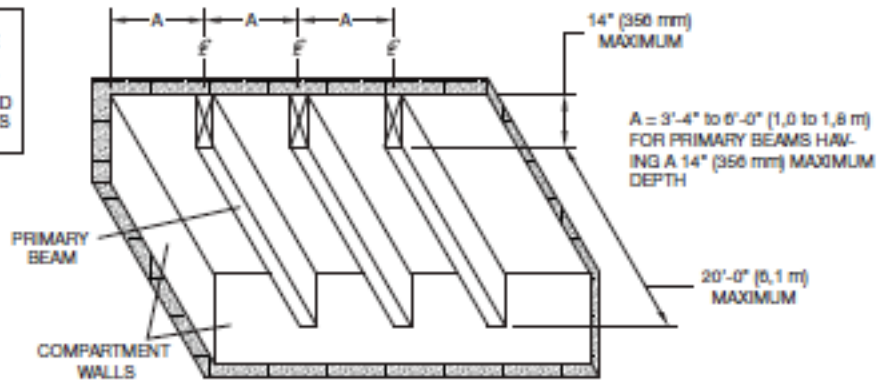
### NOTICE

The number of "design sprinklers" specified in NFPA 13D and 13R for wet pipe systems is to be applied when designing dry pipe systems. There is no need to increase the design area, as is the case for density/area systems, in accordance with U.S. Patent 7,712,543. Refer to technical data sheet TFP485.

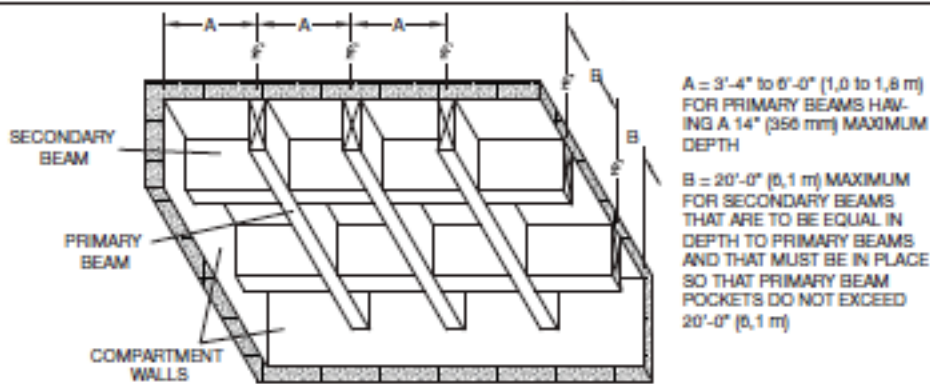
\*Registered trademark of Dupont



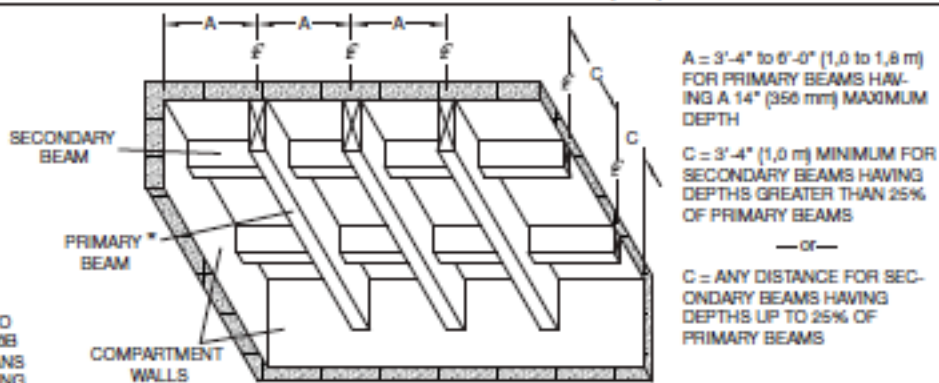
ALL FIGURES:  
DISTANCES ARE  
MEASURED TO  
COMPARTMENT  
WALL FACES AND  
TO CENTERLINES  
OF BEAMS



**FIGURE 6A**  
PRIMARY BEAM SPANS UP TO 20'-0" (6.1 m)



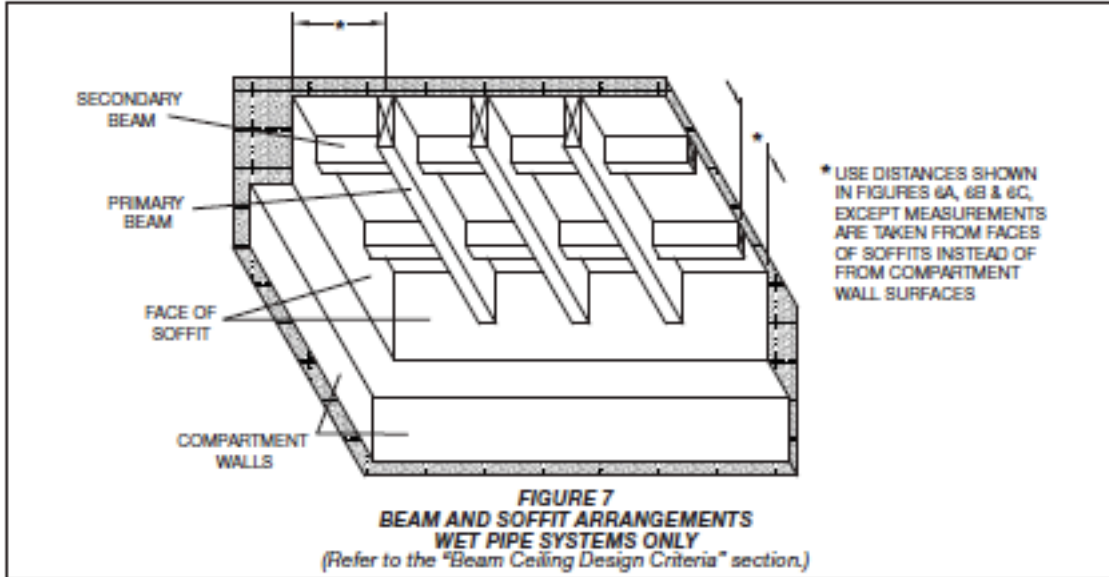
**FIGURE 6B**  
PRIMARY BEAM SPANS GREATER THAN 20'-0" (6.1 m)



**FIGURE 6C**  
COMBINATIONS OF PRIMARY AND SECONDARY BEAMS

\* REFER TO  
FIGURE 6B  
FOR SPANS  
EXCEEDING  
20'-0" (6.1 m)

**FIGURE 6**  
**BEAM ARRANGEMENTS**  
**WET PIPE SYSTEMS ONLY**  
(Refer to the "Beam Ceiling Design Criteria" section.)



**Hydraulic Design (NFPA 13)**  
 For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Tables A or B for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 GPM/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for actual coverage areas protected by the four sprinklers.

**NOTICE**  
 The number of "design sprinklers" specified in NFPA 13 for wet pipe systems is to be applied when designing dry pipe systems. There is no need to increase the design area, as is the case for density/area systems, in accordance with U.S. Patent 7,712,543. Refer to technical data sheet TFP485.

**Obstruction to Water Distribution**  
 Sprinklers are to be located in accordance with obstruction rules defined by NFPA 13 for residential sprinklers.

**Operational Sensitivity**  
 For **Horizontal Ceilings** (maximum 2-inch rise for 12-inch run), the sprinklers are to be installed with a deflector-to-ceiling distance of 1-3/8 to 4 inches or in the recessed position using only the Style 20 Recessed Escutcheon as shown in Figure 2.

**NOTICE**  
 The "Beam Ceiling Design Criteria" section permits deflector-to-ceiling distances up to 15-3/4 inches.

To help avoid obstructions to water distribution, a maximum 12-inch deflector-to-ceiling distance is permitted for NFPA 13D and NFPA 13R applications where the sprinklers are located in closets.

For **Sloped Ceilings** (greater than 2-inch rise up to 8-inch rise for 12-inch run), the sprinklers are to be installed with a deflector-to-ceiling distance of 1-3/8 to 4 inches or in the recessed position using only the Style 20 Recessed Escutcheon as shown in Figure 2.

**Sprinkler Spacing**  
 The minimum spacing between sprinklers is 8 feet (2.4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area (Table A) being hydraulically calculated; maximum 12 feet for a 12 ft. x 12 ft. coverage area, or 20 feet for a 20 ft. x 20 ft. coverage area.

## Beam Ceiling Design Criteria

The RAPID RESPONSE Series LFI Residential Pendant and Recessed Pendant Sprinklers (TY2234) are UL and C-UL Listed for installation in wet pipe systems only for residential occupancies with horizontal ceilings (that is,

slopes up to a 2-inch rise over a 12-inch run) with beams when installed in accordance with the following criteria.

**General Information**  
 The basic concept of this protection scheme is to locate the sprinklers on the underside of the beams, refer Figure 5, (not in the beam pockets); to identify the main beams that principally run in one direction as "primary beams"; and, to identify the beams that run principally perpendicular to the main beams, as may be present (or in some cases may be necessary for proper sprinkler protection), as "secondary beams".

**Primary and Secondary Beam Types**  
 Solid surface, solid or hollow core, combustible or non-combustible.

**Primary and Secondary Beam Positioning**  
 Directly attached to the underside of a combustible or non-combustible smooth ceiling at any elevation.

**Primary Beam Cross-Section**  
 Maximum depth of 14 inches and the maximum width is unlimited. The cross-sectional shape of the primary beam may be rectangular to circular.

**Secondary Beam Cross-Section**  
 Maximum depth to be no greater than the primary beam and the maximum width is unlimited. The cross-sectional shape of the secondary beam may be rectangular to circular.



#### Primary Beam Spacing

The primary beams (Figure 6A) are to be 3 ft. - 4 in. to 6 ft. from the compartment wall to center of the nearest beam and from center to center between beams.

#### Secondary Beam Spacing

The secondary beams principally run perpendicular to the primary beams. Secondary beams of a depth equal to the primary beam must be placed so that the beam pockets created by the primary beams do not exceed 20 feet in length (Figure 6B).

#### NOTICE

When the beam pockets created by the primary beams exceed 20 feet in length, the installation will require the use of secondary beams as described above. Otherwise, secondary beams need not be present.

Secondary beams of a cross-sectional depth greater than one-quarter the depth of the primary beams are to be a minimum of 3 ft. - 4 inches from the compartment wall to center of the nearest beam and from center to center between beams (Figure 6C).

Secondary beams of a cross-sectional depth no greater than one-quarter the depth of the primary beams may be placed at any compartment wall to center of the nearest beam distance and from any center to center distance between beams (Figure 6C).

#### Lintels

Lintels over doorways exiting the compartment must be present. The minimum height for the lintels is 8 inches or no less than the depth of the Primary Beams, whichever is greater.

#### Sprinkler Types

Series LFI Pendent and Recessed Pendent Residential Sprinklers (TY2234), 155°F (68°C) and 175°F (79°C).

#### Sprinkler Coverage Area and Hydraulic Design

The sprinkler coverage areas and hydraulic design criteria as presented in the Table A for "Horizontal Ceilings" are to be applied.

#### Sprinkler Position

The deflector to bottom of primary beams for the Series LFI Pendent and Recessed Pendent Sprinklers (TY2234) is to be 1-1/4 to 1-3/4 inches (Figure 5A). The vertical center-line of the Series LFI Pendent Sprinklers is to be no greater than half the primary beam cross-sectional width plus 2 inches from the centerline of the primary beam (Figure 5B).

#### NOTICE

Core drilling of beams to allow the installation of sprinkler drops requires consulting with a structural engineer.

Where core drilling is not permitted, the previously stated sprinkler position criteria for the Series LFI Residential Pendent and Recessed Pendent Sprinklers (TY2234) allows placement of the sprinkler drop adjacent to the primary beam.

#### Beam and Soffit Arrangements

A soffit is permitted to be placed around the perimeter of a compartment with the beam arrangement within the soffit area (Figure 7).

The cross-section of the soffit may be any size as long as it does not create an obstruction to water distribution per the obstruction rules of NFPA 13 for residential sprinklers.

When soffits are present, the previously provided 3 ft.-4 inches to 6 ft. "compartment wall to adjacent beam" distance for the primary and secondary beams is to be measured from the face of the soffit as opposed to the compartment wall.

**Note:** Although the distance to the beams is measured from the face of the soffit, the sprinkler coverage area is to be measured from the compartment wall.

## Installation

The RAPID RESPONSE Series LFI Residential Pendent and Recessed Pendent Sprinklers (TY2234) must be installed in accordance with the following instructions.

#### NOTICE

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm).

Obtain a leak-tight 1/2 inch NPT sprinkler joint by applying a minimum-to-maximum torque of 7 to 14 ft. lbs. (9,5 to 19,0 Nm). Higher levels of torque can distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under- or over-tightening the Sprinkler. Re-adjust the position of the sprinkler fitting to suit.

#### Series LFI Residential Pendent Sprinklers

The Series LFI Residential Pendent Sprinklers must be installed in accordance with the following instructions.

1. Install pendent sprinklers in the pendent position with the deflector parallel to the ceiling.
2. With pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.
3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Figure 3). With reference to Figure 1, apply the W-Type 6 Sprinkler Wrench to the wrench flats.

#### Series LFI Residential Recessed Pendent Sprinklers

The Series LFI Residential Recessed Pendent Sprinklers must be installed in accordance with the following instructions.

1. Install recessed pendent sprinklers in the pendent position with the deflector parallel to the ceiling.
2. After installing the Style 20 Mounting Plate over the sprinkler threads and with pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.
3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Figure 4). With reference to Figure 1, apply the W-Type 7 Recessed Sprinkler Wrench to the sprinkler wrench flats.
4. After the ceiling has been installed or the finish coat has been applied, slide on the Style 20 Closure over the Series LFI Residential Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling.

## Care and Maintenance

The RAPID RESPONSE Series LFI Residential Pendent and Recessed Pendent Sprinklers (TY2234) must be maintained and serviced in accordance with the following instructions.

#### NOTICE

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection systems from the proper authorities and notify all personnel who may be affected by this action.



Absence of the outer piece of an escutcheon, which is used to cover a clearance hole, can delay sprinkler operation in a fire situation.

Owners must assure that the sprinklers are not used for hanging of any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Exercise care to avoid damage to sprinklers before, during, and after installation. Never paint, plate, coat, or otherwise alter automatic sprinklers after they leave the factory.

Replace sprinklers that:

- were modified or over-heated.
- were damaged by dropping, striking, wrench twisting, wrench slippage, or the like.
- are leaking or exhibiting visible signs of corrosion.
- were exposed to corrosive products of combustion but have not operated, if you cannot easily remove combustion by-products with a cloth.
- have a cracked bulb or have lost liquid from the bulb. Refer to the Installation section in this data sheet.

Initial and frequent visual inspections of random samples are recommended for corrosion-resistant sprinklers to verify the integrity of the corrosion-resistant material of construction. Thereafter, annual inspections per NFPA 25 should suffice.

Inspections of corrosion-resistant sprinklers are recommended at close range, instead of from the floor level per NFPA. Inspection at close range can better determine the exact sprinkler condition and the long-term integrity of the corrosion-resistant material, which can be affected by the corrosive conditions present.

Responsibility lies with the owner for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (that is, NFPA 25), in addition to the standards of any authorities having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

## Limited Warranty

Products manufactured by Tyco Fire Suppression & Building Products (TFSBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFSBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFSBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFSBP to be defective shall be either repaired or replaced, at TFSBP's sole option. TFSBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFSBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFSBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFSBP was informed about the possibility of such damages, and in no event shall TFSBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

## Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

**Sprinkler Assembly**  
Specify Series LFI Residential Pendent and Recessed Pendent Sprinkler (TY2234), K=4.9, with (temperature rating), (finish), and P/N (below).

155°F (65°C) or Chrome Plated .....	P/N 51-201-9-155
155°F (65°C) White Polyester .....	P/N 51-201-4-155
155°F (65°C) White [RAL9010] .....	P/N 51-201-3-155
155°F (65°C) Natural Brass .....	P/N 51-201-1-155
175°F (79°C) or Chrome Plated .....	P/N 51-201-9-175
175°F (79°C) White Polyester .....	P/N 51-201-4-175
175°F (79°C) White [RAL9010] .....	P/N 51-201-3-175
175°F (79°C) Natural Brass .....	P/N 51-201-1-175

\*Eastern Hemisphere sales only.

**Recessed Escutcheon**  
Specify Style 20 Recessed Escutcheon with finish and P/N. Refer to Technical Data Sheet TFP770.

**Sprinkler Wrench**  
Specify W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.



## Riser Manifold

- ① Verteiler Steigleitung
- ② Manifold Riser



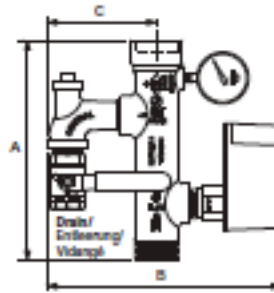
RISER MANIFOLD



TFP962

Body: Steel  
Körper: Stahl  
Corps: Acier

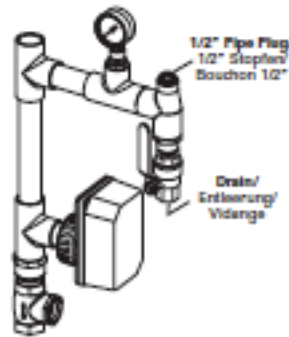
Coating: Red Paint  
Beschichtung: Rot lackiert  
Revêtement: Peinture rouge



Art. Nr.	DN	Inlet eingang entrée	Outlet ausgang sortie	Drain entleerung vidange	A mm	B mm	C mm	⚠	⚠
4055	40 1.1/2"	Male Full Thread Male	Female Full Thread Female	1"	362	321	156	5.1	✓ ✓
4056	40 1.1/2"	Male Full Thread Male	Male Full Thread Male	1"	362	321	156	5.1	✓ ✓
4060F	50 2"	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN50-113 mm	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN50-113 mm	1"	426	332	126	6.1	✓ ✓
4061	65 2.1/2"	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN65-113 mm	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN65-113 mm	1.1/4"	427	348	146	7.6	✓ ✓
4062	80 3"	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN80-113 mm	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN80-113 mm	1.1/4"	427	362	152	8.5	✓ ✓
4065F	100 4"	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN100-143 mm	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN100-143 mm	2"	521	422	192	14.8	✓ ✓
4066	150 6"	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN150-183 mm	Ground 1/2" (20) (Rale 1/2mm) (Raleut) DN150-183 mm	2"	521	470	216	18.9	✓ ✓



CPVC RESIDENTIAL RISER



Art. Nr.	DN	Drain entleerung vidange	⚠	UL
RR025CPVC	25 1" BSP	3/4"	2.0	✓
RR032CPVC	32 1.1/4" BSP	1"	2.1	✓
RR040CPVC	40 1.1/2" BSP	1"	2.4	✓
RR050CPVC	50 2" BSP	1"	2.5	✓





Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

## Model 513 (13) Riser Manifold 1-1/2 thru 6 Inch (DN40 thru DN150) For NFPA 13 Sprinkler Systems

### General Description

The Figure 513 (13) Riser Manifolds described in this technical data sheet provide the necessary waterflow alarm, pressure gauge, alarm test orifice, drain, and sight glass equipment in a single assembly for use in NFPA 13 sprinkler systems as follows:

#### NFPA 13\*

- 1-1/2 Inch (DN40)  
Male Thread x Female Thread
- 1-1/2 thru 6 Inch (DN40 thru DN150)  
Groove x Groove

\*Although the Riser Manifold described in this data sheet is intended for NFPA 13 sprinkler systems, it may be used for NFPA 13D or 13R residential sprinkler systems, where a test orifice of 5.6K (80K) is acceptable.

The variety of sizes and grooved end connections allow cost effective and easy transition to check valves, control valves, and system piping. The Riser Manifolds may be installed in either the horizontal (flow switch on top) or vertical (flow going up) for both single sprinkler risers and floor control in high rises.

#### WARNING

The Riser Manifolds described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

### Technical Data

#### Approvals

The Figure 513 (13) Riser Manifolds with a cover tamper switch for the waterflow alarm switch are UL Listed, ULC Listed, and FM Approved.

The Figure 513 (13) Riser Manifolds without a cover tamper switch for the waterflow alarm switch are UL Listed and FM Approved.

**Maximum Working Pressure**  
175 psi (12,1 bar)

**Test Orifice**  
5.6K (80K)

#### Assembly

The manifold body of the Figure 513 is ductile iron, whereas the manifold body of the Figure 13 is cast iron. The two assemblies are completely interchangeable in function, application, and end-to-end laying length.

#### Finish

Red painted.

### Installation

The Riser Manifolds may be installed in either the horizontal (flow switch on top) or vertical (flow going up). The inlet of the Riser Manifold may be directly connected to a shut-off control valve.

#### NOTES

Where applicable pipe thread sealant is to be applied sparingly. Use of a non-hardening pipe thread sealant is recommended.

Never remove any piping component nor correct or modify any piping deficiencies without first depressurizing and draining the system.

**Step 1.** Install the manifold body with the flow arrow pointing in the downstream position using threaded con-



nections and/or listed mechanical grooved connections, as applicable

**Step 2.** Connect the drain line, and then close the drain valve.

**Step 3.** Refer to Figure 3 for wiring guidance. All wiring must be performed in accordance with the Authority Having Jurisdiction and/or the National Electrical Code.

**Step 4.** Refer to Figure 4 for optional relief valve.

**Step 5.** Place the system in service by filling the system with water. When filling the system, partially open the control valve to slowly fill the system. Filling the system slowly will help avoid damaging the waterflow alarm switch.

After the system is fully pressurized, completely open the control valve.

**Step 6.** Secure all supply valves open.



NO.	DESCRIPTION	QTY.	P/N
1	1-1/2" Manifold Body, Male x Female NPT . . . . . 1	N/A	
	Groove x Groove . . . . . 1	N/A	
2	Waterflow Alarm Switch: VSR-SF with Paddle, ULTM . . . . . 1	971-096-00	
	VSR-SF with Paddle and Cover Tamper Switch, ULCFM . . . . . 1	975-519-02	
3	300 psi/2000 kPa Water Pressure Gauge . . . 1	2341	

- NOTES:
1. Approximate weight, 11.2 lbs. (5.1 kg).
  2. ULC Listed Manifolds are equipped with Cover Tamper Switches installed internal to the Waterflow Alarm Switches.
  3. CH: Common Hardware

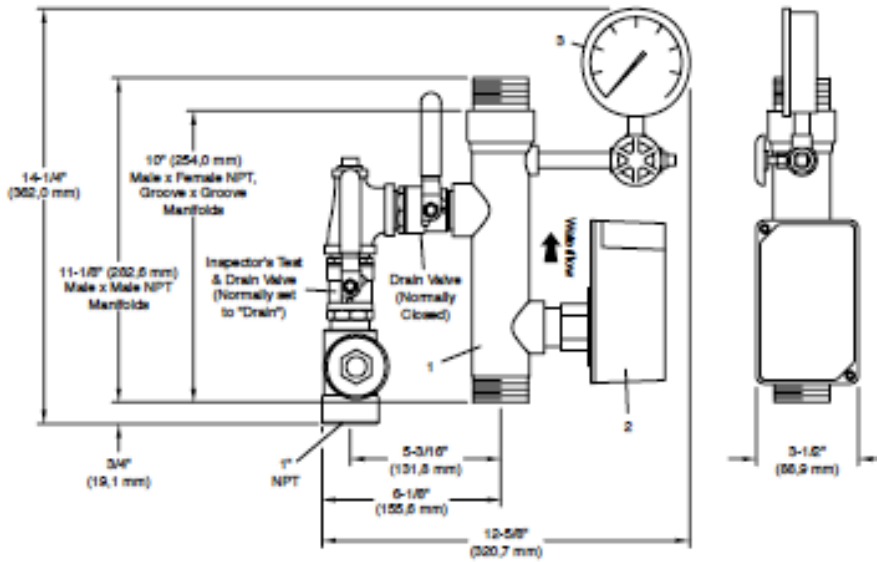
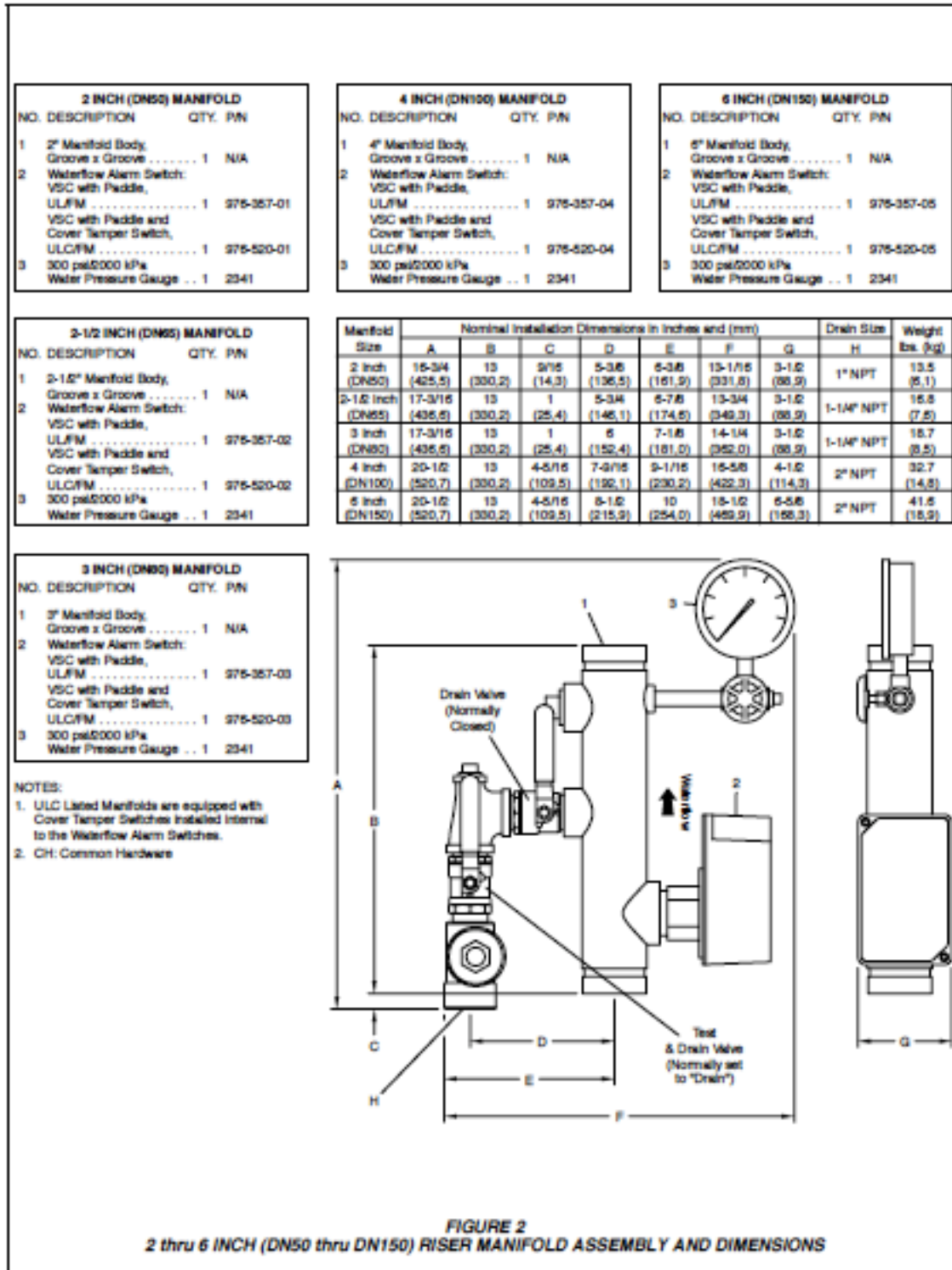
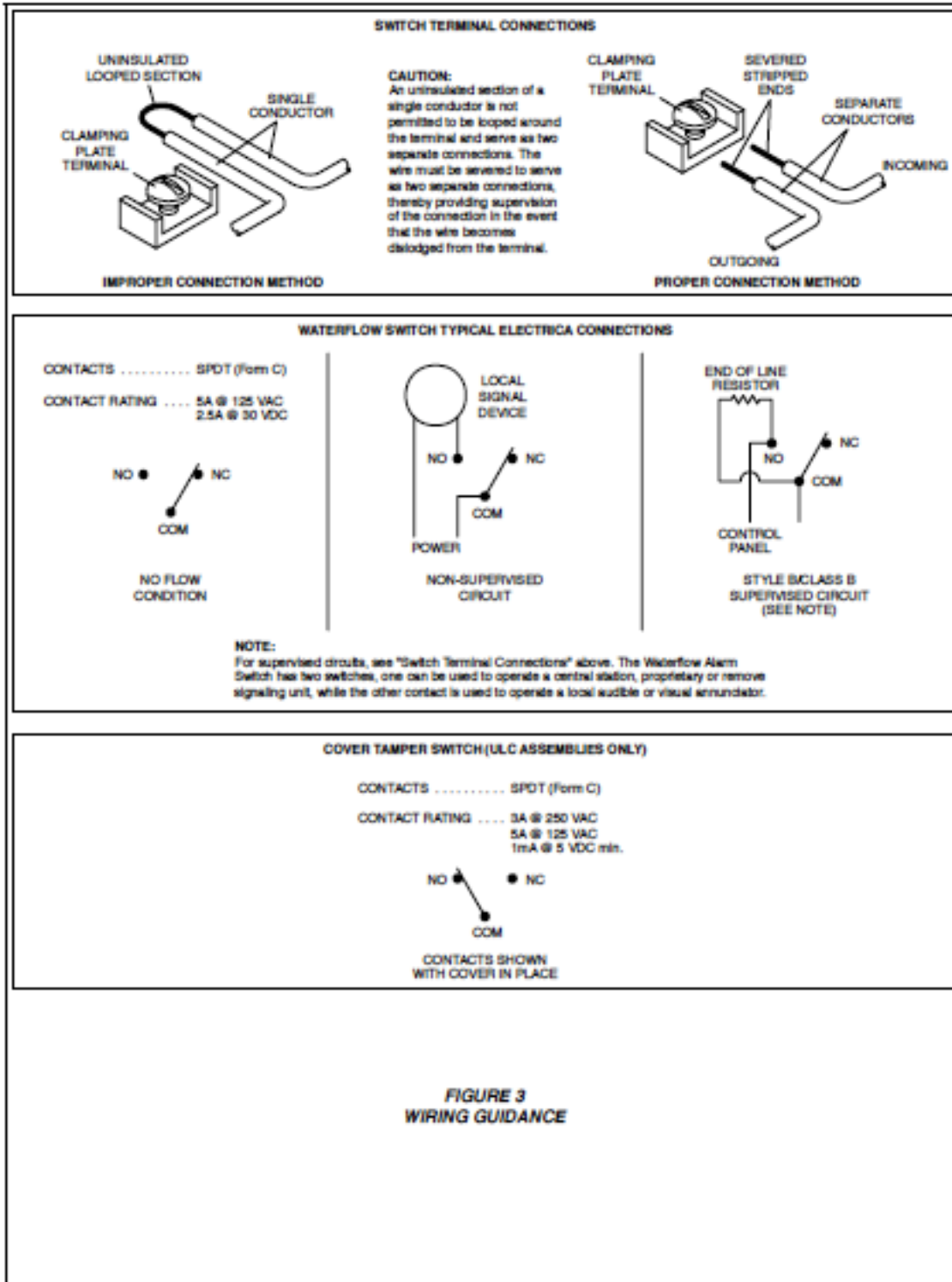
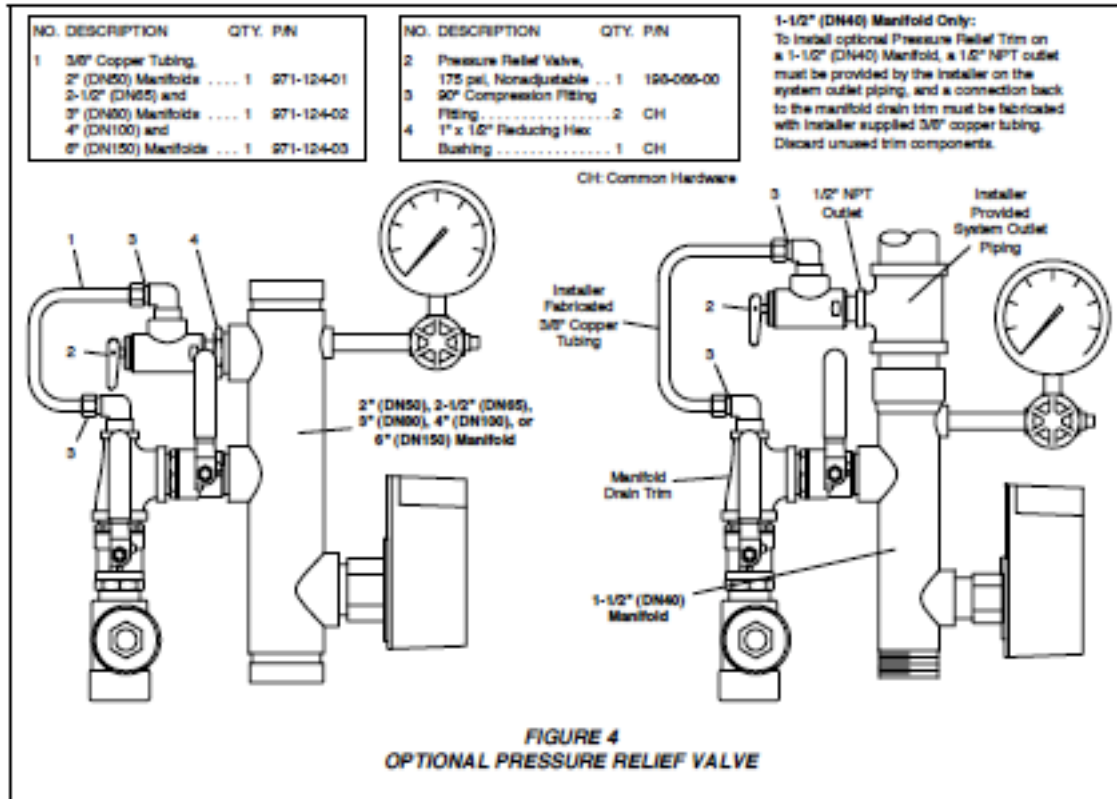


FIGURE 1  
 1-1/2 INCH (DN40) RISER MANIFOLD ASSEMBLY AND DIMENSIONS







## Care and Maintenance

The following inspection procedure must be performed as indicated, in addition to any specific requirements of the NFPA, and any impairment must be immediately corrected.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified inspection Service in accordance with local requirements and/or national codes.

### NOTES

No attempt is to be made to repair any

*Riser Manifold component in the field. Only the pressure gauge, waterflow alarm switch, or relief valve can be replaced. If any other problems are encountered the entire riser manifold must be replaced.*

*The alarm/flow test procedure will result in operation of the associated alarms. Consequently, notification must be given to the owner and the fire department, central station, or other signal station to which the alarms are connected, and notification must be given to the building occupants.*

*Before closing a fire protection system control valve for inspection or maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must first be obtained from the proper authorities and all personnel who may be affected by this action must be notified.*

*After placing a fire protection system in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.*

### Alarm/Flow Test Procedure

- Step 1.** Place the test & drain Valve in the "test" position.
- Step 2.** Fully open the drain valve. Make certain that drainage water will not cause any damage or injury.
- Step 3.** Verify operation of associated alarms.
- Step 4.** Close the drain valve.
- Step 5.** Place the test & drain Valve in the "drain" position.
- Step 6.** Verify that the residual (flowing) pressure indicated by the pressure gauge is no less than originally recorded for the system when it was first installed.
- Step 7.** Close the drain valve.
- Step 8.** Verify that the static (not flowing) pressure indicated by the pressure gauge is no less than originally recorded for the system when it was first installed.



## Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

## Ordering Information

### Riser Manifold:

Specify: Size (specify), Figure 513, (specify connection type Inlet x outlet) Riser Manifold (specify - without or with) a cover tamper switch for the waterflow alarm switch, P/N (specify).

### NOTES

Orders for Figure 513 may be filled with a Figure 13. The two assemblies are completely interchangeable in function, application, and end-to-end laying length.

If a ULC Listing is required, the Riser Manifold must be ordered with a cover tamper switch for the waterflow alarm switch.

### UL/LC/FM Assemblies With Cover Tamper Switch

1-1/2 Inch (DN40) MT x FT .....	P/N 4085
1-1/2 Inch (DN40) MT x MT .....	P/N 4087
2 Inch (DN50) G x G .....	P/N 4090
2-1/2 Inch (DN65) G x G .....	P/N 4091
3 Inch (DN80) G x G .....	P/N 4092
4 Inch (DN100) G x G .....	P/N 4095
6 Inch (DN150) G x G .....	P/N 4095

### UL/FM Assemblies Without Cover Tamper Switch

1-1/2 Inch (DN40) MT x FT .....	P/N 4055
1-1/2 Inch (DN40) MT x MT .....	P/N 4055
2 Inch (DN50) G x G .....	P/N 4060
2-1/2 Inch (DN65) G x G .....	P/N 4061
3 Inch (DN80) G x G .....	P/N 4062
4 Inch (DN100) G x G .....	P/N 4065
6 Inch (DN150) G x G .....	P/N 4065

### Optional Pressure Relief Valve:

Specify: Operational Pressure Relief Valve and Trim for use with (specify size) Figure 513 or 13 Series Riser Manifold, P/N (specify).

1-1/2" or 2" .....	P/N 4063
2-1/2" or 3" .....	P/N 4072
4" or 6" .....	P/N 4073

### Replacement Parts:

Specify: (description) for use with Figure 513 or 13 Riser Manifold, P/N (Ref. Figure 1 or 2, as applicable).



## 21 40 00 Fire-Suppression Water Storage



Branch of Sioen Industries



Fabrieksstraat 23, B-8850 Ardoorie - Tel +32(0)51 74 09 00 - Fax +32(0)51 74 09 64  
sioline@sioen.be - <http://www.sioen.com>

### Technical Data Sheet

## B6000

Fabric / Weefsel / Tissu / Gewebe / Tejido	100 % PES / 1100 dtex	
Total weight / Gewicht totaal / Poids total / Totalgewicht / Peso total	900 g/m <sup>2</sup>	DIN EN ISO 2286/2 1998
Lacquering / Vernis / Lackierung / Lacado	1/1	
Embossing / Kalander / Calandre / Lackierung / Embossing	Glossy	
Breaking strength Warp Treksterkte Ketting Résistance rupture Chaine Höchstzugkraft Kette Resistencia a la ruptura Urdimbre	4000 N/5cm	EN ISO 1421/1 1998
Breaking strength Weft Treksterkte Inslag Résistance rupture Trame Höchstzugkraft Schuss Resistencia a la ruptura Trama	4000 N/5cm	EN ISO 1421/1 1998
Tear strength Warp Scheurweerstand Ketting Résistance à la déchirure Chaine Weiterreisskraft Kette Resistencia a la rasgadura Urdimbre	600 N	DIN 53363 2003
Tear strength Weft Scheurweerstand Inslag Résistance à la déchirure Trame Weiterreisskraft Schuss Resistencia a la rasgadura Trama	500 N	DIN 53363 2003
Adhesion / Hechting / Adhérence / Haftung / Adherencia	100 N/5cm	EN ISO 2411 2000
Temperature resistance / Temperatuurbestendigheid / Tenue à la température / Temperatuurbestendigheid / Resistencia à la temperatura	-30/+70 °C	DIN EN 1876/2 1998
Light fastness (Except white and (half-)transparent) Lichtechtheid (Uitgezonderd wit en (half-)transparent) Tenue à la lumière (Excepté en blanc et (semi-)transparent) Lichtechtheit (Ausnahme weiss und (semi-)transparent) Resistencia a la luz (Excepto blanco / (semi-)transparente)	7-8	ISO 105 B02 1988
Fire behavior / Brandgedrag / Reaction au feu / Brennverhalten / Fire behavior	< 100 mm/min	ISO 3795 1989
Application Truck/SideCurtain		

"This product may for certain colours contain substances which fall under the Annex XIV of the Reach Regulation 1907/2006/CE. In order to know which colours fall under this annex, you can take contact with the technical department of Sioen Industries. Upon request those substances can be eliminated from the product."

All our technical characteristics are indicative  
Rev. 04/11



## 1 PIPES

### 1 1.1.2 Composition of the Henco multilayer pipe: PE-Xc/AL/PE-Xc

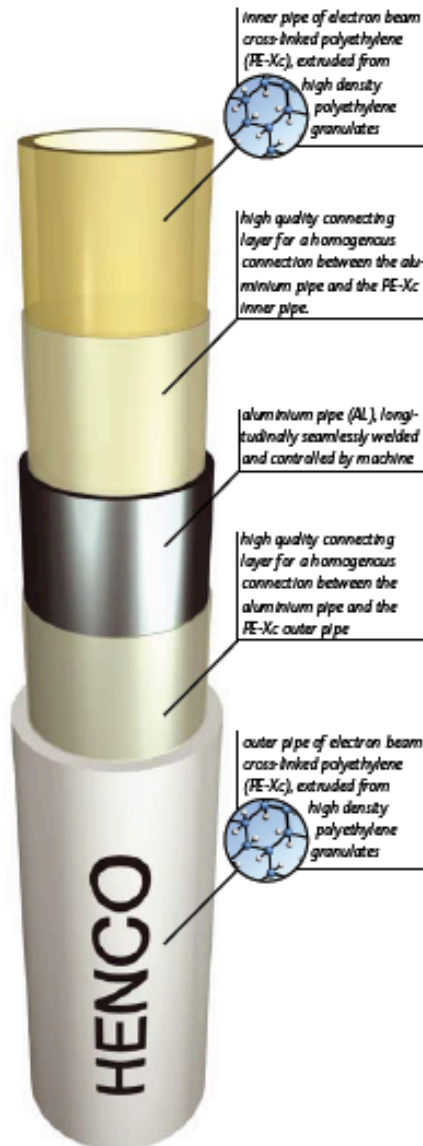
The Henco multilayer pipe consists of lengthwise butt welded aluminium pipe provided with an inner and outer layer of electron beam cross-linked polyethylene.

The different layers are joined to each by a high quality connecting layer. The result is the Henco multilayer pipe: It combines all the advantages of synthetic materials and metal pipes.

The inner and outer pipe are made of high density polyethylene (HDPE) granulates cross-linked by electron beams. Cross-linking multiplies the natural qualities of the polyethylene many times. This results in aspects such as the improved pressure and temperature resistance of the pipe.

The pipe meets the requirements of the strictest of standards for drinking water installations, and is even resistant to aggressive substances.

The aluminium pipe guarantees the oxygen-tightness and shape retaining properties of the pipe. The longitudinal butt welding of the aluminium pipe means the aluminium keeps the same thickness along its whole length. Consequently, the cross-linked outer layer applied with the connecting layer on the aluminium pipe will also have the same thickness everywhere. This also offers advantages when pressing, because the press loads are perfectly distributed. Depending on the diameter of the pipe, the thickness of the aluminium layer is calculated so the pipe always retains optimal flexibility and pressure-resistance







  Geldig van 28/05/2009 tot 27/05/2012	<b>Belgische Unie voor de technische goedkeuring in de bouw</b> Federale Overheidsdienst (FOD) Economie, KMO, Middenstand en Energie, Kwaliteit en Veiligheid, Kwaliteit en Innovatie, Bouw WTC 3, 6 <sup>e</sup> verdieping, Simon Bolivarlaan 30, 1000 Brussel Tel.: +32 2 277 61 76, Fax: 32 2 277 54 44 Lid van de Europese Unie voor de technische goedkeuring in de bouw (EUTgb)
	<b>Technische Goedkeuring met Certificatie</b>  PE-X <sub>2</sub> /AMPE-X <sub>2</sub> drukleidingsysteem voor de verdeling van sanitair koud en warm water, voor de verdeling van verwarmingswater, voor radiatieraansluiting en voor oppervlakte-koeling en -verwarming Henco Press met meerlagenbuizen en perskoppelingen uit metaal of kunststof of Henco Vision met meerlagenbuizen en kunststof insteekverbinding  Henco Industries N. V. Toekomstlaan 27, B – 2200 Herentals Tel +32 14 285060 – Fax +32 14 218712 e-mail <a href="mailto:info@henco.be">info@henco.be</a> Info <a href="http://www.henco.be">http://www.henco.be</a>

Uitrusting  
Ausrüstung

Equipment  
Equipment

Samenstelling van het Uitvoerend Bureau "Uitrustingen": Dhm Basunga Ngelesi (Bocova), Bloys (SECO), Blomme (SECO), Clauwaert (SECO), Cornu (WTCB), Verlaassen (Bocova), Wiens (Becotel)

## Draagwijdte

### 1. Technische goedkeuring met certificatie

De Technische Goedkeuring (ATG) is een beschrijving van een bouwproduct of een bouwsysteem dat een gunstig advies heeft gekregen voor het in de goedkeuring beschreven gebruiksdomain. Het advies kan gegeven worden op basis van:

- BUtg-richtlijnen voor de goedkeuring van dergelijke producten of systemen, indien reeds opgesteld; of
- een technische analyse van de gelijkwaardigheid van de prestaties van het product of het systeem aan de prestatie-eisen gesteld aan een in normen en typebestekken beschreven gelijkwaardig product of systeem.

Bij een Technische Goedkeuring met certificatie wordt het bouwproduct of bouwsysteem onderworpen aan een productcertificatie volgens het toepasselijke ATG-certificatiereglement.

### 2. Technische goedkeuring met certificatie voor drukleidingen

#### a) voor de verdeling van sanitair koud en warm water

De technische goedkeuring van dergelijke systemen is een positieve beoordeling van het hierna beschreven systeem, dit wil zeggen de buizen, de verbindingstukken, de verbinding- en plaatsingstechnieken, gebruikt om binnen een gebouw de verdeling van sanitair koud en warm water, conform de STS 62 "Sanitairleidingen", volgens de Technische voorlichting TV 207: "Kunststofbuissystemen voor de distributie van warm en koud water onder druk in gebouwen" en de referentiedocumenten 904 van de Regie der Gebouwen.



b) voor de verdeling van koel- en verwarmingswater en voor radiatieraansluitingen

De technische goedkeuring van dergelijke systemen is een positieve beoordeling van het hierna beschreven systeem, dit wil zeggen de buizen, de verbindingstukken, de verbinding- en plaatsingstechnieken, gebruikt om binnen een gebouw de verdeling van koel- en verwarmingswater voor radiatieraansluitingen, volgens de Technische voorlichting TV 207: "Kunststofbuissystemen voor de distributie van warm en koud water onder druk in gebouwen" en de referentiedocumenten 904 van de Regie der Gebouwen.

c) voor vloerverwarming.

De technische goedkeuring van dergelijke systemen is een positieve beoordeling van het hierna beschreven systeem, dit wil zeggen de buizen, de verbindingstukken, de verbinding- en plaatsingstechnieken, gebruikt om binnen een gebouw de verdeling te verwezenlijken van het verwarmingswater, de radiatieraansluitingen en voor vloerverwarming, volgens de Technische voorlichting TV 207: "Kunststofbuissystemen voor de distributie van warm en koud water onder druk in gebouwen", TV 189: "Dekvloeren" en TV 193: "Dekvloeren – deel 2 Uitvoering".

De certificatieprocedure bevat, conform aan de BUIgb goedkeuringsrichtlijn "Drukleidingsystemen van kunststof", versie oktober 2007:

- een doorlopende productiecontrole door de fabrikant
- aangevuld met een regelmatig extern toezicht daarop door een door de BUIgb toegewezen certificatie-instelling

Deze certificatie geeft de producent het recht om het ATG-merk aan te brengen op de producten die met de Technische Goedkeuring conform zijn.

### 3. Geldigheid

De voorschrijver en de aannemer dienen zich te vergewissen dat deze technische goedkeuring nog geldig is en dat de aanwending strookt met de voorschriften van deze technische goedkeuring.

## Beschrijving

### 1. Voorwerp

Het drukleidingsysteem Henco Press voor de hier aangehaalde toepassingsdomeinen bestaat uit:

- PE-X<sub>c</sub>/Al/PE-X<sub>c</sub> meerlagenbuizen met buitendiameters 14 mm, 16 mm, 18 mm, 20 mm, 26 mm, 32 mm en 40 mm, indien gevraagd bij de productie van een geribde PE mantelbuis of van een isolatiemantel voorzien;
- PE-X<sub>c</sub>/Al/PE-X<sub>c</sub> "RIXc" meerlagenbuizen met buitendiameters 16 mm, 20 mm en 26 mm, indien gevraagd bij de productie van een geribde PE mantelbuis of van een isolatiemantel voorzien;
- perskoppelingen
  - messing perskoppelingen met roestvaste pershuizen en gelijkaardige toebehoren, voor alle diameters uitgezondend 40 mm; of
  - kunststof perskoppelingen met roestvaste pershuizen en gelijkaardige toebehoren, voor alle diameters.
- gereedschap.

Het drukleidingsysteem Henco Vision voor de hier aangehaalde toepassingsdomeinen bestaat uit:

- dezelfde PE-X<sub>c</sub>/Al/PE-X<sub>c</sub> meerlagenbuizen met buitendiameters 16 mm, 20 mm en 26 mm, indien gevraagd bij de productie van een geribde PE mantelbuis of van een isolatiemantel voorzien;
- dezelfde PE-X<sub>c</sub>/Al/PE-X<sub>c</sub> "RIXc" meerlagenbuizen met buitendiameters 16 mm, 20 mm en 26 mm, indien gevraagd bij de productie van een geribde PE mantelbuis of van een isolatiemantel voorzien;
- kunststof insteekkoppelingen en gelijkaardige toebehoren; en



- gereedschap.

Deze drukleidingsystemen zijn geschikt voor:

- a) voor de verdeling van sanitair koud en warm water

Het leidingsysteem Henco Press en Henco Vision kan binnenshuis gebruikt worden voor de verdeling van koud- en warm sanitair water, bij maximaal 10 bar druk.

Bij een continue gebruikstemperatuur van 60 °C is de overblijvende veiligheidsfactor op de barstdruk groter dan 2,3.

- b) voor de verdeling van verwarmingswater en voor radiatoraansluitingen

Het leidingsysteem Henco Press en Henco Vision kan binnenshuis gebruikt worden voor de verdeling van verwarmingswater en radiatoraansluitingen, bij maximaal 3 bar druk.

Bij een continue gebruikstemperatuur van 80 °C is de overblijvende veiligheidsfactor op de barstdruk groter dan 6,0.

- c) voor de verdeling van koelwater en voor oppervlaktekoeling of –verwarming

Het leidingsysteem Henco Press en Henco Vision kan binnenshuis gebruikt worden voor de verdeling van koelwater en voor oppervlaktekoeling of oppervlakteverwarming, bij maximaal 3 bar druk.

Bij een continue gebruikstemperatuur van 40 °C is de overblijvende veiligheidsfactor op de barstdruk groter dan 9,6.

## 2. Materialen

### 2.1. Leidingen

Deze meerlagenbuis bestaat uit een geëxtrudeerde polyethyleen buis waarrond een stompgelaste aluminium mantel gekleefd wordt. Rond deze mantel en hieraan verlijmd wordt een externe polyethyleen buis getrokken. Het geheel wordt dan door electronen vernet.

Het systeem omvat volgende buisafmetingen, uitgedrukt in "buitendiameter [mm] x wanddikte [mm]":

Tabel 1 — Opsomming benamingen met voornaamste afmetingen

Benaming	Buitendiameter mm	Wanddikte mm	Binnendiameter mm	Dikte Al-buis mm
14 x 2,0	14 ±0,2	2 ±0,2	10	0,4 ±0,04
16 x 2,0	16 ±0,2	2 ±0,2	12	0,4 ±0,04
16 x 2,0 RIXc	16 ±0,2	2 ±0,2	12	0,2 ±0,04
18 x 2,0	18 ±0,2	2 ±0,2	14	0,4 ±0,04
20 x 2,0	20 ±0,2	2 ±0,2	16	0,4 ±0,04
20 x 2,0 RIXc	20 ±0,2	2 ±0,2	16	0,28 ±0,04
26 x 3,0	26 ±0,2	3 ±0,2	20	0,5 ±0,04
26 x 3,0 RIXc	26 ±0,2	3 ±0,2	20	0,28 ±0,04
32 x 3,0	32 ±0,2	3 ±0,2	26	0,7 ±0,04
40 x 3,5	40 ±0,2	3,5 ±0,2	33	0,7 ±0,04

Het gebruikte aluminium voldoet aan de norm NBN EN 573-3.

Het gebruikte materiaal van de binnenbuis bestaat uit stralingsvernet polyethyleen (PE-X<sub>c</sub>) en voldoet aan de norm NBN EN ISO 15875-2.



De buiseigenschappen van de samengestelde buis, bij voorbeeld voor de buis "16 x 2" zijn:

Tabel 2 — Opsomming van de voornaamste eigenschappen voor de buis "16 x 2"

Thermisch uitzettingscoëfficiënt	25.10 <sup>-6</sup> m/m.K
Weerstand tegen inwendige druk	
– omgevingstemperatuur van 20 °C – inwendige druk van 70 bar	> 3 h
– omgevingstemperatuur van 95 °C – inwendige druk van 27 bar	> 1000 h
Barstdruk bij 20 °C	> 90 bar
Krimp bij hogere temperatuur (60 min bij 120 °C)	< 1 %
Vernellingsgraad van de binnenbuis	≥ 60 %
Zuurstofdoorlaatbaarheid	te verwaarlozen (0,022 mg/m <sup>2</sup> /dag)
Kleur	wit met zwarte markering

De buizen worden gangbaar geleverd in volgende lengtes (op vraag kunnen andere lengtes worden bekomen):

Tabel 3 — Opsomming van de leveringswijzen voor onbeklede buis

Benaming	Enkele buis	
	op rol m	stangen m
14 x 2,0	50, 100, 200	—
16 x 2,0	50, 100, 200, 500	2, 3, 4, 5
16 x 2,0 RIXc	50, 100, 200, 500	2, 3, 4, 5
18 x 2,0	100, 200	2, 3, 4, 5
20 x 2,0	100	2, 3, 4, 5
20 x 2,0 RIXc	100	2, 3, 4, 5
26 x 3,0	50	2, 3, 4, 5
26 x 3,0 RIXc	50	2, 3, 4, 5
32 x 3,0	50	2, 3, 4, 5
40 x 3,5	—	2, 3, 4, 5

De buizen worden verpakt:

- alle rollen omwikkeld met verpakkingspapier of in kartonnen dozen op aanraag
- alle rechte stukken in PVC buizen

De markering van de buizen is als volgt (voorbeeld van buis "16 x 2"): "HENCO © Made in BELGIUM  
www.henco.be PE-Xc/ALD.4/PE-Xc 16\*2 250607 L722 HN000 10bar/95°C Kiwa klasse 2 ISO 10508 KOMO  
DVGW DW-8241AU 2292 DW-8501AU/2293-2294 ÖVGW 1.377 ATG 2432,2433,2440 ÖN B 5157 Typ 1 ATW  
Silac 1422 0536/01 0138/98 10bar/70°C SKZ VA1. 14/12039 UNI 10954-1 tipo classe 1 IIP UNI 319 SVGW  
Nr 8910-4140 NBI Nr 0024 STF DIN 4726 Pkt 3.1.1.3 IKP-UNI Stuttgart 002 m <I>"



Tabel 4 — Opsomming van de markeringen op de onbeklede buis

Geregistreerde handelsnaam	HENCO ®
Land van oorsprong	Made in BELGIUM
Internet-adres	www.henco.be
Binnenbuis: stralenvernet polyethyleen	PE-Xc
Dikte aluminiummantel	AL0.4
Buitenmantel: stralenvernet polyethyleen	PE-Xc
Buitendiameter * wanddikte	16*2
Productiedatum	250607
Productielijn en tijdcode	L722
Code voor Henco-merkleken	HN000
Nominale werkdruk en nominale temperatuur	10 bar / 95 °C
Verschillende certificaten, waaronder Belgisch:	ATG 2432;2433;2440
Lengte-aanduiding van het productie-lot	002 m <>

De kleur van de buitenbuis is wit, de binnenbuis is natuurkleur. De markering is in zwart uitgevoerd.

De markering op de verpakking gebeurt door middel van zelfklevende tape waarmee de papieren wikkel wordt vastgekleefd. De markering is als volgt (voorbeeld van 18x2):

Figuur 1 — Afbeelding zelfklevende tape



Tabel 5 — Opsomming van de markeringen op de verpakking van de onbeklede buis

Geregistreerde handelsnaam	HENCO
Buitendiameter/wanddikte	18.2 op blauwe achtergrond (14.2 op gele achtergrond; 16.2 op rode achtergrond)
Duitse normreferentie	In anlehnung DIN 4726-4729
Gegevens productiesite	B-2200 HERENTALS BELGIË
Telefoonnummer	Tel. 0032 14218847 218703
Overeenstemming met Nederlandse voorschriften	KNA

De meerlagenbuis wordt geproduceerd door Henco Industries, te Herentals (België).

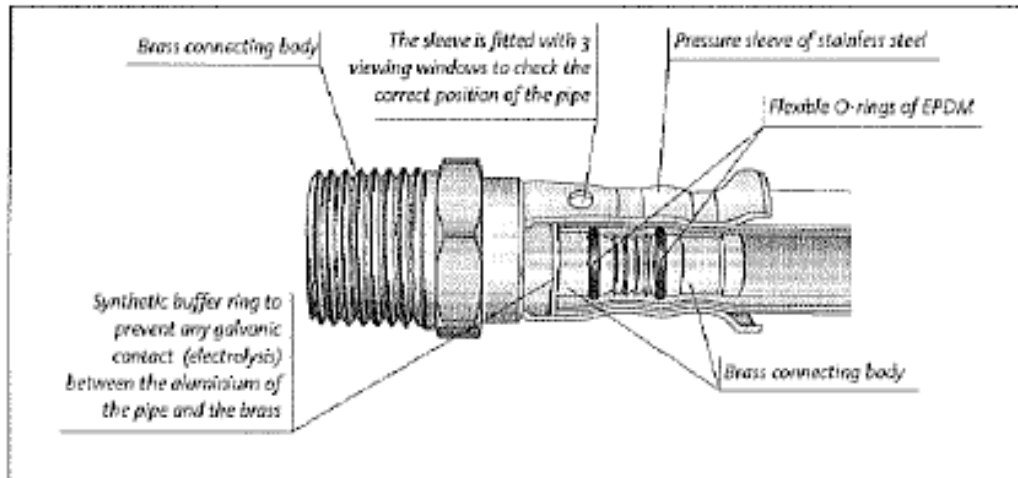


## 2.2. Koppelingen

### 2.2.1 Metalen perskoppelingen (voor alle diameters tot en met 32 mm)

De koppelingen (zie figuur 2) en toebehoren bestaan uit messing (CuZn40Pb2 volgens DIN 17672) met een dubbele dichtingsring en een stootring

Figuur 2: Metalen perskoppeling



De dichtingsringen zijn uit EPDM. De stootring die elk galvanisch contact tussen het aluminium van de buis en de messing moet vermijden is uit polypropyleen (PP). De pershuls is uit roestvrij staal van het type 1.4301 (AISI 304).

De verschillende koppelstukken (sanitaire muurplaten, bochten met binnen- of buitendraad, bochten van 45° of 90° met tweezijdige aansluiting voor perskoppeling, T zonder reductie, met één of tweevoudige reductie, T met vergroting, T met binnen- of buitenschroefdraad, rechte tweezijdige aansluiting met of zonder reductie, rechte nippel met binnen- of buitendraad met of zonder vlakke dichting, rechte nippel met euroconus koppeling) worden in de Henco Press prijslijst vermeld.

De perskoppeling draagt op het messing verbindingslichaam een markering; de markering is als volgt (voorbeeld van draadovergangstuk):

Tabel 6 — Opsomming van de markeringen op metalen perskoppelingen

Afkorting merk	HN
Buistype	20 x 2
Diameter buitendraad in duim	1/2

De perskoppelingen worden individueel in kunststof zakjes verpakt met opdruk; de deze opdruk is als volgt (voorbeeld van draadovergangstuk):



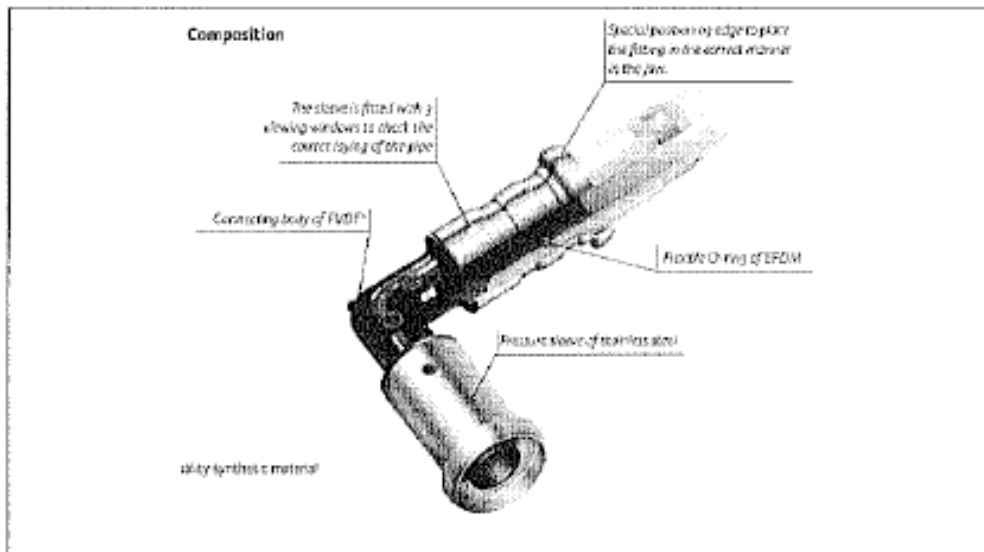
Tabel 7 — Opsomming van de markeringen op de verpakking van de metalen perskoppelingen

Merk	Henco Industries
Omschrijving stuk	Straight Nipple
Buistype	20
Diameter buitendraad in duim	x 1/2"
Benaming	
Bestelnummer	
Aantal stuks	10 PCS
Datum	

**2.2.2 kunststof perskoppelingen (voor alle buisdiameters tot en met 40 mm).**

De koppelingen (zie figuur 3) en toebehoren bestaan uit een lichaam uit PVDF (polyvinylidene fluoride) met een enkele dichtingsring en zonder slootring.

Figuur 3: Kunststof perskoppeling



De dichtingsringen zijn uit EPDM. De pershuis is uit roestvrij staal van het type 1.4301 (AISI 304).

De verschillende koppelstukken (sanitaire muurplaten, bochten met binnen- of buitendraad, bochten van 45° of 90° met tweezijdige aansluiting voor perskoppeling, T zonder reductie, met één of tweevoudige reductie, T met vergroting, T met binnen- of buitenschroefdraad, rechte tweezijdige aansluiting met of zonder reductie, rechte nippel met binnen- of buitendraad met of zonder vlakke dichting) worden in de Henco PVDF Perskoppeling prijslijst vermeld.

De perskoppeling draagt op het kunststof verbingslichaam een markering; de markering is als volgt (voorbeeld):



Tabel 8 — Opsomming van de markeringen op kunststof perskoppelingen

Afkorting merk	HN
Buisstype	20
Productiemaand en -jaar	(wijzerplaatje)
Logo	

De perskoppelingen worden individueel in kunststof zakjes verpakt met opdruk; de deze opdruk is als volgt (voorbeeld van draadovergangstuk):

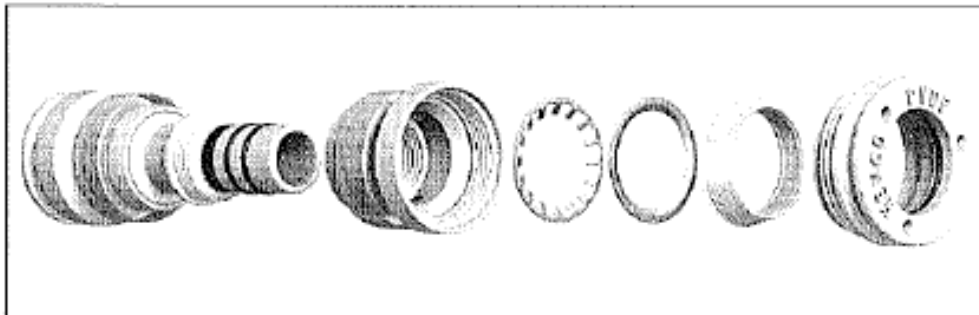
Tabel 9 — Opsomming van de markeringen op de verpakking van de kunststof perskoppelingen

Merk	Henco Industries
Omschrijving stuk	Straight Nipple
Aantal stuks	10 PCS
Datum	
Keurmerken	KIWA, Komo, DVGW

### 2.2.3 Kunststof insteekkoppelingen (voor de buisdiameters 16, 20 en 26 mm).

De koppeling (zie figuur 3) bestaat uit een lichaam en een aansluit-huls, beide uit PVDF (polyvinylidene fluoride), met twee EPDM dichtingsringen en zonder stetring.

Figuur 4: Kunststof insteekkoppeling



Bij levering zijn lichaam en aansluit-huls gebruiksklaar inengeschoefd geleverd waarbij de opening door een beschermkap wordt afgesloten. Om reparaties of vervangingen te kunnen uitvoeren, kunnen lichaam en aansluit-huls uit elkaar geschroefd worden. In dat geval kan de aansluit-huls worden vervangen door gebruik van een zogenaamde reparatieset. Dergelijke reparatieset bestaat uit een nieuwe aansluit-huls en nieuwe dichtingsringen.

Indien een aansluit-huls dient te worden vervangen, wordt eerst de buis die in de aansluit-huls is geplaatst, op een voldoende afstand van de huls doorgeslipt; daarna worden lichaam en aansluit-huls uit elkaar geschroefd.

Het steunstuk voor de huls moet worden voorzien van nieuwe dichtingsringen en vastgeschroefd worden in de huls. Hierna moet de verbinding met de buis opnieuw worden uitgevoerd, indien nodig door een buisend aan de bestaande installatie te verbinden door middel van een bijkomend recht tweezijdig verbindingstuk.

De verschillende koppelstukken (sanitaire muurplaten, bochten met binnen- of buitendraad, bochten van 90° met tweezijdige aansluiting voor perskoppeling, T zonder reductie, met één of tweevoudige reductie, T met vergroting, T met binnen- of buitenschroefdraad, rechte tweezijdige aansluiting met of zonder reductie, rechte nippel met binnen- of buitendraad met of zonder vlakke dichting, verdelers en collectoren) worden in de Henco PVDF Perskoppeling prijslijst vermeld.





De insteekkoppeling worden vooreerst in grote hoeveelheid verpakt met een zelfklever met opdruk; in deze verpakking bevinden zich meerdere verpakkingen met een kleiner aantal eenheden met zelfklever met eenzelfde opdruk (voorbeeld van een euroconus verloopstuk):

Tabel 10 — Opsomming van de markeringen op kunststof insteekkoppelingen

Merk	Henco
Oorsprong	Made in Belgium
Omschrijving stuk	Push fit adapter to eurocone 16 x 3/4"
Aantal stuks	80 PCS
Productcode	19SK-1605 VISION
Keurmerken	KIWA, DVGW, ...

### 2.3. Mantelbuis

Alle voormelde buistypes kunnen geleverd worden, voorzien van een fabrieksmatig aangebrachte geribde mantelbuis in de kleuren rood, blauw of zwart. De mantelbuis draagt geen markering behalve de benaming "Henco" die elke meter herhaald wordt.

Specifieke buistypes kunnen geleverd worden, voorzien van een fabrieksmatig aangebrachte geribde mantelbuis in de kleur zwart-zilver waarbij twee mantelbuizen (elk met een eigen buis) punctueel aan elkaar verbonden zijn. Eén van beide mantelbuizen is daarbij voorzien van een markering in de vorm van een doorlopende rode streep; de mantelbuis draagt geen overige markering behalve de benaming "Henco" die elke meter herhaald wordt.

Tabel 11 — Opsomming fabrieksmatig ommantelde buizen met beschikbare afmetingen

Benaming	Lengte rol		Buitendiameter mantel	
	enkelvoudige mantel m	combinatie-mantel m	enkelvoudige mantel mm	combinatie-mantel mm
Kleur mantel	rood, blauw, zwart	zilver		
14 x 2,0	25, 50, 100	50	23	2 x 25
16 x 2,0	25, 50, 100	50	23	2 x 25
16 x 2,0 RIXc	25, 50, 100	50	23	2 x 25
18 x 2,0	50, 100	50	23	2 x 25
20 x 2,0	25, 50	—	28	—
20 x 2,0 RIXc	25, 50	—	28	—
26 x 3,0	50	—	35	—
26 x 3,0 RIXc	50	—	35	—
32 x 3,0	—	—	—	—
40 x 3,5	—	—	—	—



#### 2.4. Isolatiemantel

Alle voormelde buistypes kunnen geleverd worden, voorzien van een fabrieksmatig aangebrachte isolatiemantel in de kleuren rood en/of blauw. Deze isolatie kan rond zijn (isolatiedikte 6, 10 of 13 mm) of excentrisch (6 mm boven en 13 mm onder of 6 mm boven en 26 mm onder).

De isolatiemantel bestaat uit CFK-vrij geëxtrudeerd polyethyleenschuim; de  $\lambda$ -waarde bedraagt 0,040 W/m.K bij 40 °C. De isolatie kan worden toegepast bij oppervlaktetemperaturen van -35 °C tot +95 °C. De isolatie wordt overtrokken met een gekleurde geëxtrudeerde PE folie.

Tabel 12 — Opsomming fabrieksmatig geïsoleerde buizen met beschikbare afmetingen

Benaming	Concentrisch geïsoleerde buis			Excentrisch geïsoleerde buis	
	op rol, 6 mm isolatie m	op rol, met 10 mm isolatie m	op rol, met 13 mm isolatie m	op rol, met 13+6 mm isolatie m	op rol, met 26+6 mm isolatie m
kleur mantel	rood, blauw	rood, blauw	blauw	blauw	blauw
14 x 2,0	100	50	—	—	—
16 x 2,0	100	50	50	50	25
16 x 2,0 RIXc	100	50	50	—	—
18 x 2,0	50	50	50	—	—
20 x 2,0	50	50	50	25	25
20 x 2,0 RIXc	50	50	50	—	—
26 x 3,0	25	25, 50	50	25	25
26 x 3,0 RIXc	25	25	50	—	—
32 x 3,0	25	25	25	—	—
40 x 3,5	—	—	—	—	—

#### 2.5. Toebehoren

Het productgamma "Henco meerlagenbuis met perskoppelingen" wordt aangevuld met onderdelen die enkel betrekking hebben op de bevestiging van de verschillende onderdelen aan de overige delen van de constructie.

- stalen enkelvoudige of dubbele ophangingen voor collectoren, met of zonder rubber ringen;
- kunststof of metalen inbouwkasten;
- inbouwdozen; en
- bevestigingsbeugels voor inbouwdozen.

#### 2.6. Gereedschap

Om naar behoren verbindingen te realiseren volgens de voorschriften van deze technische goedkeuring is volgend gereedschap nodig:

- slijtang: om de meerlagenbuis haaks af te snijden;
- buigveer: intern of extern te plaatsen voor om bochten met een minimum radius te verwezenlijken;
- kalibreerstel: gereedschap dat dient ter correctie van de eventuele ovaliteit van de buis; het kalibreerstel freest tevens de binnen- en buitenbuis licht conisch af;
- perslang: elektrisch aangedreven perslang, uitgerust met de voor elke diameter overeenstemmende persklemmen, gemarkeerd met "Henco". Onder andere wegens het gebruik van een specifieke positioneringsrib, is het gebruik van een andere dan deze perslang niet toegestaan; en



- sleutel (open sleutel met specifieke grijppunten; het gebruik van een verstelbare moersleutel of pijptang wordt niet toegelaten).

### 3. Plaatsing

#### 3.1. Installatie van het leidingsysteem

Bij de plaatsing van het Henco meerlagenbuis leidingsysteem met Henco Press perskoppelingen of Henco Vision insteekkoppelingen zijn de montage- en plaatsingsvoorschriften van Henco in acht te nemen, alsook de aanbevelingen van de Technische Voorlichtingsnota 207 van het WTCB "Kunststofbuissystemen voor de distributie van warm en koud water onder druk in gebouwen" en de normenserie NBN D 30-00X (Centrale verwarming, ventilatie en luchtbehandeling), tenzij anders vermeld in deze goedkeuring. Voor de toepassing als vloerverwarming dienen ook de aanbevelingen van de Technische Voorlichtingsnota's 179, 189 en 193 van het WTCB "Dekvloeren deel I", "Harde vloerbedekkingen op verwarmde vloeren" en "Dekvloeren deel II" in acht te worden genomen.

De uitvoerder dient bijzondere aandacht te besteden aan volgende punten:

- Alle onderdelen van het systeem dienen met zorg in de originele fabrieksverpakking te worden vervoerd en opgeslagen en volgens verbruik uitgepakt.
- Bij het verwijderen van de verpakkingsmaterialen moet zorg worden besteed de onderdelen niet te beschadigen, bij voorbeeld door gebruik te maken van een mes of dergelijke.
- Rechte lengten op een horizontale en vlakke bodem stockeren.
- Het ontrollen van de rollen dient te gebeuren in tegengestelde zin van het oprollen, dus vertrekkend van het buisende aan de buitenkant van de rol.
- Elk stuk buis met ploelen of builen dient te worden verwijderd en mag niet in de montage gebruikt worden.
- De buizen dienen torsievrij te worden geplaatst.
- De buizen dienen beschermd te worden tegen directe langdurige zoninval, van elke vervorming, vervuiling of beschadiging. Accidentele vervormingen van de buis, permanent wegens haar samenstelling, zijn te vermijden. Vervormde buisdelen moeten verwijderd worden.
- Bij het plaatsen van het leidingsysteem dient de omgevingstemperatuur minimum 0 °C te bedragen. Bij vorstgevaar tussen het moment van de uitvoering en de indienststelling van de installatie dient men de leidingen te ledigen.
- Bij toepassingen met koeling moeten maatregelen worden genomen om het optreden van condensatie op ongewenste plaatsen te vermijden.
- Voor verbindingen tussen meerlagenbuis enerzijds en draadverbinding aan een toebehoren of uitrusting van de installatie anderzijds, dient eerst de draadverbinding gerealiseerd te worden.
- Verdeelers en collectoren moeten, indien mogelijk, op een lager niveau dan de aflappunten geplaatst worden.
- Geen chemische middelen, verf of andere producten op de buis aanbrengen.
- Na het plaatsen van de buizen en voor de aansluiting van de sanitaire toestellen wordt het leidingsysteem tegen het binnendringen van vuil en stof beschermd. Het ganse leidingsysteem dient grondig te worden gespoeld voor ingebruikname van de installatie.
- De gerealiseerde verbindingen dienen steeds zichtbaar te blijven tot na de drukproef.

#### 3.2. Verbindingen

Verbindingen worden slechts toegestaan in de rechte buisdelen van de installatie en op minstens 5 maal de buitendiameter van de kromming.

Voor verbindingen tussen een meerlagenbuis enerzijds en een draadverbinding anderzijds, moet eerst de geschroefde verbinding uitgevoerd worden en daarna de overige verbinding.

- a) De montage van de metalen perskoppeling gebeurt als volgt:
  - de buis op de gewenste lengte met de snijtang haaks afkorten;



- het buiseinde ontbramen en kalibreren met het Henco gereedschap;
  - visueel controleren of de stoorring aanwezig is tegen de aanslag en dan de buis volledig in de perskoppeling duwen; indien de stoorring ontbreekt, mag de koppeling niet gebruikt worden;
  - de perstang met de HENCO gemerkte persklemmen, overeenkomstig aan de te verbinden buisdiameter, op de pershuls plaatsen, zodanig dat de uitspringende metalen ring past in de geul aangebracht op de klemmen;
  - de klemmen in één beweging volledig sluiten;
  - na het klemmen moet de buis tot aan de aanslag gebleven zijn op de persklemmen.
- b) De montage van de metalen kunststof koppeling gebeurt als volgt:
- de buis op de gewenste lengte met de snijtang haaks afkorten;
  - het buiseinde ontbramen en kalibreren met het Henco gereedschap;
  - buis volledig in de perskoppeling duwen; indien de stoorring ontbreekt, mag de koppeling niet gebruikt worden;
  - de perstang met de HENCO gemerkte persklemmen, overeenkomstig aan de te verbinden buisdiameter, op de pershuls plaatsen, zodanig dat de uitspringende metalen ring past in de geul aangebracht op de klemmen;
  - de klemmen in één beweging volledig sluiten;
  - na het klemmen moet de buis tot aan de aanslag gebleven zijn op de persklemmen.
- c) De montage van de insteekkoppeling gebeurt als volgt:
- de buis op de gewenste lengte met de snijtang haaks afkorten;
  - het buiseinde ontbramen en kalibreren met het Henco gereedschap;
  - de beschermkap van de koppeling verwijderen;
  - de koppeling in één beweging op de buis schuiven tot aan de aanslag
  - nakijken of de controlevensterjes allemaal wit kleuren

### 3.3. Buigen van de buizen

De buizen dienen koud gebogen worden. De oorsprong van een buiging moet zich ten minste op 5 x de buitendoormeter van een koppeling bevinden. Enkel buizen met een buitendiameter tot en met 28 mm mogen worden gebogen. De volgende buigstralen dienen in acht genomen te worden.



Tabel 13 — Opsomming minimale buigstralen

Benaming	Minimum buigstraal met de hand of buitenbuigveer	Minimum buigstraal met binnenbuigveer
	mm	mm
14 x 2	70	42
16 x 2	80	48
16 x 2 RIXc	128	128
18 x 2	90	54
20 x 2	100	60
20 x 2 RIXc	140	100
26 x 3	135	78
26 x 3 RIXc	182	130
32 x 3	—	—
40 x 3	—	—

#### 3.4. Plaatsing van de leidingen

Het legpatroon van het leidingstelsel, het type van de inbouwdozen, aansluit- en aftappunten, en het benodigd aantal collectoren maken deel uit van het ontwerp.

Vooraf om de installatie tijdens de uitvoering van de bouwwerken tegen elke schade te vrijwaren, wordt aangeraden gebruik te maken van ommantelde buizen waar mogelijk.

Het inbouwen van koppelingen is in de mate van het mogelijke te vermijden en moet geval per geval gerechtvaardigd worden en door de bouwpartners aanvaard worden. Om dit inbouwen zo veel mogelijk te beperken moet men bij voorkeur buizen gelavend op rollen gebruiken. De eventueel ingebouwde metalen perskoppelingen zijn tegen corrosie te beschermen, bij voorkeur in gemakkelijk bereikbare en waterdichte inbouwdozen (of bijvoorbeeld, in een met tape afgedichte mantel, ofwel in een met tape afgedichte omhulling uit kunststof cellenmateriaal). De hiervoor aangewende materialen mogen noch de buis noch de koppeling aantasten.

Verdelers en collectoren moeten, indien mogelijk, op een lager niveau dan de aftappunten geplaatst worden.

Het systeem biedt als mogelijkheden:

- a) voor de verdeling van sanitair koud en warm water:
  - elk aftappunt met een individuele leiding te voeden, vertrekkend van een hoofdleiding of van collectoren; of
  - de serieschakeling van tappunten waarbij de voeding langs 2 leidingen plaats heeft en waar elk aftappunt gerealiseerd wordt door een in de muur aangebrachte inbouwdoos met doorverbinding
- b) voor de verdeling van koel- of verwarmingswater en voor de aansluiting van koelelementen en radiatoren:
  - een opstelling waarin elk verwarmingselement afzonderlijk aangesloten wordt door middel van een aangepast T- stuk, zowel op de toevoer als op de retour leiding; of
  - een opstelling waarin elke radiator met een vertrek- en een retourleiding, rechtstreeks, en telkens uit één stuk, met een verdeler en een collector verbonden worden; of
  - een opstelling waar de verwarmingselementen, bij middel van een speciale uitrusting in serie kunnen verbonden worden (één-pijp-systeem).



c) voor oppervlakteverwarming en –koeling

- een opstelling op een eventuele thermische isolatie bedekt met een polyethyleenfolie, afdoend bevestigd volgens de mogelijkheden geboden door de fabrikant met een regelmatige tussenafstand, met telkens een aanvoer- en terugloopleiding naast elkaar, waarbij de verschillende kringen bestaan uit één doorlopende buislengte tussen verdeler en collector.

De volgende werkwijze moet worden toegepast:

a) bij inbouw

- de te gebruiken leidingen worden bij voorkeur onder vorm van haspels geleverd.
- de sleuven voor de leidingen en openingen voor inbouwdozen en inbouwkasten voor collectoren worden in de wanden uitgeslepen met ruimte bochten en voldoende uitzettingsmogelijkheden gevuld met elastisch vulmateriaal;
- de inbouwdozen worden op de daartoe bestemde plaatsen gemonteerd;
- de buis wordt met een vormstuk aan de koppeling vastgemaakt;
- het vrije uiteinde van de buis wordt naar de verdeler of collector gebracht, op maat ingekort en met een koppeling haaks vastgemaakt aan de verdeler of collector. Om de verbinding spanningsvrij te garanderen, dient minstens een vrije lengte van 30 cm te bestaan tussen de collector of verdeler en de afgewerkte vloer. De koppelingen dienen ter hoogte van de verdeler en collector bereikbaar te blijven.
- het inbouwen is altijd in de mate van het mogelijke te vermijden en slechts aanvaardbaar mits akkoord van de bouwpartners (bouwheer, aannemer en installateur).
- leidingen mogen geen uitzettingsvoegen van het gebouw kruisen, zonder dat hiervoor bijzondere schikkingen worden getroffen;
- voor de inbouw in de vloer van oppervlakteverwarming en –koeling geldt bijkomend:
  - de zuurstofdichte aluminiummantel in de kunststof buis maakt de leiding extra geschikt om toegepast te worden bij oppervlakteverwarming.
  - de RIXc buistypes zijn hebben een kleinere buigstijfheid door de dünnere aluminium mantel: het plaatsen vraagt minder inspanning.
  - de buizen worden geplaatst op een eventueel door de ontwerper voorgeschreven thermische isolatie bedekt met een polyethyleenfolie. Bijzondere voorzieningen dienen genomen te worden langs de randen van de te verwarmen ruimte, ter hoogte van deurdoorgangen en bij de verdeelkasten.
  - de buizen worden met een regelmatige tussenafstand van elkaar geplaatst, met telkens een aanvoer- en terugloopleiding naast elkaar, en afdoend bevestigd volgens de mogelijkheden geboden door de fabrikant. De tussenafstanden zijn afhankelijk van het benodigde vermogen, de uitvoerbaarheid, de kwaliteit van de deklaag en de wijze van bevestiging van de verschillende kringen.
  - alle kringen van het vloerverwarmingsysteem bestaan uit één lengte tussen de verdeler en de collector waaraan ze verbonden worden;
  - Verbindingen tussen en het kruisen van de leidingen worden niet toegelaten.

b) bij opbouw

- de te gebruiken leidingen worden bij voorkeur onder vorm van rechte buizen geleverd;
- de uitzettingsmogelijkheden onder invloed van temperatuurvariaties moeten gevrijwaard blijven, door gebruik te maken van bochten, uitzettingslussen, buigarmen, glijdende en vaste ophangingen;
- ter hoogte van muurdoorgangen dienen de buizen ommanteld te zijn;



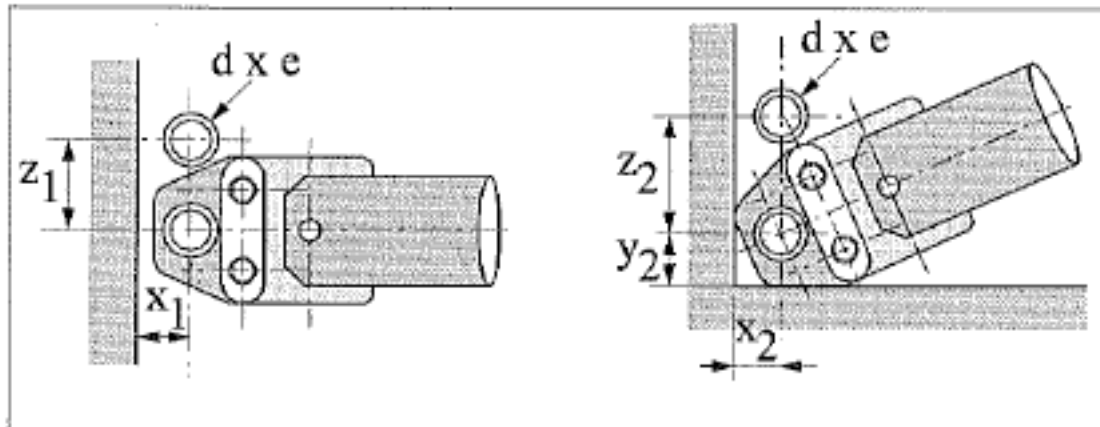
- de doorbuigingen tussen ophangingen, en indien noodzakelijk de te gebruiken verstevigingen moeten in overeenstemming zijn met de Technische Voorlichtingsnota 207 van het WTCB "Kunststofbuissystemen voor de distributie van warm en koud water onder druk in gebouwen". De ophangbeugels zijn uit metaal of kunststof, in beide gevallen met een kunststof ring ter bescherming van de buis;
- de afstanden tussen ophangbeugels bedragen ten hoogste:

Tabel 14 — Opsomming minimale bevestigingsstussenafstanden

Benaming	Horizontale afstand tussen ophangbeugels cm	Verticale afstand tussen ophangbeugels cm
14 x 2	120	150
16 x 2	120	150
16 x 2 RIXc	---	---
18 x 2	120	150
20 x 2	130	190
20 x 2 RIXc	---	---
26 x 3	150	195
26 x 3 RIXc	---	---
32 x 3	175	200
40 x 3,5	175	200

- de afstanden van leidingen tot de muur moet minimaal voldoen aan volgende mastvoering, om de correcte plaatsing van de perstangen toe te laten:

Figuur 5: Minimale werkafstanden



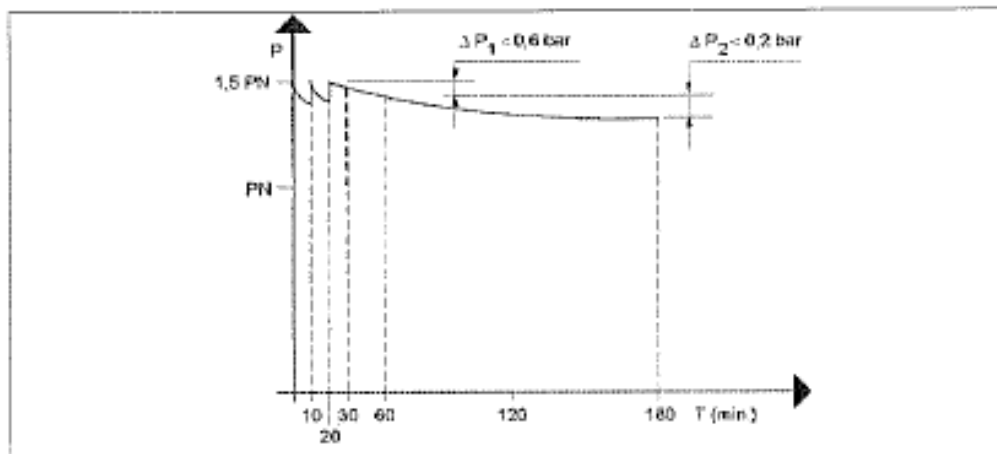


Tabel 15 — Opsomming minimale werkafstanden

Benaming	X <sub>1</sub> mm	Z <sub>1</sub> mm	X <sub>2</sub> mm	Y <sub>2</sub> mm	Z <sub>2</sub> mm
14 x 2	30	65	40	40	90
16 x 2	30	65	40	40	90
16 x 2 RIXc	30	65	40	40	90
18 x 2	30	65	40	40	90
20 x 2	30	65	40	40	90
20 x 2 RIXc	30	65	40	40	90
26 x 3	35	70	50	50	100
26 x 3 RIXc	35	70	50	50	100
32 x 3	35	75	50	50	110
40 x 3,5	50	110	70	70	135

### 3.5. Dichtheidscontrole

Vooraleer het leidingsysteem in te werken (chape, bepleistering, isolatie of verwarmingslinten) en in alle geval vóór de ingebruikname van de installatie, dient deze aan een dichtheidscontrole onderworpen te worden, volgens de hierna volgende procedure (zie Figuur 6). De accessoires van het leidingsysteem die niet weerstaan aan een druk van 1,5 x PN dienen op voorhand afgeschakeld te worden.



Figuur 6 — Dichtheidscontrole

- de gemonteerde doch niet ingebouwde leidingen worden met drinkbaar water gevuld en ontluicht;
- een druk van 1,5 x PN wordt aangebracht;
- na 10 minuten wordt de druk een eerste maal hersteld tot 1,5 x PN;
- na 10 minuten wordt de druk een tweede maal hersteld tot 1,5 x PN;
- na 10 minuten wordt de druk gemeten ( $P_{T=30}$ );
- na 30 minuten wordt de druk nogmaals opgemeten ( $P_{T=60}$ ).





$$\Delta P_1 = P_{T=30} - P_{T=60} \leq 0,6 \text{ bar}$$

Het drukverlies  $\Delta P_1$  tussen deze twee laatste metingen mag niet groter zijn dan 0,6 bar. Indien het drukverlies groter is dan 0,6 bar dient de oorzaak van de ondichtheid opgespoord en verholpen te worden en wordt de procedure van begin af aan hernomen;

- 120 minuten later wordt de druk nogmaals opgenomen ( $P_{T=120}$ )

$$\Delta P_2 = P_{T=60} - P_{T=120} \leq 0,2 \text{ bar}$$

Het drukverlies  $\Delta P_2$  tussen deze twee laatste metingen mag niet groter zijn dan 0,2 bar. Indien het drukverlies groter is dan 0,2 bar dient de oorzaak van de ondichtheid opgespoord en verholpen te worden en wordt de procedure van begin af aan hernomen;

- de leidingen worden visueel nagezien op lekken en ondichtheden.

De dichtheidsproef moet per afgewerkte leidingsectie uitgevoerd worden, met een zo constant mogelijke water- en omgevingstemperatuur. De manometer voor registratie van de drukverliezen dient een afzetting tot 0,1 bar nauwkeurig toe te laten.

### 3.6. Spoeling van sanitaire leidingen

Sanitaire leidingen moeten vóór ingebruikname met drinkwater grondig gespoeld worden.

### 3.7. In werking stellen van de vloerverwarming

Alvorens de verwarming op te starten is een wachttijd te voorzien zodanig dat de mechanische weerstand en een voldoende uitdroging van de dekvloer bereikt worden. Versnelling van dit proces mits temperatuursverhoging wordt niet toegelaten. De wachttijd is afhankelijk van de gebruikte materialen, toeslagstoffen, type dekvloer en andere parameters.

Om schade door scheurvorming te vermijden moeten de temperatuurveranderingen zo geleidelijk mogelijk gebeuren. Het in werking stellen gebeurt stapsgewijs met 5 °C per 24 h, vertrekkend van de koude toestand tot de maximale werkingstemperatuur. De terugkeer naar de begintemperatuur gebeurt met eenzelfde 5 °C per 24 h. De maximale werkingstemperatuur wordt tenminste gedurende 72 h aangehouden om een maximale uitzetting te verkrijgen en de krimp te vervolledigen.

De vloerverwarmingsinstallatie dient steeds beveiligd te worden ten opzichte van temperatuuroverschrijdingen.

### 3.8. Bijkomende buisisolatie

Bij toepassing van bijkomende buisisolatie, dient men na te gaan of de eventuele gebruikte lijmen, zelfs indien niet rechtstreeks gebruikt om de isolatie aan de kunststofbuis te bevestigen, geen voor de kunststof leidingen en voor de koppelingen schadelijke producten bevatten. Hiervoor voorafgaand Henco raadplegen.

### 3.9. Verwarmingslinten voor sanitaire installaties

De maximaal continu toegelaten temperatuur moet kleiner dan 60 °C zijn. Bij gebruik van tape, ter bevestiging van het verwarmingslint op de buis dient men na te gaan of de eventuele gebruikte lijmen, zelfs indien niet rechtstreeks gebruikt om de verwarmingslinten aan de kunststofbuis te bevestigen, geen voor de kunststof leidingen en voor de koppelingen schadelijke producten bevatten. Hiervoor voorafgaand Henco raadplegen.

### 3.10. Ontsmetting

Bij toepassing van ontsmetting met additieven, dient men na te gaan of de gebruikte producten geen voor de kunststof leidingen en voor de koppelingen schadelijke producten bevatten.

Bij toepassing van ontsmetting door een thermische cyclus met temperaturen hoger dan de in deze goedkeuring aangehaalde gebruikstemperatuur, dient men na te gaan of deze temperaturen in combinatie met de voorkomende drukken, geen onaantvaardbare belasting voor de kunststof leidingen en voor de koppelingen veroorzaken.

In beide gevallen hiervoor voorafgaand Henco raadplegen.



#### 4. Gebruiksgeschiktheid

Het leidingsysteem Henco meerlagenbuis met verbindingssystemen Henco Press of Henco Vision met PE-Xc/AUPE-Xc leidingen vertoont de volgende levensduurkarakteristieken, waarbij de veiligheidsfactor de kleinste verhouding is tussen de barstdruk, genomen uit de regressiecurven bij de desbetreffende temperatuur en levensduur en de werkdruk van het systeem.

a) voor de verdeling van sanitair koud en warm water

Werkdruk Bar	Temperatuur °C	Minimale levensduur	Veiligheidsfactor <sup>(4)</sup>
10	20 <sup>(1)</sup>	50 jaar	3,5
	60 <sup>(1)</sup>	48 jaar	2,3
	80 <sup>(2)</sup>	2 jaar	2,1
	95 <sup>(2)</sup>	1000 uur	1,9

b) voor de verdeling van koel- of verwarmingswater en voor de aansluiting van koelelementen en radiatoren

Werkdruk Bar	Temperatuur °C	Minimale levensduur	Veiligheidsfactor <sup>(4)</sup>
3	20 <sup>(1)</sup>	50 jaar	11,7
	80 <sup>(1)</sup>	48 jaar	6,0
	95 <sup>(2)</sup>	2 jaar	5,6
	110 <sup>(3)</sup>	1000 uur	4,9

c) voor oppervlakteverwarming en -koeling

Werkdruk Bar	Temperatuur °C	Minimale levensduur	Veiligheidsfactor <sup>(4)</sup>
3	40 <sup>(1)</sup>	48 jaar	9,6
	50 <sup>(2)</sup>	2 jaar	9,9
	65 <sup>(3)</sup>	1000 uur	9,2

<sup>(1)</sup> gebruikstemperatuur

<sup>(2)</sup> maximale temperatuur

<sup>(3)</sup> uitzonderlijke temperatuur

<sup>(4)</sup> de resterende veiligheidsfactor is de kleinste verhouding tussen de barstdruk, genomen uit de regressiecurven en de werkdruk van het systeem



## 5. **Garantieverklaring**

Zie de algemene verkoopvoorwaarden van de firma Henco Industries N. V.



## Goedkeuring

Gelet op het Ministerieel Besluit van 6 september 1991 tot inrichting van de technische goedkeuring en opstelling van typevoorschriften in de bouwsector (Belgisch Staatsblad van 29 oktober 1991);

Gelet op aanvraag ingediend door de firma Henco Industries N. V. (A/G 070819);

Gelet op het advies van de Gespecialiseerde Groep "Uitrusting" van de Goedkeuringscommissie, uitgebracht tijdens haar vergadering van 23/10/2008, op grond van het verslag voorgedragen door het Uitvoerend Bureau "Uitrusting" van de BUtgb;

Gelet op de overeenkomst ondertekend door de fabrikant, waarbij hij zich onderwerpt aan de doorlopende controle op de naleving van de voorwaarden van deze goedkeuring;

Wordt de technische goedkeuring met certificatie verleend aan de firma Henco Industries N. V. voor het PE-Xc/AlPE-Xc drukleidingsstelsel voor de verdeling van sanitair koud en warm water, voor de verdeling van verwarmingswater, voor radiatoraansluiting en voor oppervlakte-koeling en -verwarming Henco Press met perskoppelingen uit metaal of kunststof of Henco Vision met kunststof insteekverbinding

rekening houdend met de hierboven gegeven beschrijving en voorwaarden.

Deze goedkeuring dient hernieuwd te worden op 27/05/2012.

Brussel, 29-05-2009

Namens de Directeur-generaal, afwezig

Hugues DUMONT  
Adviseur-generaal



Certificaat

# KOMO®

## attest-met-productcertificaat



Nummer	K43862/D1	Vervangt	--
Uitgegeven	2007-03-01	d.d.	--
Geldig tot	Onbepaald	Pagina	1 van 3



### Hencovision systeem

## Henco Industries N.V.

#### VERKLARING VAN KIWA

Dit attest-met-productcertificaat is afgegeven op basis van RRI 5676 "Kunststof leidingssystemen van PE-X bestemd voor verwarmingsinstallaties: Radiatieraansluitingen" d.d. 1997-09-15, conform het Kiwa-Reglement voor Productcertificatie.

Kiwa verklaart dat het gerechtvaardigd vertrouwen bestaat dat:

- de door de certificaathouder vervaardigde producten aan de in dit attest-met-productcertificaat vastgelegde technische specificaties voldoen, mits zij zijn voorzien van het KOMO®-merk op de wijze zoals aangegeven in dit attest-met-productcertificaat;
- de met de gecertificeerde producten samengestelde Vision systeem prestaties leveren die in dit attest-met-productcertificaat zijn vastgelegd, mits:
  - de vervaardiging van het Vision systeem geschiedt overeenkomstig de in dit attest-met-productcertificaat vastgelegde verwerkingsmethoden;
  - voldaan wordt aan de in dit attest-met-productcertificaat omschreven toepassingsvoorwaarden.

Door Kiwa wordt in het kader van dit attest-met-productcertificaat geen controle uitgeoefend op de productie van de overige onderdelen van het Vision systeem, noch op de vervaardiging van het Vision systeem zelf.

ing. B. Meekma  
directeur Certificatie en Keuringen, Kiwa N.V.

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Advies: raadpleeg [www.kiwa.nl](http://www.kiwa.nl) om na te gaan of dit certificaat geldig is.



® is een collectief merk van Stichting Bouwkeuring.

Beoordeeld is:  
kwaliteitsysteem  
product  
prestatie product  
in toepassing  
Periodieke controle



# KOMO<sup>®</sup> attest-met-productcertificaat

K43862

## Hencovision systeem

### TECHNISCHE SPECIFICATIE

#### ONDERWERP

Kunststof leidingstelsel van Aluminium-PE-X composiet, bestaande uit buis en kunststof insteekfitting, conform beoordelingsrichtlijn BRL-K 536 deel E.

#### PRODUCTSPECIFICATIE

De in onderstaande tabel aangegeven afmetingen behoren tot dit attest-met-productcertificaat.

Diameter x wanddikte (mm)
16 x 2
20 x 2
26 x 3

Kleur fittingen: wit

Kleur buis: transparant binnen, wit buiten

#### Merken

De producten worden gemerkt met het KOMO<sup>®</sup>-merk.

De PE-X/Al buizen worden minimaal voorzien van de volgende merken:

- KOMO (of KOMO<sup>®</sup> woordmerk) + temperatuurprofiel/ontwerp (Klasse 5 / 6 bar)
- fabrieksnaam, handelsnaam, systeemnaam logo of certificaatnummer van het bijbehorend attest(systeem)certificaat.
- materiaal identificatie : PE-X/Al/buitenlaag;
- nominale buitenmiddellijn en nominale wanddikte in mm;
- productiecode.

De uitvoering van deze merken is als volgt: duidelijk en onuitwisbaar op onderlinge afstand van maximaal 2 m.

De fittingen worden minimaal voorzien van de volgende merken:

- fabrieksnaam, handelsnaam of logo;
- nominale buitenmiddellijn in mm van de bijbehorende buis;
- productie code

De kleinste verpakkingseenheid van de fittingen dient minimaal voorzien te zijn van de volgende informatie:

- KOMO (of KOMO<sup>®</sup> woordmerk);
- fabrieksnaam, handelsnaam, systeemnaam, logo of certificaatnummer van het bijbehorend attest(systeem)certificaat, overeenkomstig de markering op de bijbehorende buis.
- nominale buitenmiddellijn en nominale wanddikte in mm van de bijbehorende buis;
- materiaal identificatie indien de fitting body van kunststof is vervaardigd.

De uitvoering van de merken is als volgt: deugdelijk en duurzaam op iedere fitting/verpakking.

De mantelbuizen worden voorzien van de volgende merken\*:

- KOMO (KOMO<sup>®</sup> woordmerk of KO);
- fabrieksnaam, handelsnaam, logo, certificaatnummer van de mantelbuis of certificaatnummer van het bijbehorend attest(systeem)certificaat.

De uitvoering van de merken is als volgt: duidelijk en duurzaam op onderlinge afstanden van ten hoogste 2,5 m.



# KOMO<sup>®</sup> attest-met-productcertificaat

K43862

## Hencovision systeem

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### VERWERKING

#### Algemeen

De producent moet installatierichtlijnen verstrekken. Op of bij de verpakking moet daarnaar verwezen worden. De richtlijnen moeten zijn vastgesteld in de Nederlandse taal en tenminste aanwijzingen bevatten betreffende transport en opslag, verwerkingstemperatuur en het maken van de verbindingen.

In individuele woningverwarmingsinstallaties worden veelal zogenaamde "combiketels" toegepast. In deze ketels is geen dubbele scheiding tussen drinkwater en verwarmingsmedium aanwezig. Een lek in de enkele scheiding kan tot gevolg hebben dat er verwarmingsmedium in het verwarmde drinkwater terecht komt. In verband hiermee is het van belang, voor het geval aan het verwarmingsmedium additieven worden toegevoegd, de eis dat hieraan door Kiwa een Attest Toxicologische Aspecten (ATA) is afgegeven.

De warmte-afgifte naar de vloer is afhankelijk van de dikte van de afwerklaag en de onderlinge afstand van de buizen. De randvoorwaarden hiervoor moeten duidelijk in de richtlijnen omschreven zijn.

### PRESTATIES

1. Het systeem moet voldoende zuurstofdicht zijn.
2. Alle verbindingen zijn lek dicht en hebben voldoende klemkracht tegen externe invloeden.
3. Voor alle onderdelen van het systeem geldt dat deze ontworpen moeten zijn voor een levensduur van 50 jaar met een temperatuurprofiel volgens klasse 5 uit ISO 10508 bij een werkdruk van 6 bar absoluut.

### WENKEN VOOR DE GEBRUIKER

Inspecteer bij aflevering van de onder "technische specificatie" vermelde producten of:

- geleverd is wat is overeengekomen;
- het merk en de wijze van merken juist zijn;
- de producten geen zichtbare gebreken vertonen als gevolg van transport en dergelijke.

Keur bij aflevering van de onder "verwerking" vermelde producten of deze voldoen aan de daarin genoemde specificatie.

Indien u op grond van het hiervoor gestelde tot afkeuring overgaat, neem dan contact op met:

- Henco Industries N.V.  
en zo nodig met:
- Kiwa N.V.

Voer de opslag, het transport en de verwerking uit overeenkomstig de onder "verwerking" genoemde bepalingen.

Neem de onder "prestaties" genoemde toepassingsvoorwaarden in acht.

### LIJST VAN VERMELDE DOCUMENTEN\*

\* Voor de juiste versie van de vermelde normen wordt verwezen naar het laatste wijzigingsblad bij BRL 5606



Partner for progress

Nummer	K43864/01	Waarvat	-
Uitgegeven	2007-05-15	d.d.	-

attest-met-productcertificaat  
**Hencovision systeem**

Op grond van onderzoek, alsmede regelmatig door Kiwa uitgevoerde controles, worden de door

**Henco Industries N.V.**

geleverde producten, die gespecificeerd zijn in dit certificaat, en die voorzien zijn van het onder "Merken" aangegeven Kiwa-keur, bij aflevering geschikt te voldoen aan Kiwa-beoordelingsrichtlijn "Kunststof leidingsystemen van Aluminium/PE-X composiet, bestemd voor het transport van koud en warm drinkwater".

ing. B. Moekna  
Directeur Certificatie en Keuringen, Kiwa N.V.

Dit certificaat is afgegeven conform het Kiwa-Reglement voor productcertificatie.

Dit certificaat bestaat uit 3 pagina's.  
Openbaarmaking van het certificaat is toegestaan.

Kiwa N.V.  
Certificatie en Keuringen  
Str. W. Druytsdijken 273  
Postbus 70  
2380 AB RIJSWIJK ZH  
  
Tel. 070 414 44 00  
Fax 070 414 44 20  
E-mail cert@kiwa.nl  
www.kiwa.nl

Onderneming  
Henco Industries N.V.  
Toekomstlaan 27  
2200 HERENTALS  
België  
Tel. +32 14285660  
Fax +32 14218712  
E-mail info@henco-ind.com  
Internet www.henco.be







Pagina	2	Nummer	K43864/01	Vervangt	-
		Uitgegeven	2007-05-15	D.d.	-

## Hencovision systeem

### PRODUCTSPECIFICATIE

#### Algemeen

Kunststof leidingsysteem van Aluminium-PE-X composiet, bestaande uit buis en kunststof insteekfitting, conform beoordelingsrichtlijn BRL-K 536 deel E.

#### Nadere specificatie

De in onderstaande tabel aangegeven afmetingen behoren tot dit attest-met-productcertificaat.

Diameter x wanddikte (mm)
16 x 2
20 x 2
26 x 3

Kleur fittingen: wit

Kleur buis: transparant binnen, wit buiten.

### TOXICOLOGISCHE EISEN

#### Toelating:

De in dit systeem toegepaste buizen en fittingen zijn toegelaten op basis van de eisen die zijn vastgelegd in de "Regeling materialen en chemicaliën leidingwatervoorziening" (gepubliceerd in de Staatscourant). De ATA-criteria zijn vastgelegd in de bijbehorende productcertificaten

### LOGISTIEK

Productie en assemblage is vastgelegd in de bijlage van de attest-met-productcertificatie-overeenkomst.

### TOEPASSING EN GEBRUIK

De producten zijn bestemd om te worden toegepast voor de aanleg van leidingsystemen voor het transport van koud en verwarmd drinkwater met een temperatuurprofiel volgens klasse 2 uit ISO 10508 en een toelaatbare werkdruk van maximaal 10 bar.



A-2/2

DW-8501BS0520

water supply

Typ <i>type</i>	Technische Daten <i>technical data</i>	Bemerkungen <i>remarks</i>
Henco Vision	Durchmesser: 16,0 x 2,0 mm	Aluminiumschichtdicke: 0,4 mm
Henco Vision	Durchmesser: 20,0 x 2,0 mm	Aluminiumschichtdicke: 0,4 mm
Henco Vision	Durchmesser: 26,0 x 3,0 mm	Aluminiumschichtdicke: 0,5 mm

**zertifizierte Bauteile / Werkstoffe**  
*certified components*

Registr.-Nr. <i>registration no.</i>	Bauteil (Produktart) <i>component</i>	Modell/Typ <i>model/type</i>	Hersteller <i>manufacturer</i>
DW-8241AU2292	PE-Xc/Al/PE-Xc-Rohr, Fert.-Gr. 1	Henco RIXc/Henco; Henco RIXc	Henco Industries N.V.

**Verwendungshinweise / Bemerkungen**  
*hints of utilization / remarks*

zu verwendende Steckverbinder: Kunststoff (PVDF), Typ: M-KV, Hersteller: Henco Industries N.V., B-2200 Hemelste



Pagina	3	Nummer	K43864/01	Vervangt	-
		Uitgegeven	2007-05-15	D.d.	-

## Hencovision systeem

---

### MERKEN

De **PE-X/Al buizen** worden minimaal voorzien van de volgende merken:

- Kiwa klasse 2/10 bar
- fabrieksnaam, handelsnaam, systeemnaam logo of certificaatnummer van het bijbehorend attest(systeem)certificaat.
- materiaal identificatie : PE-X/Al/buitenlaag;
- nominale buitenmiddellijn en nominale wanddikte in mm;
- productiecode.

De uitvoering van deze merken is als volgt: duidelijk en onuitwisbaar op onderlinge afstand van maximaal 2 m.

De **fittingen** worden minimaal voorzien van de volgende merken:

- fabrieksnaam, handelsnaam of logo;
- nominale buitenmiddellijn in mm van de bijbehorende buis;
- productie code

De kleinste verpakkingseenheid van de fittingen dient minimaal voorzien te zijn van de volgende informatie:

- Kiwa;
- fabrieksnaam, handelsnaam, systeemnaam, logo of certificaatnummer van het bijbehorend attest(systeem)certificaat, overeenkomstig de markering op de bijbehorende buis.
- nominale buitenmiddellijn en nominale wanddikte in mm van de bijbehorende buis;

### WENKEN VOOR DE AFNEMER

1. Inspecteer bij de aflevering:
  - 1.1 geleverd is wat is overeengekomen;
  - 1.2 het merk en wijze van merken juist zijn;
  - 1.3 de producten geen zichtbare gebreken vertonen als gevolg van transport en dergelijke.
2. Indien u op grond van het hiervoor gestelde tot afkeuring overgaat, neem dan contact op met:
  - 2.1 Henco Industries N.V.  
en zo nodig met:
  - 2.2 Kiwa N.V.
3. Raadpleeg voor de juiste wijze van opslag en transport de verwerkingsrichtlijnen van de producent.
4. Controleer of dit certificaat nog geldig is, raadpleeg hiertoe [www.kiwa.nl](http://www.kiwa.nl).



# 1 PIPES

## 1 1.2 Technical data

### 1.2.1 Technical profile of Henco multilayer pipe

Outer diameter (mm)	14	16	16 RDXc	18	20	20 RDXc	26	26 RDXc	32	40	50	63
Inner diameter (mm)	10	12	12	14	16	16	20	20	26	33	42	54
Wall thickness (mm)	2	2	2	2	2	2	3	3	3	3,5	4,0	4,5
Thickness of aluminium (mm)	0,4	0,4	0,2	0,4	0,4	0,28	0,5	0,28	0,7	0,7	0,9	1,2
Max. working temperature (°C)	95	95	95	95	95	95	95	95	95	95	95	95
Max. working pressure (bar)	10	10	10	10	10	10	10	10	10	10	10	10
Coefficient of thermal conduction (W/m/K)	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43
Linear expansion coefficient (mm/m/K)	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025
Surface roughness of inner pipe (µ)	7	7	7	7	7	7	7	7	7	7	7	7
Oxygen diffusion (mg/l)	0	0	0	0	0	0	0	0	0	0	0	0
Smallest bending radius manual / external spiral spring (mm)	5xDu	5xDu	8xDu	5xDu	5xDu	7xDu	5xDu	7xDu	*	*	*	*
Smallest bending radius with internal spiral spring (mm)	3xDu	3xDu	8xDu	3xDu	3xDu	5xDu	3xDu	5xDu	*	*	*	*
Degree of cross-linking (%)	60	60	60	60	60	60	60	60	60	60	60	60
Weight (kg/m)	0,108	0,125	0,101	0,132	0,147	0,129	0,252	0,261	0,39	0,528	0,766	1,155
Water volume (l/m)	0,072	0,113	0,113	0,154	0,201	0,201	0,314	0,314	0,53	0,803	1,32	2,042
Per coil (m) or on request	100 200	50 100 200	100 200	100 200	100	100	50	50	50	-	-	-
Per straight length	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5

\* necessary to use elbow fittings

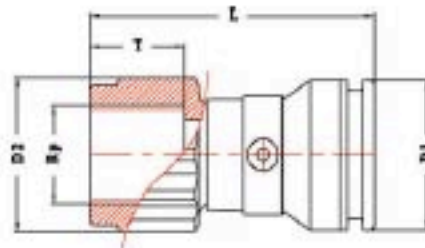




# HENCO VISION



## GAMMA



Artikelnummer	Type	L	D1	D2	Rp	T
188K-1804	18x1/2"	64	28	33	1/2"	14
188K-2004	20x1/2"	63	33	33	1/2"	14
188K-2005	20x3/4"	68	33	40	3/4"	18
188K-2605	26x3/4"	67	40	40	3/4"	18
188K-2606	26x1"	70	40	46	1"	18



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 Tel. +32 14 28 58 60  
 e-mail: [info@henco.be](mailto:info@henco.be)  
[www.henco.be](http://www.henco.be)

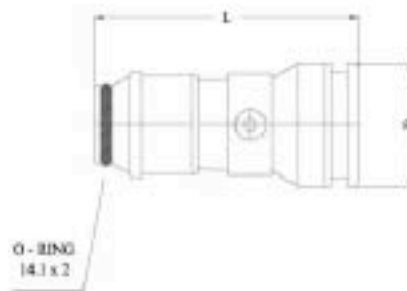


# HENCO VISION



## GAMMA VISION VERDELERS

Stel zelf je verdeler samen ...



Artikelnummer	Type	L	D
198K-1605	1605	60	28
198K-2005	2005	62	33



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 2200 Herentals  
 Tel. +32 14 28 58 60  
 e-mail: [info@henco.be](mailto:info@henco.be)  
[www.henco.be](http://www.henco.be)



HENCO VISION



## GAMMA VISION VERDELERS

Stel zelf je verdeler samen ...



Artikelnummer	Type
SK-B05	B05



Toekomstlaan 27  
2200 Herentals  
Tel. +32 14 28 58 60  
e-mail: [info@henco.be](mailto:info@henco.be)  
[www.henco.be](http://www.henco.be)



HENCO VISION



GAMMA



Artikelnummer	
Stop clip 18	
Stop clip 20	
Stop clip 28	





# HENCO VISION



## GAMMA VISION VERDELERS

Stel zelf je verdeler samen ...



Artikelnummer	Type	L	D	T
VS-ENDCAP	ENDCAP	29	30	Special thread

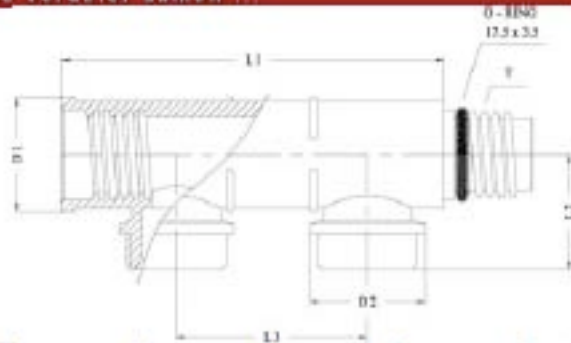


# HENCO VISION



## GAMMA VISION VERDELERS

Stel zelf je verdeler samen ...



Artikelnummer	Type	L1	L2	L3	D1	D2	T
VSKEK-0502	0502	100	80	50	30	30	Special thread

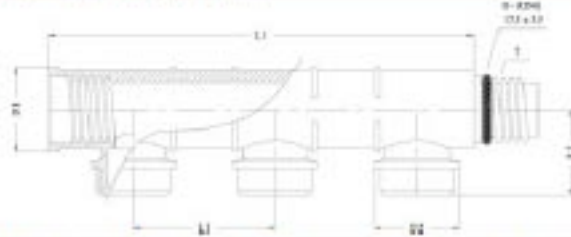


## HENCO VISION



### GAMMA VISION VERDELERS

Stel zelf je verdeler samen ...



Artikelnummer	Type	L1	L2	L3	D1	D2	T
VSKEK-0503	0503	150	30	50	30	30	Special thread

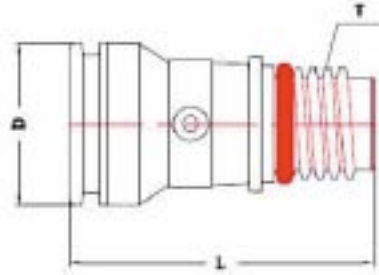


HENCO VISION



## GAMMA VISION VERDELERS

Stel zelf je verdelers samen ...



Artikelnummer	Type	L	D	T
WSK-20	20	65	33	Special thread
WSK-26	26	62	40	Special thread



HENCO VISION



GAMMA



Artikelnummer	
Vision set 18	
Vision set 20	
Vision set 26	



Type: 19PK



Perskoppeling met euroconus aansluiting  
Press fit to eurocone  
Raccord avec raccord à visser eurocone  
Pressfitting mit Eurokonus

Article number	Bag / Box	Type	Subgroup
• 19PK-1605	10 pc. / 80 pc.	16x3/4"	
• 19PK-2005	10 pc. / 80 pc.	20x3/4"	

Type: 27PK



Bocht dubbel 45°  
45° bend  
Coude 45°  
Winkel 45°

Article number	Bag / Box	Type	Subgroup
27PK-4040	5 pc. / 25 pc.	40x40	
27PK-5050	1 pc. / 10 pc.	50x50	
27PK-6363	1 pc. / 5 pc.	63x63	

Type: 28PK-04



Bogel voor 28PK-2PK1604, 28PK-6PK1604 en 28PK-13PK160416  
Clip for 28PK-2PK1604, 28PK-6PK1604 en 28PK-13PK160416  
Attache pour 28PK-2PK1604, 28PK-6PK1604 et 28PK-13PK160416  
Bügel für 28PK-2PK1604, 28PK-6PK1604 en 28PK-13PK160416

Article number	Box	Type	Subgroup
28PK-04	50 pc.	1/2"	

*Now model: rainbroodf*

Type: 28PK-2PK1604



Dubbele muurplaat 153mm asafstand voor art. 2PK-1604  
Double backplate 153mm centres for art. 2PK-1604  
Culasse double, ortraxe 153mm pour art. 2PK-1604  
Wandwinkel doppelt 153mm Abstand für Art.2PK-1604

Article number	Bag / Box	Type	Subgroup
28PK-2PK1604BP *	2 pc. / 10 pc.	2x(18x1/2")	

*\* With black plug BPD4 1/2" male Now model: rainbroodf*



Type: ENDCAP



Eindstop voor afdrukken leidingsysteem, herbruikbaar  
End cap, temporary air vent plug, reusable  
Bouchon purgair pour tubes, réutilisable  
Stopf zum abdruken Rohrsysteme, wieder verwendbar

Article number	Packing	Type	Subgroup
ENDCAP16	1 pc.	Ø 16	

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11

Type: DRILLY



Drilly voor afdrukken leidingsysteem, herbruikbaar  
Drilly temporary air vent plug, reusable  
Drilly pour tester le système de tubes, réutilisable  
Drilly zum abdruken Rohrsysteme, wieder verwendbar

Article number	Packing	Type	Subgroup
DRILLY14	1 pc.	Ø 14	
DRILLY16	1 pc.	Ø 16	
DRILLY18	1 pc.	Ø 18	
DRILLY20	1 pc.	Ø 20	
DRILLY26	1 pc.	Ø 26	
DRILLY32	1 pc.	Ø 32	

Type: PLUG



Afdrukplug  
Plug  
Bouchon  
Stopf

Article number	Bag	Type	Subgroup
PLUG04-B80	20 pc.	1/2" - 80 mm blue	
PLUG04-R80	20 pc.	1/2" - 80 mm red	
PLUG05-B80	20 pc.	3/4" - 80 mm blue	
PLUG05-R80	20 pc.	3/4" - 80 mm red	
PLUG04-B55	20 pc.	1/2" - 55 mm blue	
PLUG04-R55	20 pc.	1/2" - 55 mm red	

Type: RRW-S



Stangenmachine voor stangen max. Ø26  
Pipe straightener max Ø26  
Machine à produire des barres Ø26 au max.  
Stangenmaschine für die Stangen max. Ø26

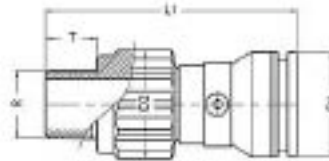
Article number	Packing	Type	Subgroup
RRW-S	1 pc.	RRW	



# HENCO VISION



## GAMMA



Artikelnummer	Type	L	D1	D2	R	T
175K-1604	16x1/2"	76	28	33	1/2"	14
175K-2004	20x1/2"	76,5	33	33	1/2"	14
175K-2005	20x3/4"	78	33	40	3/4"	16
175K-2605	26x3/4"	80	40	40	3/4"	16
175K-2606	26x1"	82	40	46	1"	18

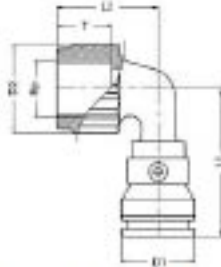


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HENCO VISION



Artikelenummer	Type	L1	L2	D1	D2	D3	T
88K-1004	18x17°	88	42	24	22	12°	14
88K-2004	30x17°	88	40	20	22	10°	14
88K-2006	30x24°	81	48	20	40	24°	18
88K-3004	36x24°	88	48	40	40	24°	18



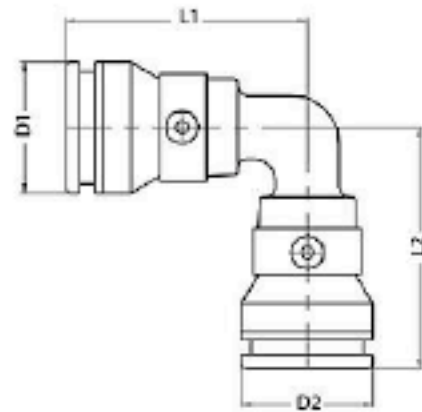
Tekortellen 27  
 2300 Herestraat  
 Tel: +32 (0) 14 20 88 60  
 e-mail: info@henco.be  
 www.henco.be



## HENCO VISION



### GAMMA



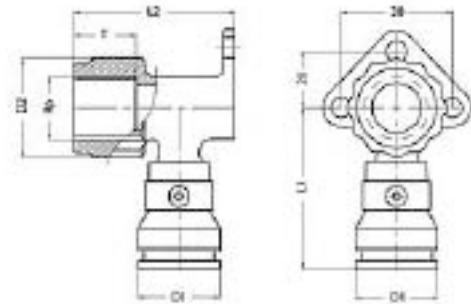
Artikelnummer	Type	L1	L2	D1	D2	
18K-1616	16X16	52	52	28	28	
18K-2020	20X20	53	53	33	33	
18K-2626	26X26	59	59	40	40	



## HENCO VISION



### GAMMA



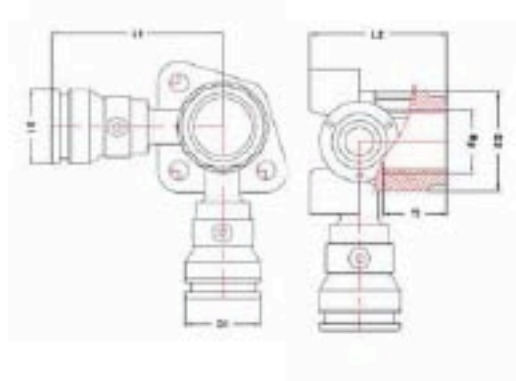
Artikelnummer	Type	L1	L2	D1	D2	Rp	T
20K-1604	16X1/2"	54	55	28	33	1/2"	14
20K-2004	20X1/2"	57	60	33	33	1/2"	14
20K-2005	20X3/4"	62	61	33	40	3/4"	16
20K-2605	26X3/4"	63	66	40	40	3/4"	16



## HENCO VISION



### GAMMA



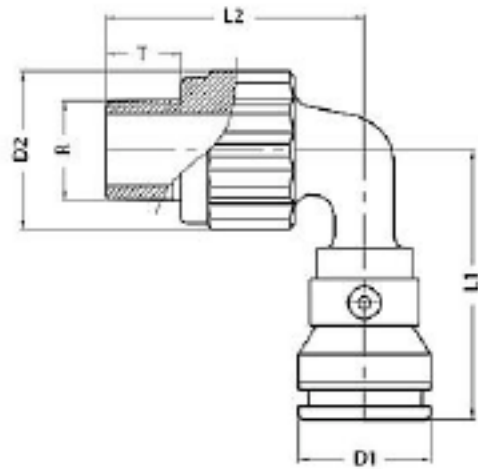
Artikelnummer	Type	L1	L2	D1	D2	Rp	T
30K-160416	16X1/2"X16	62	42	28	33	1/2"	14
30K-200420	20X1/2"X16	62	44	33	33	1/2"	14



# HENCO VISION



## GAMMA



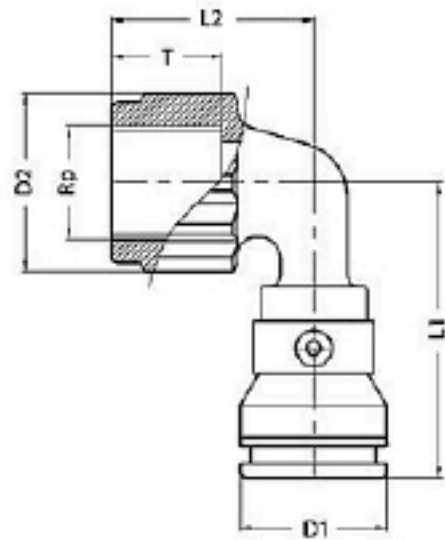
Artikelnummer	Type	L1	L2	D1	D2	R	T
58K-1604	16X1/2"	57	54	28	33	1/2"	14
58K-2004	20X1/2"	60	57	33	33	1/2"	14
58K-2005	20x3/4"	63	58	33	40	3/4"	16
58K-2605	26x3/4"	64	62	40	40	3/4"	16



## HENCO VISION



### GAMMA



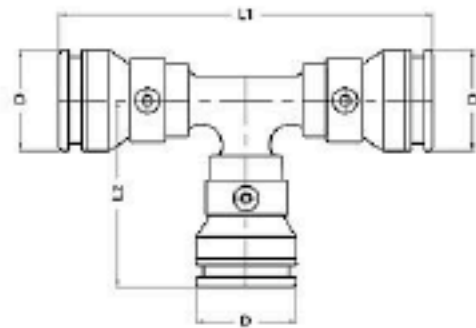
Artikelnummer	Type	L1	L2	D1	D2	Rp	T
68K-1604	16x1/2"	56	40	28	33	1/2"	14
68K-2004	20x1/2"	58	40	33	33	1/2"	14
68K-2005	20x3/4"	63	48	33	40	3/4"	16
68K-2605	26x3/4"	65	48	40	40	3/4"	16



## HENCO VISION



### GAMMA



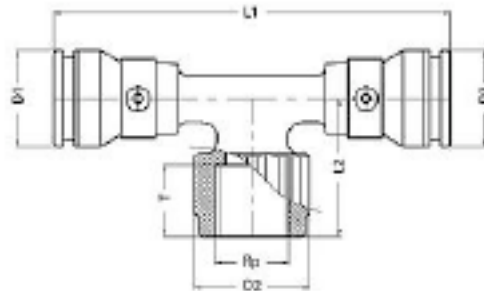
Artikelnummer	Type	L1	L2	D	
90K-161616	16X16X16	101	50,5	28	
90K-202020	20X20X20	106,5	53	33	
90K-262626	26X26X26	117	59	40	



## HENCO VISION



## GAMMA



Artikelnummer	Type	L1	L2	D1	D2	D3	Rp	T
139K-160416	16x1/2"x16	116	39	28	33	28	1/2"	14
139K-200420	20x1/2"x20	117	39	33	33	33	1/2"	14
139K-200520	20x3/4"x20	120	45	33	40	33	3/4"	16
139K-260420	26x1/2"x20	118	42	40	33	33	1/2"	14
139K-260426	26x1/2"x26	120	42	40	33	40	1/2"	14
139K-260526	26x3/4"x26	121	44	40	40	40	3/4"	16

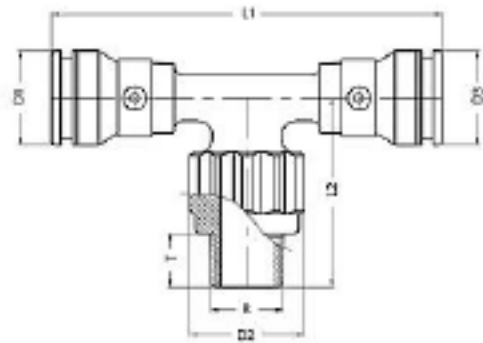




## HENCO VISION



### GAMMA



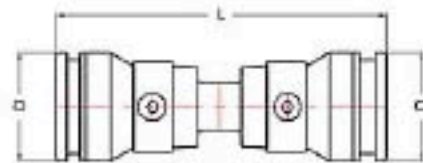
Artikelnummer	Type	L1	L2	D1	D2	D3	R	T
149K-160416	16x1/2"x16	111	54	28	33	28	1/2"	14
149K-200420	20x1/2"x20	111	54	33	33	33	1/2"	14
149K-260426	26x1/2"x26	116	57	40	33	40	1/2"	14



## HENCO VISION



### GAMMA



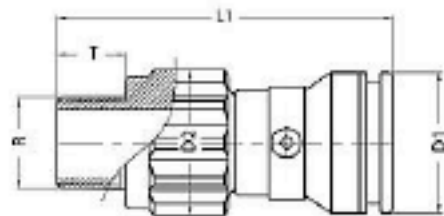
Artikelnummer	Type	L	D	
158K-1516	16x16	83,5	28	
158K-2020	20x20	85	33	
158K-2526	25x26	90	40	



## HENCO VISION



### GAMMA



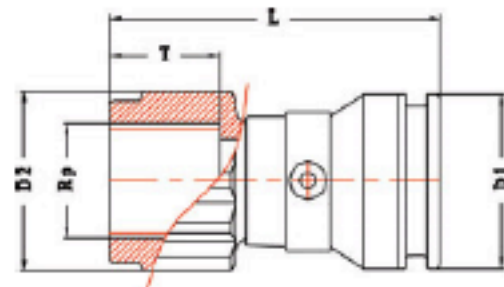
Artikelnummer	Type	L	D1	D2	R	T	
179K-1604	16x1/2"	76	28	33	1/2"	14	
179K-2004	20x1/2"	76,5	33	33	1/2"	14	
179K-2005	20x3/4"	78	33	40	3/4"	16	
179K-2605	26x3/4"	80	40	40	3/4"	16	
179K-2606	26x1"	82	40	46	1"	18	



## HENCO VISION



### GAMMA



Artikelnummer	Type	L	D1	D2	Rp	T	
189K-1604	16x1/2"	64	28	33	1/2"	14	
189K-2004	20x1/2"	63	33	33	1/2"	14	
189K-2005	20x3/4"	68	33	40	3/4"	16	
189K-2605	26x3/4"	67	40	40	3/4"	16	
189K-2606	26x1"	70	40	46	1"	18	

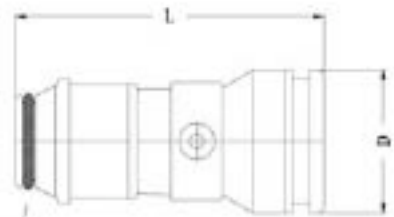


# HENCO VISION



## GAMMA VISION VERDELERS

Stel zelf je verdeler samen ...



O-RING  
14.1 x 2

Artikelnummer	Type	L	D	
190K-1605	1605	60	28	
190K-2005	2005	62	33	



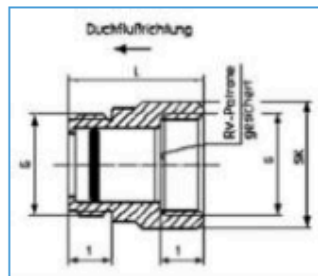
**K 2545**  
**AFTAPPER (buitendraad)**



Klik hier voor technische informatie

Artikel-nr.	Maat	Materiaal	Opmerking
049793.7	1/4	Messing / Kunststof	Met draaibare uitloop, losse fiberring

**S 8089**  
**KEERKLEP (buitendraad x binnendraad)**

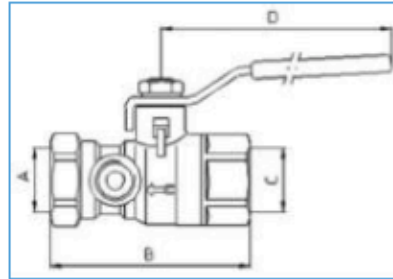


Klik hier voor technische informatie

Artikel-nr.	Maat	Materiaal	Opmerking
048891.7	DN 15 (1/2)	Messing, verchroomd	EB, Pijl = stroomrichting water Bi > Bu



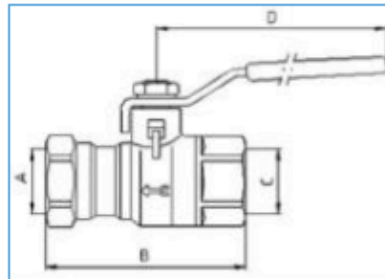
**K 2310**  
**KOGELKRAAN MET AFTAPGELEGENHEID (2x binnendraad)**



[Klik hier voor technische informatie](#)

Artikel-nr.	Maat	Materiaal
050402.0	DN15 (1/2)	Messing
050408.6	DN20 (3/4)	Messing

**K 2300**  
**KOGELKRAAN ZONDER AFTAPGELEGENHEID (2x binnendraad)**

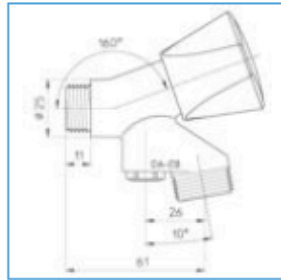


[Klik hier voor technische informatie](#)

Artikel-nr.	Maat	Materiaal
050401.1	DN15 (1/2)	Messing
050407.5	DN20 (3/4)	Messing
050441.6	DN25 (1)	Messing



**B 3500**  
**LUXE BELUCHTERKRAAN PREMIUM MET KEERKLEP (DA-EB)**



[Klik hier voor technische informatie](#)

Artikel-nr.	Maat	Materiaal	Opmerking
058880.8	1/2 x 3/4	Messing, verchroomd	Met knop Premium (zwart)

**V 1151.25**  
**SEPP DUBBELDIENST TAPKRAAN DIN-MODEL MET BELGAQUA KEUR**



[Klik hier voor technische informatie](#)

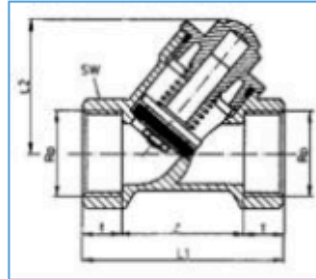
Artikel-nr.	Maat	Materiaal
049600.1	1/2	Messing, mat verchroomd
049601.2	1/2	Messing, verchroomd
049602.3	3/4	Messing, mat verchroomd
049603.4	3/4	Messing, verchroomd
049605.6	1	Messing, mat verchroomd
049606.7	1	Messing, verchroomd





S 1551

TERUGSLAGKLEP (2x binnendraad)

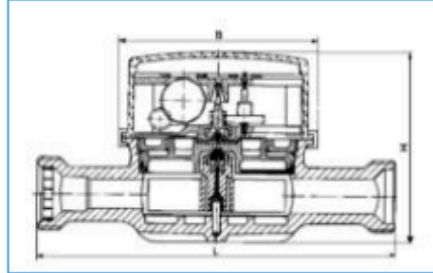


[Klik hier voor technische informatie](#)

Artikel-nr.	Maat	Materiaal	Opmerking
318800.9	DN 15 (1/2)	Messing, blank	EB, Pijl = stroomrichting water
318801.1	DN 20 (3/4)	Messing, blank	EB, Pijl = stroomrichting water
318802.0	DN 25 (1)	Messing, blank	EB, Pijl = stroomrichting water
318803.1	DN 32 (1.1/4)	Messing, blank	EB, Pijl = stroomrichting water
318804.2	DN 40 (1.1/2)	Messing, blank	EB, Pijl = stroomrichting water
318805.3	DN 50 (2)	Messing, blank	EB, Pijl = stroomrichting water
318806.4	DN 65 (2.1/2)	Messing, blank	EB, Pijl = stroomrichting water
318807.5	DN 80 (3)	Messing, blank	EB, Pijl = stroomrichting water



**R 2511**  
**WATERMETER MET PULSE OUTPUT ETR IA**



**Klik hier voor technische informatie**

- Enkelstraalsmeter voor drinkwater
- Maximale temperatuur: koudwatermodel: 30°C warmwatermodel: 90°C
- Maximale druk: 16bar
- Maximale voltage: 30 V DC en 0,2 A
- kabellengte: 1,5 meter

Artikel-nr.	Maat	Uitvoering	Opmerking
640343.0	G3/4 - 1,5m <sup>3</sup> /h	Koudwater, 10 liter per pulse	Verchroomd
640338.6	G3/4 - 1,5m <sup>3</sup> /h	Koudwater, 100 liter per pulse	Verchroomd
640339.7	G3/4 - 1,5m <sup>3</sup> /h	Warmwater, 100 liter per pulse	Verchroomd
640345.2	G1 - 2,5m <sup>3</sup> /h	Koudwater, 10 liter per pulse	Verchroomd
640341.9	G1 - 2,5m <sup>3</sup> /h	Koudwater, 100 liter per pulse	Verchroomd
640342.1	G1 - 2,5m <sup>3</sup> /h	Warmwater, 100 liter per pulse	Verchroomd



D 1104  
VERLOOPNIPPEL (2x buitendraad)



Klik hier voor technische informatie

Artikel-nr.	Maat	Materiaal
041132.3	1/4 x 1/8	Messing DZR, blank
045331.0	3/8 x 1/8	Messing DZR, blank
045347.5	3/8 x 1/4	Messing DZR, verchroomd
045332.1	3/8 x 1/4	Messing, blank
041133.4	3/8 x 1/4	Messing DZR, blank
041134.5	1/2 x 1/4	Messing DZR, blank
041135.6	1/2 x 3/8	Messing DZR, blank
045343.1	1/2 x 3/8	Messing, blank
045349.7	1/2 x 3/8	Messing DZR, verchroomd
045352.1	3/4 x 1/4	Messing, blank
041136.7	3/4 x 3/8	Messing DZR, blank
045353.0	3/4 x 3/8	Messing, blank
045351.9	3/4 x 3/8	Messing, verchroomd
045355.2	3/4 x 1/2	Messing DZR, verchroomd
045354.1	3/4 x 1/2	Messing, blank
041131.2	3/4 x 1/2	Messing DZR, blank
041240.1	3/4 x 1/2	Messing DZR, verchroomd
041137.8	1 x 1/2	Messing DZR, blank
041138.9	1 x 3/4	Messing DZR, blank
045365.1	1 x 3/4	Messing, blank
045357.4	1 x 3/4	Messing DZR, verchroomd
041742.8	1, 1/4 x 1/2	Messing, blank
045375.0	1, 1/4 x 3/4	Messing, blank
045376.1	1, 1/4 x 1	Messing, blank
041138.1	1, 1/4 x 1	Messing DZR, blank
041744.1	1, 1/2 x 3/4	Messing, blank
045386.0	1, 1/2 x 1	Messing DZR, blank
041140.0	1, 1/2 x 1, 1/4	Messing DZR, blank
041745.0	2 x 1	Messing, blank
041746.1	2 x 1, 1/4	Messing, blank
045366.1	2 x 1, 1/2	Messing DZR, blank
041746.3	2, 1/2 x 2	Messing, blank



21 10 00 P... ..





## Grundfos ALPHA2

Met veel trots introduceert Grundfos de nieuwe generatie energiezuinige circulatiepompen – de ALPHA2.

De ALPHA2 is een revolutie van formaat in een kleine verpakking. Met een A-label op de energieschaal, is de ALPHA2 binnen de circulatiepompen markt de meest verantwoorde keuze voor uw omgeving.

De ALPHA2 is tot nog toe de meest compacte Grundfos circulatiepomp en is ideaal voor installatie in krappe ruimtes. Met de ALPHA2 wordt ook voor het eerst de AUTOADAPT functie voor circulatiepompen in woningen geïntroduceerd. De AUTOADAPT functie kiest altijd automatisch het beste werkpunt en is hiermee de ideale keuze in meer dan 80% van de situaties. Indien u een specifieke instelling wenst dan is dit nog steeds mogelijk, indien u uw systeemvereisten kent. Ontdek de nieuwe standaard in milieuvriendelijke pomptechnologie.



## Haal uw voordeel uit het label

Vervanging door een A-label circulatiepomp levert de hoogste besparingen op.

Energiezuinigheid is een verkoopargument dat steeds belangrijker wordt. Informeer daarom uw klanten over de besparing die een A-Label circulatiepomp kan opleveren en dat deze pomp daarnaast bijdraagt aan een schoner milieu. A-label pompen verminderen het energieverbruik tot 80% in vergelijking met traditionele circulatiepompen en naar schatting zijn er momenteel 120 miljoen van deze energieverslindende circulatiepompen in Europa geïnstalleerd.

Gemiddeld jaarlijks energieverbruik in Europese huishoudens in kWh

Circulatiepomp

D 550

A 115

Wasmachine

G 398

A 236

Koelkast

G 305

A 115



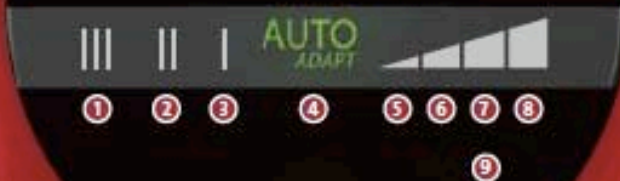


## Werking

Het verbeterde rendement heeft ons in staat gesteld hetzelfde debiet  $Q$  en dezelfde opvoerhoogte  $H$  te leveren en tegelijkertijd het energieverbruik te reduceren. In onderstaand voorbeeld van een 4 meter pomp kunt u duidelijk de overeenkomst tussen de menustructuur en de verschillende instellingen zien.

## ALPHA2 Technische gegevens

Voedingsspanning	1x230 V -10%/+6%, 50Hz, PE
Motor bevoeding	Geen externe bevoeding
Beschermingsklasse	IP 42
Isolatieklasse	F
Rel. vochtigheidsgraad	Max. 95%
Omgevingstemperatuur	0°C tot +40°C
Medium temperatuur	+2°C tot +110°C
Temperatuur klasse	TF 110 volgens de norm CEN 335-2-51
Systeem druk	Max. 1.0 MPa, 10 bar, 10,2 mWk
Voordruk	+75°C 0,005 MPa, 0,05 bar, 0,5 mWk +90°C 0,028 MPa, 0,28 bar, 2,8 mWk +110°C 0,108 MPa, 1,08 bar, 10,8 mWk
EMC	EN 61 000-6-1 and EN 61 000-6-3
Geluidsniveau	Lager dan 43db(A)
Opgenomen vermogen	Min 5W, Max 22-45W
inbouwlengte	130, 180 mm
Materiaal pomphuls	Gietijzer / Roestvaststaal





## Van Uitstekend naar Uitmuntend!

Het elegante en oogstrelende design is hét kenmerk bij uitstek van de ALPHA2 geworden. Doordat de elektronica binnenin de pomp is geïntegreerd is de ALPHA2 nog compacter dan zijn voorganger, de ALPHA Pro. De volledig nieuwe motortechnologie en de revolutionaire AUTOADAPT-technologie zorgen ervoor dat het energieverbruik nog verder wordt gereduceerd.

Hieronder gaan we wat verder in op de constructie, de werking en enkele technische specificaties van de ALPHA2.



## Voordelen van de ALPHA2



### A Compact

De compacte vorm van de ALPHA2 maakt het mogelijk om deze pomp te installeren op plaatsen waar de ALPHA Pro niet kan worden geplaatst.



### B AUTOADAPT

De technologie AUTOADAPT zorgt ervoor dat de pomp het juiste aantal omwentelingen per minuut bereikt en houdt zich aan de ingestelde snelheid van de motor.



### C Geïntegreerde elektronica

Door de elektronica te integreren in de ALPHA2 is de pomp nog compacter en eenvoudiger te installeren. De elektronica is beschermd en wordt geïntegreerd met de motor in een speciale constructie.



### D Hoog rendement

De nieuwe motor van de ALPHA2 zorgt voor een efficiëntere werking van de pomp. Het rendement is verbeterd en het energieverbruik is lager.



① Display  
Het eenvoudige afleesbare LED display geeft continu het huidige energieverbruik weer.



② RV5 pomphuis  
De nieuwe roestvaststaal versie biedt een betrouwbare bescherming tegen corrosie in huishoudelijke warmwatersystemen en zeer veeleisende verwarmingssystemen.



③ Nachtbedrijf functie  
In daarvoor geschikte systemen wordt door de nachtbedrijf functie het energieverbruik tot een minimum beperkt.

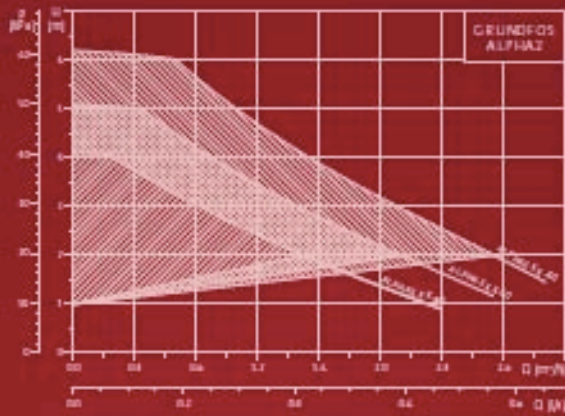


④ Eenvoudige bediening  
De innovatieve one-touch bediening zorgt voor eenvoudige instelling.

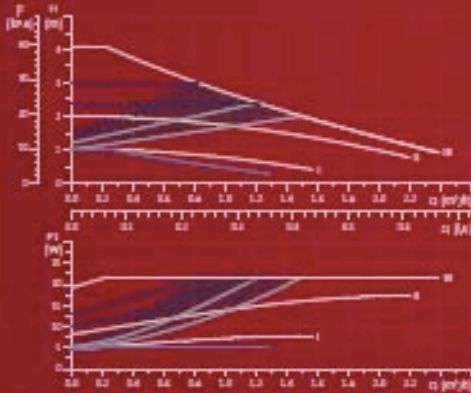




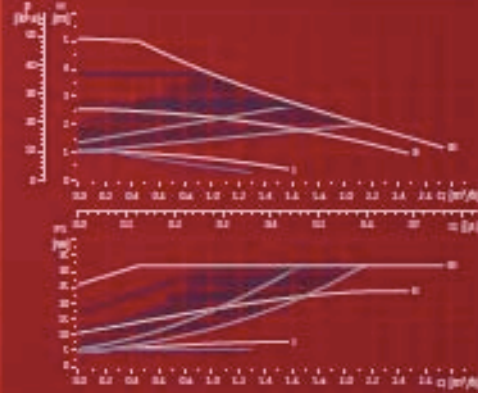
# Capaciteitscurves



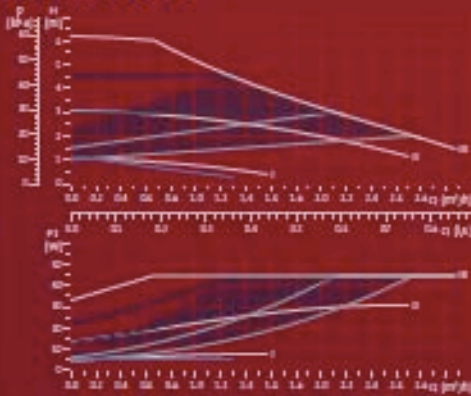
## ALPHA2 XX-40



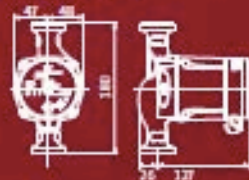
## ALPHA2 XX-50



## ALPHA2 XX-60

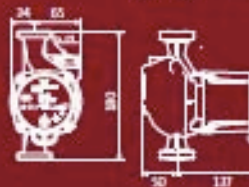


## Afmetingen



ALPHA2 25-40(N)  
 25-60(N)  
 32-40, 32-60

Inbouwmaat:  
 ook beschikbaar 130 mm



ALPHA2 25-40A /  
 ALPHA2 25-60 A



## De A generatie

			
	ALPHA2	MAGNA	Mini MAGNA
			
Variabele Toerental	•	•	•
AUTOADAPT	•	•	•
BUS Communicatie mogelijk		•	•
IR Communicatie met R100		•	•
Extern relais		•	•
Bedrijf/Storing signaal	•	•	•
ALPHA Power plug	•		•
Permanente magneet rotor	•	•	•
Automatische nachtbedrijf functie	•	•	•
RVS Pomphuis beschikbaar	•	•	•
Pomphuis met autom. ontluichtingsventiel	•		

## www.energyproject.com

Meer belangstelling? Bezoek dan [www.energyproject.com](http://www.energyproject.com) – Het Grundfos forum met advies over energiebesparingen in woningen.



U vindt er tips, trucs en handige wetenswaardigheden die u ondersteunen bij de verkoop. Gebruik bijvoorbeeld de handige calculator op de website om energiebesparingen in het huis van uw klant te berekenen.

Verder zal u ontdekken dat energie besparen niet enkel om het besparen van geld draait maar ook om het sparen van het milieu.

Adviseer ook uw klanten om de website [www.energyproject.com](http://www.energyproject.com) te bezoeken. Er is een speciale particulieren sectie waarin alles duidelijk wordt uitgelegd.



## Grundfos maakt selectie eenvoudig

### De juiste keuze maken

Huis in m <sup>2</sup>	Radiator systeem $\Delta t$ 20°C m <sup>3</sup> /h	Pomptype	Vloerverwarming $\Delta t$ 5°C m <sup>3</sup> /h	Pomptype
80-120	0.4	ALPHA2 XX-40	1.5	ALPHA2 XX-40
120-160	0.5	ALPHA2 XX-60	2.0	ALPHA2 XX-40
160-200	0.6	ALPHA2 XX-60	2.5	ALPHA2 XX-60
200-240	0.7	MAGNA 25-60	3.0	MAGNA 25-100
240-280	0.8	MAGNA 25-60	3.5	MAGNA 25-100

### Overzicht toepassingen

Applicatie	Pomptype								
	Een- pijpssystemen	MAGNA N	ALPHA2	ALPHA2 N	ALPHA+	UP/E/UPS	Comfort/UP-N/B	LP Solar	Stand and spare head
Eenpijpssysteem	x	x	x		o	o			
Tweepijpssysteem	x	x	x		o	o			
Vloerverwarming	x	x	x	x	o	o			
Warm water recirculatie		x		x			x		
Warmwater							x		
Zonne-energie systemen	o	x	o	x				x	
Verwarmingketels met geïntegreerde S-pomp									x
Verwarmingketels met een externe pomp		x	x		o	o			
<b>Warmtebron</b>									
Warmtewisselaar	x	x	x	x	o	o			
Stadsverwarming	x	x	x	x	o	o			
Zonne-energie	o	o	o	x				x	
Warmtepomp	o	x	o	x				x	

x = Beste keuze  
o = Tweede keuze



# GRUNDFOS CMBE

## DE IDEALE OPLOSSING VOOR HUISHOUDELIJKE DRUKVERHOOGING

### Comfortabel, stil en zuinig

De zeer efficiënte elektrische motor met geïntegreerde frequentiewormer zorgt voor de benodigde drukverhoging aan extreem lage werkingskosten. Door de constante drukregeling worden lastige drukschommelingen bij verschillende debieten vermeden. De geoptimaliseerde motorventilator van de Grundfos CMBE is ook erg stil met slechts 35 dBA in werking.

### Robuust en duurzaam

Basis voor de CMBE is de beproefde industriële centrifugaalpomp CME-1. De roestvrijstalen hydraulica is zelfs zeer goed bestand tegen agressieve media en zorgt voor een lange en storingsvrije werking van de installatie.

### Eenvoudige installatie en bediening

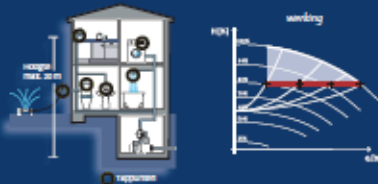
De CMBE is eenvoudig te installeren. De motorbeveiliging is geïntegreerd en gewenste constante druk kan gemakkelijk worden ingesteld op het bedieningspaneel op de motor of via de K100 Infrarood afstandsbediening. De compacte afmetingen van CMBE maken ook installatie mogelijk in krappe ruimtes.

### Geïntegreerde droogloopbeveiliging

De pomp waakt ook steeds over verschillende motorparameters, en beschermt zo onder andere ook tegen drooglopen. Een externe droogloopbeveiliging is dus overbodig.

### Selectie + voorbeeld\*

Verdiepingen	Aantal tappunten			
	1-5	6-10	11-20	21-50
4	CMBE 3-4	CMBE 3-4	CMBE 3-4	
3	CMBE 3-3	CMBE 3-3	CMBE 3-4	CMBE 5-3
2	CMBE 1-4	CMBE 3-3	CMBE 3-3	CMBE 3-4
1	CMBE 1-4	CMBE 1-4	CMBE 3-3	CMBE 3-4



\* Het voorbeeld selectie om 7 bar aan de tappunten te verkrijgen, voor 6 bar diepte 2 verdiepingen bij 10 l/min. De lijn 100 dBA gemiddeld per tappunt. Grundfos is niet verantwoordelijk voor verkeerde dimensionering aan de hand van deze tabel. Raadpleeg Grundfos voor meer informatie.



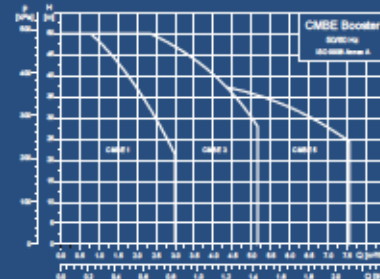
Grundfos heeft ook oplossingen voor drukverhoging in grotere gebouwen zoals appartementsblokken, kantoorruimtes, ziekenhuizen... Voor meer informatie hierover raadpleeg Grundfos of neem reeds een kijkje op onze website: [www.grundfos.com](http://www.grundfos.com)

### Technische gegevens

De CMBE bestaat uit één voormonteerde CME-1 pomp met geïntegreerde frequentiewormer (pomphuis, as en waaijer in AISI 304, flens in gietijzer), S-wegkraan met terugslagklep, drukvat, manometer, drukverschilsensor.

Vloeistoftemperatuur : 0°C > +60°C  
Netspanning: 1x 200-240V - 50Hz

Type	P <sub>1</sub> (kW)	Aanzuig	Penzijde	Artikelnr.
CMBE 1-4	0,69	Rp 1	Rp 1	97 75 54 81
CMBE 3-3	0,82	Rp 1	Rp 1	97 75 54 83
CMBE 3-4	1,05	Rp 1	Rp 1	97 75 54 85
CMBE 5-3	1,30	Rp 1 K	Rp 1	97 75 54 87



### CMBE: alle voordelen op een rij:

- ▶ Constante druk zonder drukschommelingen dankzij geïntegreerde frequentiewormer
- ▶ Lage werkingskosten door hoogefficiënte motor
- ▶ Stille werking
- ▶ Robuuste constructie en lange levensduur
- ▶ Compact op te stellen



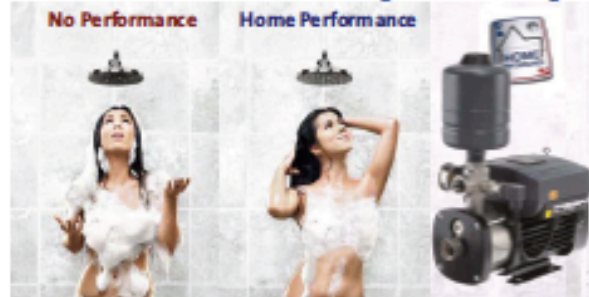
BE > THINK > INNOVATE >

GRUNDFOS



## Product flash: Grundfos CMBE

Laat een onvoldoende druk u niet uit uw goed humeur brengen

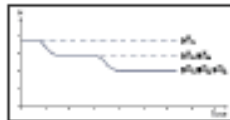


### De ideale oplossing voor een comfortabele druk binnenshuis

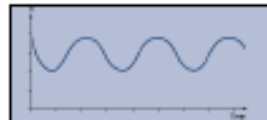
De Grundfos CME Booster is een compact systeem voor drukverhoging in huishoudelijke toepassingen. Dankzij de geïntegreerde frequentieomvormer kan de CME Booster een constante druk houden in het leidingstelsel en dit ongeacht de schommelingen in voordruk en / of waterafname (binnen het bereik van pomp).

#### Hoe werkt het?

Een druksensor meet de wijzigingen in het waterverbruik en stuurt een signaal naar de frequentieomvormer die de motorsnelheid zal aanpassen. Een toename van het waterverbruik veroorzaakt een drukdaling. Deze wordt opgemeten en de drukopnemer stuurt een signaal naar de frequentieomvormer. Deze zal de snelheid van de pomp laten toenemen om zo de druk te kunnen herstellen op de gewenste waarde. De reactietijd is zo snel dat niemand de regelactie opmerkt aan het tappunt.



Bij het openen van meerdere tappunten zal de druk verder afnemen. Dit zal door de gebruiker als oncomfortabel ervaren worden.



De druk op het waterdistributienet zal gedurende de dag wijzigingen in functie van de waterafname.



Met de CME Booster hebben beide drukschommelingen geen enkel effect binnen de woning. U geniet van een constantedruk.

#### Voordelen voor de klant

De CME Booster is zeer eenvoudig te installeren. Eenmaal de boosterinstallatie hydraulisch is aangesloten (gemonteerd tussen de leidingen, zuigaansluiting R1"/R1 1/4" – persaansluiting R1") dient de eenheid enkel nog in het stopcontact gestoken worden. Vanaf dat moment is het systeem operationeel.

#### Unieke eigenschappen

- Constante druk dankzij de geïntegreerde toerentalregeling
- Compact
- Robuust geheel dankzij de volledig roestvrij stalen pomp, EN 1.4301/AISI 304
- Eenvoudige installatie. De CMBE Booster behoeft geen externe motorbeveiliging. De Grundfos MGE motor heeft een geïntegreerde thermische beveiliging tegen het langzaam overbelasten en blokkeren [IEC 34-11:TP 211]
- Geïntegreerde droogloopbeveiliging
- Laag geluidsniveau
- Energie-efficiënte oplossing
- Laag geluid druk niveau, max. 55 dBA



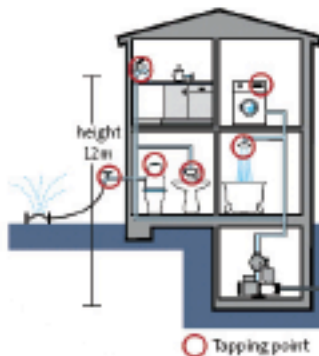
Wist u dat ...

- De CME pomp wordt geleverd met geïntegreerde frequentieomvormer en is voorzien van een 1,5m lange elektrische voedingskabel met SHUKO-plug.
- Een 5-wegstuk heeft met ingebouwde terugslagklep (aansluiting perszijde pomp, drukopnemer, drukvat, manometer, persaansluiting)
- Het expansievat wordt meegeleverd
- Op de manometer is de druk afleesbaar
- De druksensor is gemonteerd en aangesloten.
- Alle delen van de pomp in contact met de vloeistof zijn uit roestvrijstaal AISI 304.



... Dat is KWALITEIT en COMFORT voor uw klant.

Het selecteren van een CME Booster is uitermate éénvoudig met de Grundfos selectiegids. Op basis van het totaal aangesloten tappunten en het aantal verdiepingen kunt u onmiddellijk de juiste boosterinstallatie kiezen.

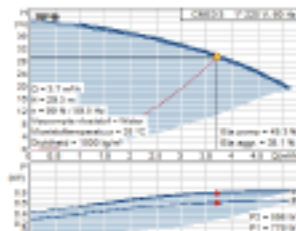
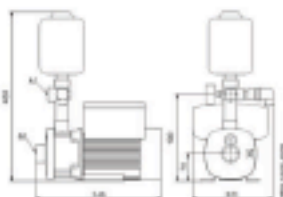


1. Het uitgangspunt voor het selecteren van een CME booster is een energiezuinige en comfortverhogende constante druk boosterinstallatie.
2. Als dit de eis is van de gebruiker dien je nog volgende informatie te achterhalen:
  - Tel het aantal verbruikers
  - Bekijk de totale hoogte van het gebouw. (In streken met een te lage voordruk om een comfortabele aangename druk te voorzien bijvoorbeeld in de doucheal, is de voordruk schommelend tussen de 2 en 3 bar)

Hoogte	3-5	6-10	11-20	21-50
4	CM BE 1-4	CM BE 2-4	CM BE 3-4	
3	CM BE 1-3	CM BE 2-3	CM BE 3-3	CM BE 4-3
2	CM BE 1-2	CM BE 2-2	CM BE 3-2	CM BE 4-2
1	CM BE 1-1	CM BE 2-1	CM BE 3-1	CM BE 4-1

**Overzicht van het aanbod**

Artikelnummer Numéro d'article	Omschrijving Description	bruto eenheidsprijs Prix unitaire brut
97529685	CM BE 1-4 1x200-240V, 50/60Hz R1°F/R1°F	1.100 €
97529689	CM BE 3-3 1x200-240V, 50/60Hz R1°F/R1°F	1.200 €
97529693	CM BE 3-4 1x200-240V, 50/60Hz R1°F/R1°F	1.350 €
97529697	CM BE 5-3 1x200-240V, 50/60Hz R1°F/R1 1/4°F	1.850 €

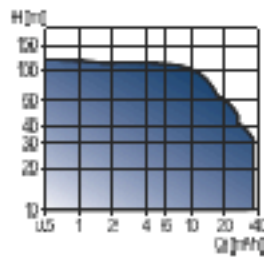


De afmetingen van de 4 modellen CM BE zijn identiek. De uitvoering CM BE 3-3 zal in de meeste gevallen geschikt zijn voor elke woning. 2,0 bar drukverhoging tot ongeveer 5,0 m³/h of 3,0 bar drukverhoging bij 3,7 m³/h.



### CM, CME

Multistage centrifugal pumps



#### Technical data

Flow rate: max. 36 m<sup>3</sup>/h  
Head: max. 130 m  
Liquid temp.: -30 °C to +120 °C  
Operat. pressure: max. 16 bar.

#### Applications

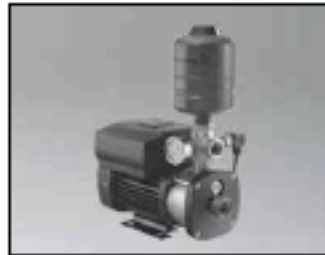
- Washing and cleaning
- Water treatment
- Temperature control
- Pressure boosting.

#### Features and benefits

- Compact design
- Modular design
- Very low noise level down to 41 dB(A).

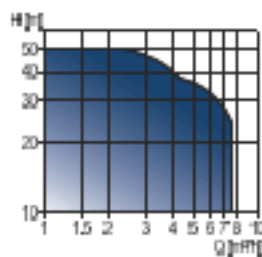
#### Options

- Customised products
- Built-in or stand-alone
- Variable frequency drive.



### CMBE

Frequency controlled booster systems



#### Technical data

Flow rate: max. 7.6 m<sup>3</sup>/h  
Head: max. 50 m  
Liquid temp.: 0 °C to +60 °C  
Operat. pressure: max. 6 bar.

#### Applications

- Single-family houses
- Two-family houses
- Cluster homes
- Blocks of flats
- Schools
- Small hotels/guest houses
- Small office buildings.

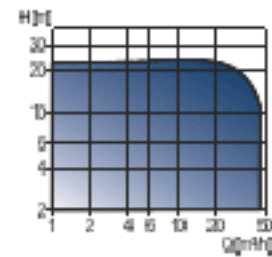
#### Features and benefits

- Constant pressure via integrated speed control
- Compact
- Robust, stainless steel
- Easy installation
- Dry-running protection
- Low noise level, 55 dB(A).



### AC

Single-stage centrifugal pumps



#### Technical data

Flow rate: max. 45 m<sup>3</sup>/h  
Head: max. 23 m  
Liquid temp.: -10 °C to +55 °C  
Operat. pressure: max. 6.5 bar.

#### Applications

- Liquid transfer
- Temperature control.

#### Features and benefits

- Compact design
- High reliability
- Low noise level.



## Liftaway B 40-1 and Liftaway C 40-1



### Versatile lifting stations for flexible solutions

These small lifting stations are designed for installation in bathrooms, kitchens and hobby rooms. Providing a fast and cost-effective solution, the Liftaway lifting stations are ideal for collecting and removing wastewater from washbasins, showers, washing machines and floor drains in basements, etc.

#### Liftaway C 40-1

The Grundfos Liftaway C 40-1 can be placed either on the floor or mounted on a wall. Although compact and attractively designed with hidden side inlets, this lifting station has a large and efficient lifting volume.

The Liftaway C 40-1 which can be fitted with different types of pumps is an extremely flexible solution where the pumping of domestic wastewater from e.g. washing machines, dishwashers, washbasins or tubs is required.

#### Liftaway B 40-1

The Grundfos Liftaway B 40-1 is a small lifting station for installation below floor level. This lifting station provides a simple solution where pumping is required in existing buildings without necessitating major structural modifications.

The Liftaway B 40-1 can be combined with KP's and AP 12 stainless steel pumps, thereby allowing for the tailoring of the lifting stations to specific applications in consideration of variations in the amounts of wastewater generated.

The Grundfos Liftaway B 40-1 features an adjustable manhole which makes subsequent adjustment of floor surface easy.









## 22 12 00 Facility potable water storage tanks



Branch of Sioen Industries



Fabrieksstraat 23, B-8850 Ardoole - Tel +32(0)51 74 09 00 - Fax +32(0)51 74 09 64  
sioline@sioen.be - <http://www.sioen.com>

### B6303

Fabric / Weefsel / Tissu / Gewebe / Tejido	100 % PES / 1100 dtex	
Total weight / Gewicht totaal / Poids total / Totalgewicht / Peso total	1100 g/m <sup>2</sup>	DIN EN ISO 2286/2 1998
Characteristics / Eigenschappen / Caractéristiques / Eigenschaften / Characteristics	Foodgrade	
Laquering / Vernis / Lackierung / Lacado	1/-	
Embossing / Kalander / Calandre / Lackierung / Embossing	Dull	
Breaking strength Warp Treksterkte Ketting Résistance rupture Chaine Höchstzugkraft Kette Resistencia a la ruptura Urdimbre	4000 N/5cm	EN ISO 1421/1 1998
Breaking strength Weft Treksterkte Inslag Résistance rupture Trame Höchstzugkraft Schuss Resistencia a la ruptura Trama	3500 N/5cm	EN ISO 1421/1 1998
Tear strength Warp Scheurweerstand Ketting Résistance à la déchirure Chaine Weiterreiskraft Kette Resistencia a la rasgadura Urdimbre	600 N	DIN 53363 2003
Tear strength Weft Scheurweerstand Inslag Résistance à la déchirure Trame Weiterreiskraft Schuss Resistencia a la rasgadura Trama	500 N	DIN 53363 2003
Adhesion / Hechting / Adhérence / Haftung / Adherencia	125 N/5cm	EN ISO 2411 2000
Temperature resistance / Temperatuurbestendigheid / Tenue à la température / Temperatuurbestendigheid / Resistencia à la temperatura	-30/+70 °C	DIN EN 1876/2 1998
Light fastness (Except white and (half-)transparent) Lichtechtheid (Uitgezonderd wit en (half-)transparent) Tenue à la lumière (Excepté en blanc et (semi-)transparent) Lichtechtheit (Ausnahme weiss und (semi-)transparent) Resistencia a la luz (Excepto blanco / (semi-)transparente)	7-8	ISO 105 B02 1988
Fire behavior / Brandgedrag / Reaction au feu / Brennverhalten / Fire behavior	< 100 mm/min	ISO 3795 1989
EU Directive 2002/72/EC + Amendments (direct food contact materials)	Conform	
Application Packaging and coverage of aqueous foods having a pH > 4.5 (e.g. drinking water) and dry foods (e.g. vegetables, fruits), intended to be used at ambient temperatures		

All our technical characteristics are indicative  
Rev. 12/2010



Technical Data Sheet

**B6000**

Fabric / Weefsel / Tissu / Gewebe / Tejido	100 % PES / 1100 dtex	
Total weight / Gewicht totaal / Poids total / Totalgewicht / Peso total	900 g/m <sup>2</sup>	DIN EN ISO 2286/2 1998
Laquering / Vernis / Lackierung / Lacado	1/1	
Embossing / Kalander / Calandre / Lackierung / Embossing	Glossy	
Breaking strength Warp Trekssterkte Ketting Résistance rupture Chaîne Höchstzugkraft Kette Resistencia a la ruptura Urdimbre	4000 N/5cm	EN ISO 1421/1 1998
Breaking strength Weft Trekssterkte Inslag Résistance rupture Trame Höchstzugkraft Schuss Resistencia a la ruptura Trama	4000 N/5cm	EN ISO 1421/1 1998
Tear strength Warp Scheurweerstand Ketting Résistance à la déchirure Chaîne Weiterreisskraft Kette Resistencia a la rasgadura Urdimbre	600 N	DIN 53363 2003
Tear strength Weft Scheurweerstand Inslag Résistance à la déchirure Trame Weiterreisskraft Schuss Resistencia a la rasgadura Trama	500 N	DIN 53363 2003
Adhesion / Hechting / Adhèrence / Haftung / Adherencia	100 N/5cm	EN ISO 2411 2000
Temperature resistance / Temperatuurstendigheid / Tenue à la température / Temperatuurstendigheid / Resistencia à la temperatura	-30/+70 °C	DIN EN 1876/2 1998
Light fastness (Except white and (half-)transparent) Lichtechtheid (Uitgezonderd wit en (half-)transparent) Tenue à la lumière (Excepté en blanc et (semi-)transparent) Lichtechtheid (Ausnahme weiss und (semi-)transparent) Resistencia a la luz (Excepto blanco / (semi-)transparente)	7-8	ISO 105 B02 1988
Fire behavior / Brandgedrag / Reaction au feu / Brennverhalten / Fire behavior	< 100 mm/min	ISO 3795 1989
Application Truck/SideCurtain		

"This product may for certain colours contain substances which fall under the Annex XIV of the Reach Regulation 1907/2006/CE. In order to know which colours fall under this annex , you can take contact with the technical department of Sioen Industries. Upon request those substances can be eliminated from the product."

All our technical characteristics are indicative  
Rev. 04/11



## 22 13 13 Facility Sanitary Sewers

### Ecoulement PVC / Afvoer in PVC



#### EUPEN

##### EUCARIGID

##### Tubes en PVC / PVC buizen

Pour eaux à températures moyennes jusque 65°C en continu.

Voor water van gemiddelde temperatuur tot 65°C doorlopend.



Longueurs de 4 m Benor (prix par longueur).  
 Lengten van 4 m Benor (prijs per lengse).

Ø mm	code	€	s	
3,0 mm	32	215102	8,84	1
3,0 mm	40	215103	10,32	1
3,0 mm	50	215104	13,12	1
3,0 mm	75	215105	20,16	1
3,0 mm	90	215107	24,28	A
3,2 mm	110	215109	31,64	A
3,2 mm	125	215120	36,12	A



Longueurs de 4 mètres (prix par longueur).  
 Lengten van 4 meter (prijs per lengse).

1,8 mm	32	213004	5,32	A
1,8 mm	40	213005	6,84	A
1,8 mm	50	213006	8,76	A
1,8 mm	75	213007	12,88	A
1,8 mm	90	213008	15,12	A
2,2 mm	110	213009	23,32	A
2,5 mm	125	213040	29,36	1



Longueurs de 5 mètres (prix par longueur).  
 Lengten van 5 meter (prijs per lengse).

3,2 mm	160	213041	53,45	1
--------	-----	--------	-------	---

##### PVC à emboîter / PVC met steekmof



Courbe 87°30 RA 1B.  
 Bocht 87°30 RA 1B.

32	266130	1,18	A
40	266140	1,36	A
50	266150	1,66	A
75	266160	3,24	A
90	266170	4,52	A
110	266190	6,48	A
125	266200	8,28	1



Courbe 67° RA 2B.  
 Bocht 67° RA 2B.

32	266210	1,98	1
40	266220	2,36	A
50	266230	2,75	1



Courbe 45° RA 3B.  
 Bocht 45° RA 3B.

32	266290	1,20	A
40	266300	1,34	A
50	266310	1,60	A
75	266320	2,89	A
90	266330	3,82	A
110	266350	5,58	A
125	266360	6,89	1

Indutieve prijs/een inclusief BTW. Voor actuele prijzen,  
 gelieve de e-commerce te raadplegen via [www.facq.be](http://www.facq.be)

18.3

Prix indicatifs hors TVA. Pour les prix à jour  
 consultez notre e-commerce sur [www.facq.be](http://www.facq.be)



## Écoulement PVC / Afvoer in PVC



### EUPEN



Manchon de dilatation RA 16B.  
Expansiemof RA 16B.

Ø mm	code	€	s
32	266680	2,42	1
40	266690	2,68	A
50	266700	2,96	A
75	266710	3,80	1
90	266720	4,51	A
110	266740	6,73	A
125	266750	7,98	1



Embranchement 87°30 RA 7B.  
Vertakking 87°30 RA 7B.

32	266530	1,95	A
40	266540	2,29	A
50	266550	2,64	A
75	266560	5,18	1
90	266570	6,94	A
110	266590	9,35	1
125	266600	7,64	1



Embranchement 45° RA 5B.  
Vertakking 45° RA 5B.

32	266370	2,35	A
40	266380	2,64	A
50	266390	3,24	A
75	266400	5,18	1
90	266410	6,94	A
110	266430	9,37	A



Réduction excentrique RA 20B.  
Excentrische verloopmof RA20B.

40-32	311485	1,38	A
50-32	311486	1,46	1
50-40	311487	1,46	A
75-50	311488	1,86	1
90-50	311489	2,83	1



Embranchement 87°30 RA 33B.  
Vertakking 87°30 RA 33B.

40/32	267000	3,19	1
50/40	267020	3,48	1
75/50	267040	8,84	1
90/40	267050	8,10	A
110/90	267090	12,82	1



Embranchement 45° RA 34B.  
Vertakking 45° RA 34B.

50/40	267140	3,48	A
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Manchon double avec rebord RA 42B.  
Steekmof met stootrand RA 42B.

32	251340	2,86	A
40	251341	2,92	A
50	251342	3,13	A
75	251343	4,42	1
90	311483	8,26	1



Manchon coulissant sans rebord RA 41B.  
Overschuifmof zonder stootrand RA 41B.

32	251344	2,86	A
40	251345	2,92	A
50	251346	3,13	A
90	311484	8,26	1



## Écoulement PVC / Afvoer in PVC



### PIPELIFE

		Ø mm	code	€	s
	Smartline T-simple 90° lisse. T-stuk 90° glad.	40x40	353919	2,30	1
		50x40	353920	2,83	1
		50x50	353921	2,83	1
	Réduction MF. Reductie MV.	40 x 32	202394	16,00	1
	Reduction lisse. Verloopstuk glad.	40x32	353927	1,37	1
	Reduction avec raccord. Verloopstuk met koppelstuk.	50 x 40	353928	1,85	1
	Collier. Klembeugel.	40 x 32	353929	1,04	1
		50 x 32	353930	1,32	1
	Bouchon avec raccord. Eindstop met koppelstuk.	40	353949	5,77	1
		50	353950	6,10	1
	Té-regard. Ontstoppingstuk.	50	353947	9,88	1
	Coude siphon FM. Bocht sifon VM.	40 x 32	202457	8,05	1
	Siphon bouteille verticale. Vertikale bekersiston.	40x40	353933	11,20	1
	Siphon bouteille combi avec crépine. Combi bekersiston met plug.	40x40	353934	22,40	1





Écoulement PVC / Afvoer in PVC



FIM'S



Raccord PP-H avec caoutchouc MF.  
Verlofstuk PP-H met rubber MV.



Manchon couissant PP-H MF.  
Schuifmof PP-H MV.



Siphon entonnoir PP.  
Trechtersifon PP.

Ø mm	code	€	s
75-50	200392	9,86	A
110-50	200393	9,86	A
110-90	200394	9,86	A
160-110	200395	11,50	f
110	200396	12,30	f
	200397	11,60	f



**Code Facq? Plus d'erreur possible avec le code Facq!**  
**Un article, un code. Un code, un article.**

PDF

-  | [Op Schroefmof](#)
-  | [Messing-afdichtings](#)
-  | [Bouwstopventiel](#)
-  | [Dubbele schijfmof](#)
-  | [Flensadapter](#)
-  | [HT-aansluitang](#)
-  | [WC-aansluitbuis](#)
-  | [Overgangstuk](#)
-  | [Buisverbindings-afop](#)
-  | [Montagegereedschap](#)
-  | [Schroef-afkapping](#)
-  | [Schuifmof](#)
-  | [Trichtersifon](#)
-  | [afdichtbak sortiment](#)
-  | [afstelbare bochten](#)
-  | [Buisbeluchter](#)
-  | [Armatuur](#)
-  | [Vulventil 3/8"](#)

**De montagevriendelijkste trechtersifon aller tijden.**



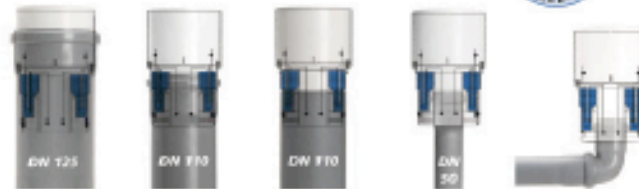
- Montagetijd minder dan 30 seconden
- Zonder boren, met pluggen bevestigen en schroeven
- Geen montage noodzakelijk
- Neemt weinig plaats in
- Toevoer van meerdere buizen mogelijk
- Geen schroefverbindingen met dichtingen
- 100 % dicht
- Na verwijdering van het binnendeel kan de sifon als reinigingsopening gebruikt worden
- Geen gereedschap nodig voor de montage
- Universeel aan te sluiten
- De Airfit TRECHTERSIFON insteken – klaar

De trechtersifon is goedgekeurd volgens DIN-EN 274 door MPA-NRW

**Art.-Nr. 50125TS**

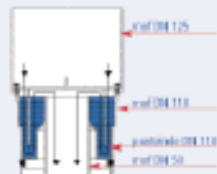


**Gebruiksvoorbeelden:**



De trechtersifon is getest conform DIN-EN 274 door MPA-NRW.

**Voordelen ten opzichte van traditionele trechtersifon:**



Art.-Nr. 50125TS



- Geen montage noodzakelijk.
- Altijd dicht, want geen schroefverbindingen.
- Kleine bouwvorm.
- 4 buisaansluitmogelijkheden.
- Geen bevestiging noodzakelijk.
- Montagetijd minder dan 30 seconden.





## Écoulement PVC / Afvoer in PVC



### EUPEN

#### Matériel de ventilation / Ventilatiemateriaal



Chapeau de ventilation en PVC RA 43.  
Ventilatielid in PVC RA 43.

Chapeau de ventilation en PVC RA 43.  
Ventilatielid in PVC RA 43.

Plaque d'asphaltage en PVC RA 57.  
Asphalteringsplaat in PVC RA 57.

Plaque d'asphaltage en PVC RA 57.  
Asphalteringsplaat in PVC RA 57.

### NICOLL



Valve de ventilation Venticlair en ABS. Supprime les odeurs d'égoût. A placer au bout de la conduite d'évacuation.  
Ventilatielid Venticlair in ABS. Voorkomt rioolgeuren. Te plaatsen op het einde van de afvoertelling.

Aérateur à membrane PVC.  
Ventilator met membraan PVC.

Aérateur active avec filtre-odeurs à charbon actif contre les mauvaises odeurs. Avec joint souple en caoutchouc. Montage horizontale ou verticale.  
Beluchter met geurfilter in actieve koolstof tegen onaangename geuren. Met soepele dichting in rubber. Horizontale of verticale plaatsing.

Chapeau ventilation avec plaque en plomb.  
Ventilatielid met loden plaat.

Ø mm	code	€	s
50	269900	6,95	1
90	269920	9,41	1
110	269930	12,04	1
125	269940	13,16	1
100	313920	11,31	1
90	411050	9,31	1
110	411060	9,71	1
125	411070	9,71	1
100	313980	9,31	1
32	244090	9,83	A
40	244100	9,83	A
50	244110	9,83	A
32-40	234710	15,92	A
50-63	879740	34,62	A
80-75	708640	35,68	A
110-100	242810	47,80	A
70-80-100	319817	77,07	1
90	316306	26,19	1
100	239524	26,45	1
110	314895	30,38	1



## Ontluchters met membraan

# Ontluchters met membraan

De ontluchters met membraan kunnen gebruikt worden voor een gedeeltelijke vervanging van de primaire ventilatie van gescheiden afvoeren van huizen.

## Omschrijving

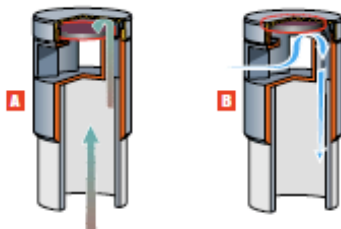
Geïnjecteerd stuk in PVC



Referentie	Ø D	Ø d	DIM. H
<b>ONTLUCHTER</b>			
SAV43	40	32	68
SAV65	63	50	84
SAV87	80	75	97
SAV111	110	100	132

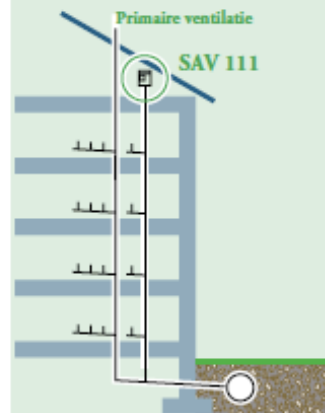
## Werking

De bovenkant van het membraan is in contact met de opstijgende lucht van de afvoerbuï, terwijl de onderzijde van het membraan in contact is met de omringende lucht. De afvoerleiding is dus afgesloten en verhindert het ontsnappen van geuren **A**, en dit des te meer naarmate de overdruk groter wordt. Tijdens het ledigen **B** van een sanitair toestel daarentegen ontstaat bovenaan de afvoerleiding een onderdruk, waardoor het membraan opgetild wordt en waardoor de benodigde verse lucht wordt aangevoerd om de goede functioning van de sifons te behouden.



## DE ONTLUCHTER NICOLL

GENIET VAN EEN  
TECHNISCHE  
GOEDKEURING  
ATEC CSTB  
N° 15/87 107



Voorbeeld gebruik van een ontluclter van grote diameter



Voorbeeld gebruik van een ontluclter van kleine diameter geplaatst aan het uiteinde van een leiding met grote lengte.



## Raccordements / Aansluitingen



### GEBERIT



**151.100**  
Coupe-air Uniflex - modèle tubulaire. Blanc alpin.  
*Reukafsluiter Uniflex voor wastafel - buismodel.*  
Alpenwit.

Ø mm	code	€	s
5/4"x40	171310	12,15	A



**151.107**  
Coupe-air Uniflex pour lavabo - modèle pour meuble. Blanc alpin.  
*Reukafsluiter Uniflex voor wastafel - meubelmodel.* Alpenwit.

5/4"x40	406180	15,90	A
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**151.120**  
Coupe-air à encastrer Uniflex avec plaque de recouvrement et coude de raccordement. Blanc alpin.  
*Inbouwreukafsluider Uniflex met afdekplaat en aansluitbocht.* Alpenwit.

5/4"x50/56	297640	49,00	1
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**152.860**  
Coupe-air Ø 40 avec clapet à boule et rosace murale. Blanc alpin.  
*Reukafsluider Ø 40 met bolventiel en muurozet.* Alpenwit.

6/4-5/4	283910	49,00	1
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### MC ALPINE



Siphon blanc avec grille allongé et rosace.  
*Witte hevel met verlengde rooster en rozet.*

5/4"x32	379830	8,85	1
---------	--------	------	---



Siphon Orienta "U".  
*Orienta "U" hevel.*

40	249350	12,22	1
----	--------	-------	---



Siphon Universel en trois parties, peut se placer dans chaque situation S,P ou Q.  
*Universele hevel in drie delen, kunnen in S,P of Q situatie geplaatst worden.*

6/4"x40	296890	14,03	1
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Siphon bouteille en polyéthylène blanc.  
*Witte fleshevel in polyethyleen.*

5/4"x32	249260	13,07	1
6/4"x40	249290	14,75	1



## Colliers / Beugels



		Ø mm	code	€	s
	Fix-ring simple Fix-ring enkel.				
	100 pièces / 100 stuks	16	403274	21,00	A
	100 pièces / 100 stuks	18	204709	21,75	A
	100 pièces / 100 stuks	20	403275	22,25	A
	100 pièces / 100 stuks	22	403276	23,12	A
	100 pièces / 100 stuks	25	403277	23,62	A
	100 pièces / 100 stuks 50 pièces / 50 stuks	28 32	403278 403279	28,87 17,89	A A
	Fix-ring double. Fix-ring dubbel.				
	100 pièces / 100 stuks	16	403280	24,87	A
	100 pièces / 100 stuks	20	403281	28,25	A
	100 pièces / 100 stuks	22	403282	29,50	A
	100 pièces / 100 stuks	25	403283	32,75	A
	50 pièces / 50 stuks	28	403284	21,20	A
	Fix-ring quadruple. Fix-ring vierdubbel.				
	50 pièces / 50 stuks	25	403285	29,20	A
	Fast-ring. Fast-ring.				
	100 pièces / 100 stuks 100 pièces / 100 stuks	16 x 16 20 x 20	403286 403287	22,37 23,87	A A
	Collier de sécurité en PVC gris foncé M7. Veiligheidsbeugel in donker grijze PVC M7.				
		32	247040	0,42	A
		40	247070	0,49	A
		50	247100	0,76	A
		75	247140	0,91	A
		80	247150	1,08	A
		90	247160	1,18	A
		100	247170	1,59	A
	110	247180	1,79	A	
	Attache de sécurité pour collier en PVC M7. Veiligheidsklem voor beugel in PVC M7.				
		40	247310	0,11	A
		90	247400	0,18	f
		110	247420	0,18	f
	Collier "clic" en PVC M7. "Clic" beugel in PVC M7.				
		32	371820	0,71	A
		40	371830	0,79	A
		50	371840	0,89	A
	Rosace conique. Konische rozet.				
		14	735610	0,31	A
		19	748680	0,63	A



## Écoulement pluvial PVC / Regenafvoer in PVC



### EUPEN

Écoulement en PVC type EUCARIGID / Afvoer in PVC type EUCARIGID.



Longueurs circulaires de 4 mètres (prix par longueur).  
Lengten van 4 meter rondvormig (prijs per lengsel).



Courbe 45° - RR3.  
Bocht 45° - RR3.



Courbe 67° - RR2.  
Bocht 67° - RR2.



Courbe 90° - RR1.  
Bocht 90° - RR1.



Té 45° - RR5.  
T-stuk 45° - RR5.



Té 90° - RR7.  
T-stuk 90° - RR7.



Entonnoir RR9.  
Trekter RR9.

### NICOLL



Manchon FF.  
Mof VV.

JRGT

80

246720

2,16

1



Manchon FF.  
Mof VV.

JTGT

100

246830

2,38

1



Collier à charnière.  
Scharnierbeugel.

COR

80

380400

1,31

A

COS

90

380410

1,48

A

COT

100

380420

1,66


A



## 22 41 00 Residential Plumbing Fixtures



**Half-inbouw**







**Loop&Friend - rond**

204976 • 38 cm	433,18 €
204978 • 43 cm	445,28 €

**ceramicplus**  
Tubalid Black

**Opbouwwaskommen**



	<b>Loop&amp;Friend - rond Ø 38 cm</b>		
	502198 • met overloop	417,45 €	
	112437 • zonder overloop	461,01 €	
	<b>Loop&amp;Friend - vierkant 43x43 cm</b>		
	194922 • met overloop	451,33 €	
	457720 • zonder overloop	494,89 €	
	<b>Loop&amp;Friend - ovaal</b>		
	234294 • 60x43 cm	525,14 €	
	234295 • 53x38 cm	467,06 €	

**Inbouwwaskommen**



**Florende - rond**

232492 • 48 cm	119,79 €
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**Loop&Friend - rond**

707219 • 52 cm	326,70 €
707218 • 45 cm	296,45 €
707217 • 39 cm	269,83 €
707216 • 34 cm	240,79 €

**Loop&Friend - vierkant**

234278 • 45x45 cm	308,55 €
234279 • 40x40 cm	281,93 €

**Loop&Friend - rechthoek**

457572 • 60x40 cm	370,26 €
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**Loop&Friend - vierkant**

252853 • 50,5x50,5 cm	361,79 €
240252 • 45,5x45,5 cm	333,96 €

**Loop&Friend - rechthoek**

250300 • 67,5x45 cm	425,92 €
252600 • 60x40 cm	395,67 €

**Memento - 60x42 cm**

292125 • wit	441,65 €
311282 • zwart	565,07 €
252643 • tablet 130x52,5 cm	690,91 €

**Memento - 120x47 cm**

297122 • wit	986,15 €
297861 • tablet 170x52,5 cm	781,66 €

**Loop & Friend - rond**

351983 • 43 cm	444,07 €
----------------	----------

**Loop & Friend - vierkant**

351985 • 38x38 cm	448,91 €
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**Loop & Friend - ovaal**

58,5x38 cm	
351986 • met overloop	477,95 €
355837 • zonder overloop	521,51 €

**Loop & Friend - rechthoek**

58,5x38 cm	
351987 • met overloop	477,95 €
348366 • zonder overloop	521,51 €

Datumsjedscode = product in voorraad in onze depots en snel leverbaar - indicatieve prijzen 21% BTW inbegrepen.



# Concept 100

Made by Ideal Standard

*Finn's*



KRAANWERK  
T

	<b>Wastafel</b> Met automatische lediging 295647 • verchromd 108,74 € Met ketting 295648 • verchromd 85,31 € Lage druk 295649 • verchromd 130,32 €		<b>Bidet</b> Met automatische lediging 295650 • verchromd 118,39 €
	<b>Bad/douche</b> 295652 • verchromd 129,11 €		<b>Bad/douche thermostaat</b> 295659 • verchromd 232,22 €
	<b>Douche</b> 295651 • verchromd 91,19 €		<b>Douchethermostaat</b> 295658 • verchromd 183,36 €



De kern van de kraan serie is de keramische cartridge die dankzij de uiterst moderne di-d-technologie veel details en voordelen biedt:

**Tot 50% waterbesparing** - De nieuwe, variabele water-besparingsfunctie van de click-cartridge maakt het mogelijk om het waterverbruik individueel te regelen.

**Een bijzonder bedieningscomfort** - De temperatuur kan heel gemakkelijk en traploos worden geregeld.

**Betrouwbare veiligheid** - Met de geïntegreerde heet water temperatuurcontrole kan de maximale temperatuur worden begrensd.



440



**CONCEPT 100**  
Wandkraan met draaibare uitloop  
295652 • verchroomd 120,75 €



**CONCEPT 100**  
295655 • verchroomd 136,83 €



**CONCEPT 200**  
Draaibare uitloop  
295662 • verchroomd 206,58 €



**CONCEPT 200**  
Draaibare uitloop, uittrekbare sproeier  
295669 • verchroomd 277,73 €



**ACTIVE**  
Uittrekbare sproeier  
403183 • verchroomd 261,72 €



**ACTIVE**  
Draaibare uitloop  
311730 • verchroomd 193,18 €



**ACTIVE**  
Draaibare verhoogde uitloop  
311729 • verchroomd 180,71 €



**CERAPLAN**  
Draaibare uitloop  
238752 • verchroomd 143,32 €





434



# Spoeltafels in Inox

FRANKE



**Planar:** voor inbouw,  
met plug en overloop.  
**Kubus:** voor onderbouw,  
met plug en overloop.

## Onderbouw of inbouw spoeltafels



**KUBUS KBX 210 530**  
Lb: 530x430 mm  
348777 • inox 887,58 €



**KUBUS KBX 210 480**  
Lb: 480x430 mm  
371470 • inox 792,08 €



**KUBUS KBX 120**  
Lb: 770x455 mm  
Wasbakken: 340x400 mm  
362789 • inox 1.337,97 €



**KUBUS KBX 210 370**  
Lb: 370x430 mm  
344030 • inox 730,79 €



**KUBUS KBX 210 190**  
Lb: 190x430 mm  
401543 • inox 688,96 €



**KUBUS KBX 260**  
Lb: 570x444 mm  
Wasbakken: 340x400 - 160x340 mm  
366132 • inox 1.201,23 €



**PLANAR PPX 211**  
Lb: 1000x470 mm  
Wasbak: 470x410 mm  
222525 • inox 1.106,10 €



**PLANAR PPX251**  
Ld: 1000x470 mm  
Wasbakken: 340x410 - 160x410 mm  
280374 • inox 1.263,95 €



	<b>Tempesta Duo 2 stralen</b> 294829 • verchroomd	42,35 €		<b>Rainshower Cosmopolitan 3 stralen</b> 13 cm 258677 • verchroomd	139,15 €		<b>Rainshower Classic 13 cm - 3 stralen</b> 296515 • verchroomd	114,95 €
	<b>Tempesta Duo 2 stralen</b> Met houder 294935 • verchroomd	56,87 €		<b>Rainshower Cosmopolitan 4 stralen</b> 16 cm 260242 • verchroomd	163,35 €		<b>Rainshower Classic 16 cm - 4 stralen</b> 242132 • verchroomd	139,15 €
	<b>Tempesta Trio 3 stralen</b> 294931 • verchroomd	47,19 €		<b>Sena</b> Met houder 198923 • verchroomd	199,65 €			



**GROHE**  
ENJOY WATER



Ephoria met SprayDimmer: de nieuwe SprayDimmer is een op maat instelbare waterspaarfunctie. Het laat de gebruiker toe met een intuïtieve vingertophoeving de waterstroom bij te stellen zonder de sproongatjes af te sluiten.

#### Slangen

	<b>Groflex – 1/2"</b> 239400 • 125 cm 226730 • 150 cm 410120 • 175 cm 303890 • 200 cm	15,13 € 17,55 € 19,97 € 21,78 €		<b>Ephoria 100 cm</b> Met SprayDimmer 346537 • mono 400662 • champagne 346536 • massage Zonder SprayDimmer 346538 • mono	157,30 € 175,45 € 175,45 € 145,20 €		<b>Tempesta Duo 2 stralen - 60 cm</b> 294933 • verchroomd	83,49 €
	<b>Silverflex – 1/2"</b> 220200 • 125 cm 422171 • 150 cm 273854 • 175 cm 304139 • 200 cm	30,86 € 32,07 € 33,28 € 35,09 €		<b>Rainshower</b> Rainshower Classic 90 cm 296516 • 3 stralen - 13 cm 242060 • 4 stralen - 16 cm Rainshower Cosmopolitan 90 cm 260052 • 3 stralen - 13 cm 259548 • 4 stralen - 16 cm	235,95 € 260,15 € 252,89 € 277,09 €		<b>Tempesta Trio 3 stralen - 60 cm</b> 296053 • verchroomd Met zeefhouder 294934 • verchroomd	89,54 € 102,85 €

Datetijdscode = product in voorraad in onze depots en snel leverbaar - Indicatieve prijzen 21% BTW inbegrepen.



**Moderna Duobloc 128.307**

Spoelbak 9 l, met anti-condensatie, spoel- en stop-toets rechts in het deksel opgenomen, 2 spoelknoppen 6-9 liter of 3 liter, met compact vlotterkraan 3/8", zonder afsluiterkraan, wateraansluiting links of rechts, met dosetdichting en bevestigingsmateriaal. Regelbare bevestigingsijzer, aangepast aan de meeste closetpotten. 598460 • wit 122,09 €



De universele spoelbakken zijn voorzien van twee bedienings-toetsen: de kleine (3L) voor een kleine spoeling, de grote (6L) voor een grote spoeling. De zeer fraaie vormgeving van de spoelbak past perfect bij de meeste closetpotten die op de markt te verkrijgen zijn. Materiaalkeuze: polyethyleen.



**GELUX**

W.-C. duobloc met closetpot in porselein, spoelbak Geberit Moderna met waterbesparende bedieningstoets, zonder zit.

316640 • uitgang H 277,09 €  
317040 • uitgang C 289,19 €

WC HDEKJE



**GELUX-FIX**

Voorwandinstallatiesysteem met closetpot Wilery & Boch in ceramic Plus en Geberit inbouwspoelbak met 2 toetsen voor een spoeling met 2 hoeveelheden: 6/7,5L en 3/4L of voor een start/stop spoeling. Bedieningsplaat Samba in witte kunststof inbegrepen. 502495 • gelux-fix 516,67 €



**FIM'S - Aquarine**

Universele zit met snelmoer en soft closing systeem. 203574 • wit 83,49 €

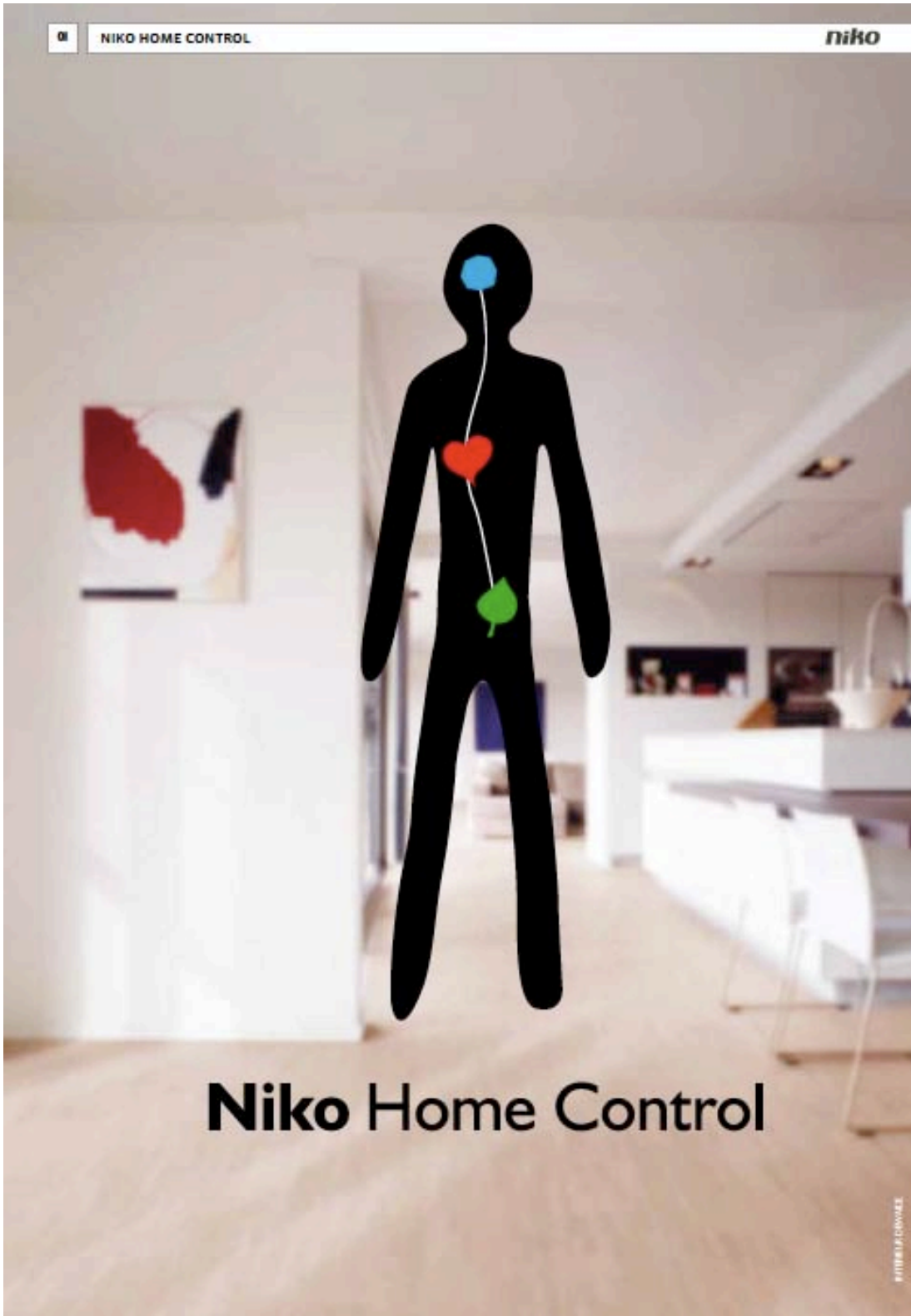


**FIM'S**

In duroplast door en door gekleurd, inox schamieren. 525880 • F600 61,11 €  
312660 • F400 48,88 €



## 23 09 00 Instrumentation and control for HVAC

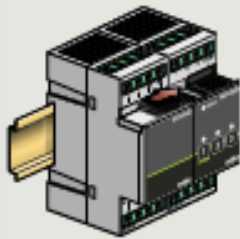




# Niko Home Control (available from 1 August 2011)

Live it, love it

Niko Home Control is a modern electrical installation allowing users to operate all functions from one central location, and to monitor – and possibly reduce – their energy use. The way to create a more safe and comfortable home environment!



## NIKO HOME CONTROL – THE INSTALLATION

- 2-wire non-polarized cabling to all controls
- free topology with standard wiring
- convenient system, requires minimal space in electrical cabinet
- minimal cabling in electrical cabinet; modules are connected via unique cross connectors
- minimal programming required; each functionality has a dedicated module
- low-power system
  - the installation itself only uses a minimal amount of energy
  - the modules have an ultra long life span through reduced heat emission in the electrical cabinet

## EASY AND QUICK INSTALLATION PROCESS

- simple connection via 2-wire non-polarized cabling
- touch screen connection only requires 1 wire
- wall-mounted printed circuit board concept: only requires 1 flush-mounting box, even for multiple controls

## USER-FRIENDLY PROGRAMMING

- graphical visualization of the system installation via programming software
- floorplan can be loaded into the software or can be redrawn
- library of pre-programmed actions included
- programming back-up stored within the system





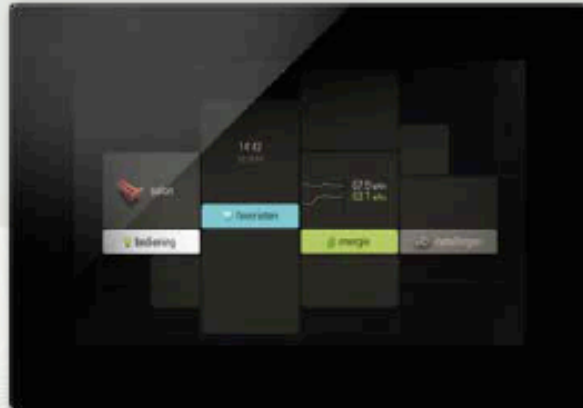
#### IMPROVED FUNCTIONALITY FOR END-USERS

- user-friendly operation via push buttons, display, touch screen and smartphone
- central control of all system functions, such as lighting, ventilation, heating, automated window shutters and blinds, burglar alarms, etc.
- measures energy use and energy production (of e.g. solar panels)
- the installation provides insight into the end-user's energy consumption and includes a number of energy-saving options, such as zone-based heating and energy consumption display
- the installation itself only uses a minimal amount of energy
- switching and dimming of new lamp types, such as dimmable compact fluorescent lamps and dimmable LED lights
- flexible installation, low-threshold:
  - customers select the functions to be included in their Niko Home Control system
- compact Niko Home Control modules require minimal space in the electricity cabinet
- end-users maintain ultimate control over their system by selecting different settings and preferences (e.g. how long the driveway lights should stay on after they have left the property)



#### TIMELESS DESIGN

- controls available in any Niko finish
- the Niko Home Control touch screen perfectly matches the design of the controls





#### Controller

The central control unit of Niko Home Control is essential and controls the entire installation. This module is required in every system for programming purposes. It includes a test button to verify the proper functioning and status of all other modules. The program key allows you to manually program the basic functions such as lighting and roller blinds, without a computer. All system data is centrally stored in the module.

A Niko Home Control installation manual and additional information is provided together with the controller.

- RJ45 connection for PC programming
- program key
- sliding contact to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 2U
- CE compliant

#### Complete unit

Controller	<b>550-00001</b>	Pack: 1
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#### Power supply

The power supply module provides 26V to the modules and control units. By pressing the push button, you can select one master power supply module if the system includes several different ones. Please refer to the manual for more information concerning the required number of power supply modules. Power, status and bus activity are LED-indicated.

- input voltage: 230V AC
- output voltage: 26V DC, 400mA
- power: 10W
- 4 connection terminals to connect the module to the other DIN rail
- sliding contact to connect the module to other modules on the DIN rail
- SELV
- ambient temperature: 0 to 45°C without derating
- dimensions: 4U
- CE compliant

#### Complete unit

Power supply	<b>550-00010</b>	Pack: 1
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#### Rail coupler

This module is always mounted first on the left at the start of a new row of DIN rail modules. Connect the power supply and bus to the rail coupler on next DIN-rail through the contacts at the top and bottom.

- 2 x 4 connection terminals to connect to the rail coupler on next DIN rail
- sliding contact to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 2U
- CE compliant

#### Complete unit

Rail coupler	<b>550-00020</b>	Pack: 1
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#### IP interface

The IP interface connects the Niko Home Control system to a local IP network via the RJ45 connection at the bottom of the module. Possible applications: linking touch screens, external IP systems (such as Wi-Fi routers for smartphone-controlled operations), IP audio systems and PC networks for user software applications. The IP interface is also required for logging data from the electricity measuring module and data from the pulse counter.

- RJ45 connection at the bottom of the module to connect the module to an IP network
- sliding contact to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 2U
- CE compliant

#### Complete unit

IP interface	<b>550-00508</b>	Pack: 1
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#### Splitter module

This module is used to split one system into several subsystems. These subsystems are interlinked via the IP port on the splitter module.

- RJ45 connection at the bottom of the module to connect the module to an IP network
- sliding contact to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 2U
- CE compliant

#### Complete unit

Splitter module	<b>550-00509</b>	Pack: 1
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#### Programming software

You program the installation with the programming software. This software is user-friendly, intuitive and structured very visually. The software is available to be downloaded from [www.nikouk.com](http://www.nikouk.com).

- PC:** minimum configuration: Pentium IV, 1Gb RAM. Compatible with Windows XP SP2 or a more recent version.
- Mac:** minimum configuration: Core duo, 1Gb RAM. Compatible with OS X 10.5 or a more recent version.



WALL-MOUNTED PRINTED CIRCUIT BOARDS



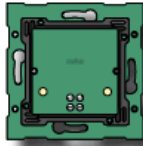
**Simple wall-mounted printed circuit board with bridge**

The wall-mounted printed circuit board enables you to connect a control unit to the installation. It is mounted onto an existing flush-mounting box or on very uneven walls. Several wall-mounted printed circuit boards with bridge can be clicked together. The wall-mounted printed circuit board with bridge can be used in combination with all Niko flush-mounting frames.

- dual input connector: possible connection of 2 wires per plug-in terminal, each with a diameter of 0.5mm to 1.5mm
- wall mounting: screws or claws
- mounting push button: click mechanism

**Complete unit**

Simple wall-mounted printed circuit board with bridge	550-14115	Pack: 1
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**Simple wall-mounted printed circuit board with connector**

The wall-mounted printed circuit board allows you to connect a control unit to the installation. The wall-mounted printed circuit board with dual input connector is mounted onto a simple flush-mounting box with screw connection. A set of claws for boxes with no screw connection can be ordered separately.

- dual input connector: possible connection of 2 wires per plug-in terminal, each with a diameter of 0.5mm to 1.5mm
- wall mounting: screws or a set of claws
- mounting push button: click mechanism

**Complete unit**

Simple wall-mounted printed circuit board with connector	550-14110	Pack: 1
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**Accessories**

Set of claws for wall-mounted printed circuit board	450-00067	Pack: 20
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**Wall-mounted printed circuit board to be used with connection unit**

The wall-mounted printed circuit board is mounted onto a simple flush-mounting box with screw connection. No additional flush-mounting boxes are required for the assembly of multiple flush-surround plates. You can work from either direction of the flush-mounting box, i.e. bottom, top, left or right, which allows you to expand push buttons without the need for additional drilling or channelling work. A set of claws for boxes with no screw connection can be ordered separately. Please note: Order a connection unit with every order for wall-mounted printed circuit boards as this is what provides the connection between the wall-mounted printed circuit board and the system.

- mounting push button: click mechanism
- wall mounting: screws or a set of claws

**Wall-mounted printed circuit boards**

Double wall-mounted printed circuit board (centre distance 71mm, horizontal)	550-14020	Pack: 1
Double wall-mounted printed circuit board (centre distance 60mm, vertical)	550-14021	Pack: 1
Double wall-mounted printed circuit board (centre distance 71mm, vertical)	550-14027	Pack: 1
3-fold wall-mounted printed circuit board (centre distance 71mm, horizontal)	550-14030	Pack: 1
3-fold wall-mounted printed circuit board (centre distance 60mm, vertical)	550-14031	Pack: 1
3-fold wall-mounted printed circuit board (centre distance 71mm, vertical)	550-14037	Pack: 1
4-fold wall-mounted printed circuit board (centre distance 71mm, horizontal)	550-14040	Pack: 1



**Connection unit for multiple wall-mounted printed circuit board**

The connection unit connects the installation to the multiple wall-mounted printed circuit board. This unit can be mounted into any position. The connection unit is required for multiple wall-mounted printed circuit boards. Please note: Use a different set of claws.

- dual connector: possible connection of 2 wires per plug-in terminal, each with a diameter of 0.5mm to 1.5mm
- mounting on wall-mounted printed circuit board: 2 screws

**Complete unit**

Connection unit for multiple wall-mounted printed circuit board	550-14090	Pack: 1
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**Accessories**

Set of claws for connection unit	450-00068	Pack: 20
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## ENERGY CONTROLS

019

### Ecodisplay

The eco display has 3 main functions: displaying energy consumption or production, activating the 'switch all off' function, and activating the presence simulation function. Depending on the monitoring modules (electricity meter or pulse counter), electricity consumption/production as well as gas and water usage will be displayed. Current usage may be displayed as a total of the previous 7 days in terms of cost or as an average figure. The end-user can press the eco button to switch off all lights and connected circuits when leaving the house. The home's energy usage will immediately decrease. The presence simulation can be activated with the pres of a button as well. The programming software indicates which energy-saving lights are included in the simulation. This adds to the feeling of safety while using the least amount of energy. The eco display is best located near the door through which the end-user usually leaves the house.

- recommended mounting height: 140-150cm
- 3 keys
- two-wire connection to installation
- back-lit colour display



### Complete unit

for mounting with claws	550-13080	Pack: 1
for mounting with screws	550-13081	Pack: 1



#### Electricity measuring module (1 channel)

This module allows end-users to monitor the electricity consumption of their home. The module is suitable for measuring the total electricity consumption or electricity production of homes connected to a single-phase network. Put the accompanying current clamp onto one or more conductors for more accurate measurements. The electricity consumption or production will be indicated on the eco display.

Using the touch screen or energy software, end-users can easily monitor their electricity consumption or electricity production and detect unusual peaks. The system must be equipped with an IP module that logs the measured data in order to obtain a detailed analysis and historical review. Includes 1 feedback LED per channel that indicates if electric current is measured, and 1 status LED for the module.

- measuring range: 5-14500W, 22mA-63A
- accuracy: IEC62053-21 class 1 (R), class 2 (L)
- connection: single phase, 230V AC, 50Hz
- max. cable diameter for current clamp: 1 x VOB 10mm<sup>2</sup> or 6 x 2.5mm<sup>2</sup> or 9 x 1.5mm<sup>2</sup>
- length of connector cable for current clamp: 100cm
- input voltage: 230V AC
- 2 connection terminals to measure the voltage of the circuit monitored
- 2 connection terminals to connect the current clamp supplied
- cross connector to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 2U
- CE compliant

#### Complete unit

Electricity measuring module (1 channel) **550-00801** Pack: 1



#### Electricity monitoring module (3 channels)

This module allows end-users to monitor the electricity consumption of their home. The module is suitable for measuring the total electricity consumption or electricity production of homes connected to a three-phase network. The module can also be used to measure part of the installation, e.g. one or some of the circuits, a specific appliance (washing machine) or the energy production of solar panels. Put the three accompanying current clamps onto one or more conductors for more accurate measurements. The electricity consumption or production will be indicated on the eco display.

Using the touch screen or energy software, end-users can easily monitor their electricity consumption or electricity production and detect unusual peaks. The system must be equipped with an IP module that logs the measured data in order to obtain a detailed analysis and historical review. Includes 1 status LED and 1 feedback LED that indicate if electric current is measured.

- measuring range: 5-14500W, 22mA-63A
- accuracy: IEC62053-21 class 1 (R), class 2 (L)
- connection: three-phase, 3 x 230V AC or 3 x 400V AC, 50Hz, single-phase, 3 circuits of 230V AC, 50Hz
- max. cable diameter for current clamp: 1 x VOB 10mm<sup>2</sup> or 6 x 2.5mm<sup>2</sup> or 9 x 1.5mm<sup>2</sup>
- length of connector cable for current clamp: 100cm
- input voltage: 230V AC
- 2 connection terminals to measure the voltage of the circuit monitored
- 2 connection terminals to connect the current clamp supplied
- cross connector to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 4U
- CE compliant

#### Complete unit

Electricity measuring module (3 channels) **550-00803** Pack: 1



#### Pulse counter

This module is used to monitor the gas, water or electricity consumption (or production). It is connected to the pulse output of a gas, water or electricity meter. The consumption or the production appears on the eco display.

Using the touch screen or the energy software, the resident can easily monitor the easy-to-read consumption or production data and detect deviations.

For a detailed analysis and history, the installation should always be equipped with an IP module which logs the measurement data. The module has three pulse inputs so that it can be connected to three meters. The pulse scale factor is entered in the installation software (e.g. 1 pulse = 1 litre). The module includes one feedback LED per channel that indicates when a pulse is detected, and one status LED for the module.

Ask the architect to provide a meter with pulse output when a connection to the utilities to be measured is being ordered.

- pulse frequency: max. 10Hz
- 3 inputs for the connection to pulse output of meter
- common connection
- 4 screw terminals
- sliding contact for the connection with other modules on the DIN rail
- ambient temperature: 0 – 60°C
- dimensions: 2U
- CE compliant

#### Complete unit

Pulse counter **550-00250** Pack: 1



#### Energy software

This software gives the resident an overview of the electricity consumption or the electricity production of his solar panels. Depending on the number of measuring modules, the consumption of specific devices or circuits is also indicated. It is possible to see the current consumption as well as the consumption history. An IP module is required to log the measurement data. The resident can also monitor the water and gas consumption if a Niko Home Control pulse counter is present. The pulse counter is connected to a gas and/or water meter with a pulse output.

With this software, the resident can analyse his consumption, set a target consumption, detect abnormal consumption and receive tips for saving energy. The software is available to be downloaded from [www.niko.be](http://www.niko.be).

**PC:** minimum configuration: Pentium IV, 1Gb RAM. Compatible with Windows XP SP2 or a more recent version.

**Mac:** minimum configuration: Core duo, 1Gb RAM. Compatible with OS X 10.5 or a more recent version.



**Thermostat**

The thermostat can be mounted in any room fitted with a radiator, floor heating system, heating unit or cooling unit. The thermostat is used for zone heating or cooling. As the Niko Home Control system controls the heating or cooling in several different rooms, end-users can reduce their energy bill considerably by linking the thermostat to the 'all off' function or calendar-based functions – as opposed to maintaining the same temperature throughout, such as in thermostatic mixer taps, for instance. To achieve the best zone heating or cooling experience, the thermostat should be used in combination with the heating or cooling module.

- 4 weekly programmes
- 4 temperature levels: nighttime, daytime, eco and antifrost
- manual operation
- recommended mounting height: 140-150cm
- 3 modes: heating, cooling, heating & cooling
- two-wire connection to installation
- back-lit display

**Complete unit**

For mounting with claws	550-I3050	Pack: 1
For mounting with screws	550-I3051	Pack: 1

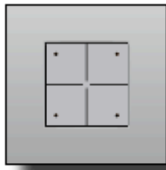


**Ventilation control**

The resident programs four ventilation settings with this push button. The push button is attached to a wall-mounted printed circuit board via a click mechanism. Key included.

**Complete unit**

<b>I01-51004</b> Pack: 1	<b>I21-51004</b> Pack: 1	<b>I22-51004</b> Pack: 1	<b>I23-51004</b> Pack: 1	<b>I24-51004</b> Pack: 1	<b>I54-51004</b> Pack: 1	<b>I57-51004</b> Pack: 1	<b>I61-51004</b> Pack: 1



**Ventilation control with led**

The resident programs four ventilation settings with this push button. An LED in the key indicates the status of the control. The push button is attached to a wall-mounted printed circuit board via a click mechanism. Key included.

**Complete unit**

<b>I01-52004</b> Pack: 1	<b>I21-52004</b> Pack: 1	<b>I22-52004</b> Pack: 1	<b>I23-52004</b> Pack: 1	<b>I24-52004</b> Pack: 1	<b>I54-52004</b> Pack: 1	<b>I57-52004</b> Pack: 1	<b>I61-52004</b> Pack: 1



MOTOR CONTROLS



**Simple motor control**

The resident operates a roller blind, a curtain or a sun blind with this push button. The push button is attached to a wall-mounted printed circuit board via a click mechanism. Key included.

**3-fold key**

<b>I01-S1003</b> Pack: 1	<b>I21-S1003</b> Pack: 1	<b>I22-S1003</b> Pack: 1	<b>I23-S1003</b> Pack: 1	<b>I24-S1003</b> Pack: 1	<b>I54-S1003</b> Pack: 1	<b>I57-S1003</b> Pack: 1	<b>I61-S1003</b> Pack: 1

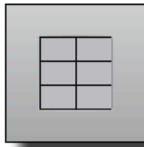


**Simple motor control with LED**

The resident operates a roller blind, a curtain or a sun blind with this push button. An LED in the key indicates the status of the control. The push button is attached to a wall-mounted printed circuit board via a click mechanism. Key included.

**3-fold key**

<b>I01-S2003</b> Pack: 1	<b>I21-S2003</b> Pack: 1	<b>I22-S2003</b> Pack: 1	<b>I23-S2003</b> Pack: 1	<b>I24-S2003</b> Pack: 1	<b>I54-S2003</b> Pack: 1	<b>I57-S2003</b> Pack: 1	<b>I61-S2003</b> Pack: 1

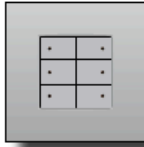


**Double motor control**

The resident operates two roller blinds, two curtains, two sun blinds or a combination of these elements with this push button. The push button is attached to a wall-mounted printed circuit board via a click mechanism. Key included.

**6-fold key**

<b>I01-S1006</b> Pack: 1	<b>I21-S1006</b> Pack: 1	<b>I22-S1006</b> Pack: 1	<b>I23-S1006</b> Pack: 1	<b>I24-S1006</b> Pack: 1	<b>I54-S1006</b> Pack: 1	<b>I57-S1006</b> Pack: 1	<b>I61-S1006</b> Pack: 1



**Double motor control with LED**

The resident operates two roller blinds, two curtains, two sun blinds or a combination of these elements with this push button. An LED in the key indicates the status of the control. The push button is attached to a wall-mounted printed circuit board via a click mechanism. Key included.

**6-fold key**

<b>I01-S2006</b> Pack: 1	<b>I21-S2006</b> Pack: 1	<b>I22-S2006</b> Pack: 1	<b>I23-S2006</b> Pack: 1	<b>I24-S2006</b> Pack: 1	<b>I54-S2006</b> Pack: 1	<b>I57-S2006</b> Pack: 1	<b>I61-S2006</b> Pack: 1



LINKING SENSORS AND OTHER INPUTS



**Digital potential-free sensor module**

The digital potential-free sensor module allows the connection of sensors with a NPN or digital output to Niko Home Control. The button on the module can be used to temporarily change the contact status for simulation purposes. Typical applications are contacts used in twilight switches, smoke detectors, motion detectors, door communication systems or contacts used in locks, telephone interfaces and alarm systems. The connected sensors must comply with SELV standards (safety extra-low voltage).

- 3 inputs for normally open (NO) contact or NPN transistor output
- 4 screw terminals
- sliding contact to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 2U
- CE compliant

**Complete unit**

Digital potential-free sensor module	550-00210	Pack: 1
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**Nikobus interface**

The Nikobus interface allows you to connect a Nikobus system for home automation to Niko Home Control. Two screw terminals are included to connect the interface to the Nikobus system.

- 2 screw terminals
- sliding contact to connect the module to other modules on the DIN rail
- ambient temperature: 0 to 60°C
- dimensions: 2U
- CE compliant

**Complete unit**

Nikobus interface	550-00505	Pack: 1
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**Twilight switch, 24V, 1 channel, 4A**

Twilight switch for outdoor wall mounting (IP54), suitable for switching outdoor lighting. Light sensitivity adjustable from 2 to 200lux. Large sensor surface for accurate light measuring. In compliance with the European directives for EMC and safety EN60669-2-1.

- 24V AC/DC ±10%
- relay contact: N.O. max. 4A
- incandescent lamps: 40W
- hysteresis on light sensitivity: +50%
- switch-off delay: ±60s
- light sensitivity: 2-200lux
- protection degree: IP54
- operating temperature: -50 to 50°C
- dimensions: H102mm x W73mm x D39mm

**Complete unit**

Twilight switch, 24V, 1 channel, 4A	350-10032	Pack: 1
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CLIMATE

01-13

**Ventilation module**

The resident controls the ventilation system (type C, D or other) with this module. You connect the ventilation with the module instead of the supplied switch with three or four settings. The module connects the ventilation control to the Niko Home Control functions such as the "all off" function or calendar-based functions. By controlling the ventilation based on presence, the resident will be saving a lot of energy while maintaining optimum air quality. The programming software allows you to decide when and how long the ventilation should be activated in which setting (low (eco), medium or high). The module only has to be connected. You can also operate each contact via a button on the module. The module includes three feedback LEDs and one status LED. Bistable relays ensure a low energy consumption.

- connection terminals for controlling 3 settings: low (eco) – medium – high
- connection terminals: 3 x 1.5mm<sup>2</sup> or 2 x 2.5mm<sup>2</sup> or 1 x 4mm<sup>2</sup>
- sliding contact for the connection with other modules on the DIN rail
- ambient temperature: 0 – 60°C
- dimensions: 2U
- CE compliant



**Complete unit**

Ventilation module	550-00140	Pack: 1
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**Heating or cooling module**

This module allows zone heating or cooling for four zones or rooms. The module includes four valve outputs (eg. for electronic valves at 230V~ or 24V DC), and one output contact for programming the heating or cooling installation for daytime or nighttime activation (depending on the need for heating or cooling in one of the zones). Most heating or cooling units include an input contact (eg. telephone contact, kettle contact). If there are more than four zones or rooms, an extra module is required. Each zone or room should be fitted with a Niko Home Control room thermostat. You can also operate each contact via a button on the module. The module includes five feedback LEDs and one status LED. Bistable relays ensure a low energy consumption.

Consult the HVAC installer to have the system fitted with control valves (eg. electronic valves on the heating collector or radiator) and to verify the contact of the heating or cooling unit to which the system should be connected.

- connection terminals for the operation of 4 valves at 230V~ or 24V DC
- connection terminals for the operation of the heating or cooling unit
- connection terminals: 3 x 1.5mm<sup>2</sup> or 2 x 2.5mm<sup>2</sup> or 1 x 4mm<sup>2</sup>
- sliding contact for the connection with other modules on the DIN rail
- ambient temperature: 0 – 60°C
- dimensions: 4U
- CE compliant



**Complete unit**

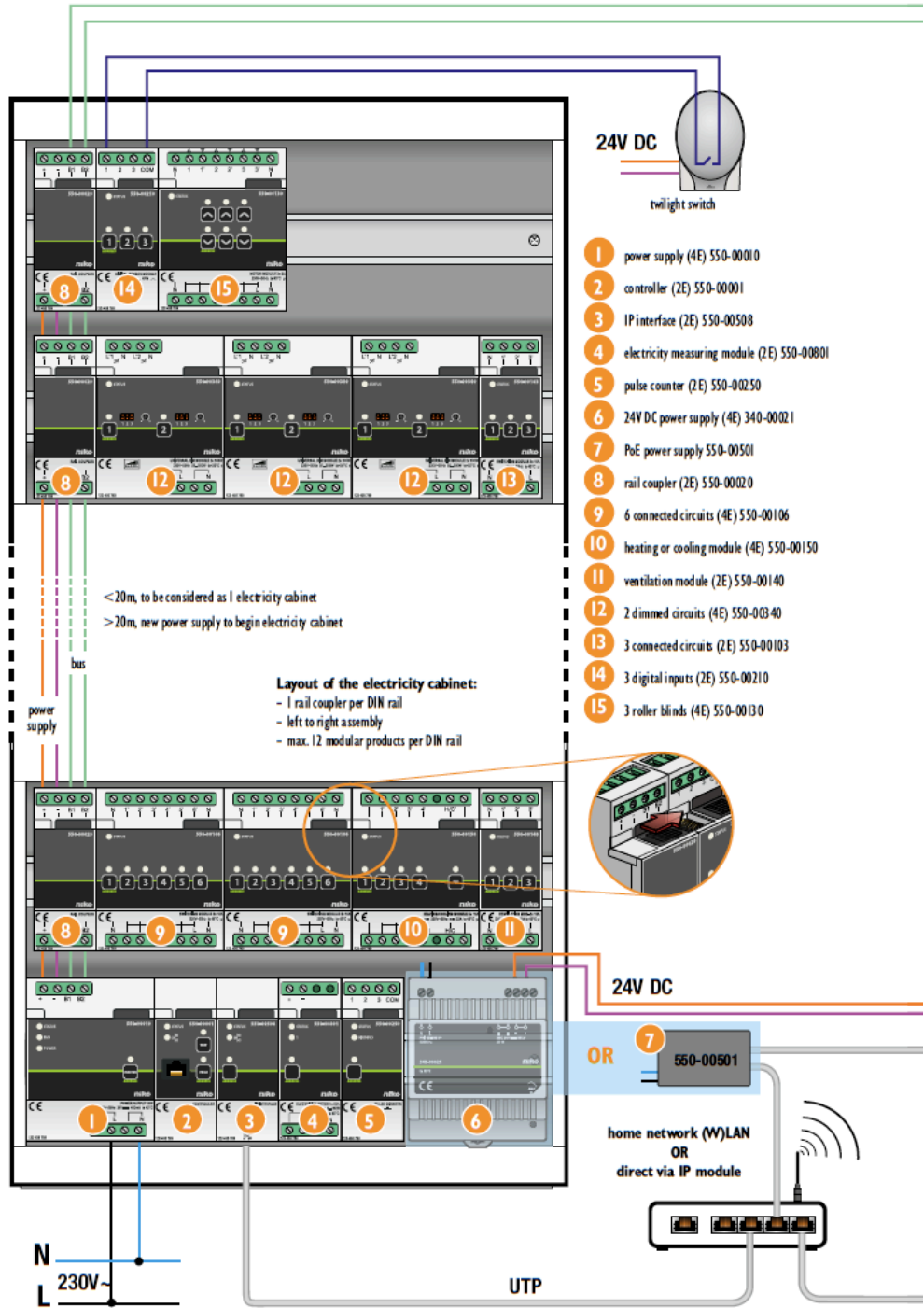
Heating or cooling module	550-00150	Pack: 1
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TECHNICAL INFORMATION



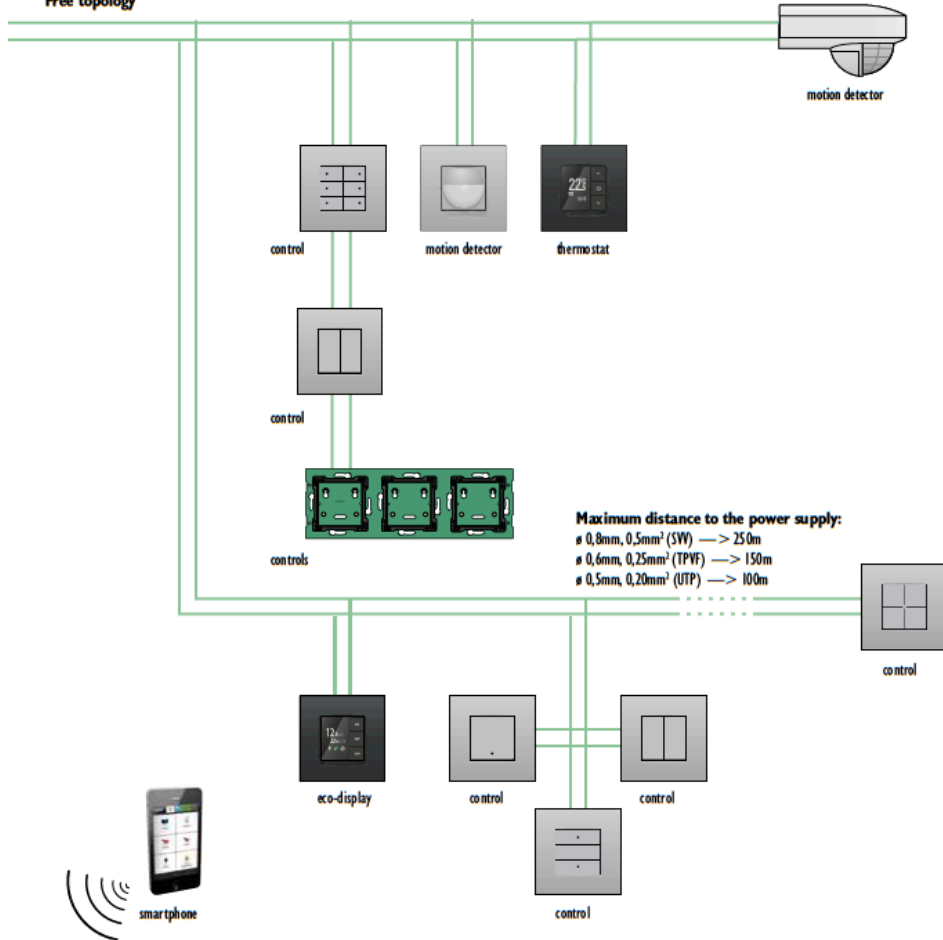
Installation example





TECHNICAL INFORMATION

Two-wire, non-polarised  
Free topology



**Maximum distance to the power supply:**  
 ø 0,8mm, 0,5mm<sup>2</sup> (SVV) —> 250m  
 ø 0,6mm, 0,25mm<sup>2</sup> (TPVF) —> 150m  
 ø 0,5mm, 0,20mm<sup>2</sup> (UTP) —> 100m



**installation sizing:**

- per power supply (maximum 3):
  - maximum 24 modular Niko Home Control products inside electrical cabinet
  - maximum 70 controls, incl. 20 with feedback / motion detector / thermostat / eco-display
- if an additional power supply or controller is provided, they will operate as a back-up







## 23 30 00 HVAC Air Distribution

### 12.1.1.1 23 31 00 HVAC Ducts and Casings

air duct systems | safe

## The Safe system

### The Safe-system

- Safe is a quickly assembled system for round ventilation ducts.
- Safe is type approved to class D by SITAC, no. 1358/88.
- The complete programme has dimensions according to Eurovent 2/3 and Swedish Standard SS-EN 1506.
- The system is based on a double-lipped, factory-installed seal made from EPDM rubber. The moulding, which can withstand rough handling, and is almost insensitive to temperature changes, gives a very airtight seal.

### Advantages of the Safe-system

- Quick assembly.
- Factory fitted seal with no loose fittings.
- Can be twisted and adjusted with tightness unaffected.
- Installation without sealant or solvents.
- Can be used in all climates.
- Seal moulding remains tight from 5 000 Pa negative pressure to 3 000 Pa positive pressure. Duct resistance to collapse differs from these pressures, and is noted on page 51.
- Type approved to sealing class D.

### Click function

The Click function exists in principle on all Safe-products. The exceptions are stated under each product. The Click function exists on the dimensions Ø 80-315. The Click function means:

- that an end with male measure has an open turned-over end and
- that an end with female measure has a number of notches.

### Type approval

Approval no 1358/88 means that the Safe-system complies with the requirements for tightness class D without any demand for pressure testing after installation. The approval is only valid on condition that all fittings are marked by us in accordance with the example and are installed in accordance with the accompanying installation instruction.

### Marking

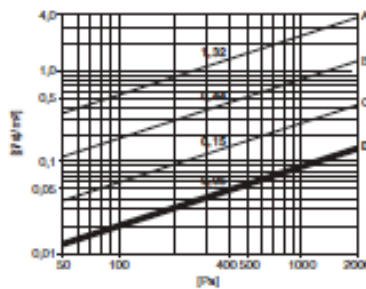
Each individual product is marked with a special label or stamped in the metal.



### Tightness

A duct system will never be "completely tight". The system will normally have some leaks at joints between ducts and fittings. The leakage will also increase as the pressure difference between the in- and outside of the duct sides increases.

The leakage factor in  $(l/s)/m^2$  is always specified in relation to the pressure difference in Pa. (The unit  $(l/s)/m^2$  denotes the leakage flow in l/s in or out of the system in relation to its duct area in  $m^2$ .) The graph below shows the leakage factor for the sealing classes A-D as a function of the pressure difference.



The graph shows that sealing class D is 3 times better than class C, which in turn is 3 times better than class B etc. Class D thus entails demands on not only the seal moulding but also the fittings and how well the system is installed.

This is one reason why we have given all fittings a turned-over edge and have given still more fittings a stop bead. This gives us stable products which are better suited to withstand handling on site at the same time as the risk of skewed assembly falls.



Turned-over edge design



## Lindab Safe® Click Assemble easy and fast



The new, innovative duct system from Lindab is based on a principle well known to you. A simple click is all it takes to assemble ducts and fittings. Save time and create a perfect ventilation solution.

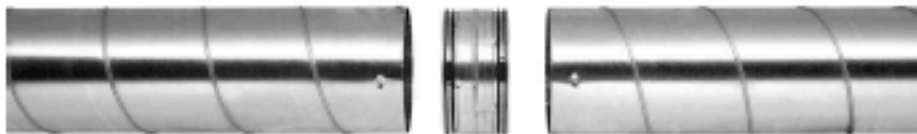
The new system is installed quickly and improves working conditions especially where space is limited. Lindab Safe Click is based on our well-known, tested and documented Safe system. We just added simplicity. One click and the job is done.

### Advantages during installation

- Quick assembly
- Minimised use of screws or rivets
- Easy to install, especially where space is limited
- Better ergonomics
- Assembling and adjusting is made easier

### Advantages during use

- Fewer holes from screws or rivets in the duct system and thereby a tighter system
- Fewer sharp parts from screws or rivets in the duct
- The ducts are easier to clean and the risk of bacteria growth is reduced
- Based on our well-known, tested and well-documented Lindab Safe system
- Compatible with other systems





## Assembly Instruction Lindab Safe and Lindab Safe Click

1

The Lindab Safe and the Lindab Safe Click duct system are type-approved, as per certificate no. 1358/88 issued by SITAC and are subject to continuous production checks.

2

This means that the requirements for air tightness class D are met if ducts and fittings of the systems are used and if assembly is performed as per these instructions.

3

The products covered by the type approval are either specified on the delivery note or are supplied with the following labelling. Labelling can comprise a sticker or an embossing on the sheet metal.

4



6

NOTE! The assembly methods described herein only cope with the forces from the "Static pressure limits" defined in EN 12237. Forces from other sources, e.g. gravity or wind, have to be dealt with using other means, e.g. suspensions or supports.

7

NOTE! If the system shall be tested for air tightness, this shall be done before integration and insulation so that there is an opportunity for inspection and taking action. Any complaints regarding air tightness will only be dealt with provided the system is fully accessible for inspection.

8

### Joining systems (general characteristics)

9

Lindab Safe	Lindab Safe Click
Is joined with screws or blind rivets.	Is joined with snapping heels, below called notches. Is based on Lindab Safe.
Spans all dimensions.	Spans only a restricted number of dimensions. See table 2. For the other dimensions use Lindab Safe.
	Lindab Safe Click can be complementary joined with screws or blind rivets. This may be done in order to: <ul style="list-style-type: none"> <li>• achieve a stronger joint</li> <li>• prevent a joint from twisting</li> <li>• join a Click product with a non-Click product</li> <li>• join a Click product with a non-Click product to create an operable joint.</li> </ul>

10

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# Circular duct

SR



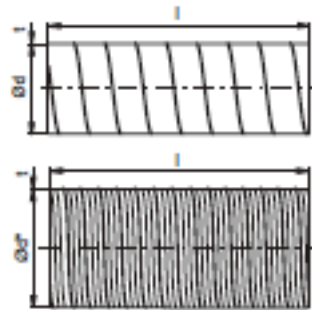
### Description

#### Circular duct

Ducts are always produced locally and can therefore have different thicknesses and other specifications per country.

Has normally not any Click function – hasn't any notches.  
Can to order be delivered with Click function – i.e. with notches.

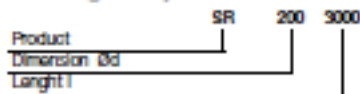
### Dimensions



Ød std nom	Ø std m	A std <sup>2</sup> /4 m <sup>2</sup>	t std mm	l std mm	ml std kg/m
63	0,198	0,003	0,5	3000	0,89
80	0,251	0,005	0,45	3000	0,91
100	0,314	0,008	0,45	3000	1,14
112	0,352	0,010	0,5	3000	1,42
125	0,393	0,012	0,45	3000	1,41
140	0,440	0,015	0,5	3000	1,76
150	0,471	0,018	0,5	3000	1,89
160	0,503	0,020	0,5	3000	2,02
180	0,565	0,025	0,5	3000	2,26
200	0,628	0,031	0,5	3000	2,56
224	0,704	0,039	0,6	3000	3,42
250 *	0,785	0,049	0,5	3000	3,18
280	0,880	0,062	0,55	3000	3,92
300 *	0,942	0,071	0,55	3000	4,20
315 *	0,990	0,078	0,55	3000	4,41
355 *	1,115	0,099	0,55	3000	4,96
400 *	1,257	0,126	0,55	3000	6,01
450 *	1,414	0,159	0,7	3000	8,60
500 *	1,571	0,196	0,7	3000	9,54
560 *	1,759	0,246	0,8	3000	12,2
600 *	1,885	0,283	0,7	3000	13,1
630 *	1,979	0,312	0,7	3000	12,0
710 *	2,231	0,396	0,8	3000	15,5
800 *	2,513	0,503	0,8	3000	17,4
900 *	2,827	0,636	0,9	3000	21,7
1000 *	3,142	0,785	0,9	3000	24,1
1120 *	3,519	0,985	0,9	3000	27,0
1250 *	3,927	1,227	0,9	3000	30,2
1400 *	4,398	1,539	1,25	2400	48,0
1500 *	4,712	1,767	1,25	2400	51,4
1600 *	5,027	2,011	1,25	2400	54,8

\* With outturned stiffening corrugation

### Ordering example



- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18



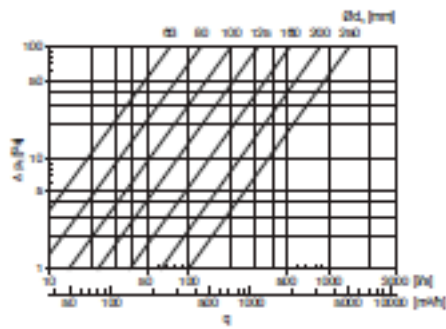
# Bend

# BU 90°

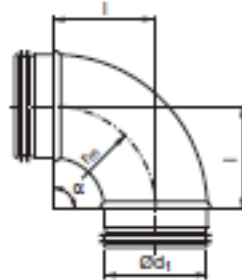


### Description

Pressed and seam welded bend.



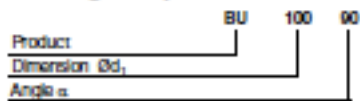
### Dimensions



$m \approx l \cdot d_1$

$D_{d1}$ nom	l mm	m kg
83	110	0,20
80	105	0,26
100	100	0,31
112	120	0,39
125	125	0,48
140	135	0,66
150	150	0,66
160	160	0,74
180	180	1,02
200	200	1,12
224	225	1,33
250	250	1,77

### Ordering example



We reserve the right to make changes without prior notice



55

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18



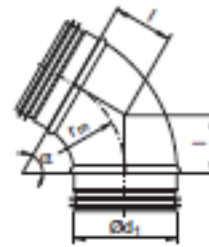
# Bend

# BU 60°

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18

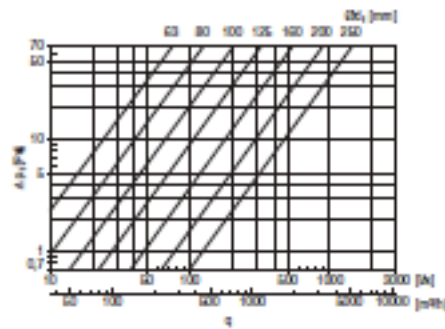


### Dimensions



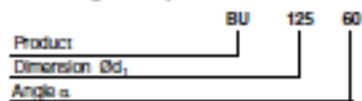
$$r_m = 1 \cdot d_1$$

**Description**  
Pressed and seam welded bend.



Ød <sub>1</sub> nom	l mm	m kg
63	64	0,30
80	58	0,32
100	58	0,33
112	69	0,37
125	72	0,33
140	78	0,51
150	87	0,50
160	92	0,56
180	104	0,79
200	115	0,82
224	130	0,95
250	144	1,12

### Ordering example





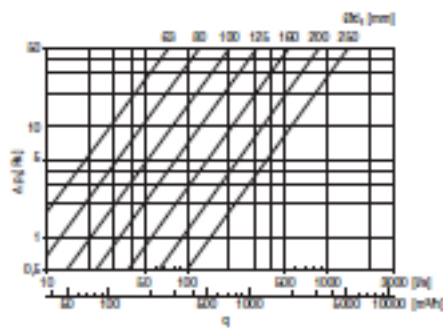
# Bend

# BU 45°

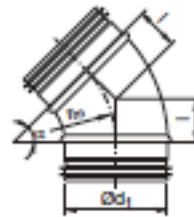


### Description

Pressed and seam welded bend.



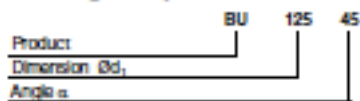
### Dimensions



$l \approx 1 \cdot d_1$

Ød <sub>1</sub> nom	l mm	m kg
63	46	0,16
80	41	0,17
100	41	0,21
112	81	0,24
125	52	0,29
140	56	0,43
150	62	0,42
160	66	0,48
180	76	0,65
200	83	0,80
224	93	0,82
250	103	1,05

### Ordering example



We reserve the right to make changes without prior notice



57

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18



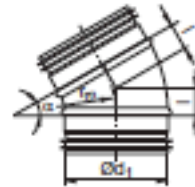
# Bend

# BU 30°

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18



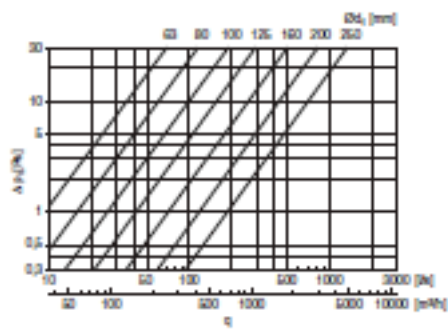
### Dimensions



$r_m = 1 \cdot d_1$

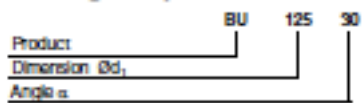
### Description

Pressed and seam welded bend.



Ød <sub>1</sub> nom	l mm	m kg
63	29	0,13
80	27	0,15
100	27	0,18
112	30	0,21
125	33	0,20
140	36	0,36
150	40	0,35
160	43	0,32
180	48	0,51
200	54	0,62
224	60	0,72
250	67	0,91

### Ordering example







# Reducer

# RCFU

- 1
- 2
- 3
- 4
- 5
- 6
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- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18



### Description

Pressed, concentric reducer with female coupling, with a 45° angle to meet demands for short installation length with low pressure drop and low internal noise generation. Ød fits outside another fitting.

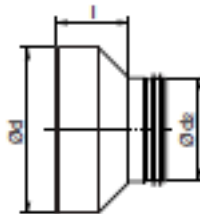
Pressure drop, see graphs on page 79.

Has Click function at the Safe end – has an open turned-over end.

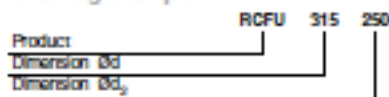
Has normally not any Click function at the female end – hasn't any notches.

Can to order be delivered with Click function at the female end as well – i.e. with notches.

### Dimensions



### Ordering example



### Dimensions

Ød nom	Ød <sub>2</sub> nom	l mm	m kg
80	63	57	0,11
100	63	70	0,14
100 *	80	61	0,16
125 *	80	73	0,16
125 *	100	64	0,14
150	100	78	0,16
150 *	125	66	0,17
160 *	80	92	0,24
160 *	100	83	0,16
160 *	125	71	0,20
160	150	59	0,25
180	100	98	0,24
180	125	85	0,31
180	150	68	0,24
180	160	66	0,27
200 *	100	84	0,23
200 *	125	90	0,27
200	150	75	0,34
200 *	160	73	0,26
200	180	63	0,32
224	150	92	0,45
224	160	87	0,49
224	180	76	0,46
224	200	66	0,45
250 *	125	133	0,57
250	150	122	0,56
250 *	160	117	0,40
250	180	107	0,55
250 *	200	103	0,42
250	224	89	0,53
300	200	119	0,68
300	250	94	0,66
315 *	160	153	0,82
315 *	200	134	0,77
315 *	250	108	0,65
355	250	136	1,04
355	315	97	0,89
400 *	200	196	1,31
400 *	250	174	1,37
400 *	315	133	1,20
500 **	250	208	2,12
500 **	315	185	2,09
500 **	400	150	1,95
630 **	315	240	2,76
630 **	400	198	2,72
630 **	500	148	2,69

- \* With turned-over edge
- \*\* Hand made
- † With stream-lined transition



# T-piece

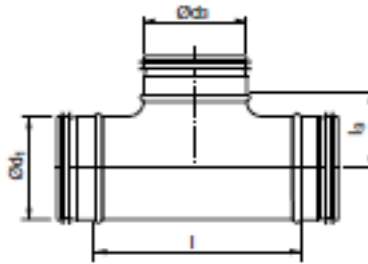
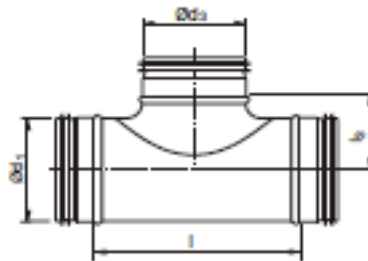
# TCPU

- 1
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- 14
- 15
- 16
- 17
- 18



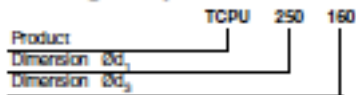
**Description**  
T-piece built with PSU saddle or a fully pressed top section.  
Pressure drop, see graphs on page 85.  
Pressure drop, see graphs on page 85.

### Dimensions



Ød <sub>1</sub> nom	Ød <sub>2</sub> nom	l mm	l <sub>2</sub> mm	m kg
63	63	125	42	0,26
80	63	125	50	0,31
80	80	140	52	0,36
100	63	125	60	0,35
100	80	103	65	0,23
100	100	130	65	0,32
112	63	125	66	0,41
112	80	140	68	0,47
112	100	175	71	0,55
112	112 *	175	56	0,57
125	63	125	73	0,44
125	80	97	75	0,34
125	100	130	78	0,37
125	112	175	78	0,61
125	125	165	83	0,44
140	80	140	82	0,56
140	100	175	85	0,65
140	112	175	85	0,67
140	125 *	215	70	0,76
140	140	230	90	0,78
150	80	140	87	0,58

### Ordering example





12.1.1.2 23 37 00 Air Outlets and Inlets

comfort | displacement diffusers



# Theatre diffuser

CRU



### Description

CRU is a rectangular displacement diffuser for installation under seats in theatres, auditoriums, etc. The diffuser is supplied with a circular connection. The diffuser can be supplied with a fixed resistance adapted to the correct air volume and pressure, specified according to the actual conditions.

- Circular connection with Lindab Safe.
- The diffuser can be supplied with a fixed resistance at a specified pressure setting
- The diffuser is available in other dimensions.

### Maintenance

The front plate can be removed from the diffuser for cleaning of the internal components. The visible parts of the diffuser can be wiped with a damp cloth.

### Materials and finish

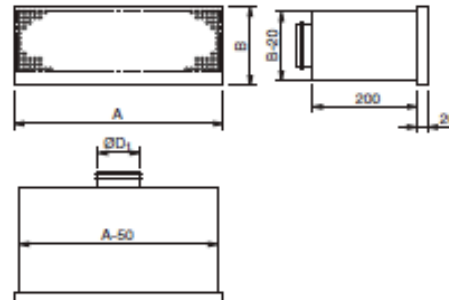
Diffuser:	Galvanised steel
Nozzles:	Black plastic
Front plate:	1 mm galvanised steel
Standard finish:	Powder-coated
Standard colour:	RAL 7040 - grey, gloss 30
	RAL 9010 - white, gloss 30

The diffuser is available in other colours. Please contact Lindab's sales department for further information.

### Ordering example

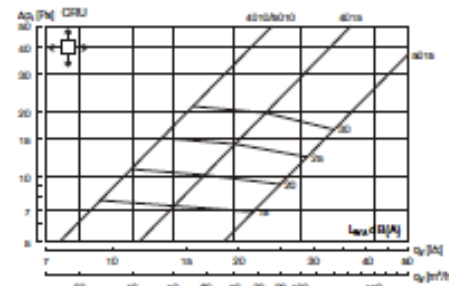
Product	CRU	a	bbbb
Type			
Colour	RAL 7040 - grey	0	
	RAL 9010 - white	1	
	Special colour	2	
Size			

### Dimensions

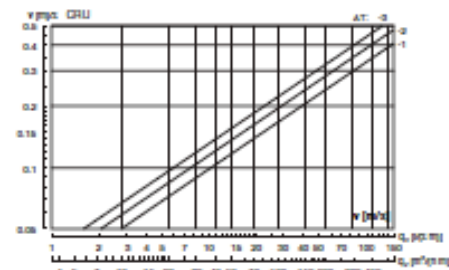


Size	A mm	B mm	ØD <sub>1</sub> mm	m kg
4010	400	100	80	1.4
4015	400	150	100	2.0
5010	500	100	80	1.7
5015	500	150	125	2.5

### Pressure, sound level



### Near zone



The speed is measured 0.5 m from the diffuser.



Heating

# Technical Data

Daikin Altherma



EEDEN10-710



## Daikin Altherma LT Monobloc

### 2 / MONOBLOC OUTDOOR UNIT: ALL IN ONE

In addition to Daikin Altherma outdoor and indoor unit systems, Daikin has introduced a monobloc version in which all hydraulic parts are located within the outdoor unit.

In this new system the water pipes, rather than refrigerant lines, run indoors from the outdoor unit, making installation much quicker and easier for the installer.

### 4 / SOLAR KIT - optional

The solar kit provides the transfer of solar heat to the Daikin Altherma hot water tank via an external heat exchanger. In contrast to tanks with two heat exchangers, this system allows the entire content of the tank to be efficiently heated with solar heat and, if necessary, with heat pump energy.

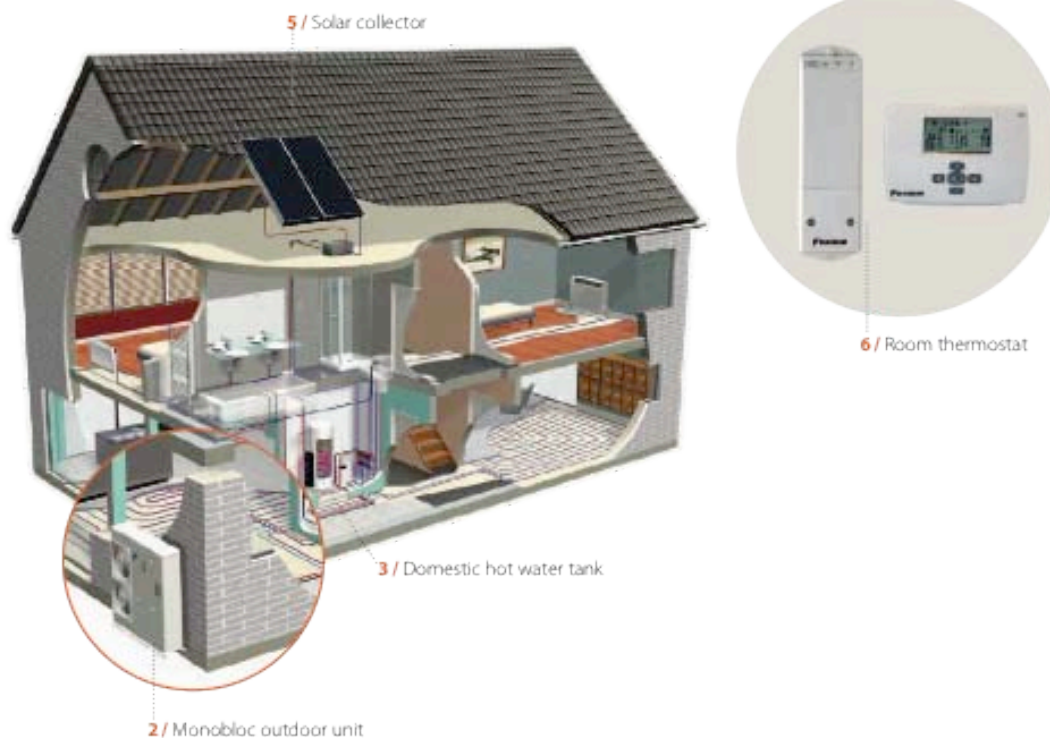
### 6 / ROOM THERMOSTAT - optional

With the wired or wireless room thermostat, the ideal temperature can be easily, quickly and conveniently regulated. An external sensor (EKRTETS) can be placed between the under floor heating and the floor, as an option to the wireless room thermostat. It allows for more precise measurement and can regulate the comfort level of your customer even more optimally and energy efficiently.

\*EKRTW for wired wall-mounting and EKRTR for the wireless type.

### 5 / SOLAR COLLECTOR - optional

The high-efficiency collectors transfer all the short-wave solar radiation into heat as a result of their highly selective coating. The collectors can be mounted on the roof tiles.





## DAIKIN ALTHERMA - LOW TEMPERATURE (LT)

### HOW DOES THE DAIKIN ALTHERMA AIR TO WATER HEAT PUMP WORK?

#### Daikin Altherma LT Split

##### 1A / OUTDOOR UNIT :

##### AN EFFICIENT USE OF ENERGY FROM THE AIR

Daikin Altherma uses a natural source of energy. The outdoor unit extracts heat from the outside air and raises its temperature to a level high enough to supply heating. This heat is then transferred to the indoor unit through refrigerant pipes (thus, the additional advantage is that the pipes can never freeze). The compact outdoor unit is easily installed and, as no drilling or excavation work is required, it can also be installed in flats and apartments.

##### 1B / INDOOR UNIT :

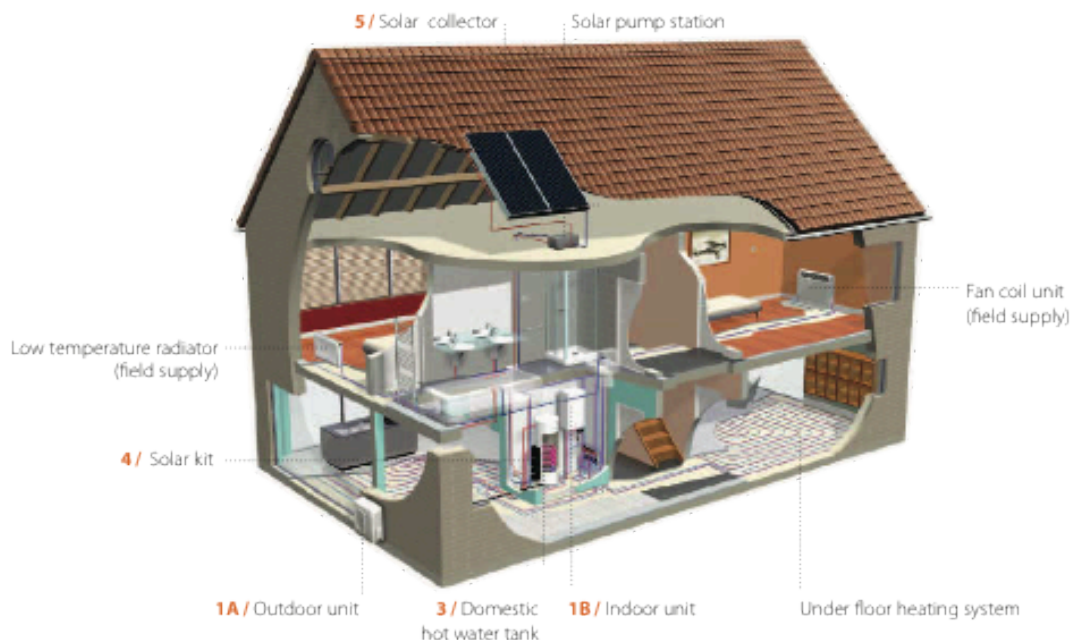
##### THE HEART OF THE DAIKIN ALTHERMA SYSTEM

The indoor unit heats the water that circulates through low temperature radiators, floor heating systems or fan coil units and also provides domestic hot water. If you opt for the combination of heating and cooling, then the indoor unit can also decrease the water temperature to distribute a refreshing coolness.

##### 3 / DOMESTIC HOT WATER TANK : FOR LOW ENERGY CONSUMPTION

As for your domestic hot water, Daikin Altherma is just as clever. The unique lay-out and special placement of the system components maximise energy efficiency. The water inside the storage tank is primarily warmed up by thermal energy from the outside air, thanks to a heat exchanger connected to the heat pump. However, an additional electrical heating element in the domestic water tank

can take care of extra heat required in the shower, tub or sink. At necessary intervals the water is automatically heated to 70°C to prevent the risk of bacteria growth. With Daikin Altherma you can enjoy delightfully warm and perfectly safe water at all times. Depending on the daily consumption of hot water, Daikin Altherma domestic hot water tanks are available in different sizes.





## Daikin Altherma LT Monobloc

### 2 / MONOBLOC OUTDOOR UNIT: ALL IN ONE

In addition to Daikin Altherma outdoor and indoor unit systems, Daikin has introduced a monobloc version in which all hydraulic parts are located within the outdoor unit.

In this new system the water pipes, rather than refrigerant lines, run indoors from the outdoor unit, making installation much quicker and easier for the installer.

### 4 / SOLAR KIT - optional

The solar kit provides the transfer of solar heat to the Daikin Altherma hot water tank via an external heat exchanger. In contrast to tanks with two heat exchangers, this system allows the entire content of the tank to be efficiently heated with solar heat and, if necessary, with heat pump energy.

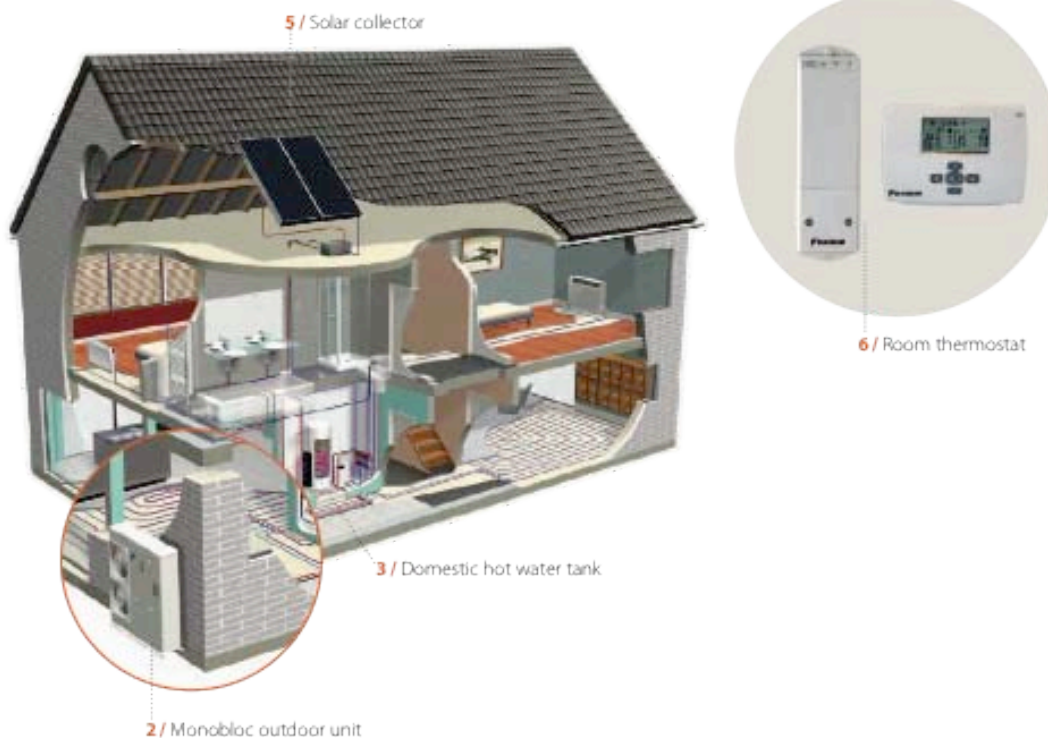
### 6 / ROOM THERMOSTAT - optional

With the wired or wireless room thermostat, the ideal temperature can be easily, quickly and conveniently regulated. An external sensor (EKRTETS) can be placed between the under floor heating and the floor, as an option to the wireless room thermostat. It allows for more precise measurement and can regulate the comfort level of your customer even more optimally and energy efficiently.

\*EKRTW for wired wall-mounting and EKRTR for the wireless type.

### 5 / SOLAR COLLECTOR - optional

The high-efficiency collectors transfer all the short-wave solar radiation into heat as a result of their highly selective coating. The collectors can be mounted on the roof tiles.





## TECHNICAL DATA - MONOBLOC

### NEW OUTDOOR UNIT



SINGLE PHASE			HEATING ONLY			REVERSIBLE		
			EDLQ011B6V3	EDLQ014B6V3	EDLQ016B6V3	EBLQ011B6V3	EBLQ014B6V3	EBLQ016B6V3
			EDHQ011B6V3	EDHQ014B6V3	EDHQ016B6V3	EBHQ011B6V3	EBHQ014B6V3	EBHQ016B6V3
	With bottom plate heater							
	Without bottom plate heater							
Dimensions	HxWxD	mm	1,418x1,435x382			1,418x1,435x382		
Nominal capacity	Heating	KW	11.20	14.00	16.00	11.20	14.00	16.00
	Cooling	KW	-	-	-	12.85	15.99	16.73
Nominal power input	Heating	KW	2.47	3.20	3.79	2.47	3.20	3.79
	Cooling	KW	-	-	-	3.78	5.65	6.28
COP			4.54	4.37	4.22	4.54	4.37	4.22
EER			-	-	-	3.39	2.83	2.66
Operation range	Heating	°CDB	-15-35 (1)			-15-35 (1)		
	Cooling	°CDB	-			10-46		
	Domestic water	°CDB	-15-43			-15-43		
Sound power level	Heating	dBA	64		66	64	66	
	Cooling	dBA	-		-	65	66	
Sound pressure level	Heating	dBA	51		52	51		52
	Cooling	dBA	-		-	50	52	
Weight		kg	180			180		
Refrigerant charge	R-410A	kg	2.95			2.95		
Power supply			1~230V/50Hz			1~230V/50Hz		
Recommended fuses		A	32			32		

Measuring conditions: Heating Ta DBL/WB 7°C/6°C - LWC 35°C (DT=5°C) - Cooling Ta 35°C - LWE18°C (DT=5°C)  
(1) E/D/B/L\* models can reach -20°C / E/D/B/L\*6W1 models can reach -25°C but without capacity guarantee



THREE PHASE			HEATING ONLY			REVERSIBLE		
			EDLQ011B6W1	EDLQ014B6W1	EDLQ016B6W1	EBLQ011B6W1	EBLQ014B6W1	EBLQ016B6W1
			EDHQ011B6W1	EDHQ014B6W1	EDHQ016B6W1	EBHQ011B6W1	EBHQ014B6W1	EBHQ016B6W1
	With bottom plate heater							
	Without bottom plate heater							
Dimensions	HxWxD	mm	1,418x1,435x382			1,418x1,435x382		
Nominal capacity	Heating	KW	11.20	14.00	16.00	11.20	14.00	16.00
	Cooling	KW	-	-	-	12.85	15.99	16.73
Nominal power input	Heating	KW	2.51	3.22	3.72	2.51	3.22	3.72
	Cooling	KW	-	-	-	3.78	5.32	6.06
COP			4.46	4.35	4.30	4.46	4.35	4.30
EER			-	-	-	3.39	3.01	2.76
Operation range	Heating	°CDB	-15-35 (1)			-15-35 (1)		
	Cooling	°CDB	-			10-46		
	Domestic water	°CDB	-15-43 (1)			-15-43 (1)		
Sound power level	Heating	dBA	-		-	64	66	
	Cooling	dBA	-		-	65	66	
Sound pressure level	Heating	dBA	49	51	53	49	53	
	Cooling	dBA	-		-	50	52	
Weight		kg	180			180		
Refrigerant charge	R-410A	kg	2.95			2.95		
Power supply			3N~400V/50Hz			3N~400V/50Hz		
Recommended fuses		A	20			20		

Measuring conditions: Heating Ta DBL/WB 7°C/6°C - LWC 35°C (DT=5°C) - Cooling Ta 35°C - LWE18°C (DT=5°C)  
(1) E/D/B/L\* models can reach -20°C / E/D/B/L\*6W1 models can reach -25°C but without capacity guarantee





NEW SOLAR COLLECTOR



		EKSV26P	EKSH26P
Position		Vertical	Horizontal
Dimensions	HxWxD mm	2,050x1,300x85	1,300x2,000x85
Outer surface	m <sup>2</sup>		2.60
Absorber surface	m <sup>2</sup>		2.36
Weight	kg		42
Water content	l	1.7	2.1
Absorber	harp-shaped copper pipe registers with laser-welded highly selective coated aluminium plate		
Coating	micro-thin absorption max. 96%, emission ca. 5% +/- 2%		
Glazing	Single pane safety glass, transmission +/- 92%		
Heat insulation	mineral wool, 50mm		
Max. pressure drop at 1000/h	mbar	3	0.5
Allowed roof angle			15° to 80°
Max. standstill temperature	°C		200
Max. operating pressure	bar		6

The collectors are standstill resistant over a long period and are tested for thermal shock.  
 Minimum collector yield over 525kWh/m<sup>2</sup> at 40% covering proportion, location Würzburg, Germany.





## 1 Features

- High temperature application: up to 50°C without electric heater
- Three phase large capacity indoor unit
- Cost effective alternative to a fossil fuel boiler
- Low energy bills and low CO2 emissions
- Easy to install
- Total solution for year round comfort

6  
1





2-1 Technical Specifications				BEHRD011AA1	EKBRD014AY1	ENBRD015AA1
Casing	Colour			Metal c grey		
	Material			Precoated sheet metal		
Dimensions	Packing	Height	mm	860	860	860
		Width	mm	680	680	680
		Depth	mm	800	800	800
	Unit	Height	mm	705	705	705
		Width	mm	600	600	600
		Depth	mm	695	695	695
Weight	Unit		kg	147,25		
	Packed Unit		kg	156	156	156
Packing	Material			EPS		
				Cardboard		
				MDF		
				Wood (pallet)		
				Metal		
Weight			kg	8,75		
Main components	Refrigerant side heat exchanger	Type	Plate heat exchanger			
		Quantity	1	1	1	
Refrigerant side heat exchanger	Plates	Quantity	60	60	60	
Main components	Refrigerant side heat exchanger	Material	AISI 316			
		Insulation material	EPDM type			
	Pump	Type	DC motor			
		Nr. of speed	Inverter controlled			
Pump	Nominal ESP unit	Heating	kPa	94,0	91,9	89,7
Main components	Pump	Power input	W	87	95	101
		Water side Heat exchanger	Type	Plate heat exchanger		
Water side Heat exchanger	Plates	Qty	1	1	1	
		Quantity	50	50	50	
Main components	Water side Heat exchanger	Material	AISI 316			
		Water volume	l	2,78	2,78	2,78
Water side Heat exchanger	Water flow rate Nom.	Heating	l/min	15,8	20,1	22,9
Main components	Water side Heat exchanger	Water flow rate Max.	l/min	31,6	40	45,8
		Insulation material	EPDM type			
	Expansion vessel	Volume	l	12	12	12
		Max. water pressure	bar	3	3	3
		Pre pressure	bar	1	1	1
	Water filter	Diameter perforations	mm	1	1	1
		Material	Brass			
Cascade compressor	Quantity	1	1	1		
Cascade compressor	Motor	Type	Hermetically sealed scroll compressor			
		Starting Method	Direct on line			
Motor	Crankcase Heater	Quantity	1	1	1	
Cascade compressor	Motor	Crankcase Heater Output	W	33	33	33
Water circuit	Piping connections diameter		Inch	G 1"1/4 (female)		
	Piping		Inch	1"		
	Safety valve		bar	3	3	3
	Manometer			Yes		
	Drain valve / Fill valve			Yes		
	Shut off valve			Yes		
	Air purge valve			Yes		
Heating water system	Water volume	Min	l	20	20	20
		Max	l	400	400	400

**6**  
**2**



## 2 Specifications

2-1 Technical Specifications				BOHRD01AAJ1	EKHRD04AAJ1	BOHRD016AAJ1
Refrigerant Circuit	Gas side diameter	mm		15,9		
	Liquid side diameter	mm		9,52		
	High pressure side	Design pressure	bar	38	38	38
Sound level	Sound Pressure	dBA	43(1)/46(2)	45(1)/48(2)	46(1)/48(2)	
Sound Level Night Quiet	Sound Pressure	dBA	40	43	45	
Ambient	Heating	Min	°C	-20	-20	-20
		Max	°C	20	20	20
	Domestic hot water	Min	°C	-20	-20	-20
		Max	°C	35	35	35
Waterside	Heating	Min	°C	25	25	25
		Max	°C	80	80	80
	Domestic hot water	Min	°C	25	25	25
		Max	°C	80	80	80
Installation place				Indoor		
Notes				Nominal water flow rate for $\Delta t = 10^{\circ}\text{C}$		
				Maximum water flow rate for $\Delta t = 5^{\circ}\text{C}$		
				(1) Sound levels are measured at condition 1: EW: 55°C; LW: 65°C		
				(2) Sound levels are measured at condition 3: EW: 70°C; LW: 80°C		
				Sound level in night quiet mode is measured at condition 1: EW: 55°C; LW: 65°C		
				Sound level is valid in the field condition because it is measured in a semi-echoic room. Measured value under actual installation conditions will be higher due to environmental noise and sound reflections. Values are sound pressure values measured at all sides (front, back, left, right, top) at 1m distance. The values do not occur simultaneously on all mentioned sides.		
				For details on operation range: cf. TW drawing		

6

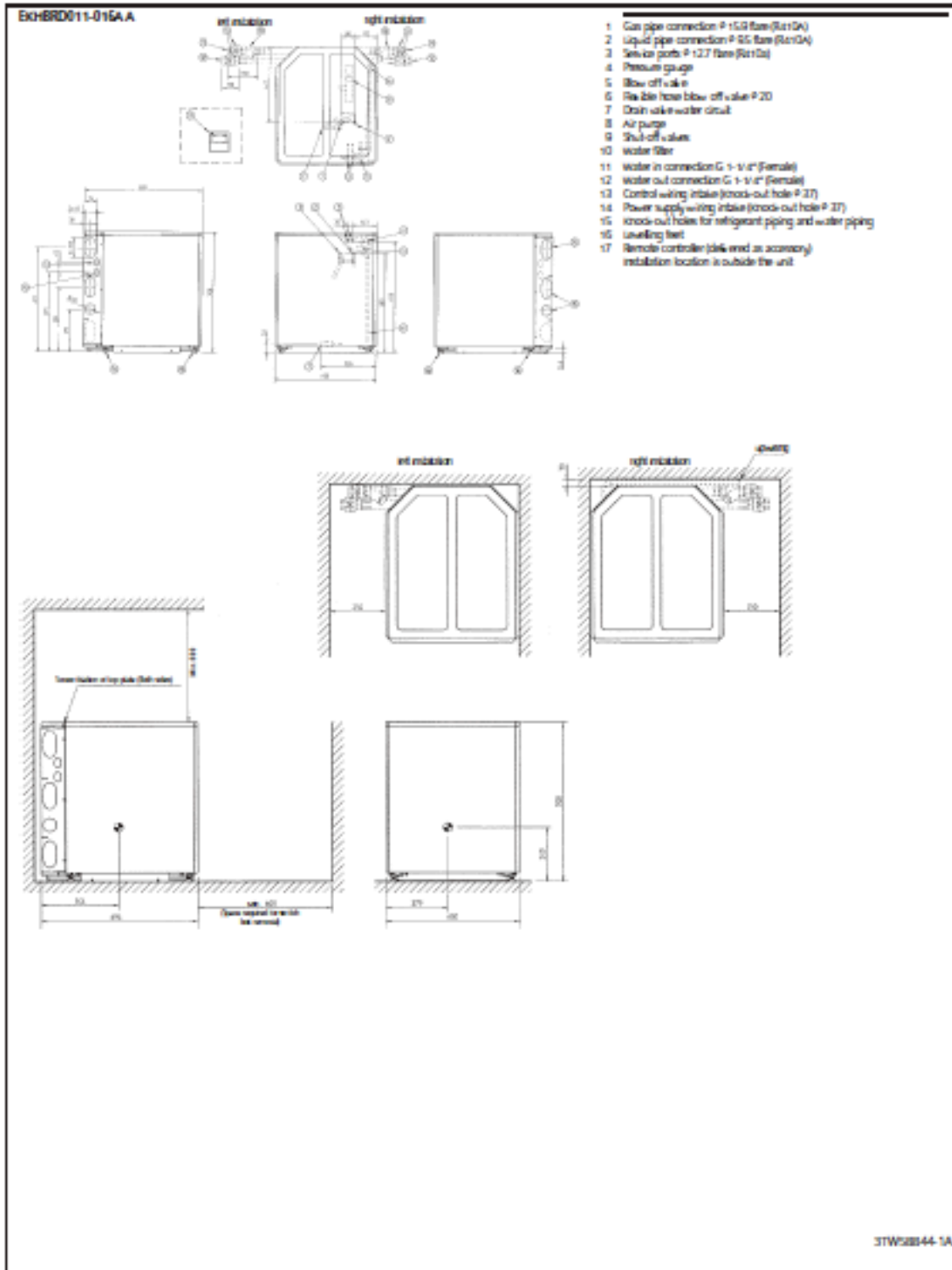
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2-2 Electrical Specifications				BOHRD01AAJ1	EKHRD04AAJ1	BOHRD016AAJ1
Power Supply	Name	Y1				
	Phase	3-				
	Frequency	Hz	50	50	50	
	Voltage	V	380-415			
Maximum running Current	Heating	A	12,5			
Recommended fuses		A	16	16	16	
Voltage range	Minimum	-10%				
	Maximum	+10%				
Wiring connections	For Power Supply	Quantity	4G			
		Type of wires	(3) Size of diameter and type according to national and local regulations			
		Quantity	4G+2G			
		Connection type	For power supply with benefit kWh rates			
		Type of wires	(3) Size of diameter and type according to national and local regulations			
Power Supply Intake				Both indoor and outdoor unit		
Wiring connections	Connection type		For connection with outdoor unit			
	Quantity of wires		2	2	2	
	Type of wires		F1+F2			



## 4 Dimensional drawing & centre of gravity

### 4 - 1 Dimensional drawing





## 23 70 00 Central HVAC Equipment



Ventilation

# Technical Data

Heat Reclaim Ventilation



EED08-205A



## 1 External appearance



VAM150FA8VE



VAM250FA8VE



VAM350FA8VE



VAM500FA8VE



VAM650FA8VE



VAM800FA8VE



VAM1000FA8VE



VAM1500FA8VE

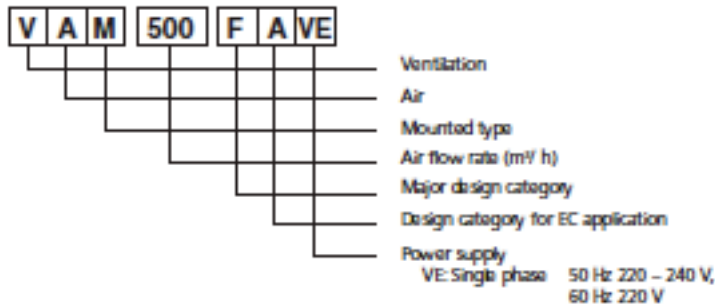


VAM2000FA8VE

## 2 Model series

- VAM150FA8VE
- VAM250FA8VE
- VAM350FA8VE
- VAM500FA8VE
- VAM650FA8VE
- VAM800FA8VE
- VAM1000FA8VE
- VAM1500FA8VE
- VAM2000FA8VE

## 3 Nomenclature

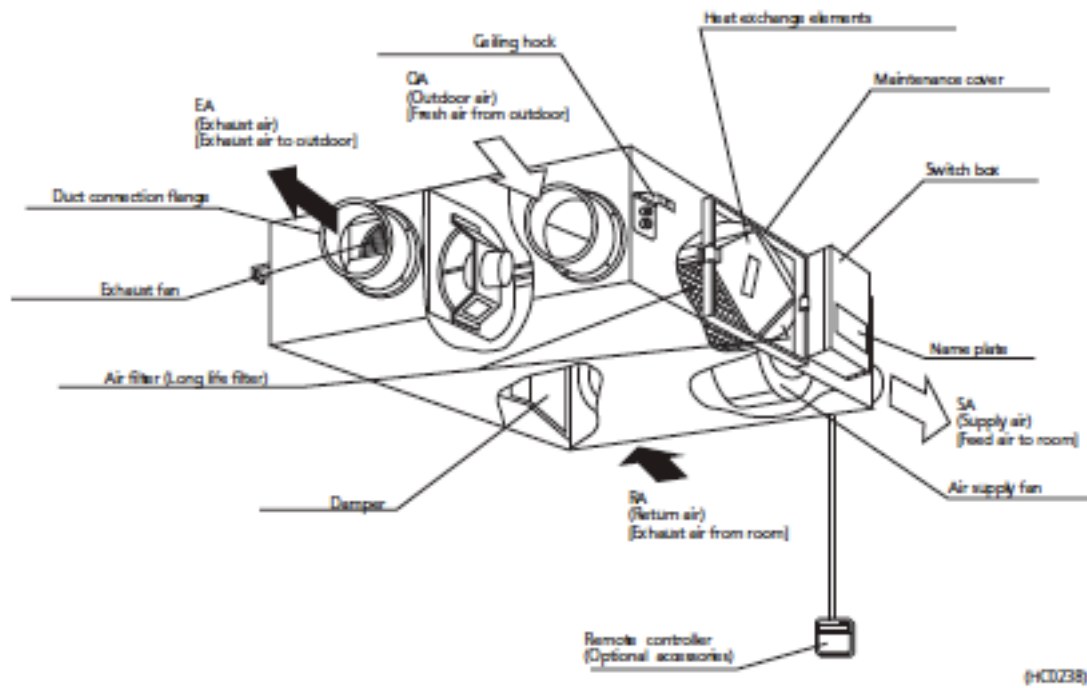


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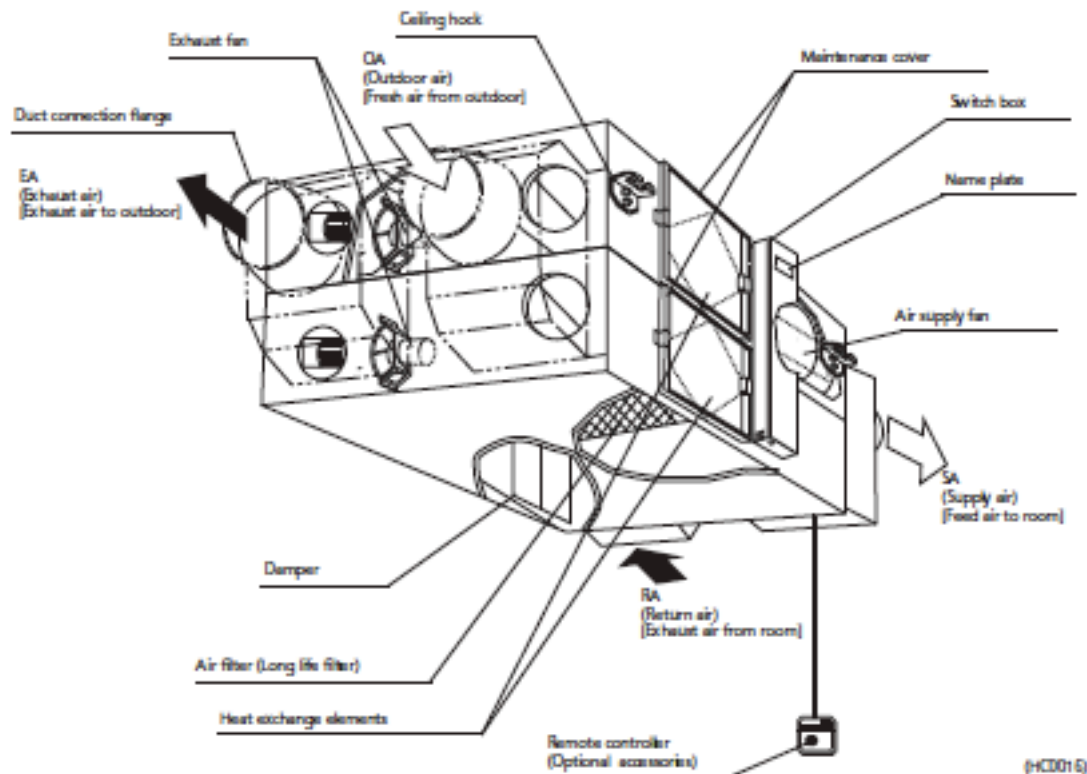


## 4 Structures

### VAM150-1000FA



### VAM1500,2000FA







## 7 Product Specification

### 7-1 Specifications

#### 7-1-1 Technical specifications

(50Hz)

Model name			VAM150FA	VAM250FA	VAM350FA		
Power supply			Single phase 220 – 240 V / 50Hz				
Temperature exchanging efficiency	Ultra-High	%	74	72	75		
	High	%	74	72	75		
	Low	%	79	77	80		
Enthalpy exchange efficiency	Cooling	Ultra-High	%	58	58	61	
		High	%	58	58	61	
		Low	%	64	62	67	
	Heating	Ultra-High	%	64	64	65	
		High	%	64	64	65	
		Low	%	69	68	70	
Normal input	Heat exchange mode	Ultra-high	W	116	141	194	
		High	W	100	112	175	
		Low	W	56	60	111	
	Bypass mode	Ultra-high	W	116	141	194	
		High	W	100	112	175	
		Low	W	56	62	111	
Normal Amp.	Heat exchange mode	Ultra-high	A	0.67	0.72	1.00	
		High	A	0.57	0.57	0.85	
		Low	A	0.33	0.32	0.54	
	Bypass mode	Ultra-high	A	0.67	0.72	1.00	
		High	A	0.57	0.57	0.85	
		Low	A	0.33	0.32	0.54	
Casing			Galvanized steel plate				
Insulating material			Self-extinguishable urethane foam				
Dimensions			H x W x D	mm	285 x 776 x 525	285 x 776 x 525	381 x 828 x 816
Heat exchanging system			Air to air cross flow total heat (sensible heat + latent heat) exchange				
Heat exchanging element			Specially processed nonflammable paper				
Air filter			Multidirectional fibrous fibrous				
Fan	Type	Sirocco fan					
	Fan speed	Ultra-High	m <sup>3</sup> /h	150	250	350	
		High	m <sup>3</sup> /h	150	250	350	
		Low	m <sup>3</sup> /h	110	155	230	
	External static pressure	Ultra-High	Pa	69	64	98	
		High	Pa	39	39	70	
Low		Pa	20	20	25		
Fan motor			Type Open type capacitor permanent split-phase induction motor, 4 poles x 2				
Motor output			kW	0.090 x 2	0.090 x 2	0.090 x 2	
Sound pressure level	Heat exchange mode	Ultra-High	dBA	27 – 28.5	28 – 29	32 – 34	
		High	dBA	26 – 27.5	26 – 27	31.5 – 33	
		Low	dBA	20.5 – 21.5	21 – 22	23.5 – 26	
	Bypass mode	Ultra-High	dBA	27 – 28.5	28 – 29	32 – 34	
		High	dBA	26.5 – 27.5	27 – 28	31 – 32.5	
		Low	dBA	20.5 – 21.5	21 – 22	24.5 – 26.5	
Operation range (Ambient)			-15 °C to 50 °CDB (80% RH or less)				
Connection duct diameter			mm	ø 100	ø 150	ø 150	
Weight			kg	24	24	33	
Drawing number				40036749	40036750	40036751	

(+C0049)

Test conditions are as follows

Condition	Indoor		Outdoor	
	°CDB	Rel (%)	°CDB	RH (%)
Cooling condition	27	50	35	60
Heating condition	20	40	7	70

Notes:

1. Operation sound is measured at 1.5 m below the center the body.
2. Fan speed can be changed over to Low mode or High mode.
3. Operating sound is measured in an anechoic chamber.  
Operating sound level generally become greater than this value depending on the operating conditions, reflected sound, and peripheral noise.
4. The sound level at the air discharge port is about 8 dB higher than the unit's operating sound.



## 7 Product Specification

### 7-1 Specifications

#### 7-1-2 Electrical specifications

Model name	Units		Power supply		FM	
	50Hz	60Hz	MCA	MFA	kW	FLA
VAM50FA	Power supply max.16V min.10V	Power supply max. 24V min.13V	0.9	15	0.03 × 2	0.4 × 2
VAM50FA			0.9	15	0.03 × 2	0.4 × 2
VAM50FA			1.35	15	0.03 × 2	0.6 × 2
VAM50FA			1.35	15	0.03 × 2	0.6 × 2
VAM50FA			2.3	15	0.14 × 2	1.0 × 2
VAM80FA			3.4	15	0.23 × 2	1.5 × 2
VAM100FA			3.4	15	0.23 × 2	1.5 × 2
VAM150FA			6.75	15	0.23 × 4	1.5 × 4
VAM200FA			6.75	15	0.23 × 4	1.5 × 4

#### SYMBOLS:

- MCA: min. circuit amps. (A)
- MFA: max. fuse amps. (A) (See note 5)
- FM: fan motor
- FLA: full load amps. (A)
- kW: fan motor rated output (kW)

#### NOTES:

1. Voltage range units are suitable for use on the electrical systems where the voltage supplied to the unit terminals is not below or above the listed range limits.
2. Maximum allowable voltage variation between phases is 2 %.
3. MCA/MFA  
 $MCA = 1.25 \times FLA_{(1)} + FLA_{(2)}$   
 $MFA \leq 4 \times FLA$   
 (VAM200FA5/8VE is regarded as 2 × VAM100FA5/8VE)
4. Select wire size based on the value of MCA.
5. Instead of the fuse, use the circuit breaker.

4D036862

#### Specifications for field supplied fuses and wire

Model	Type	Power supply wiring			Transmission wiring	
		Field supplied fuses	wire	Size	wire	Size
VAM150FA VAM250FA VAM350FA VAM500FA VAM500FA VAM800FA VAM1000FA VAM1500FA VAM2000FA	VE	15A	H05VV-U3G	Wire size must comply with local codes.	Shield wire (2 wire)	0.75 – 1.25 mm <sup>2</sup>



## 1 Features

- Single phase outdoor unit with bottom plate heater
- Cost effective alternative to a fossil fuel boiler
- Low energy bills and low CO2 emissions
- Easy to install
- Total solution for year round comfort



7

1



## 2 Specifications

2-2 TECHNICAL SPECIFICATIONS			ERLQ006BAV0	ERLQ007BAV0	ERLQ008BAV0	ERLQ011BAV0	ERLQ014BAV0	ERLQ016BAV0	
Weight	Unit	kg	57	57	57	103	103	103	
	Packed Unit	kg	62	62	62	114	114	114	
Packing	Material		EPS						
			Carbon						
						Wood	Wood	Wood	
						PE (Staps)	PE (Staps)	PE (Staps)	
Weight	kg	5	5	5	11	11	11		
Heat Exchanger	Dimensions	Length	mm	845	845	845	857	857	857
		Nr of Rows		2	2	2	2	2	2
		Fin Pitch	mm	1.8	1.8	1.8	1.4	1.4	1.4
		Nr of Passes					6	6	6
		Face Area	m <sup>2</sup>				0.08	0.08	0.08
		Nr of Stages		32	32	32	52	52	52
	Tube type		H-Xu(8)	H-Xu(8)	H-Xu(8)	H-XSS(8)	H-XSS(8)	H-XSS(8)	
	Fin	Type	WF fin						
	Treatment	Anti-corrosion treatment (PE)							
Fan	Type		Propeller						
	Quantity		1	1	1	2	2	2	
Air Flow Rate (nominal at 230V)	Heating	High	m <sup>3</sup> /min			90	90	90	
	Cooling	High	m <sup>3</sup> /min			96	100	97	
Fan	Discharge direction		Horizontal						
	Motor	Quantity		1	1	1	2	2	2
		Model					Brushless DC motor	Brushless DC motor	Brushless DC motor
Output	W	53	53	53					
Motor	Speed (nominal)	Steps				8	8	8	
		Heating	rpm			760	760	760	
		Cooling	rpm			800	850	830	
Fan	Motor	Output	W			70	70	70	
		Drive				Direct drive	Direct drive	Direct drive	
Compressor	Quantity		1	1	1	1	1	1	
	Motor	Model		2YC63B1D4C	2YC63B1D4C	2YC63B1D4C	JT 100G-VD	JT 100G-VD	JT 100G-VD
		Type		Hermetically sealed oiling compressor	Hermetically sealed oiling compressor	Hermetically sealed oiling compressor	Hermetically sealed scroll compressor	Hermetically sealed scroll compressor	Hermetically sealed scroll compressor
		Motor Output	W	1,920	1,920	1,920	2,200	2,200	2,200
Starting Method					Inverter driven	Inverter driven	Inverter driven		
Motor	Crankcase Heater	Output	W			33	33	33	
Operation Range	Heating	Min	°CWB	-20	-20	-20	-20	-20	
		Max	°CWB	25	25	25	35	35	
	Cooling	Min	°CDB	10	10	10	10	10	
		Max	°CDB	43	43	43	46	46	
	Sanitary water	Min	°CDB	-20	-20	-20	-20	-20	
		Max	°CDB	43	43	43	43	43	
Sound Level (nominal)	Heating	Sound Power	dBA	61	61	62	64	66	
		Sound Pressure	dBA	48	48	49	49	51	
	Cooling	Sound Power	dBA	63	63	63	64	66	
		Sound Pressure	dBA	48	48	50	50	52	
Sound Level (Night quiet)	Heating	Sound Pressure	dBA			42	42	43	
	Cooling	Sound Pressure	dBA			45	45	46	
Refrigerant	Type		R410A						
	Charge	kg	1.7	1.7	1.7	3.7	3.7	3.7	
	Control		Expansion valve (electronic type)						
	Nr of Circuits		1	1	1	1	1	1	
Refrigerant Oil	Type		PVC60K	PVC60K	PVC60K	Daphne FVC68D	Daphne FVC68D	Daphne FVC68D	
	Charged Volume		l	0.75	0.75	0.75	1.0	1.0	1.0

7  
2



## 2 Specifications

2-2 TECHNICAL SPECIFICATIONS			ERLQ006AV3	ERLQ016AV3	ERLQ036AV3	ERLQ046AV3	ERLQ061AV3	ERLQ081AV3	
Piping connections	Liquid (OD)	Quantity				1	1	1	
		Type	Flare connection						
		Diameter (OD) mm	6,35	6,35	6,35	9,52	9,52	9,52	
	Gas	Quantity				1	1	1	
		Type	Flare connection						
		Diameter (OD) mm	15,9						
	Drain	Quantity	1	1	1	3	3	3	
		Type	Socket	Socket	Socket	Hole	Hole	Hole	
		Diameter (OD) mm	18	18	18	26	26	26	
	Piping Length	Minimum	m	3	3	3	5	5	5
		Maximum	m	30	30	30	75	75	75
		Equivalent	m				95	95	95
		Chargeless	m				30	30	30
	Additional Refrigerant Charge		kg/m	0,02> 10m	0,02> 10m	0,02> 10m	See installation manual outdoor unit 4PW37976-1B	See installation manual outdoor unit 4PW37976-1B	See installation manual outdoor unit 4PW37976-1B
Installation height difference	Maximum	m				30	30	30	
Max. interunit level difference		m	20	20	20				
Heat Insulation						Both liquid and gas pipes	Both liquid and gas pipes	Both liquid and gas pipes	
Defrost Method			Reverse cycle	Reverse cycle	Reverse cycle	Pressure equalising	Pressure equalising	Pressure equalising	
Defrost Control			Sensor for outdoor heat exchanger temperature						
Capacity Control Method			Inverter controlled						
Safety Devices						Fin motor thermal protector	Fin motor thermal protector	Fin motor thermal protector	
						Fuse	Fuse	Fuse	
						High pressure switch	High pressure switch	High pressure switch	



## 2 Specifications

2-2 TECHNICAL SPECIFICATIONS		ERLQ006AV3	ERLQ007BAV3	ERLQ008BAV3	ERLQ011BAV3	ERLQ014BAV3	ERLQ016BAV3
Standard Accessories	Item	Installation manual	Installation manual	Installation manual	Tie-wraps	Tie-wraps	Tie-wraps
	Quantity	1	1	1	2	2	2
	Item	Drain plug	Drain plug	Drain plug	Installation manual	Installation manual	Installation manual
	Quantity	1	1	1	1	1	1
Notes		See operation range drawing	See operation range drawing	See operation range drawing	The sound pressure level is measured via a microphone at a certain distance from the unit. It is a relative value depending on the distance and acoustic environment. Refer to sound spectrum drawing for more information.	The sound pressure level is measured via a microphone at a certain distance from the unit. It is a relative value depending on the distance and acoustic environment. Refer to sound spectrum drawing for more information.	The sound pressure level is measured via a microphone at a certain distance from the unit. It is a relative value depending on the distance and acoustic environment. Refer to sound spectrum drawing for more information.
		The sound pressure level is measured via a microphone at a certain distance from the unit. It is a relative value depending on the distance and acoustic environment. Refer to sound spectrum drawing for more information.	The sound pressure level is measured via a microphone at a certain distance from the unit. It is a relative value depending on the distance and acoustic environment. Refer to sound spectrum drawing for more information.	The sound pressure level is measured via a microphone at a certain distance from the unit. It is a relative value depending on the distance and acoustic environment. Refer to sound spectrum drawing for more information.	Down to 3m with recharging of the outdoor unit. Refer to the installation manual of the outdoor unit.	Down to 3m with recharging of the outdoor unit. Refer to the installation manual of the outdoor unit.	Down to 3m with recharging of the outdoor unit. Refer to the installation manual of the outdoor unit.

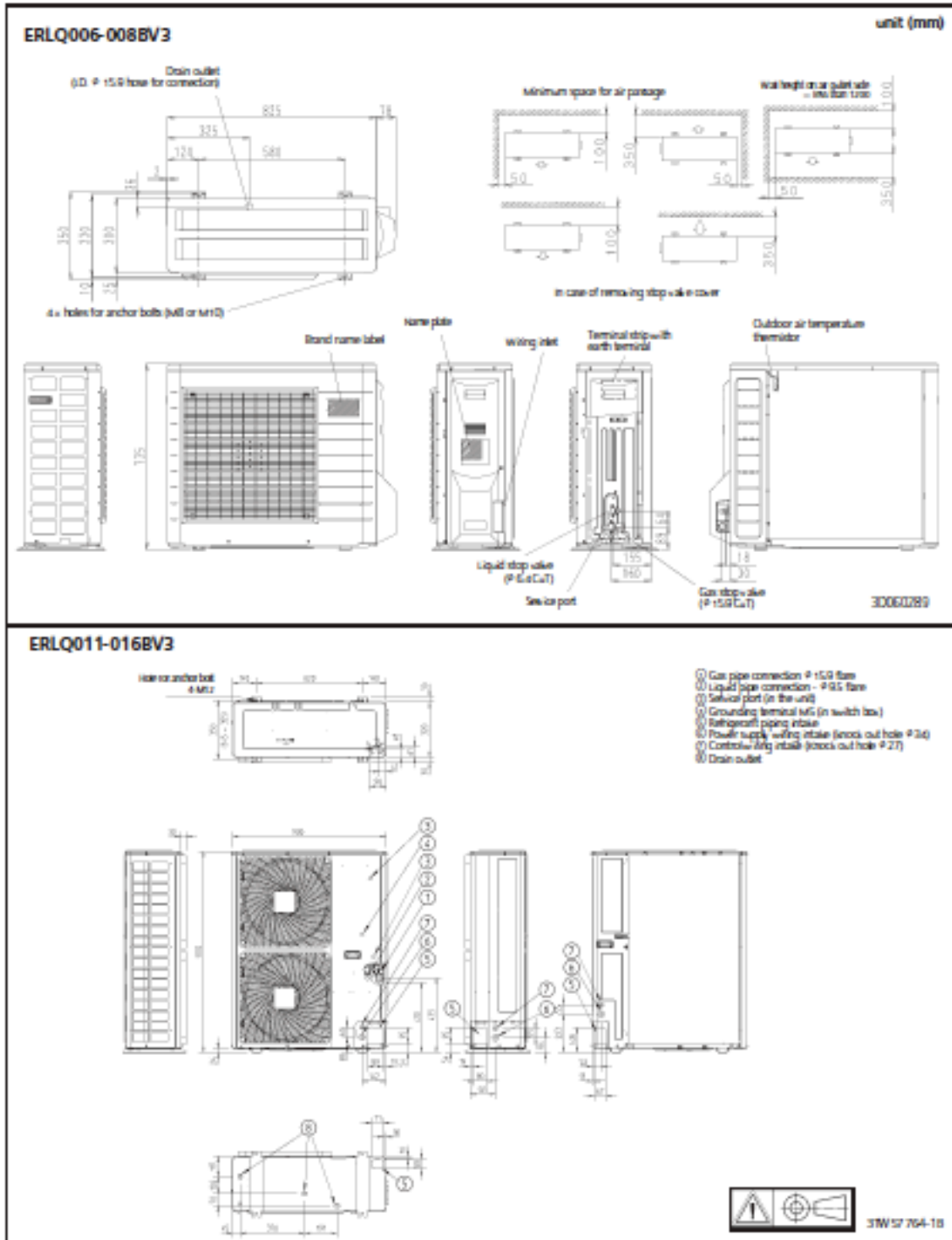
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2-3 ELECTRICAL SPECIFICATIONS		ERLQ006AV3	ERLQ007BAV3	ERLQ008BAV3	ERLQ011BAV3	ERLQ014BAV3	ERLQ016BAV3
Power Supply	Name	VS					
	Phase	1~					
	Frequency	Hz	50	50	50	50	50
	Voltage	V	230	230	230	230	230
	Voltage range	Minimum	V				
Maximum		V					+10%



## 4 Dimensional drawing & centre of gravity

### 4 - 1 Dimensional drawing



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4



DAIKIN • Domestic Hot Water Tank • EKHTS-A

## 1 Features

- High temperature application: up to 80°C without electric heater
- Stainless steel domestic hot water tank
- Cost effective alternative to a fossil fuel boiler
- Low energy bills and low CO2 emissions
- Easy to install
- Total solution for year round comfort

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1







## 2 Specifications

2-1 Technical Specifications				BOHTS200A	BOHTS260A	
Casing	Colour		Metallic gray			
	Material		Galvanised steel (precoated sheet metal)			
Dimensions	Packing	Height	mm	1,470	1,745	
		Width	mm	680	680	
		Depth	mm	800	800	
Unit	Height	Height	mm	1,335	1,610	
		Integrated on indoor unit	mm	2,010	2,285	
Dimensions	Unit	Width	mm	600	600	
		Depth	mm	695	695	
Weight	Machine weight - empty		kg	70	78	
	Gross Weight - empty		kg	81	89	
Packing	Material		EPS			
			Carton			
			Wood			
Weight		kg	11	11		
Main components	Tank	Water volume	l	200	260	
		Material		Stainless steel (DIN 1.4521)		
		Max. temperature	°C	75	75	
		Max. water pressure	bar	10	10	
Tank	Insulation	Material		EPS		
		Heat loss	kWh/24h	1.2	1.5	
Main components	Heat exchanger	Quantity		1	1	
		Material		Duplex steel LDX 2101		
		Surface	m <sup>2</sup>	1.56	1.56	
		Internal coil volume	l	7.5	7.5	
3-Way Valve	Coefficient of flow (kV)	space heating	m <sup>3</sup> /h	13	13	
		domestic hot water tank	m <sup>3</sup> /h	8	8	
Main components	3-Way Valve	Inlet	Inch	Male Quick coupling 3/5		
3-Way Valve	Outlet	space heating	mm	Female Quick coupling 35		
		domestic hot water tank	mm	Female Quick coupling 25		
Temperature sensor	Cable length		m	11.5	11.5	
Piping connections	Water inlet heat exchanger	Diameter	mm	Female Quick coupling 25		
	Water outlet heat exchanger	Diameter	mm	Female Quick coupling 25		
	Water inlet heat exchanger	Diameter	Inch	G 3/4 (female)		
	Water outlet heat exchanger	Diameter	Inch	G 3/4 (female)		
	Cold water in Diameter		Inch	G 3/4 (female)		
	Hot water out Diameter		Inch	G 3/4 (female)		
Recirculation connection		Inch	G 1/2 (male)			
Safety Devices				Thermal cutoff (on indoor unit): 90-95°C		
Service hole	Size	Diameter	mm			



### 3 Capacity tables

#### 3 - 1 Heating capacity tables

##### Altherma HT-TW Domestic hot water tank

The DAIKIN ALTHERMA heat pump in combination with the optional domestic hot water tank provide hot water for household usage. The below mentioned data allow a proper selection of the domestic hot water tank size for maximum comfort and efficiency.

##### (1) Capacity:

	BB15700	BB15750
Total capacity (l)	710	758
Actual capacity (l)	191,5	250,5

Total capacity = internal volume of tank – effective water volume + coil volume  
Actual capacity = effective water volume inside the tank

##### (2) Maximum volume of usable hot water:

The volume of hot water available for domestic usage depends on the physical volume of the tank, on the domestic water setpoint temperature and on the temperature spreading in the tank.

##### Definition:

Maximum volume of usable hot water = the volume of hot water available for domestic usage at a temperature of 40°C. 40°C is considered a comfortable domestic hot water temperature. (cold water inlet temp = 10°C)

Tank	Setpoint temp.	Maximum volume of usable hot water	Tapping pattern*			
			Small	Medium	High	Very high
BB15700	40	190	+++	+	-	-
	50	255	+++	++	-	-
	60	320	+++	+++	-	-
	70	385	+++	+++	+	-
BB15750	40	250	+++	++	-	-
	50	320	+++	+++	-	-
	60	405	+++	+++	++	-
	70	500	+++	+++	+++	+

Grade: +++ more than excessive availability of sanitary hot water (more than 40% of EHW is still available after tapping pattern)  
 ++ Excessive availability of sanitary hot water. (10% of EHW still available after tapping pattern < 40%)  
 + Sufficient availability of sanitary hot water. (EHW still available after tapping pattern < 10%)  
 - Temporary shortage of sanitary hot water can occur.

Tapping pattern\*\* Small Daily demand up to 90l -> typical 1-person daily usage pattern  
 Medium Daily demand up to 190l -> typical 2-persons daily usage pattern  
 High Daily demand up to 370l -> typical 3 to 4 persons daily usage pattern  
 very high Daily demand up to 500l -> 5 to 6 persons daily usage pattern

\* based upon heat up to tank once / 24 hours  
 \*\* Heat losses (over 24 hrs) are included in the tapping patterns

##### (3) Standing Heat loss:

Tank	Heat loss (Wh/24h)
BB15700	13
BB15750	15

\*heat loss of tank at  $\Delta T = 45K$

##### (4) Heat-up time:

##### Definition:

Heat-up time = The time is required to heat up the domestic hot water tank from 15°C to 60°C (minutes)

Tank	Heat up time <min>		
	BB15701	BB15704	BB15706
BB15700	50	50	40
BB15750	70	60	50

conditions for testing: Ta = 7°CDB / 6°CWB, Tstart = 15°C

##### (5) Reheat time:

##### Definition:

Reheat time = The time required to reheat the domestic hot water tank back to 60°C after tapping 70% of the actual volume.

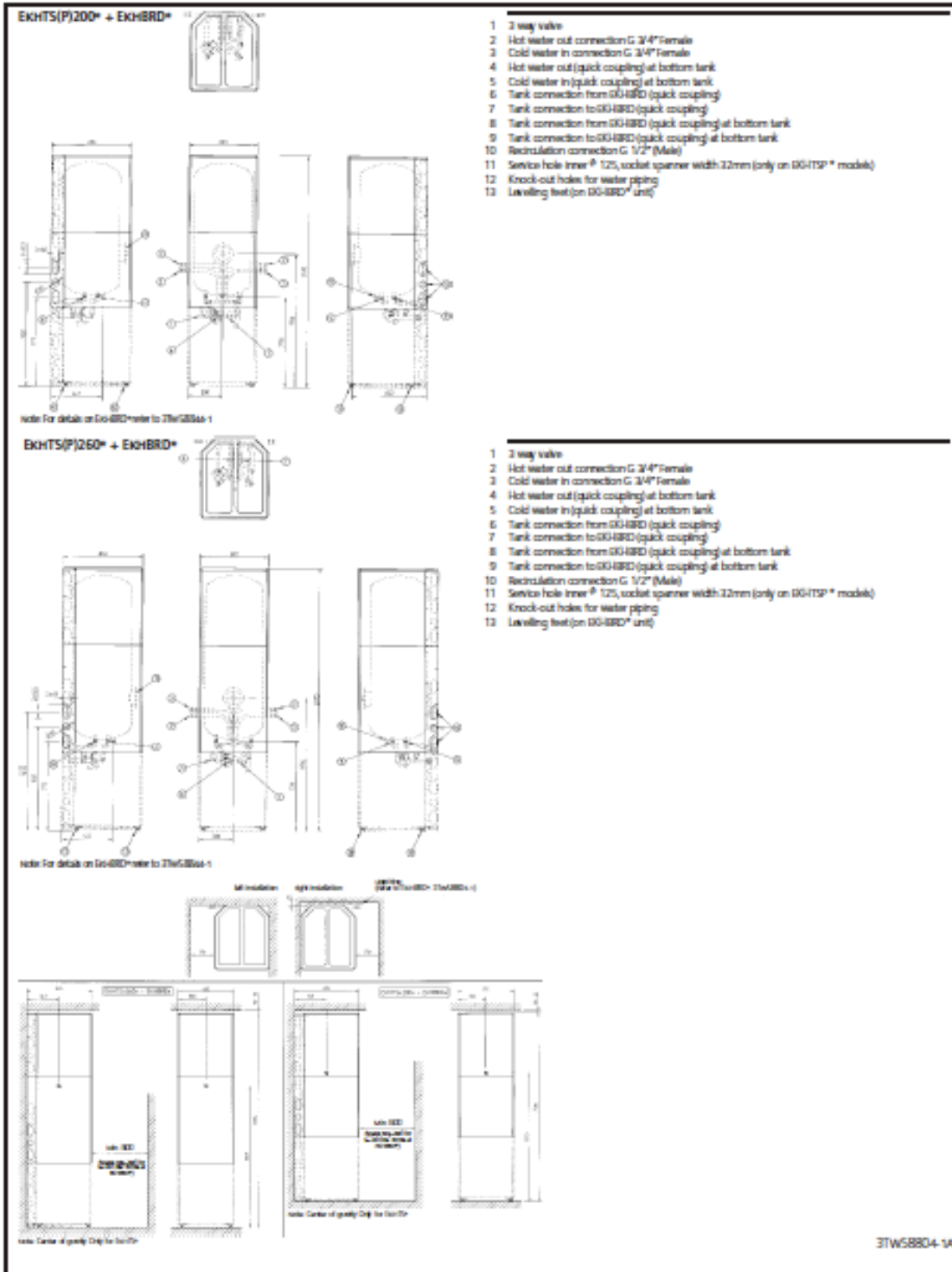
Tank	Reheat time <min>		
	BB15701	BB15704	BB15706
BB15700	50	40	30
BB15750	60	50	40

Starting condition before tapping 70% of volume tank at 60°C  
 conditions for testing: Ta = 7°CDB / 6°CWB, Tcold = 15°C



## 4 Dimensional drawing & centre of gravity

### 4 - 1 Dimensional drawing



2  
4



## 4 Dimensional drawing & centre of gravity

### 4 - 1 Dimensional drawing

21  
4

**EKHTS(P)200\***

- 1 3 way valve
- 2 Hot water out connection G 3/4" Female
- 3 Cold water in connection G 3/4" Female
- 4 Hot water out (quick coupling) at bottom tank
- 5 Cold water in (quick coupling) at bottom tank
- 6 Tank connection from EG-IBRD (quick coupling)
- 7 Tank connection to EG-IBRD (quick coupling)
- 8 Tank connection from EG-IBRD (quick coupling) at bottom tank
- 9 Tank connection to EG-IBRD (quick coupling) at bottom tank
- 10 Recirculation connection G 1/2" (Male)
- 11 Sensor hole inner  $\varnothing$  125, socket spawner width 32mm (only on EG-TSP\* models)
- 12 Knock-out holes for water piping
- 13 Levelling feet (in option kit EGMA-T4A)
- 14 Flexible pipes (in option kit EGMA-T4A)
- 15 Adaptor quick connection- G 3/4" (in option kit EGMA-T4A)
- 16 Field piping

Note for details on EG-IBRD\* refer to 3TW58804-1

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**EKHTS(P)260\***

- 1 3 way valve
- 2 Hot water out connection G 3/4" Female
- 3 Cold water in connection G 3/4" Female
- 4 Hot water out (quick coupling) at bottom tank
- 5 Cold water in (quick coupling) at bottom tank
- 6 Tank connection from EG-IBRD (quick coupling)
- 7 Tank connection to EG-IBRD (quick coupling)
- 8 Tank connection from EG-IBRD (quick coupling) at bottom tank
- 9 Tank connection to EG-IBRD (quick coupling) at bottom tank
- 10 Recirculation connection G 1/2" (Male)
- 11 Sensor hole inner  $\varnothing$  125, socket spawner width 32mm (only on EG-TSP\* models)
- 12 Knock-out holes for water piping
- 13 Levelling feet (in option kit EGMA-T4A)
- 14 Flexible pipes (in option kit EGMA-T4A)
- 15 Adaptor quick connection- G 3/4" (in option kit EGMA-T4A)
- 16 Field piping

Note for details on EG-IBRD\* refer to 3TW58804-1

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**EKHTS(P)200\***      **EKHTS(P)260\***

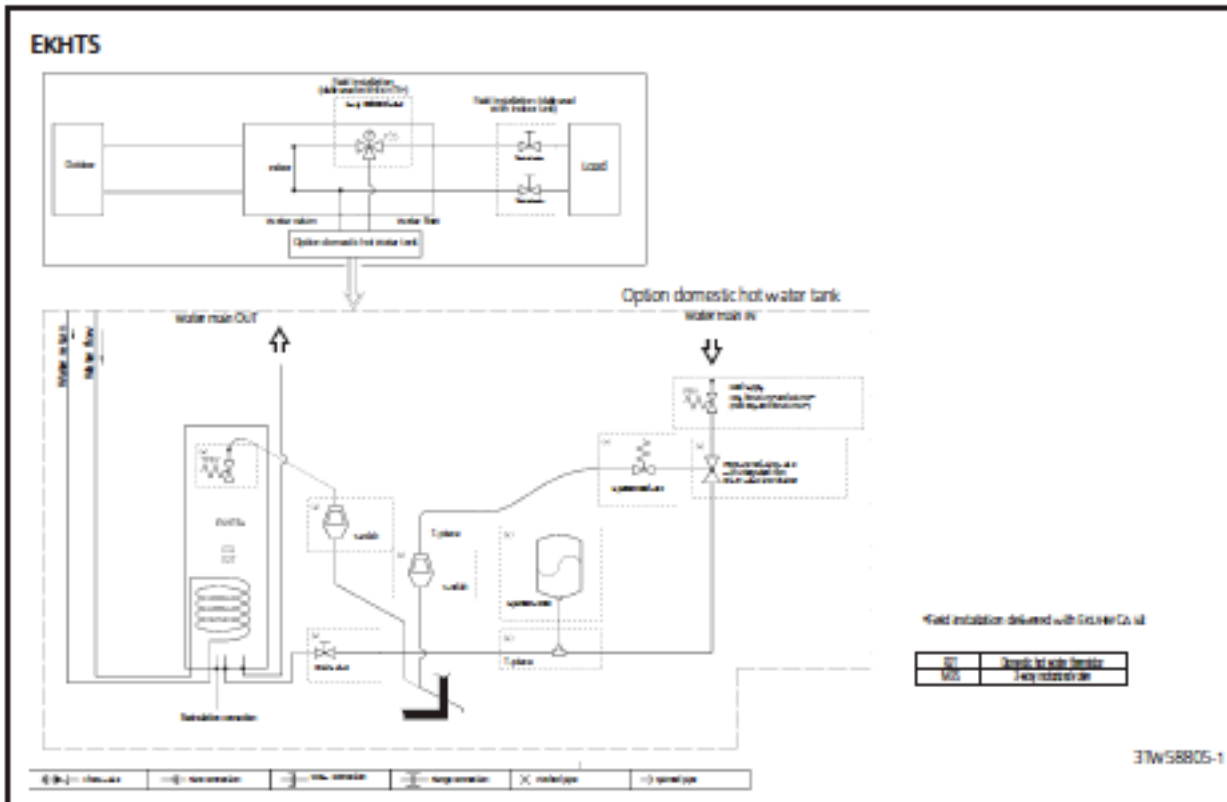
Note for details on EG-IBRD\* refer to 3TW58804-1

3TW58804-2



## 5 Piping diagram

### 5 - 1 Piping diagram





 **BOILER MET OPWARMINGSSPIRAAL**

## R-boilers

U zoekt een esthetische en efficiënte boiler? De Bulex R-boiler is geschikt om te werken met elke verwarmingsketel die voorzien is om een warm water boiler te voeden.



### Troeven

- Geëmailleerde boiler
- Snelle opwarmtijd
- Performante isolatie
- Snelle en makkelijke installatie
- Uitstekende bescherming met magnesiumanode
- Uitbreidbaar met elektrische kit
- In combinatie met Bulex FAS-ketels
- Muur of staand model
- Boven- of zijaansluiting





## Technische kenmerken R-boilers

						Afmetingen (mm)			Anode	
		Model	Inhoud (l)	Vermogen (kW)	Opwarmtijd (min)*	Leeggewicht (kg)	Hoogte	Breedte	Diepte	Magnesiumanode
WANDMODEL VERTICAAL	R75	75	27	17	42	750	515	528	*	
	R100	100	33	17	54	906	515	528	*	
	R150	150	33	23	65	1245	515	528	*	
	R200	200	33	30	76	1506	515	528	*	
VLOERMODEL VERTICAAL	RS100	100	33	17	55	835	515	600	*	
	RS100V	100	33	17	55	856	515	600	*	
	RS150	150	33	23	66	1160	515	600	*	
	RS150V	150	33	23	66	1215	515	600	*	
	RS200	200	33	30	78	1435	515	600	*	
	RS+300	300	49	30	94	1787	577	645	Al <sup>II</sup> **	

\* Bij een temperatuurverhoging van 50°C

\*\* Actieve lithiumanode

RS-V = bovinsamlatting



## 26 80 00 Decentralised HVAC equipment



Fan Coil Units

### Commercial and Technical Data







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# 1 Specifications

1-1 Nominal capacity and nominal input			FWS/AT	FWS/AT	FWS/AT	
Power input	High	W	90	100	100	
	Medium	W	90	90	90	
	Low	W	34	34	34	
Cooling capacity	Total capacity	High	kW	2.61	3.14	3.49
		Medium	kW	2.01	2.40	2.64
		Low	kW	1.34	1.50	1.67
	Sensible capacity	High	kW	1.80	2.10	2.34
		Medium	kW	1.46	1.66	1.77
		Low	kW	0.82	1.02	1.10
Heating capacity (D-ipe)	High	kW	5.47	6.01	6.47	
	Medium	kW	4.32	4.66	4.93	
	Low	kW	3.77	3.91	3.60	
Heating capacity (H-ipe)	High	kW	3.14	3.14	3.14	
	Medium	kW	2.00	2.00	2.00	
	Low	kW	1.00	1.00	1.00	

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1-1 Nominal capacity and nominal input			FWS/AT	FWS/AT	FWS/AT	
Power input	High	W	92	102	102	
	Medium	W	92	140	140	
	Low	W	36	36	36	
Cooling capacity	Total capacity	High	kW	5.08	5.40	6.47
		Medium	kW	3.96	4.10	4.94
		Low	kW	2.10	2.40	2.67
	Sensible capacity	High	kW	3.60	3.67	4.40
		Medium	kW	2.84	2.90	3.37
		Low	kW	1.52	1.67	1.78
Heating capacity (D-ipe)	High	kW	10.21	11.26	12.26	
	Medium	kW	8.20	8.92	9.48	
	Low	kW	4.56	4.77	4.94	
Heating capacity (H-ipe)	High	kW	5.36	5.36	5.36	
	Medium	kW	5.14	5.14	5.14	
	Low	kW	3.30	3.30	3.30	

1-1 Nominal capacity and nominal input			FWS/AT	FWS/AT	FWS/AT	
Power input	High	W	254	294	294	
	Medium	W	193	190	190	
	Low	W	155	150	150	
Cooling capacity	Total capacity	High	kW	7.57	8.67	10.34
		Medium	kW	5.41	6.08	7.08
		Low	kW	4.10	4.64	5.35
	Sensible capacity	High	kW	5.23	5.90	6.90
		Medium	kW	3.70	4.30	4.72
		Low	kW	2.00	2.21	2.57
Heating capacity (D-ipe)	High	kW	15.00	16.00	16.70	
	Medium	kW	10.54	11.07	12.00	
	Low	kW	6.00	6.20	6.65	
Heating capacity (H-ipe)	High	kW	12.00	12.00	12.00	
	Medium	kW	9.00	9.00	9.00	
	Low	kW	7.07	7.07	7.67	



# 1 Specifications

1-2 Technical Specifications				FWS/DA1	FWS/DA1	FWS/DA1
Dimensions	Unit	Height	mm	239	239	239
		Width	mm	1039	1039	1039
		Depth	mm	859	859	859
	Unit with packing	Height	mm	305	305	305
		Width	mm	1100	1100	1100
		Depth	mm	850	850	850
Weight	Net weight	kg	23	24	26	
	Operation weight	kg	24	26	28	
	Gross weight	kg	26	27	29	
Casing	Material	Galvanized sheet metal				
Sound level	Sound pressure	High	dBA	46.5	46.5	46.5
		Medium	dBA	34.5	34.5	34.5
		Low	dBA	24.5	24.5	24.5
	Sound power	High	dBA	58	58	58
		Medium	dBA	46	46	46
		Low	dBA	36	36	36
Water flow	Cooling	l/h	448	509	558	
	Heating	l/h	480	527	567	
	Add heat exchanger	l/h	275	275	275	
Water pressure drop	Cooling	MPa	8	14	11	
	Heating	MPa	7	10	8	
	Add heat exchanger	MPa	3	3	3	
Fan	Type	Centrifugal -forward blades- directly coupled on fan				
	Air flow rate	High	m <sup>3</sup> /h	400	400	400
		Medium	m <sup>3</sup> /h	300	300	300
		Low	m <sup>3</sup> /h	180	180	180
	Available pressure	High	Pa	71	71	71
		Medium	Pa	29	29	29
		Low	Pa	20	20	20
Speed	7 speeds (high =7, medium =4, low = 1)					
Quantity	1 1 1					
Wider	Type	Close insulation, B class insulation, winding thermal cut-out				
Standard heat exchanger	Rows	mm	3	4	6	
	Stages	mm	3	3	4	
	Fin pitch	mm	2.1	2.1	2.1	
	Face area	m <sup>2</sup>	0.15	0.15	0.15	
	Water volume	l	1.1	1.5	2.2	
Additional heat exchanger	Rows	mm	1	1	1	
	Stages	mm	2	2	2	
	Fin pitch	mm	1.8	1.8	1.8	
	Face area	m <sup>2</sup>	0.14	0.14	0.14	
	Water volume	l	0.4	0.4	0.4	
Air filter	Standard filter class EU2					
Insulation material	Class 1 self-extinguishing					
Vibration insulation	Rubber strip for fan motor					
Water connections	Std. heat exchanger	inch	3/4			
	Add heat exchanger	inch	3/4			
Drain	mm	16	16	16		
Notes	Rating conditions cooling 2 pipe air 27					
	Rating conditions heating 2 pipe air 20°CDB - entering water 70°C - leaving water 60°C					
	Sound power level according to ISO 3741 - sound pressure calculated at 1.5m distance - Q= 2					

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# 1 Specifications

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1-2 Technical Specifications				FWSMAT	FWSMAT	FWSMAT
Dimensions	Unit	Height	mm	239	239	239
		Width	mm	1309	1309	1309
		Depth	mm	639	639	639
	Unit with packing	Height	mm	305	305	305
		Width	mm	1450	1450	1450
		Depth	mm	639	639	639
Weight	Machine weight	kg	31	33	35	
	Operation weight	kg	33	35	36	
	Gross weight	kg	35	37	38	
Casing	Metal					
Sound level	Sound pressure	Gehoordete heat model				
		High	dBA	49.5	49.5	49.5
		Medium	dBA	46.5	46.5	46.5
	Sound power	High	dBA	60	60	60
		Medium	dBA	59	59	59
		Low	dBA	57	57	57
Water flow	Cooling	l/h	873	936	1111	
	Heating	l/h	904	966	1077	
	Adit. heat exchanger	l/h	526	526	526	
Water pressure drop	Cooling	kPa	65	6	14	
	Heating	kPa	62	7	10	
	Adit. heat exchanger	kPa	5	5	5	
Fan	Type					
	Centrifugal - forward blade - directly coupled on fan					
	Air flow rate	High	m³/h	800	800	800
		Medium	m³/h	600	600	600
		Low	m³/h	300	300	300
	Available pressure	High	Pa	65	65	65
		Medium	Pa	44	44	44
		Low	Pa	20	20	20
Speed	7 speeds (High = 7, medium = 4, low = 0)					
Quantity	2					
Motor	Type					
	Closed induction, 0 class insulation, winding thermal cut-out					
	Power	mm	3	4	6	
	Stage	mm	4	6	6	
	Flapch	mm	2.1	2.1	2.5	
	Face area	m²	0.22	0.22	0.23	
Additional heat exchanger	Power	mm	1	1	1	
	Stage	mm	3	3	3	
	Flapch	mm	1.8	1.8	1.8	
	Face area	m²	0.24	0.24	0.24	
	Water volume	l	0.6	0.6	0.6	
	Air filter	Standard filter class EU2				
Insulation material	Class 1 neoprene/foam					
Vibration insulation	Rubber ring for fan motor					
Water connections	Std. heat exchanger	Inch	3/4			
	Adit. heat exchanger	Inch	3/4			
Drain	mm	16				
Notes	Rating conditions cooling 2 pipe air 27					
	Rating conditions heating 2 pipe air 20°C DB - entering water 70°C - leaving water 60°C					
	Sound power level according to ISO 7241 - sound pressure calculated at 1.5m distance - Q = 2					



# 1 Specifications

1-3 Electrical Specifications			FWSM4T	FWSM4T	FWSM4T
Current input	High	A	0.51	0.51	0.51
	Medium	A	0.30	0.30	0.30
	Low	A	0.20	0.20	0.20
Required power supply		V / Hz	230/50		
Required fuse		A	1	1	1
Required wire section		mm <sup>2</sup>	1.5	1.5	1.5
Electric heater	Power input	W	2	2	2
	Current	A	0.7	0.7	0.7
	Power supply	V / Hz	230/50		
Note			The power consumption for the valve motor is 5W (peak) only during opening. For more details concerning conditional connections, see <a href="http://www.daltrivape.com">http://www.daltrivape.com</a> , select E-data Books. Finally click on the document file of your choice.		

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1-3 ELECTRICAL SPECIFICATIONS			FWSM4T	FWSM4T	FWSM4T
Current input	High	A	0.94	0.94	0.94
	Medium	A	0.70	0.70	0.70
	Low	A	0.40	0.40	0.40
Required power supply		V / Hz	230/50		
Required fuse		A	2	2	2
Required wire section		mm <sup>2</sup>	1.5	1.5	1.5
Electric heater	Power input	W	2.5	2.5	2.5
	Current	A	10.9	10.9	10.9
	Power supply	V / Hz	230/50		
Note			The power consumption for the valve motor is 5W (peak) only during opening. For more details concerning conditional connections, see <a href="http://www.daltrivape.com">http://www.daltrivape.com</a> , select E-data Books. Finally click on the document file of your choice.		

1-3 ELECTRICAL SPECIFICATIONS			FWSM4T	FWSM4T	FWSM4T
Current input	High	A	1.26	1.26	1.26
	Medium	A	0.90	0.90	0.90
	Low	A	0.70	0.70	0.70
Required power supply		V / Hz	230/50		
Required fuse		A	2	2	2
Required wire section		mm <sup>2</sup>	1.5	1.5	1.5
Electric heater	Power input	W	3	3	3
	Current	A	0	0	0
	Power supply	V / Hz	230/50		
Note			The power consumption for the valve motor is 5W (peak) only during opening. For more details concerning conditional connections, see <a href="http://www.daltrivape.com">http://www.daltrivape.com</a> , select E-data Books. Finally click on the document file of your choice.		



## 2 Electrical data

FWS		Power Input electric heater	Current Absorption	Power supply
Unit	Electric heater	kW	A	V / f / Hz
FWS04AT		2.0	0.7	230-1-50
FWS04AT		2.0	0.7	
FWS04AT		2.0	0.7	
FWS04AT		2.5	1.00	
FWS04AT		2.5	1.00	
FWS04AT		2.5	1.00	
FWS04AT		3.0	1.10	
FWS04AT		3.0	1.10	
FWS04AT		3.0	1.10	

47640206-1

**3**  
**2**



### 3 Options

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FWS											
Description	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Comments
Additional heat exchanger	SAH16AE			SAH17AE			SAH18AE				
Dewy water cooling file	S2MVC16AE						S2MVC18AE				
Dewy water add. file	S2MVC16AE						S2MVC18AE				
Dewy water cooling file	S2MVC16AE						S2MVC18AE				
Dewy water add. file	S2MVC16AE						S2MVC18AE				
Electric heater	YF12AE										
Fan stop thermostat	YF12AE										
Water side thermostat	SP1600E										
Fcu Controller - Standard version	FW16CA										
Fcu Controller - Advanced version	FW16CA										
Fcu Controller - Advanced plus version	FW16CA										
Fcu temperature sensor kit	FW16SA										
Fcu relative humidity sensor kit	FW16RA										

4TW6099-0A (15)

FWS										
Description	Additional heat exchanger	Dewy water add. file	Dewy water add. file	Fan stop thermostat	Water side thermostat	Fcu Controller - Standard version	Fcu Controller - Advanced version	Fcu Controller - Advanced plus version	Fcu temperature sensor kit	Fcu relative humidity sensor kit
	SAH16AE	S2MVC16AE	S2MVC18AE	YF12AE	SP1600E	FW16CA	FW16CA	FW16CA	FW16SA	FW16RA
Additional heat exchanger	X	X	X	X*	X	X	X	X	X	X
Dewy water add. file	X	X	X		X	X	X	X	X	X
Dewy water add. file	X	X	X		X	X	X	X	X	X
Fan stop thermostat				X*						
Water side thermostat	X	X			X	X	X	X	X	X
Fcu Controller - Standard version	X	X	X		X	X	X	X	X	X
Fcu Controller - Advanced version	X	X	X		X	X	X	X	X	X
Fcu Controller - Advanced plus version	X	X	X		X	X	X	X	X	X
Fcu temperature sensor kit	X	X	X		X	X	X	X	X	X
Fcu relative humidity sensor kit	X	X	X		X	X	X	X	X	X

\* = FWS used for heating only

4TW6099-0A (20)







## Appliance connectors

		Appliance connector M25, standard				Appliance connector M20, modular, straight			
		<p><b>With spring clamp connections</b> for rigid cables of 0.5– 2.5 mm<sup>2</sup>, fine-stranded cables of 0.5– 1.5 mm<sup>2</sup> with ferrules, stranded cables of 0.75– 1.5 mm<sup>2</sup> with ferrules. 2 connection points per pole. With locking device. Fixing in position guaranteed by flattening the thread. With M25x1.5 thread, external cable gland.</p>		<p><b>With screw connections</b> for rigid, fine-stranded and stranded cables of 0.75– 4.0 mm<sup>2</sup>. 1 connection point per pole. With locking device. Fixing in position guaranteed by flattening the thread. With M25x1.5 thread external cable gland.</p>		<p><b>With spring clamp connections</b> for rigid cables of 0.5– 2.5 mm<sup>2</sup>, fine-stranded cables of 0.5– 1.5 mm<sup>2</sup> with ferrules, stranded cables of 0.75– 1.5 mm<sup>2</sup> with ferrules. 2 connection points per pole. With locking device. Fixing in position guaranteed by flattening the thread. With M20x1.5 thread, internal cable gland.</p>		<p><b>With screw connections</b> for rigid, fine-stranded and stranded cables of 0.75– 4.0 mm<sup>2</sup>. 1 connection point per pole. With locking device. Fixing in position guaranteed by flattening the thread. With M20x1.5 thread internal cable gland.</p>	
Application	Color	Part No.	Std. Pack	Part No.	Std. Pack	Part No.	Std. Pack	Part No.	Std. Pack
<b>Female connector</b>		See "Technical Data" for insulation strip lengths and the ferrules to be used.				See "Technical Data" for insulation strip lengths.			
Mains 250V L N ground	gray black	96.031.1053.0 96.031.1053.1		96.031.5053.0 96.031.5053.1		96.031.2053.0 96.031.2053.1		96.031.6053.0 96.031.6053.1	
Mains 250V/400V 1, 2, ground	green	96.031.1055.7		96.031.5055.7		96.031.2055.7		96.031.6055.7	
Application	Color	Part No.	Std. Pack	Part No.	Std. Pack	Part No.	Std. Pack	Part No.	Std. Pack
<b>Male connector</b>									
Mains 250V L N ground	gray black	96.032.1053.0 96.032.1053.1		96.032.5053.0 96.032.5053.1		96.032.2053.0 96.032.2053.1		96.032.6053.0 96.032.6053.1	
Mains 250V/400V 1, 2, ground	green	96.032.1055.7		96.032.5055.7		96.032.2055.7		96.032.6055.7	



## Distribution units

		Distribution block, 1E/3A		Distribution block, 1E/3A		
		with mounting option with locking levers 1 input, male connector, 3 pole 3 outputs, female connector, 3 pole		without mounting option with locking levers 1 input, male connector, 3 pole 3 outputs, female connector, 3 pole		
Application	Color	Part No.	Std. Pack	Part No.	Std. Pack	
Mains 250V  L, N, ground	gray black	96.030.0153.0 96.030.0153.1		96.030.0253.0 96.030.0253.1		
Mains 250/400V  1, 2, ground	green	96.030.0155.7		96.030.0255.7		



# RST 20i3

## Connector for cable Ø 13 – 18 mm

With screw connection<sup>2</sup> or rigid, fine-stranded and stranded cables of max. 4.0 mm<sup>2</sup>. Unassembled with cable gland and locking device.

See "Technical Data" for sheath and insulation strip lengths.

Part No. Std. Pack



96.031.4553.0  
96.031.4553.1

96.031.4556.7

Part No. Std. Pack



96.032.4553.0  
96.032.4553.1

96.032.4556.7

## Splitter connector

With spring clamp connections for rigid cables of 0.5 – 2.5 mm<sup>2</sup>, fine-stranded cables of 0.5 – 1.5 mm<sup>2</sup> with ferrules, stranded cables of 0.75 – 1.5 mm<sup>2</sup> with ferrules. Unassembled with cable gland<sup>2</sup> and locking device. See "Technical Data" for sheath and insulation strip lengths as well as the ferrules to be used.

Part No. Std. Pack  
See "Accessories" for the mounting plate used to fasten the splitter connector.



96.031.0253.0  
96.031.0253.1  
96.031.0353.0  
96.031.0353.1

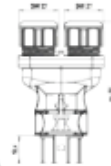
96.031.0255.7  
96.031.0355.7

With screw connection<sup>2</sup> or rigid, fine-stranded and stranded cables of 0.75 – 2.5 mm<sup>2</sup>. Unassembled with cable gland<sup>2</sup> and locking device.

See "Technical Data" for sheath and insulation strip lengths.

Part No. Std. Pack

See "Accessories" for the mounting plate used to fasten the splitter connector.



96.031.4253.0  
96.031.4253.1  
96.031.4353.0  
96.031.4353.1

96.031.4255.7  
96.031.4355.7

RST 20i3



## GST18i3

### Connector 250V, 16A

Female connector			
Application	Coding	Color	Part no.
			<b>Screw connection with strain relief</b> Cable solid/fine-stranded 0.75– 2.5 mm <sup>2</sup> Connections per pole 1, without ferrules H05VV, NYM <sup>1)</sup> 6.5 – 10.5 mm Low profile no connection point last in distribution blocks Cable strip length 31 mm Insul. strip length 7 mm
			<b>Spring-clamp connection with strain relief</b> Cable rigid 1.5– 2.5 mm <sup>2</sup> fine-stranded 1.5 mm <sup>2</sup> with ferrule <sup>2)</sup> H05VV, NYM <sup>1)</sup> 7.8– 10.3 mm, lockable <sup>2)</sup> Connections per pole 2, unassembled Cable strip length 45 mm Insul. strip length with 1.5 mm <sup>2</sup> and 2.5 mm <sup>2</sup> : 9 mm
Power with ⊕		N, L Code 1	white 92.931.3053.0 black 92.931.3053.1
		N, L Code 2	pebble gray 92.931.3453.0
		N, L Code 3	light red 92.931.3653.0
Switching application		1, 2, 3 Code 4	brown 92.931.3853.0
Type			GST180 S B12 R1
Part no.			
			92.933.0053.0 92.933.0053.1 92.933.0153.0 92.933.0553.0 92.933.0453.0 GST180 F B2 Z R1


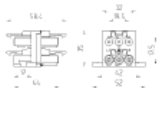
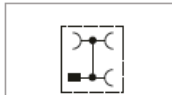

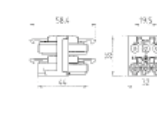
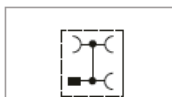


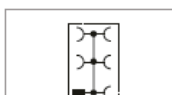

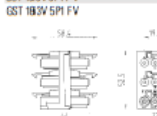
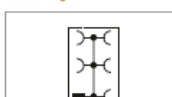
  

Male connector			
Application	Coding	Cable Ø mm	Color
			<b>Screw connection with strain relief</b> Cable solid/fine-stranded 0.75– 2.5 mm <sup>2</sup> Connections per pole 1, without ferrules H05VV, NYM <sup>1)</sup> 6.5 – 10.5 mm Low profile no connection point last in distribution blocks Cable strip length 31 mm Insul. strip length 7 mm
			<b>Spring-clamp connection with strain relief</b> Cable rigid 1.5– 2.5 mm <sup>2</sup> fine-stranded 1.5 mm <sup>2</sup> with ferrule <sup>2)</sup> H05VV, NYM <sup>1)</sup> 7.8– 10.3 mm, lockable <sup>2)</sup> Connections per pole 2, unassembled Cable strip length 45 mm Insul. strip length with 1.5 mm <sup>2</sup> and 2.5 mm <sup>2</sup> : 9 mm
Power with ⊕		L, N Code 1	white 92.932.3053.0 black 92.932.3053.1
		L, N Code 2	pebble gray 92.932.3453.0
		L, N Code 3	light red 92.032.3653.0
Switching application		1, 2, 3 Code 4	brown 92.032.3853.0
Type			GST180 S S12 R1
Part no.			
			92.934.0053.0 92.934.0053.1 92.934.0153.0 92.934.0553.0 92.934.0453.0 GST180 F S22 R1




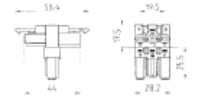
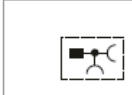

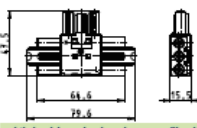


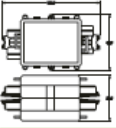
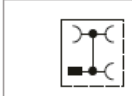

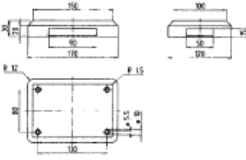
**GST18i3**

**Distribution blocks 3 pole 250V, 16A**

<b>Distribution block 11/30</b> with locking device 	<table border="1"> <thead> <tr> <th>Name</th> <th>Color</th> <th>Part no.</th> </tr> </thead> <tbody> <tr> <td>GST 183V 3P1 F V</td> <td>white</td> <td>92.030.4853.0</td> </tr> <tr> <td>GST 183V 3P1 F V</td> <td>black</td> <td>92.030.4853.1</td> </tr> </tbody> </table> 	Name	Color	Part no.	GST 183V 3P1 F V	white	92.030.4853.0	GST 183V 3P1 F V	black	92.030.4853.1	Circuit diagram 
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GST 183V 3P1 F V	white	92.030.4853.0									
GST 183V 3P1 F V	black	92.030.4853.1									
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## Distribution blocks

<b>Distribution block T-shaped</b> 	<table border="1"> <thead> <tr> <th>Name</th> <th>Color</th> <th>Part no.</th> </tr> </thead> <tbody> <tr> <td>GST 183V/2P1TV</td> <td>white</td> <td>92.030.1053.0</td> </tr> <tr> <td>GST 183V/2P1TV</td> <td>black</td> <td>92.030.1053.1</td> </tr> </tbody> </table>	Name	Color	Part no.	GST 183V/2P1TV	white	92.030.1053.0	GST 183V/2P1TV	black	92.030.1053.1		<p>Circuit diagram</p> 			
	Name	Color	Part no.												
GST 183V/2P1TV	white	92.030.1053.0													
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<p><b>with locking device</b></p> <table border="1"> <tr> <td>Input</td> <td>1, male, 3 pole</td> </tr> <tr> <td>Outputs</td> <td>2, female, 3 pole</td> </tr> </table>	Input	1, male, 3 pole	Outputs	2, female, 3 pole											
Input	1, male, 3 pole														
Outputs	2, female, 3 pole														
<b>Distribution block T-shaped low profile, depicted in white</b> 	<table border="1"> <thead> <tr> <th>Name</th> <th>Color</th> <th>Part no.</th> </tr> </thead> <tbody> <tr> <td>Distribution block T-shaped</td> <td>black</td> <td>92.030.1253.1</td> </tr> <tr> <td>Distribution block T-shaped</td> <td>white</td> <td>92.030.1253.0</td> </tr> <tr> <td>Distribution block T-shaped</td> <td>white</td> <td>92.030.1353.0</td> </tr> </tbody> </table>	Name	Color	Part no.	Distribution block T-shaped	black	92.030.1253.1	Distribution block T-shaped	white	92.030.1253.0	Distribution block T-shaped	white	92.030.1353.0		<p>Circuit diagram</p> 
	Name	Color	Part no.												
Distribution block T-shaped	black	92.030.1253.1													
Distribution block T-shaped	white	92.030.1253.0													
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<p><b>with locking device, low profile, in black and white</b></p> <table border="1"> <tr> <td>Input</td> <td>1, male, 3 pole</td> </tr> <tr> <td>Outputs</td> <td>2, female, 3 pole</td> </tr> </table>	Input	1, male, 3 pole	Outputs	2, female, 3 pole											
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	Name	Color	Part no.												
Distribution box GST183V/3P1	red	99.500.0026.0													
Distribution box GST183V/3P1	gray	99.501.0026.0													
<p><b>with locking device, in red and gray</b></p> <table border="1"> <tr> <td>Input</td> <td>1, male, 3 pole</td> </tr> <tr> <td>Outputs</td> <td>3, female, 3 pole</td> </tr> </table>	Input	1, male, 3 pole	Outputs	3, female, 3 pole											
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	Name	Color	Part no.												
Distribution box		on request													



## EUPEN V0BST16B Blauw H07V-KT Eupen

Merk : EUPEN  
Ref : V0BST16B  
Omschrijving : Blauw H07V-KT Eupen  
Type : V0BST 16=>240MM<sup>2</sup>  
Garantie :  
Leveringstermijn : 4 tot 8 werkdagen (België)  
Normale prijs : 8,68 € nu : 3,06 € Incl BTW en taksen  
( Recupel : 0,00 € Sabam : 0,00 € Ecotaks : 0,00 € Inbegrepen )  
Korting Online betalen : 0,06 €  
Verzending in België : 10,00 €



Aantal

Per 100 stuks (eenheidsverpakking)



### Meer info :

V0BST16B

### OMSCHRIJVING

VOBst 16mm<sup>2</sup> rol installatiedraad flexibel vertind PVC blauw

- installatiedraad soepel vertind 16mm<sup>2</sup> rol 100m
- buitendiameter: 7,2mm
- kopergewicht: 148kg/km
- totaal gewicht: 180kg/km
- buigradius: 6
- bedrijfsspanning: 450/750 V



## XVB-F2 0,6/1 kV

1/4

suivant / volgens / according to

**NBN IEC 502 NAD**

**NBN C30-004 F2**



### Construction

1. Conducteurs en cuivre
2. Isolation en PRC  
Couleurs des conducteurs selon HD 308
3. Recouvrement d'assemblage ruban ou extrudé
4. Gaine extérieure en PVC grts, non propageateur de l'incendie

### Opbouw

1. Kopergeleiders
2. Isolatie uit XLPE  
Aderkleuren volgens HD 308
3. Aderomhulling bandomwikkeld of geëxtrudeerd
4. PVC-buitenmantel, grijs, niet brandverspreidend

### Construction

1. Copper conductors
2. XLPE insulation  
Core colours acc. to HD 308
3. Common core covering taped or extruded
4. Fire retardant PVC outer sheath, grey

### Propriétés

- Température max. admissible au conducteur: 90°C (250°C lors d'un court-circuit de max. 5 sec.)
- Température min. de pose: 0°C
- Rayon de courbure min.:  
- Monoconducteur: 15 x D  
- Multiconducteur: 12 x D  
D= diamètre extérieur du câble

### Kenmerken

- Max. geleidertemperatuur: 90°C (250°C gedurende de kortsluiting van max. 5 sec.)
- Min. temperatuur gedurende de installatie: 0°C
- Min. buigstraal:  
- Eéngelèider: 15 x D  
- Meergeleider: 12 x D  
D= buitendiameter van de kabel

### Properties

- Max. admissible conductor temperature: 90°C (250°C during short circuit of max. 5 sec.)
- Min. laying temperature: 0°C
- Min. bending radius:  
- Singlecore: 15 x D  
- Multicore: 12 x D  
D= outer diameter of the cable

### Applications

En bâtiment, à l'air libre, en caniveau, en tuyau, sur chemin de câble.

### Toepassing

In gebouwen, in open lucht, in kabelkanaal, in buis.

### Applications

Inside buildings, in air, in ducts, in cable channels.







## XVB-F2 0,6/1 kV

3/4

Nombre de conducteurs et section	Epaisseur d'isolement	Epaisseur de la gaine	Diamètre extérieur	Poids du câble
Aantal geleiders en doorsnede	Isolatie dikte	Dikte van de buitenmantel	Buitediameter	Kabelgewicht
Number of cores and size	Insulation thickness	Outer sheath thickness	Outer diameter	Weight of cable
mm <sup>2</sup>	mm	mm	approx. mm	approx. kg/km
3 x 25RM/16RM	0,9/0,7	1,6	21,9	1230
3 x 35RM/16RM	0,9/0,7	1,7	25,2	1650
3 x 50SM/25RM	1,0/0,9	1,8	28,1	1890
3 x 70SM/35RM	1,1/0,9	1,9	31,2	2620
3 x 95SM/50RM	1,1/1,0	2,1	35,8	3570
3 x 120SM/70RM	1,2/1,1	2,2	39,6	4490
3 x 150SM/70RM	1,4/1,1	2,3	44,4	5370
3 x 185SM/95RM	1,6/1,1	2,5	49,1	6810
3 x 240SM/120RM	1,7/1,2	2,7	56,3	8790
3 x 300SM/150RM	1,8/1,4	2,9	63,3	10920
<hr/>				
4 x 1,5 RE	0,7	1,4	10,0	160
4 x 2,5 RE	0,7	1,4	11,0	210
4 x 4 RE	0,7	1,4	12,1	280
4 x 6 RE	0,7	1,4	13,3	370
4 x 10 RE	0,7	1,5	15,4	560
4 x 16 RM	0,7	1,5	18,7	885
4 x 25 RM	0,9	1,7	23,0	1360
4 x 35 RM	0,9	1,8	26,8	1880
4 x 50 SM	1,0	1,9	28,3	2120
4 x 70 SM	1,1	2,0	31,4	2970
4 x 95 SM	1,1	2,1	35,8	4030
4 x 120 SM	1,2	2,3	39,8	5000
4 x 150 SM	1,4	2,4	44,6	6150
4 x 185 SM	1,6	2,6	49,3	7710
4 x 240 SM	1,7	2,8	56,5	10010
4 x 300 SM	1,8	3,0	63,5	12450
<hr/>				
5 x 1,5 RE	0,7	1,4	10,8	190
5 x 2,5 RE	0,7	1,4	11,9	250
5 x 4 RE	0,7	1,4	13,2	340
5 x 6 RE	0,7	1,4	14,5	450
5 x 10 RE	0,7	1,5	16,9	670
5 x 16 RM	0,7	1,6	20,7	1090
5 x 25 RM	0,9	1,7	26,3	1740





## XVB-F2 0,6/1 kV

4/4

Nombre de conducteurs et section	Epaisseur d'isolement	Epaisseur de la gaine	Diamètre extérieur	Poids du câble
Aantal geleiders en doorsnede	Isolatiedikte	Dikte van de buitenmantel	Buitendiameter	Kabelgewicht
Number of cores and size	Insulation thickness	Outer sheath thickness	Outer diameter	Weight of cable
mm <sup>2</sup>	mm	mm	approx. mm	approx. kg/km
7 x 1,5 RE	0,7	1,4	10,8	235
7 x 2,5 RE	0,7	1,4	13,0	320
10 x 1,5 RE	0,7	1,4	15,4	350
10 x 2,5 RE	0,7	1,5	17,2	470
12 x 1,5 RE	0,7	1,4	15,8	390
12 x 2,5 RE	0,7	1,5	17,7	530
14 x 1,5 RE	0,7	1,5	16,7	440
14 x 2,5 RE	0,7	1,5	18,5	595
16 x 1,5 RE	0,7	1,5	17,6	490
16 x 2,5 RE	0,7	1,6	20,0	690
19 x 1,5 RE	0,7	1,5	18,4	550
19 x 2,5 RE	0,7	1,6	21,0	780
24 x 1,5 RE	0,7	1,6	21,8	710
27 x 1,5 RE	0,7	1,6	22,2	770
30 x 1,5 RE	0,7	1,7	23,1	840
37 x 1,5 RE	0,7	1,7	24,8	990

RE: RM: SM:



## H05 V-K 300/500 V — H07 V-K 450/750 V

1

gemäß / according to / suivant / volgens

HD 21.3



Aufbau	Construction	Construction	Opbouw
1. Feindrähtiger Kupferleiter 2. PVC-Isolation	1. Flexible copper conductor 2. PVC insulation	1. Conducteur souple en cuivre 2. Isolation en PVC	1. Soepele kopergeleider 2. PVC-isolatie
Anwendungen	Applications	Applications	Toepassing
- Feste geschützte Verlegung in Geräten und auf oder in Leuchten (H05) - Haus- und Industrieinstallationen (H07)	- Switchboard cabling and installations in machines (H05) - Domestic and industrial installations (H07)	- Installation fixe protégée à l'intérieur d'appareils et dans ou sur des luminaires (H05) - Installations domestiques et industrielles (H07)	- Installaties met geschikte bescherming in toestellen en op of in lampen - Huishoudelijke en industriële installaties (H07)
Eigenschaften	Properties	Propriétés	Kenmerken
- Betriebstemperatur: +5 ... +70°C - Min. Biegeradius: 4 x D	- Service temperature: +5 ... +70°C - Min. bending radius: 4 x D	- Température de service: +5 ... +70°C - Rayon de courbure min: 4 x D	- Bedrijfstemperatuur: +5 ... +70°C - Min. buigstraal: 4 x D



### EUCABOX \*

0,5 mm <sup>2</sup> :	4000 m
0,75 mm <sup>2</sup> :	3000 m
1,0 mm <sup>2</sup> :	2500 m
1,5 mm <sup>2</sup> :	2000 m
2,5 mm <sup>2</sup> :	1000 m





**H05 V-K 300/500 V — H07 V-K 450/750 V**

2

Aderzahl und Querschnitt Number of cores and size Nombre de conducteurs et section Aantal geleiders en doorsnede mm <sup>2</sup>	Wanddicke der Isolierhülle Insulation thickness Epaisseur d'isolement Isolatie dikte mm	Außen-durchmesser Outer diameter Diamètre extérieur Buitendiameter approx. mm	Kabelgewicht Weight of cable Poids du câble Kabelgewicht approx. kg/km
<b>H05 V-K</b>			
1 x 0,5 *	0,6	2,2	9
1 x 0,75 *	0,6	2,4	12
1 x 1 *	0,6	2,5	15
<b>H07 V-K</b>			
1 x 1,5 *	0,7	3,0	21
1 x 2,5 *	0,8	3,7	33
1 x 4	0,8	4,2	49
1 x 6	0,8	4,8	70
1 x 10	1,0	6,2	116
1 x 16	1,0	7,4	177
1 x 25	1,2	9,0	276
1 x 35	1,2	10,5	379
1 x 50	1,4	12,0	534
1 x 70	1,4	13,6	734
1 x 95	1,6	15,6	984
1 x 120	1,6	17,3	1230
1 x 150	1,8	19,3	1526
1 x 185	2,0	21,5	1869
1 x 240	2,2	25,0	2365

\* Auch in EUCABOX

\* Also in EUCABOX

\* Egalement en EUCABOX

\* Ook in EUCABOX

**Auf Wunsch lieferbar**

- Mit verzinntem Leiter
- H05/07 V2-K 90°C
- Halogenfrei und flammwidrig nach IEC 60332-1
- H05/07 Z-K 90°C gemäß HD 22.9

**Available on request**

- With tinned copper conductor
- H05/07 V2-K 90°C
- Halogenfree and flame retardant acc. to IEC 60332-1
- H05/07 Z-K 90°C acc. to HD 22.9

**Livable sur demande**

- Avec conducteur étamé
- H05/07 V2-K 90°C
- Exempt d'halogènes et non propageateur de la flamme suivant CEI 60332-1
- H05/07 Z-K 90°C suivant HD 22.9

**Op aanvraag**

- Met vertinde geleider
- H05/07 V2-K 90°C
- Halogeenvrij en moeilijk brandbaar volgens IEC 60332-1
- H05/07 Z-K 90°C volgens HD 22.9





## Hoofdstuk 1

# Branch Circuit Load Calculations

This chapter calculates the branch circuit loads per Article 220 of the NEC.

### 1.1 Circuit A: Lighting living room, dining room and income

**Remark:** NEC 220.12: A minimum of  $33VA/m^2$  lighting load for dwelling units.

$$\begin{aligned} \text{Surface} &= 50m^2 \\ S &= 33 \frac{VA}{m^2} \cdot 50m^2 = 1650VA \\ I &= \frac{1650VA}{230V} = 7.2A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 16 = 18A  $\Rightarrow$  AWG 16 (=1.3  $mm^2$ ) is sufficient  $\Rightarrow$  Choose XVB 1.5  $mm^2$

### 1.2 Circuit B: Lighting small bedroom, master bedroom and hall

**Remark:** NEC 220.12: A minimum of  $33VA/m^2$  lighting load for dwelling units.

$$\begin{aligned} \text{Surface} &= 25m^2 \\ S &= 33 \frac{VA}{m^2} \cdot 25m^2 = 825VA \\ I &= \frac{825VA}{230V} = 3.59A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 16 = 18A  $\Rightarrow$  AWG 16 (=1.3  $mm^2$ ) is sufficient  $\Rightarrow$  Choose XVB 1.5  $mm^2$



### 1.3 Circuit C: Receptacles downstairs

- **Remark 1:** NEC 220.52 (A): the load shall be calculated at 1500 VA for each 2-wire small-appliance branch circuit
- **Remark 2:** NEC 220.14(I): receptacle outlets shall be calculated at not less than 180 VA for each single or for each multiple receptacle on one yoke

One home cinema (Remark 1: 1500 VA) and 6 other receptacles (Remark 2: 6 times 180 VA)

$$S = 1500 + 6 \cdot 180 = 2500VA$$
$$I = \frac{2500VA}{230V} = 11.3A$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.4 Circuit D: Receptacles small bedroom, master bedroom and hall

**Remark:** NEC 220.14(I): receptacle outlets shall be calculated at not less than 180 VA for each single or for each multiple receptacle on one yoke

5 receptacles (Remark: 5 times 180 VA)

$$S = 5 \cdot 180 = 900VA$$
$$I = \frac{900VA}{230V} = 3.92A$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.5 Circuit E: Lighting kitchen and bedroom

**Remark:** NEC 220.12: A minimum of 33VA/m<sup>2</sup> lighting load for dwelling units.

Surface = 10 m<sup>2</sup> (kitchen) + 9 m<sup>2</sup> (bathroom) = 19 m<sup>2</sup>

$$Surface = 20m^2$$
$$S = 33 \frac{VA}{m^2} \cdot 20m^2 = 660VA$$
$$I = \frac{660VA}{230V} = 2.9A$$



NEC Table 310.16: allowable ampacity for AWG 16 = 18A  $\Rightarrow$  AWG 16 (=1.3 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 1.5 mm<sup>2</sup>

## 1.6 Circuit F: Lighting downstairs - toilet and technical space

**Remark:** NEC 220.12: A minimum of 33VA/m<sup>2</sup> lighting load for dwelling units.

Surface = 2 m<sup>2</sup> (toilet) + 6 m<sup>2</sup> (technical space) = 8 m<sup>2</sup>

$$\begin{aligned} \text{Surface} &= 10m^2 \\ S &= 33 \frac{VA}{m^2} \cdot 10m^2 = 330VA \\ I &= \frac{330VA}{230V} = 1.5A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 16 = 18A  $\Rightarrow$  AWG 16 (=1.3 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 1.5 mm<sup>2</sup>

## 1.7 Circuit G: Outside lighting

**Remark:** NEC 220.12: A minimum of 33VA/m<sup>2</sup> lighting load for dwelling units.

Outside, there will only be a light at the door entrances (2 lights). Take as surface 2 times 6 m<sup>2</sup>.

$$\begin{aligned} \text{Surface} &= 12m^2 \\ S &= 33 \frac{VA}{m^2} \cdot 12m^2 = 400VA \\ I &= \frac{400VA}{230V} = 1.8A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 16 = 18A  $\Rightarrow$  AWG 16 (=1.3 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 1.5 mm<sup>2</sup>

## 1.8 Circuit H: Receptacles kitchen and technical space

**Remark:** NEC 220.14(I): receptacle outlets shall be calculated at not less than 180 VA for each single or for each multiple receptacle on one yoke

6 receptacles (Remark: 6 times 180 VA)



$$S = 6 \cdot 180 = 1100VA$$
$$I = \frac{1100VA}{230V} = 5A$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.9 Circuit I: Receptacles bathroom

**Remark:** NEC 220.14(I): receptacle outlets shall be calculated at not less than 180 VA for each single or for each multiple receptacle on one yoke

2 receptacles (Remark: 2 times 180 VA)

$$S = 2 \cdot 180 = 400VA$$
$$I = \frac{400VA}{230V} = 2A$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.10 Circuit J: Sun blinds

**Appliance:** 7 times Helioscreen EVE 047 080 APA

The product datasheet says an arc-fault circuit interrupter of 16A should be used.

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.11 Circuit K: Dishwasher - fridge - hood

**Appliances:**

1. **Dishwasher:** ADG 9641 Whirlpool Full door vaatwasser 6 progr. - 6th Sense Green Generation - 3de lade SpacePlus - Latere start 1-24u - 11L - A+/A/A. **Remark:** Power unknown, but NEC 220.52 (A): the load shall be calculated at 1500 VA for each 2-wire small-appliance branch circuit  $\Rightarrow$  1500 W
2. **Fridge:** WBE 34132 A++S Whirlpool, Power rating: 150 W
3. **Hood:** Whirlpool AKR 799 IX - Decoratieve dampkap "6th Sense" 90 cm - 1 motor - 630 m<sup>3</sup>/h - "Box" design - Inox, Power rating: 215 W





$$S = 1500VA + 150VA + 215VA = 1865VA$$
$$I = \frac{1865}{230} = 8.5A$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.12 Circuit L: Microwave

**Appliance:** Whirlpool AMW 593 IX : 40L compact multifunctionele Turbo Hete lucht oven  
+ microgolfovenfunctie - Timer met text display - Genesis line - Inox

$$S = 1600VA$$
$$I = \frac{1600VA}{230V} = 7A$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.13 Circuit M: Stove

**Appliance:** ACM 754 LX 6th Sense® Green Generation inductiekookplaat 77 cm - 4 zones  
(2 koppelzones) - Tiptoetsbediening met slider - Laterale kader in inox

$$S = 7400VA$$
$$I = \frac{7400VA}{230V} = 33A$$

NEC Table 310.16: allowable ampacity for AWG 10 = 35A  $\Rightarrow$  AWG 10 (=5.3 mm<sup>2</sup>) is sufficient  
 $\Rightarrow$  Choose XVB 6 mm<sup>2</sup> (required by AREI: Belgian norms and regulations)

### 1.14 Circuit N: Washing machine

**Remark 1:** NEC 220.52 (B): a load of not less than 1500 VA shall be included for each  
2-wire laundry branch circuit installed as required by 210.11(C)(2)

**Appliance:** Whirlpool Astro 1400 8KG



$$\begin{aligned} S &= 1500VA \\ I &= \frac{1500VA}{230V} = 7A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.15 Circuit O: Dryer

**Remark:** NEC 220.54: the load for household electric clothes dryers in a dwelling unit shall be either 5000 watts or the name-plate rating, whichever is larger, for each dryer served.

**Appliance:** WHIRLPOOL AZA9780 Zephyr Condensdroger A klasse, 9kg, Green Generation, Startuitstel, Resttijdindicatie, FLD display, Zwarte deur

$$\begin{aligned} S &= 5000VA \\ I &= \frac{5000VA}{230V} = 22A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 14 with conductor temperature rating 90°C = 25A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.16 Circuit P: Fan coil unit, heat pump, fan and drain pump

- Fan coil unit: 106 W electrical power
- Heat pump: 2.27 kW electrical power
- Fan: 141 W electrical power
- Drain pump: 300 W electrical power

$$\begin{aligned} S &= 106 + 2270 + 141 + 300 = 3000VA \\ I &= \frac{3000VA}{230V} = 14A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>

### 1.17 Circuit Q: NIKO Home Control

**Remark:** NEC 220.52 (A): the load shall be calculated at 1500 VA for each 2-wire small-appliance branch circuit



$$\begin{aligned} S &= 1500VA \\ I &= \frac{1500VA}{230V} = 7A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 16 = 18A  $\Rightarrow$  AWG 16 (=1.3 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 1.5 mm<sup>2</sup>

### **1.18 Circuit: water pump for sprinklers**

**Remark:** The electric power of the pump is smaller than 2 kW  $\Rightarrow$  take S = 2 kVA

$$\begin{aligned} S &= 2000VA \\ I &= \frac{2000VA}{230V} = 9A \end{aligned}$$

NEC Table 310.16: allowable ampacity for AWG 14 = 20A  $\Rightarrow$  AWG 14 (=2 mm<sup>2</sup>) is sufficient  $\Rightarrow$  Choose XVB 2.5 mm<sup>2</sup>



## Hoofdstuk 2

# Feeder and Service Load Calculations

Method followed: NEC annex D

### General load

- $112 \text{ m}^2$  at 33 VA = 3696 VA
- One small appliance circuits at 1500 VA each = 1500 VA
- Laundry circuit: 1500 VA
- Dishwasher, fridge and hood: 1865 VA
- Microwave: 1600 VA
- Stove: 7400 VA
- Washing machine: 1500 VA
- Dryer: 5000 VA

Subtotal general load: 24061 VA

First 10 kVA at 100 % : 10000 VA

Remainder of general load at 40 % ( $14061 \text{ VA} \times 0.4$ ) = 5624.4 VA

Total net general load: 15624.4 VA

Heat pump: 2600 VA

**Totals:** 2600 VA (heat pump) + 152624.4 VA (total net general load) = 18224.4 VA

**Calculated load for service:**  $18224.4 \text{ VA} / 230 \text{ V} = 80 \text{ A}$



## 26 20 00 Low-Voltage Electrical Distribution



Distributie / PRAGMA PLUS

### Pragma Plus: De nieuwe generatie modulaire kasten



#### OPBOUWKASTEN

De opbouwkasten worden in drie verschillende modellen voorgesteld: 13, 18 en 24 modules per rij. Dit type kast is bedoeld om elektrische borden, in de Industriële en tertiaire sector en in de hogere klasse woningbouw, te realiseren. In de kast van 24 modules kan een lastschakelaar of een hoofdbewegingsautomaat NG 125 met eventueel een differentieelbeveiliging uitgerust worden.

De kasten met 13 en 18 modules zijn uit kunststof vervaardigd terwijl de kasten met 24 modules uit metaal bekleed met kunststof vervaardigd zijn. Een interface (een koker) voorziet de mogelijke installatie van modulaire en specifieke apparatuur: ultra-terminal apparaten (stopcontacten, schakelaars, ...), Industriële stopcontacten, noodstoppen en bedieningsknoppen van Telemecanique.

#### INBOUWKASTEN

Deze kasten zijn bestemd om in het metselwerk of in plastersen tussenwanden ingewerkt te worden. De modellen worden in dezelfde sectoren als de opbouwkasten gebruikt, maar hier kan men geen interface installeren. Het aanbod is hetzelfde als bij de Inbouwmodellen (beschikbaar in 13, 18 en 24 modules). Het bevestigingssysteem kan in beide omstandigheden gebruikt worden. In het geval van een bevestiging in een holte in tussenwanden, vostaat de aankoop van adequaat toebehoren.

#### DE DEUREN

Alle kasten worden zonder deur geleverd. Ze moeten samen met de kasten besteld worden. Men kan kiezen tussen doorzichtige of ondoorzichtige deuren. Deze deuren, voorzien van twee stevige schamieren, zijn eenvoudig te monteren door in de bevestiging te schuiven en daarna te roteren. Iedere deur is uitgerust met een handvat met twee sluitingspunten (boven en beneden).

#### IN HET KORT

De nieuwe kasten zijn ergonomisch, robuust en esthetisch.

Het nieuwe gamma is bestemd om het Pragma gamma C, D en F te vervangen.

Ze kunnen zelfs 160 A aan.

De laatste geavanceerde technologieën van Merlin Gerin zijn erin verwerkt.

Een keuze maken is nu eenvoudiger.

Het nieuwe gamma elektrische kasten van Merlin Gerin is zo volledig dat ze voor alle specifieke wensen een efficiënte oplossing bieden. Ze zijn ontworpen om de oudere kasten Pragma C (12 modules per rij), D (18 modules per rij) en F (24 modules per rij) te vervangen. De nieuwe kasten worden door drie sleutelwoorden gekarakteriseerd: **ergonomie, robuust en esthetiek.**

In de kasten zijn de laatste geavanceerde technologieën van Merlin Gerin verwerkt, zo zijn stroomsterkten tot zelfs **160 A toegelaten. Ze vereenvoudigen tevens de keuze tussen de verschillende referenties.**

#### EEN GESLAAGD PRODUCT!

De Pragma Plus kasten zijn op alle vlakken een ontgensprekelijk succes. Ze vervolledigen harmonieus het uitgebreid gamma waterdichte KAEDRA kasten. Ze bestaan in twee uitvoeringen: de opbouw- en inbouwkasten. De technische karakteristieken, aangevuld met het esthetisch uitzicht en een sterk doordachte ergonomie, maken er een product van waar je niet omheen kunt bij het selecteren van een elektrische kast. De kasten, die door Merlin Gerin voorgesteld worden, bezitten specifieke karakteristieken in functie van de uitvoering van het product.

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## Modulaire kasten

### Opbouw- en inbouwkasten

#### Pragma Plus opbouw

##### Functie

Deze verdeelkast is bedoeld voor kwalitatief hoogwaardige elektrische borden in tertiaire toepassingen en woningen. Een specifieke interface voor de eindgebruiker maakt het mogelijk om modulaire en specifieke apparatuur te installeren: ultra-terminalapparatuur, industriële stopcontacten, noodstopknoppen en andere knoppen en lampjes.

##### Karakteristieken van de kasten

- kasten met 13, 18 modules: thermoplastisch, titaanwit
  - kasten met 24 modules: metaal en thermoplastisch, titaanwit
  - doorzichtige deuren:
    - voor kasten met 13 en 18 modules: thermoplastisch, donker
    - voor kasten met 24 modules: metaal titaanwitte kader met glasraam
  - volle deuren:
    - voor kasten met 13 en 18 modules: thermoplastisch, titaanwit
    - voor kasten met 24 modules: metaal, titaanwit
  - brand- en hittebestendigheid (750 °C) volgens:
    - IEC 60695-2-11
    - EN 60695-2-11
  - volledige isolatie klasse II volgens:
    - IEC 60439-3
    - EN 60439-3 § 7.4.3.2.2
- Geen enkel onderdeel van de kast of de deur moet worden geaard
- beschermingsgraad volgens de IEC 60529:
    - zonder deur: IP30
    - met deur: IP40
  - beschermingsgraad tegen mechanische schokken volgens de IEC 62262:
    - zonder deur: IK08
    - met deur: IK09
  - bedrijfstemperatuur: -25 °C tot +60 °C
  - volgens de norm NBN C63-439 + add
  - keurmerk CEBEC voor de 13 M en 18 M
  - onderdelen geleverd bij elke kast
    - markeringsbanden + labelbeschermplaatje
    - afsluitband
    - aardklemmenblok: zie tabel referenties in hoofdstuk K
    - identificatielabel
  - klemmenblokken
    - toegekende isolatiespanning  $U_i$ : 800 V,  $U_{imp}$ : 8 kV
    - beantwoordt aan de norm IEC 60947-7-1
- De klemmenblokken kunnen ook in de Prisma Plus-borden worden gemonteerd. De veer- en schroefaansluitingen van de klemmenblokken werden speciaal ontworpen door Schneider Electric, waardoor u soepele en stijve draden zonder draadbusje kunt verbinden conform de normen:
- IEC 60947-1 § 8.2.4
  - IEC 60998-1
  - IEC 60998-2-1 (de draden kunnen ook met draadbusje worden verbonden)
- modulaire klemmenblokken voor snelle aansluiting zonder schroeven voor kleine kabels



Aardingsklemmenblokken



Het klemmenblok kan worden omgevormd in een eindverdelers tot 125 A met behulp van de steun PRA90048



### ISOLATIE EN BESCHERMING

Alle Pragma Plus kasten zijn conform de NBN C 63-439 +add norm.  
Deze kasten bieden een totale Isolatie klasse II volgens IEC 60439 –3/EN 60439-3 § 7.4.3.2.2. Dit heeft tot gevolg dat geen enkel element van de kast en ook de deur niet, moeten geaard worden.  
Volgens de IEC 60529 bekomt men een beschermingsgraad IP30 (zonder deur) en IP40 (met deur), terwijl de bescherming tegen mechanische schokken volgens IEC 62262 respectievelijk IK08 (zonder deur) en IK09 (met deur) zijn.  
De werkingstemperaturen liggen tussen -25°C en +60°C. Tenslotte zijn deze kasten met 13 en 18 modules CEBEC gekeurd.

### DE BELANGRIJKSTE VOORDELEN

De belangrijkste voordelen van de Pragma Plus kasten komen tot uiting in drie aspecten:

#### Ergonomie

- veel ruimte, zowel lateraal als tussen de rails
- Individuele afdekplaten (met asymmetrische vensters) aangepast aan alle mogelijke posities van de rails: zowel in hoogte als in hartafstand (125/150/175mm)
- de opbouwkast heeft een verwijderbaar montageraam om een gemakkelijke bekabeling uit te voeren voor het plaatsen van de apparaten
- de inbouwkast heeft een montageraam met muursteun voor een effectieve horizontale regeling
- zowel horizontale als verticale samenbouw-mogelijkheden
- een interfacekast, voor de uiteindelijke gebruiker, die verenigbaar is met de opbouwmodellen
- moduleerbare klemmen (verdeling) met bevestiging zonder schroeven (max. 6 mm<sup>2</sup>, grotere doorsneden hebben een schroef-bevestiging).



#### Robuust

- een concept met lange levensduur (hoogwaardig kunststof van Merlin Gerin voor het volledige gamma)
- om een maximale stevigheid te bekomen gebruikt men metalen delen voor de 24 modules per rij
- een kast met een totale Isolatieklasse II.

#### Esthetiek

- stijlvol ontworpen om zich perfect in zijn omgeving te integreren
- een verzameling van harmonieuze kleuren voor de verschillende componenten
- met de keuze van de kristal deur kan men een persoonlijk accent aanbrengen en toch een geslaagde integratie in de omgeving verkrijgen.







Referenties,  
karakteristieken

Modulaire apparatuur  
Beveiliging van personen en goederen

Praktische wenken / Afmetingen: zie hoofdstuk K

Differentieelschakelaars FREEDIS

Referenties FREEDIF ID	Aantal polen	Kaliber (A)	Gevoeligheid (mA)	Type	Breedte in modules van 18 mm	Ref.		
	2	25	10	ogenblikkelijk	2	DIF 225010		
		25	30	ogenblikkelijk	2	DIF 225030		
		40	30	ogenblikkelijk	2	DIF 240030		
		40	300	ogenblikkelijk	2	DIF 240300		
		40	300	selectief	2	DIF240300S		
		63	30	ogenblikkelijk	2	DIF 263030		
		63	300	ogenblikkelijk	2	DIF 263300		
		63	300	selectief	2	DIF263300S		
			4	25	30	ogenblikkelijk	4	DIF 425030
				25	300	ogenblikkelijk	4	DIF 425300
40	30			ogenblikkelijk	4	DIF 440030		
40	100			ogenblikkelijk	4	DIF 440100		
40	300			ogenblikkelijk	4	DIF 440300		
63	30			ogenblikkelijk	4	DIF 463030		
63	300			ogenblikkelijk	4	DIF 463300		
40	300			selectief	4	DIF440300S		
63	300			selectief	4	DIF463300S		

Tweepolig

Vierpolig



Hulpelement OSF

Functie

Onderbreekt automatisch een stroomkring wanneer een isolatiefout tussen fase en aarde optreedt, groter dan of gelijk aan de gevoeligheid. Deze zijn bijzonder goed ontworpen om mensen en goederen te beschermen tegen direct of indirect contact en tegen isolatiefouten.

Karakteristieken

- ID met ogenblikkelijke werking
- conform aan de voorschriften in artikel 248.02 van het AREG
- scheidingschakelaar
- ID met selectieve werking: realiseert een totale verticale selectiviteit met stroomafwaarts geïnstalleerde ogenblikkelijk werkende differentieelinrichtingen met gevoeligheid 30 en 100 mA
- gevaar van gelijkstroomcomponenten: Indien stroomafwaarts van een differentieelbeveiliging elektrische apparaten geïnstalleerd zijn die een bron kunnen zijn van asymmetrische stromen en gelijkstroomcomponenten kunnen veroorzaken (dioden, thyristoren...), dan zijn voorzorgsmaatregelen nodig opdat deze gelijkstroomcomponenten bij het optreden van een verliesstroom de goede werking van de beveiligingsinrichtingen niet verstoren en zodoende de veiligheid niet in gevaar brengen.
- markering: 3000 A, 22,5 kA<sup>2</sup>s
- differentieelschakelaars zijn van het type A: gevoelig voor pulsvormige gelijkstroomcomponenten
- beveiligd tegen ongewenst uitschakelen te wijten aan tijdelijke overspanning (blikseminslag, bediening van apparatuur op het net...)
- kortsluitvastheid: 3000 A
- bedrijfs spanning: 240/415 V AC +10%, -20%
- aantal cycli (O-S): 20000
- conform de normen:
  - EN 61008-1
  - leurmerk: CEBEC
  - aanduiding van verliesstroom buiten op de voorzijde: door rode controlelamp
  - identificatie: Ter hoogte van de stroomafwaartse klemmen, met vast in te klikken identificatieplaatjes.
  - tropenvastheid: uitvoering 2 (relatieve vochtigheid 95% bij 55 °C)
  - aansluiting:
    - biconnect klemmen
    - kool- en staatklemmen voor geleiders tot 35 mm<sup>2</sup>.
    - verzegelbare schroevenafdekcapen meegeleverd met elke differentieelschakelaar
    - contacten OSF
    - dit hulpelement, dat links van de auto-maat bevestigd wordt, signaleert de stand "open" of "gesloten"
    - breedte in modules van 18 mm : 0,5
    - Ref.: 26923








Referenties,  
karakteristieken

Modulaire apparatuur  
Beveiliging van stroomkringen

Praktische wenken / Afmetingen: zie hoofdstuk K

Automaten FREEDIS

Referenties FREEDIS DJ	Aantal polen	Kaliber (A)	Breedte in modules van 18 mm	Ref.
 Tweepolig	2	2	2	DIS3202
		4	2	DIS3204
		6	2	DIS3206
		10	2	DIS3210
		16	2	DIS3216
		20	2	DIS3220
		25	2	DIS3225
		32	2	DIS3232
		40	2	DIS3240
	 Driepolig	3	2	3
		4	3	DIS3304
		6	3	DIS3306
		10	3	DIS3310
		16	3	DIS3316
		20	3	DIS3320
		25	3	DIS3325
		32	3	DIS3332
		40	3	DIS3340
 Vierpolig		4	2	4
		4	4	DIS3404
		6	4	DIS3406
		10	4	DIS3410
		16	4	DIS3416
		20	4	DIS3420
		25	4	DIS3425
		32	4	DIS3432
	40	4	DIS3440	

Functie

Besturing en overstrombeveiliging van stroomkringen.

Karakteristieken

- kalibers: 2 tot 40 A ingesteld op 30 °C
- bedrijfsspanning: 440 V AC
- onderbrekingvermogen: 3000 A
- begrenziingsklasse (NBN C61-898): 3
- uitschakelcurve:
  - curve C, de magnetische spoelen werken tussen 5 en 10 In
- aantal cycli (ON-OFF): 20.000
- conform de normen:
  - NBN C61-898 (EN 60 898)
- keurmerk: CECEC
- tropenvastheid: uitvoering 2 (relatieve vochtigheid 95 % bij 55 °C)
- aansluiting:
  - biconnect klemmen
  - koolklemmen voor kabels:
    - 16 mm<sup>2</sup> soepel of 25 mm<sup>2</sup> massief tot kaliber 25 A
    - 25 mm<sup>2</sup> soepel of 35 mm<sup>2</sup> massief voor kalibers 32 A tot 40 A




Referenties,  
karakteristieken

Praktische werken / Afmetingen: zie hoofdstuk K

Modulaire apparatuur  
Energy Efficiency en comfort  
Afstandsbediening

Magneetschakelaars CT

Referenties FREETACT CT	Aantal polen	Kaliber (A)	Contact- type (NO/NF)	Spoel- spanning Uc (V-)	Hand- bediening	Breedte in modules van 18 mm	Ref.
	1	25	1 NO	230/240		1	15958
	2	16	2 NO	230/240		1	15957
		25	2 NO	230/240		1	15959
		25	2 NO	24		1	16020
		25	2 NO	230/240	■	1	15981
		25	2 NF	230		1	15900
3	25	3 NO	230/240			2	15961
	25	3 NO	230	■		2	15962
	40	3 NO	230/240			3	15967
4	25	4 NO	230/240			2	15962
	40	4 NO	230/240			3	15968

CT



CT met handbediening

\* Dag/nacht-contact

Opmerking: NO = normaal open contact  
NF = normaal gesloten contact

Functie

Via de modulaire magneetschakelaars CT kunnen eenfasige, driefasige en vierfasige stroomkringen tot 40 A bediend worden. Magneetschakelaars CT met handbediening zijn uitgerust met een manuele driestanden-schakelaar:  
- automatische werking  
- gedwongen of doorlopende werking  
- nulstand

Karakteristieken

- vermogenskring:
  - kalibers: 25 tot 40 A (categorie AC7a)
  - bedrijfsspanning:
    - 1P en 2P 250 V
    - 3P en 4P 400 V
  - frequentie: 50 Hz
- stuurkring:
  - bedrijfsspanning:
    - 24 V: -10 % +10 %
    - 230 / 240 V: -15 % +6 %
  - spoelfrequentie: 50 Hz
- conform de normen:
  - EN 61 095
  - IEC 1095
- combinatiemogelijkheden:
  - ATEt
  - gebruikstemperatuur: -5 °C tot +60 °C
  - tropenvastheid: uitvoering 2 (relatieve vochtigheid: 95 % bij 55 °C).
  - geluidarme werking (< 20 dB) voor de volledige serie.
  - aansluiting:

Type	Besturingskring	Vermogenskring	
		25 A	40 A
spoel	2 x 2,5 mm <sup>2</sup>	2 x 2,5 mm <sup>2</sup>	2 x 10 mm <sup>2</sup>
stijl	2 x 1,5 mm <sup>2</sup>	6 mm <sup>2</sup>	25 mm <sup>2</sup>

- spanningsaanduiding op de voorzijde van elk apparaat (rode verklikker: spoel onder spanning).
- identificatie: de magneetschakelaars kunnen met vastklikbare identificatieplaatjes worden uitgerust.
- toebehoren CT:

Type	Kaliber (A) cos φ = 0,6	Afm. in mod. van 18 mm	Ref.
schroefkap (zakje van 3P, 4P 10 stuks stroomop/stroomaf)	3P, 4P	25	15921
	2P	40/63	2
	3P	40/63	3
tussenschot		0,5	27062
set van 10 clips			15415



Schroefkap



Tussenschot

C18



## 26 70 00 Low-Voltage Distribution equipment



### Datasheet

Item No. F0.000.0004.5

RC switch 2 channel GESIS RC B-02ALSPDB02

gesis RC batteryless and maintenance-free radio pushbuttons with 2 channels for direct control of the actuators. The rockers in neutral center position are marked with Up/Down symbols. Between the rockers there is a marking field with detachable marking strips. The following combination frames fit these radio pushbuttons. Colour aluminium finish



Item No.	F0.000.0004.5
EAN	40 155 738 228 63
order unit	1 Piece(s)

### Technical data

#### General

Number of push-buttons	2
Bus connection included	Yes
Bus system EIB/KNX	No
Bus system radio frequent	Yes
Bus system LON	No
Colour	Aluminium
With label area	Yes
With LED indication	No
Mounting method	Surface mounted (plaster)
RAL-number (skin)	9006
Degree of protection (IP)	IP20

#### Other

Halogen free	Yes
With anti-theft/dismantling protection	No
With display	No
Surface	Varnished
Material	Plastic

### Accessories

Item No.	Typ:	Description:
F0.000.0004.8	Frame 1-fold GESIS RC A-BFALSPD1F	gesis RC combination frame, single suitable for the radio pushbuttons. Remark! Not suitable for gesis RC multivendor radio pushbuttons. Color aluminium finish.
F0.000.0004.9	Frame 2-fold GESIS RC A-BFALSPD2F	gesis RC combination frame, double suitable for the radio pushbuttons. Remark! Not suitable for gesis RC multivendor radio pushbuttons. Color aluminium finish.



Datasheet

Item No. F0.000.0004.7

RC switch 4 channel GESIS RC B-04ALSPDB02

gesis RC batteryless and maintenance-free radio pushbuttons with 4 channels for direct control of the actuators. The rockers in neutral center position are marked with Up/Down symbols. Between the rockers there is a marking field with detachable marking strips. The following combination frames fit these radio pushbuttons. Colour aluminium finish



Item No.	F0.000.0004.7
EAN	4015579822887
order unit	1 Piece(s)

Technical data

General	
Number of push-buttons	4
Bus connection included	Yes
Bus system EIB/KNX	No
Bus system radio frequent	Yes
Bus system LON	No
Colour	Aluminium
With label area	Yes
With LED indication	No
Mounting method	Surface mounted (plaster)
RAL-number (akin)	9006
Degree of protection (IP)	IP20
Other	
Halogen free	Yes
With anti-theft/dismantling protection	No
With display	No
Surface	Varnished
Material	Plastic

Accessories

Item. No.	Typ:	Description:
F0.000.0004.8	Frame 1-fold GESIS RC A-BFALSPD1F	gesis RC combination frame, single suitable for the radio pushbuttons. Remark! Not suitable for gesis RC multivendor radio pushbuttons. Color aluminium finish.
F0.000.0004.9	Frame 2-fold GESIS RC A-BFALSPD2F	gesis RC combination frame, double suitable for the radio pushbuttons. Remark! Not suitable for gesis RC multivendor radio pushbuttons. Color aluminium finish.

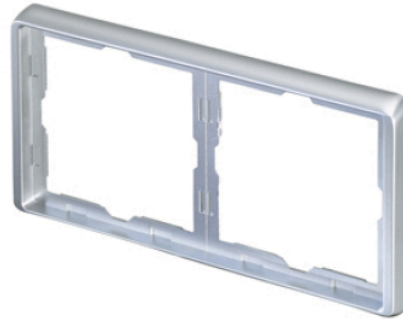


Datasheet

Item No. F0.000.0004.9

Frame 2-fold GESIS RC A-BFALSPD2F

gesis RC combination frame, double suitable for the radio pushbuttons. Remark! Not suitable for gesis RC multivendor radio pushbuttons. Color aluminium finish..



Item No.	F0.000.0004.9
EAN	40 155738 22900
order unit	1 Piece(s)

Technical data

<b>General</b>	
Number of units	2
Colour	Aluminium
Suitable for wall duct	Yes
<b>Other</b>	
Suitable for flush mounted installation	Yes
<b>General</b>	
Mounting direction	Horizontal and vertical
Fitting to switch series	Wire less push button
PAL-number (akin)	9006
Degree of protection (IP)	IP20
<b>Other</b>	
Halogen free	Yes
Hinged lid	No
Surface	Varnished
Material	Plastic



Datasheet

Item No. F0.000.0004.8

Frame 1-fold GESIS RC A-BFALSPD1F

gesis RC combination frame, single suitable for the radio pushbuttons. Remark! Not suitable for gesis RC multivendor radio pushbuttons. Color aluminium finish.



Item No.	F0.000.0004.8
EAN	4015573822894
order unit	10 Piece(s)

Technical data

General

Number of units	1
Colour	Aluminium
Suitable for wall duct	Yes

Other

Suitable for flush mounted installation	Yes
---	-----

General

Mounting direction	horizontal
Fitting to switch series	Wire less push button
PAL-number (akin)	9006
Degree of protection (IP)	IP20

Other

Halogen free	Yes
Hinged lid	No
Surface	Varnished
Material	Plastic



[Producten \(/nlbe/niko/producten/\)](#)

[Toepassingen \(/nlbe/niko/toepassingen/\)](#)

[Projecten \(/nlbe/niko/projecten/\)](#)

[Hulp en advies \(/nlbe/niko/hulp-en-advies/\)](#)

[Waar kopen \(/nlbe/niko/waar-kopen/\)](#)

**Artikel detail**  
Zoek producten

## New Hydro - Sputwaterdicht stopcontact met penaaarde, kinderveiligheid en schroefklemmen, exclusief opbouwdoos / 700-36600

[Terug \(javascript:history.go\(-1\)\)](#)



### Benaming

New Hydro - Sputwaterdicht stopcontact met penaaarde, kinderveiligheid en schroefklemmen, exclusief opbouwdoos

### Beschrijving

Dit opbouwstopcontact is voorzien van een aardpen, kinderveiligheid, schroefklemmen en een beschermklep met scharnieren. Het mechanisme wordt in een spuitwaterdichte opbouwdoos geplaatst. Het geheel is spuitwaterdicht, wat het uitermate geschikt maakt voor gebruik in vochtige ruimtes en veeleisende omgevingen. Kleur: lichtgrijs met donkergrijze beschermklep.

### Lastenboek

Sputwaterdichte opbouwcontactdoos 16A/250V~. Tweepolig met een massief messing vernikkelde aardpen en kinderveiligheid. De wandcontactdoos wordt volledig bedekt door een naar boven scharnierende beschermklep. Een veer en een bevestigingshaakje houden de beschermklep stevig dicht. Het mechanisme bevat contactbussen met een groot contactoppervlak die niet op de sokkel steunen om te klemmen en kooiklemmen met onverliesbare schroeven. Deze schroeven hebben een gemengde schroefkop (PZ2-sleuf 1x6mm). Tevens heeft elke schroef een schroevendraaiergeleiding die voorkomt dat de schroevendraaier van de schroefkop glijdt. De sokkel van de wandcontactdoos is vervaardigd uit ureumformaldehyde (UF) lichtgrijs RAL7035. De sokkel heeft een hoge hitteresistentie: hij smelt niet bij blootstelling aan hoge temperaturen. Dit in tegenstelling tot thermoplasten. Alle aansluitklemmen bevinden zich aan de bovenzijde en kunnen tot 4x2,5mm<sup>2</sup> draad bevatten, de aardingsklem zelfs tot 2x2,5mm<sup>2</sup> + 2x4mm<sup>2</sup>. De ontmantelingslengte (14mm) van de draden is achteraan op de sokkel onuitwisbaar aangebracht. De wandcontactdoos zal worden geplaatst in een spuitwaterdichte opbouwdoos. Twee lateraal geplaatste houders in de doos grijpen het mechanisme vast. Een snapverbinding houdt het bedrade mechanisme op zijn plaats. Onder het mechanisme blijft er 15,7mm bedradingsruimte over. De wandcontactdoos heeft een aangespoten dichting en sluit hermetisch af op de aangepaste doos. Dit samengestelde geheel heeft een beschermingswaarde van IP55, een mechanische slagvastheid van IK07. Ze is vervaardigd uit slagvaste, stofwerende, halogeenvrije, zelfdovende polypropyleen (UL94-V2/1,6mm). Beschermingsdeksel uit vormvaste ABS. De grondstof is in de massa gekleurd, de wandcontactdoos lichtgrijs RAL 7035 (NCS S1502-B), het beschermingsdeksel donkergrijs NCS S3502-B. Afmetingen: 73 x 73mm. CEBEC en NF gekeurd.



[/nlbe/niko/niko/home/](#) [Over Niko \(/nlbe/niko/over-niko/\)](#) [Pers \(/nlbe/niko/pers/\)](#) [Contact \(/nlbe/niko/contact/\)](#) [Country \(#\)](#) [f \(http://www.facebook.com/niko.eu\)](http://www.facebook.com/niko.eu)



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[Waar kopen \(/nlbe/niko/waar-kopen/\)](#)

Artikel detail  
Zoek producten

**Afwerkingsset voor stopcontact met penaarde en kinderveiligheid, inbouwdiepte 28,5mm, Sterling / 121-66601** [Terugn \(javascript:history.go\(-1\);\)](#)



**Benaming**

Afwerkingsset voor stopcontact met penaarde en kinderveiligheid, inbouwdiepte 28,5mm, Sterling

**Beschrijving**

Afwerkingsset voor een stopcontact met penaarde en kinderveiligheid. Dit stopcontact heeft een inbouwdiepte van 28,5mm. Kleur: Sterling.

**Lastenboek**

De centraalplaat wordt d.m.v. een schroef met gemengde schroefkop (Pz1-sleuf 1x5,5mm) vastgezet op een inbouwcontactdoos. Deze centraalplaat is omringd door een vlakke boord die op de 4 hoeken voorzien is van een rechthoekige opening waarin zich telkens een multipositionele snaphaak bevindt. De opbouw van de centraalplaat zorgt ervoor dat bij onzorgvuldig pleisterwerk de afdeklaat steeds vlak tegen de muur bevestigd kan worden dankzij de snaphaken. Dit werkt in twee richtingen: als de inbouwdoos uit het pleisterwerk steekt, vangen de multipositionele snaphaken een speling tussen 1 à 1,2mm op; als de inbouwdoos te diep in het pleisterwerk verzonken is, dan kunnen de snaphaken een speling tot 1,8mm opvangen. De vlakke boord van de centraalplaat bevat eveneens 4 ronde openingen die ervoor zorgen dat de afdeklaat correct gepositioneerd kan worden ten opzichte de centraalplaat. De achterzijde van de centraalplaat is voorzien van een kinderveiligheid. Deze laat het contact toe na gelijktijdige introductie van de pennen van een stekker, maar verhindert het maken van contact als slechts 1 pen wordt ingebracht of als de twee pennen van een stekker niet gelijktijdig worden ingebracht. Na montage van het geheel (afdeklaat, centraalplaat en wandcontactdoos) zijn er, dankzij de vlakke boord aan de centraalplaat, geen metalen delen zichtbaar. De samenstelling van een wandcontactdoos, centraalplaat met kinderveiligheid en afdeklaat heeft een beschermingswaarde IP41. De kunststofdelen van de centraalplaat voldoen aan een gloeidraadproef van 650°C en zijn halogeenvrij. De centraalplaat is vervaardigd uit vormvaste pc+asa en is sterling gelakt. Na montage is een slagvastheid van IK06 gegarandeerd. Afmetingen centraalplaat met vlakke boord: 56x56mm, afmetingen centraalplaat zichtbaar gedeelte: 45x45mm.





## enocean-IP-Gateway

RF-receiver and gateway to LAN



### Highlights

- Connects battery-less RFSensors to the PC network (LAN) no additional wiring needed
- Supports all enocean-Sensoren (Buttons, Windowcontacts, Temperature...)
- Easy integration into own applications by using the direct ASCII protocol
- OPCServer included
- contains RF-receiver and integrated LAN connector

### Overview

As sensors may be used buttons (e.g. from PEHA or Omnio), temperaturesensors (e.g. from Thermokon), glass break detectors and many more. Those sensors dont need a battery, the needed energy is generated by pressing the button or by solarcells. The enoceanIP-gateway allows switching, dimming, shutters, temperature and brightness-measurement over the PC network (LAN), with the included OPCServer the integration of the Enocean values into your visualization software becomes easy.

### Fields of application

- Expansion without additional wiring
- Use in historical buildings where no additional wiring is allowed
- Use in buildings with moveable walls
- Functions independent of fix mounted pushbuttons
- Individual controlling of rooms with removeable walls
- Pushbuttons mountable even on Glass surfaces

### Contents of delivery

- 1 enocean-IP Gateway
- OPCServer software
- Documentation

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Automations- und Steuerungstechnik GmbH



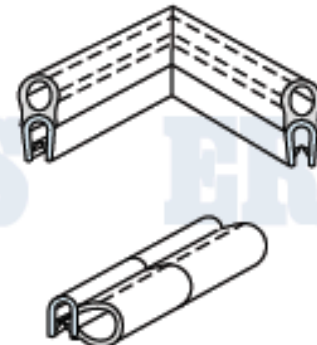
**5.9. Voirubber klemprofielen**  
**Profilés de protection de tôle**  
**Edge protector profiles**  
**Kantenschutzprofile**

Dit type klemprofiel is een combinatie van een PVC-klemprofiel met een sponrubberprofiel of met een rubberprofiel met afdichtingslip of holle kamer. Deze profielen hebben een dubbele functie. Enerzijds bieden zij de nodige bescherming aan de constructie en anderzijds dienen ze als afdichting. De sponrubberlippen of de holle kamers zijn heel flexibel en kunnen gebruikt worden voor het afdichten van deuren en kleppen.

Ce type de profilés de protection de tôle est la combinaison d'un profilé de serrage en PVC et d'un profilé en caoutchouc mousse avec livre d'étanchéité ou d'un cordon creux. Ces profilés ont une double fonction. D'un part, ils assurent la protection des rives et d'autre part ils ont une fonction d'étanchéité. Les profilés en caoutchouc mousse sont très souples et peuvent assurer l'étanchéité de portes ou de clapets.

This type of section are PVC-edge protectors in conjunction with sponge rubber sections or rubber sections with integral sealing lip or hollow chamber. They combine the advantage of simple finishing for beads required by manufacturing techniques with a second function - sealing. The sealing lips or hollow chambers are highly flexible and suitable for sealings at doors and hatches.

Kantenschutzprofile sind eine Kombination aus Kantenschutzprofilen mit aufgesetzten Moosgummiprofilen bei PVC und eine Koextrusion bei Gummiprofilen aus Weichgummi und Moosgummi. Diese Profile haben eine doppelte Funktion. Zum einen die einfache Abdeckung konstruktionsbedingter Kanten und zum zweiten die Dichtwirkung. Die Moosgummilippen bzw. Hohlkammern sind hochflexibel und geeignet für Abdichtung von Türen und Klappen.



PVC/steel edge protector profiles

Profil	ERIKS Art.n°	Colour	Clamping range (mm)	L. max. (m)	Bending radii	Profil n°
	10000353(*)	grey	0,8 - 1,5	100		2474
	10000357(*)	black	1,0 - 2,0	100		2481
	11149785	white	1,0 - 2,0	100		2481
	11084168	grey	1,0 - 2,0	100		2481
	11030401	black	1,0 - 4,0	100		2513
	10000354(*)	grey	1,0 - 4,0	100		2513

\* = Voorraad / stock / Lager



26 30 00 Facility Electrical Power Generating and Storage Equipment  
26 31 00 Photovoltaic Collectors

Think GAIA  
For Life and the Earth



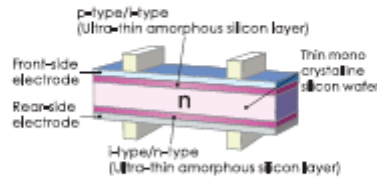
HIT Photovoltaic Module

**HIT** Power 215N  
Photovoltaic Module

**Module Efficiency: 17.1%**  
**Cell Efficiency: 19.3%**  
**Power Output - 215 Watts**



SANYO HIT® Solar Cell Structure



**SANYO'S Proprietary Technology**  
HIT solar cells are hybrids of mono crystalline silicon surrounded by ultra-thin amorphous silicon layers, and are available solely from SANYO.

**High Efficiency**

HIT® Power solar panels are leaders in sunlight conversion efficiency. Obtain maximum power within a fixed amount of space. Save money using fewer system attachments and racking materials, and reduce costs by spending less time installing per watt. HIT Power models are ideal for grid-connected solar systems, areas with performance based incentives, and renewable energy credits.

**Power Guarantee**

SANYO's power ratings for HIT Power panels guarantee customers receive 100% of the nameplate rated power (or more) at the time of purchase, enabling owners to generate more kWh per rated watt, quicker investments returns, and help realize complete customer satisfaction.

**Temperature Performance**

As temperatures rise, HIT Power solar panels produce 10% or more electricity (kWh) than conventional crystalline silicon solar panels at the same temperature.

**Valuable Features**

The packing density of the panels reduces transportation, fuel, and storage costs per installed watt.

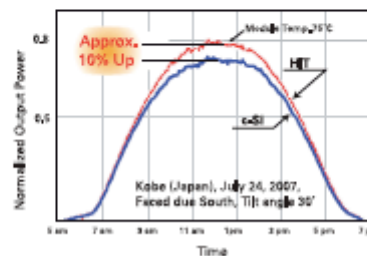
**Quality Products Made in USA**

SANYO silicon wafers located inside HIT solar panels are made in California and Oregon (from October 2009), and the panels are assembled in an ISO 9001 (quality), 14001 (environment), and 18001 (safety) certified factory. Unique eco-packing minimizes cardboard waste at the job site. The panels have a Limited 20-Year Power Output and 5-Year Product Workmanship Warranty.

Unnecessary Section When Using SANYO



Increased Performance with SANYO







# Calculations PV wiring

## Design of the inverters installed on the roof

The design temperature range will be  $T_{min} = -5,0^{\circ}\text{C}$  (268 Kelvin) and  $T_{max} = 80,0^{\circ}\text{C}$  (353 Kelvin). PhonoSolar F-series 190Wp Solar Panels will be installed on the roof of Team Belgium's E-Cube. For their specifications, see the added datasheet. The panel's voltage range within the MPP (Maximum Power Point) as well as its Maximum Open Circuit Voltage (OC) and Maximum Short Circuit Current can be calculated using the following equations and the given design temperatures. The temperature coefficient of the voltage would be referred to as  $\alpha_V$  and the temperature coefficient of the current would be referred to as  $\alpha_I$ .

$$V_{mp}(T) = \alpha_V (T - T_{STC}) + V_{mp, STC}$$

$$V_{oc}(T) = \alpha_V (T - T_{STC}) + V_{oc, STC}$$

$$I_{sc}(T) = \alpha_I (T - T_{STC}) + I_{sc, STC}$$

Where  $T_{STC} = 25^{\circ}\text{C}$  (298 Kelvin) would be the temperature under Standard Test Conditions (STC). Thus, for the PhonoSolar F-series 190Wp Solar Panels, the following results will occur.

$$V_{mp, max} = V_{mp}(T=268 \text{ Kelvin}) = 41,995\text{V}$$

$$V_{mp, min} = V_{mp}(T=353 \text{ Kelvin}) = 24,850\text{V}$$

$$V_{oc, max} = V_{oc}(T=268 \text{ Kelvin}) = 49,995\text{V}$$

$$I_{sc, max} = I_{sc}(T=353 \text{ Kelvin}) = 6,093\text{A}$$

On the roof, 3 strings with 11 solar panels each will be installed. They will deliver a maximum DC power of  $P_{dc, max} = 6.270$  Watt. This configuration will lead to the following string voltage range, maximum open circuit voltage and maximum DC current output.

$$V_{str, mp, max} = 6 V_{mp, max} = 481,945\text{V}$$

$$V_{str, mp, min} = 6 V_{mp, min} = 217,150\text{V}$$

$$V_{str, oc, max} = 6 V_{oc, max} = 549,945\text{V}$$

$$I_{dc, max} = 6 I_{sc, max} = 18,278\text{A}$$

To meet this configuration, a Sunny Boy 6000-US inverter will be used. See the specification sheet included for more information.



E-Cube UGent

## Wiring of the roof's photovoltaic configuration

In general, copper wire having a sectional area of  $A_{Cu} = 4 \text{ mm}^2$  will be used for the connection of the strings to the inverter as well as for the interconnection between the solar panels.

A total of 6 DC wires are necessary to connect the inverter to the 3 solar panel strings on Team Belgium's E-cube roof. The maximum length of each wire should not exceed  $L_{max} = 20\text{m}$ . Since the specific resistance of wires would be  $\rho = 1.68 \times 10^{-8} \Omega\text{m}$ <sup>(1)</sup>. The overall resistance of the cables is calculated as follows.

$$R_{CU} = \rho L / A$$
$$R_{CU} = 0,084 \Omega$$

For additional information on the installed DC wires, see the specification sheet included.

The following maximum current will flow through the DC wires of each string, while each string will provide a maximum DC power of  $P_{DC, max} = 2090 \text{ Wp}$ .

$$I_{DC, max} = P_{DC, max} / V_{str, mp, max} = 4,524 \text{ A}$$

Thus, the voltage drop and power loss on one wire would be:

$$\Delta V = I_{DC, max} R_{CU} = 0,380 \text{ V}$$
$$P_{loss} = \Delta V I_{DC, max} = 1,719 \text{ W}$$

For the total roof configuration together this would lead to a power loss of

$$P_{loss, total} = 12 P_{loss} = 18,914 \text{ W}$$

which is in an acceptable range (a loss of only 0,3% of the total power).

## Design of the DC wires dimensions

In general copper wire having a sectional area of  $A_{Cu} = 4\text{mm}^2$  (similar to AWG 12 wire) will be used for the connection of the strings to the inverter.

The necessary ampacity from the solar array to the inverter will be:

$$1,25 * 1,25 * I_{DC, max} = 9,520 \text{ A}$$

The maximum ampacity for a  $4\text{mm}^2$  copper cable (similar to AWG 12 wire) in open air is 40 A. As the conduit might be exposed to sunlight, an ambient temperature of  $T = 61^\circ\text{C}$  has to be taken into account. The correction factor for this type of cable and this ambient temperature is 0,58, according to Table 310.17 in the NEC Code. The maximum ampacity for the cable is:

$$40 * 0,58 = 23,200 \text{ A}$$

The maximum ampacity of the cable is bigger than the necessary ampacity, so the cable is well dimensioned.

<sup>1</sup> According to: Griffiths, David (1999) [1981]. \*7. Electrodynamics\*. In Alison Reeves (ed.). Introduction to Electrodynamics (3rd edition ed.). Upper Saddle River, New Jersey: Prentice Hall. p. 286. ISBN 0-13-805326-X.



E-Cube UGent

## Design of the AC wires dimensions

In general copper wire having a sectional area of  $A_{Cu} = 6\text{mm}^2$  (similar to AWG 10 wire) will be used for the connection of the inverter to the mini-grid.

The necessary ampacity from the inverter to the mini-grid is the maximum output current of the inverter, specified in the added datasheet, multiplied with a safety factor:

$$1,25 * I_{AC, \max} = 31,250 \text{ A}$$

The maximum ampacity for a  $6\text{mm}^2$  copper cable (similar to AWG 10 wire) in a raceway, cable or earth is 40 A. Temperatures in the technical box of Team Belgium's E-cube can reach temperatures as high as around  $40^\circ\text{C}$ . The correction factor for this type of cable and this ambient temperature is 0,91, according to Table 310.16 in the NEC Code. The maximum ampacity for the cable is:

$$40 * 0,91 = 36,400 \text{ A}$$

The maximum ampacity of the cable is bigger then the necessary ampacity, so the cable is well dimensioned.



## XVB-F2 0,6/1 kV

3/4

Nombre de conducteurs et section	Epaisseur d'isolement	Epaisseur de la gaine	Diamètre extérieur	Poids du câble
Aantal geleiders en doorsnede	Isolatie dikte	Dikte van de buitenmantel	Buitediameter	Kabelgewicht
Number of cores and size	Insulation thickness	Outer sheath thickness	Outer diameter	Weight of cable
mm <sup>2</sup>	mm	mm	approx. mm	approx. kg/km
3 x 25RM/16RM	0,9/0,7	1,6	21,9	1230
3 x 35RM/16RM	0,9/0,7	1,7	25,2	1650
3 x 50SM/25RM	1,0/0,9	1,8	28,1	1890
3 x 70SM/35RM	1,1/0,9	1,9	31,2	2620
3 x 95SM/50RM	1,1/1,0	2,1	35,8	3570
3 x 120SM/70RM	1,2/1,1	2,2	39,6	4490
3 x 150SM/70RM	1,4/1,1	2,3	44,4	5370
3 x 185SM/95RM	1,6/1,1	2,5	49,1	6810
3 x 240SM/120RM	1,7/1,2	2,7	56,3	8790
3 x 300SM/150RM	1,8/1,4	2,9	63,3	10920
<hr/>				
4 x 1,5 RE	0,7	1,4	10,0	160
4 x 2,5 RE	0,7	1,4	11,0	210
4 x 4 RE	0,7	1,4	12,1	280
4 x 6 RE	0,7	1,4	13,3	370
4 x 10 RE	0,7	1,5	15,4	560
4 x 16 RM	0,7	1,5	18,7	885
4 x 25 RM	0,9	1,7	23,0	1360
4 x 35 RM	0,9	1,8	26,8	1880
4 x 50 SM	1,0	1,9	28,3	2120
4 x 70 SM	1,1	2,0	31,4	2970
4 x 95 SM	1,1	2,1	35,8	4030
4 x 120 SM	1,2	2,3	39,8	5000
4 x 150 SM	1,4	2,4	44,6	6150
4 x 185 SM	1,6	2,6	49,3	7710
4 x 240 SM	1,7	2,8	56,5	10010
4 x 300 SM	1,8	3,0	63,5	12450
<hr/>				
5 x 1,5 RE	0,7	1,4	10,8	190
5 x 2,5 RE	0,7	1,4	11,9	250
5 x 4 RE	0,7	1,4	13,2	340
5 x 6 RE	0,7	1,4	14,5	450
5 x 10 RE	0,7	1,5	16,9	670
5 x 16 RM	0,7	1,6	20,7	1090
5 x 25 RM	0,9	1,7	26,3	1740







## XVB-F2 0,6/1 kV

4/4

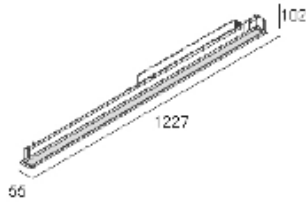
Nombre de conducteurs et section	Epaisseur d'isolement	Epaisseur de la gaine	Diamètre extérieur	Poids du câble
Aantal geleiders en doorsnede	Isolatiedikte	Dikte van de buitenmantel	Buitendiameter	Kabelgewicht
Number of cores and size	Insulation thickness	Outer sheath thickness	Outer diameter	Weight of cable
mm <sup>2</sup>	mm	mm	approx. mm	approx. kg/km
7 x 1,5 RE	0,7	1,4	10,8	235
7 x 2,5 RE	0,7	1,4	13,0	320
10 x 1,5 RE	0,7	1,4	15,4	350
10 x 2,5 RE	0,7	1,5	17,2	470
12 x 1,5 RE	0,7	1,4	15,8	390
12 x 2,5 RE	0,7	1,5	17,7	530
14 x 1,5 RE	0,7	1,5	16,7	440
14 x 2,5 RE	0,7	1,5	18,5	595
16 x 1,5 RE	0,7	1,5	17,6	490
16 x 2,5 RE	0,7	1,6	20,0	690
19 x 1,5 RE	0,7	1,5	18,4	550
19 x 2,5 RE	0,7	1,6	21,0	780
24 x 1,5 RE	0,7	1,6	21,8	710
27 x 1,5 RE	0,7	1,6	22,2	770
30 x 1,5 RE	0,7	1,7	23,1	840
37 x 1,5 RE	0,7	1,7	24,8	990

RE:  RM:  SM: 

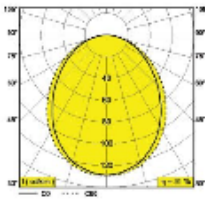


## 26 50 00 Lighting

### MICROLINE 50 1154 297 01 154



© Delta Light 2008



45 x 1214 x 100

◇ = ANO

INCL. 1 x PC SBL

INCL. 2 x INSIDE CLIP

G5 / 230-240V / 50-60Hz / 1 x 1~MULTI-EVG

1 x T16HE 28W

1 x T16HO 54W

◇ CE 4.8 IP20 850°C

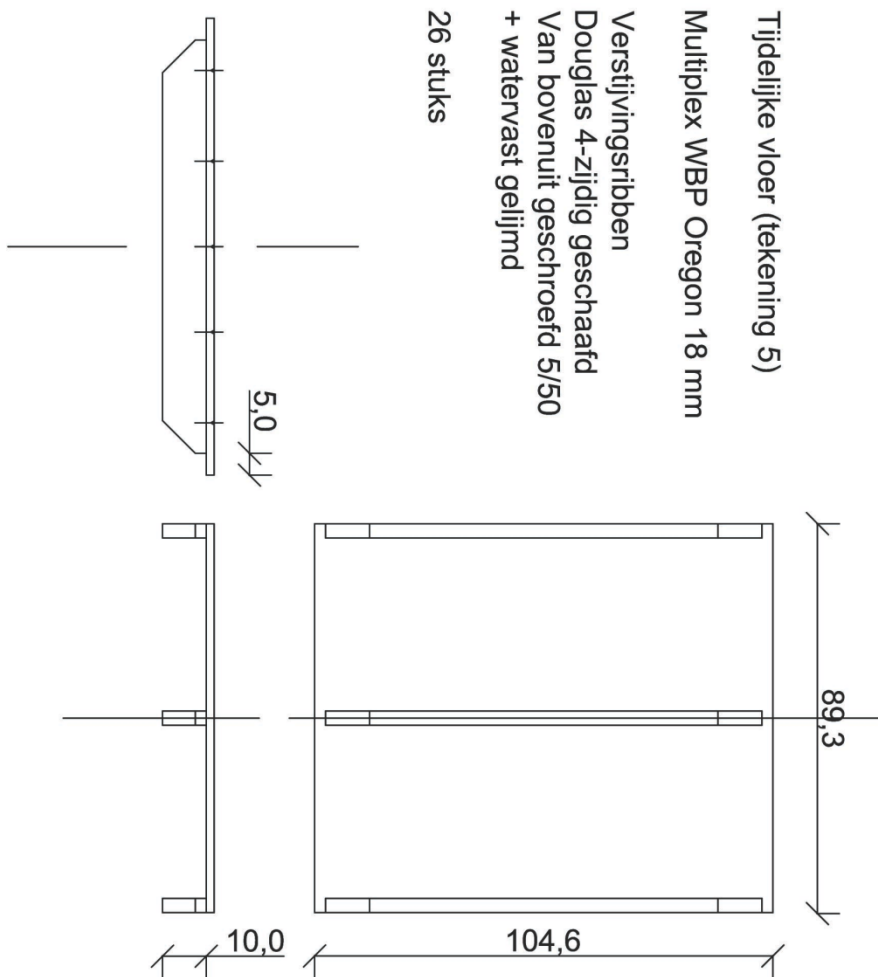
For detailed installation instructions, please consult the manual.

## DELTA LIGHT®

Headquarters Delta Light nv - Muizenstraat 2 - 8560 Wobvelgrm (Moessele)  
Tel +32 56 435 735 Fax +32 56 435 736 Email info@delta-light.com



### 32 10 00 Bases, Ballast, and Paving





## 42 31 16 Dessicant Equipment

### MCS Series Sorptieluchtontvochtiger



#### Productbeschrijving

De MCS300 sorptieluchtontvochtiger is ontworpen om op efficiënte wijze lucht te ontvochtigen in open systeemtoepassingen. Door de compacte constructie is het mogelijk het apparaat gedurende langere perioden te gebruiken met een minimum aan onderhoud. Door het ontwerp is het apparaat gemakkelijk door één persoon te vervoeren naar en binnen de te ontvochtigen ruimten. Een geavanceerd controlepaneel is standaard aanwezig voor een eenvoudige en gebruikersvriendelijke bediening van verschillende functies. Een energieverbruiksmeter die u op nul kunt stellen maakt het mogelijk het verbruik (kWh) gedurende een bepaalde periode te meten. Het robuuste metalen frame en de toegangspanelen zijn vervaardigd van roestvrij staal. Het elektrische regelsysteem voldoet aan de EN 60204 (IEC204) normen en de elektrische componenten zijn bevestigd achter het controlepaneel. De MCS300-luchtontvochtigers voldoen aan zowel de geharmoniseerde Europese normen als aan de specificaties voor de CE-markering

#### Munters Rotortechnologie

De sorptierotor is vervaardigd van geribd composietmateriaal dat op uiterst effectieve wijze waterdamp aantrekt en vasthoudt. Elke Munters-luchtontvochtiger maakt gebruik van unieke rotortechnologie. Luchtstromen, luchtomstandigheden, rotorsecties en rotortoerentallen worden optimaal aangepast aan specifieke toepassingen. Een innovatief regelsysteem zorgt voor optimaal stroomverbruik van het apparaat. Een kenmerk van de rotortechnologie van de MCS300 is een efficiënte luchtdistributiekamer, die de sectoren scheidt en de ontvochtigings- en regeneratieluchtstromen balanceert.

#### PRODUCTINFORMATIE

### MCS300

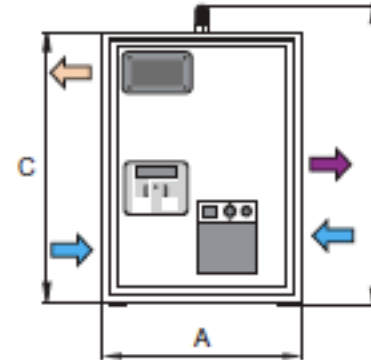
#### Kenmerken

- Vraagt weinig vloeroppervlak.
- Gebruikersvriendelijk bedieningspaneel en uitlezing.
- Uitlezing van energie-verbruik.
- Ingebouwde veiligheidsfunctie - overtemperatuur en afgeschakelde thermostaat.
- Simpel in onderhoud.
- Laagspannings hygrostaataansluiting.



### Model MCS300

Diagrammatenmaten dienen slechts ter referentie.



Breedte (A)	Diepte (B)	Hoogte (C/D)
400 mm	400 mm	550/605 mm

### Technische specificaties

#### Proceslucht

Nominale luchtstroom (m <sup>3</sup> /h)	300
Beschikbare statische druk (Pa)	200

#### Regeneratielucht

Nominale luchtstroom (m <sup>3</sup> /h)	60
Beschikbare statische druk (Pa)	200

#### Totaal vermogen, spanning en stroom

Totaal vermogen (kW)	2,1
115V 1-50/60Hz (A)	14,5
230V 1-50Hz (A)	9,1

#### Diverse gegevens

Bedrijfstemperatuur (°C)	-20/+40
Max. geluidsniveau (dBA)	60
Luchtfilter, standaard	G3
IEC beschermingsklasse (unit)	IP44
IEC beschermingsklasse (elektrisch)	IP54

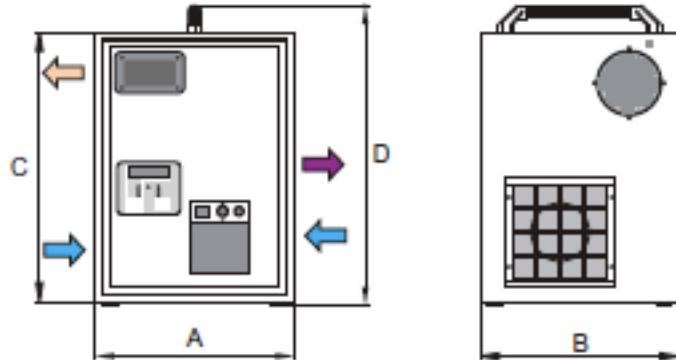




## Model MCS300

Diagrammatenmaten dienen slechts ter referentie.

AutoCAD-tekeningen op schaal zijn verkrijgbaar in het Munters DryCapprogramma.



Breedte (A)	Diepte (B)	Hoogte (C/D)	Droge lu.	Natte lu.	Gewicht
400 mm	400 mm	550/605 mm	125 mm	80 mm	25 kg

## Technische specificaties

### Proceslucht

Nominale luchtstroom (m <sup>3</sup> /h)	300
Beschikbare statische druk (Pa)	200

### Regeneratielucht

Nominale luchtstroom (m <sup>3</sup> /h)	60
Beschikbare statische druk (Pa)	200

### Totaal vermogen, spanning en stroom

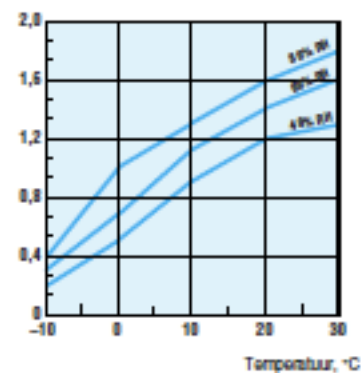
Totaal vermogen (kW)	2,1
115V 1-50/60Hz (A)	14,5
230V 1-50Hz (A)	9,1

### Diverse gegevens

Bedrijfstemperatuur (°C)	-20/+40
Max. geluidsniveau (dBA)	60
Luchtfilter, standaard	G3
IEC beschermingsklasse (unit)	IP44
IEC beschermingsklasse (elektrisch)	IP54

## Ontvochtigingscap.

Capaciteit bij benadering in kg/u.  
Voor meer informatie kunt u contact opnemen met uw dichtstbijzijnde Munters-lev. of kunt u het Munters DryCap-programma raadplegen.  
Ontvochtigingscapaciteit, kg/u



## Opties

- Elektromechanische hygrostaat
- Luchtgekoelde condensor
- Geluiddemper (luchttoevoer)
- Aansluitpakket voor de hygrostaat



## 48 10 00 Electrical power Generation Equipment



### SUNNY BOY 5000-US / 6000-US / 7000-US / 8000-US



#### UL Certified

- For countries that require UL certification (UL 1741/IEEE 1547)

#### Efficient

- 97% peak efficiency
- OptiCool™ active temperature management system

#### Safe

- Galvanic isolation

#### Simple

- Patented automatic grid voltage detection\*
- Integrated DC disconnect switch

## SUNNY BOY 5000-US / 6000-US / 7000-US / 8000-US

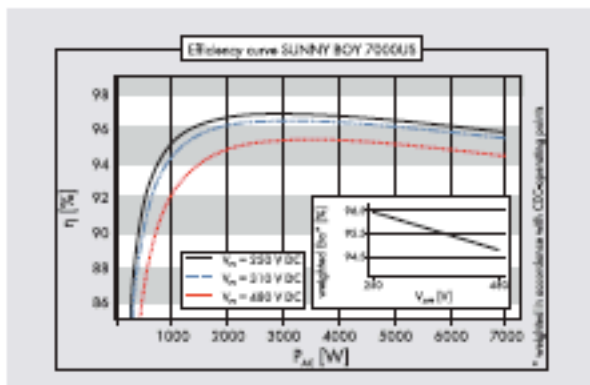
Versatile performer with UL certification

The Sunny Boy 5000-US, 6000-US, 7000-US and 8000-US inverters are UL certified and feature excellent efficiency. Graduated power classes provide flexibility in system design. Automatic grid voltage detection\* and an integrated DC disconnect switch simplify installation, ensuring safety as well as saving time. These models feature galvanic isolation and can be used with all types of modules—crystalline as well as thin-film.



Technical data	Sunny Boy 5000-US			Sunny Boy 6000-US			Sunny Boy 7000-US			Sunny Boy 8000-US	
	208VAC	240VAC	277VAC	208VAC	240VAC	277VAC	208VAC	240VAC	277VAC	240VAC	277VAC
<b>Input (DC)</b>											
Max. recommended PV power (@ module STC)	6250 W			7500 W			8750 W			10000 W	
Max. DC power (@ cos φ = 1)	5300 W			6350 W			7400 W			8600 W	
Max. DC voltage	600 V			600 V			600 V			600 V	
DC nominal voltage	310 V			310 V			310 V			345 V	
MPP voltage range	250 V - 480 V			250 V - 480 V			250 V - 480 V			300 V - 480 V	
Min. DC voltage / start voltage	250 V / 300 V			250 V / 300 V			250 V / 300 V			300 V / 365 V	
Max. input current / per string (at DC disconnect)	21 A / 20 A 36 A @ combined terminal			25 A / 20 A 36 A @ combined terminal			30 A / 20 A 36 A @ combined terminal			30 A / 20 A 36 A @ combined terminal	
Number of MPP trackers / fused strings per MPP tracker	1 / 4 (DC disconnect)										
<b>Output (AC)</b>											
AC nominal power	5000 W			6000 W			7000 W			7680 W / 8000 W	
Max. AC apparent power	5000 VA			6000 VA			7000 VA			8000 VA	
Nominal AC voltage / adjustable	208V/●	240V/●	277V/●	208V/●	240V/●	277V/●	208V/●	240V/●	277V/●	240V/●	277V/●
AC voltage range	180 - 220V / 211 - 264V / 244 - 300V			180 - 220V / 211 - 264V / 244 - 300V			180 - 220V / 211 - 264V / 244 - 300V			211 - 264V / 244 - 300V	
AC grid frequency; range	60 Hz; 59.3 - 60.5 Hz			60 Hz; 59.3 - 60.5 Hz			60 Hz; 59.3 - 60.5 Hz			60 Hz; 59.3 - 60.5 Hz	
Max. output current	24 A / 21 A / 18 A			29 A / 25 A / 22 A			34 A / 29 A / 25 A			32 A	
Power factor (cos φ)	1			1			1			1	
Phase conductor / connection phases	1/2	1/2	1/1	1/2	1/2	1/1	1/2	1/2	1/1	1/2	1/1
Harmonics	< 4%										
<b>Efficiency</b>											
Max. efficiency	96.7%	96.8%	96.8%	96.9%	96.8%	97.0%	97.1%	96.9%	97.0%	96.3%	96.5%
CEC efficiency	95.5%	95.5%	95.5%	95.5%	95.5%	96.0%	95.5%	96.0%	96.0%	96.0%	96.0%
<b>Protection devices</b>											
DC reverse-polarity protection	●			●			●			●	
AC short circuit protection	●			●			●			●	
Galvanically isolated / all-pole sensitive monitoring unit	●/—			●/—			●/—			●/—	
Protection class / overvoltage category	1/II			1/II			1/II			1/II	
<b>General data</b>											
Dimensions (W / H / D) in mm (in)	470 / 615 / 240 (18.5 / 24 / 9)										
DC Disconnect dimensions (W / H / D) in mm (in)	187 / 297 / 190 (7 / 12 / 7.5)										
Packing dimensions (W / H / D) in mm (in)	390 / 580 / 800 (16 / 23 / 31.5)										
DC Disconnect packing dimensions (W / H / D) in mm (in)	370 / 240 / 280 (15 / 9 / 11)										
Weight / DC Disconnect weight	64 kg (141 lb) / 3.5 kg (8 lb)			67 kg (147 lb) / 4 kg (9 lb)			66 kg (145 lb) / 3.5 kg (8 lb)			69 kg (152 lb) / 4 kg (9 lb)	
Packing weight / DC Disconnect packing weight	67 kg (147 lb) / 4 kg (9 lb)			69 kg (152 lb) / 4 kg (9 lb)			66 kg (145 lb) / 3.5 kg (8 lb)			69 kg (152 lb) / 4 kg (9 lb)	
Operating temperature range (full power)	-25 °C ... +45 °C [-13 °F ... +113 °F]										
Noise emission (typical)	44 dB(A)			45 dB(A)			46 dB(A)			49 dB(A)	
Internal consumption at night	0.1 W			0.1 W			0.1 W			0.1 W	
Topology	1F transformer			1F transformer			1F transformer			1F transformer	
Cooling concept	OptiCool			OptiCool			OptiCool			OptiCool	
Electronics protection rating / connection area	NEMA 3R / NEMA 3E			NEMA 3R / NEMA 3E			NEMA 3R / NEMA 3E			NEMA 3R / NEMA 3E	
<b>Features</b>											
Display: text line / graphic	●/—			●/—			●/—			●/—	
Interface: RS485 / Bluetooth	o/o			o/o			o/o			o/o	
Warranty: 10 / 15 / 20 years	●/o/o			●/o/o			●/o/o			●/o/o	
Certificates and permits (more available on request)	UL1741, UL1998, IEEE 1547, FCC Part 15 (Class A & B), CSA C22.2 No. 107.1-2001										
NOTE: US inverters ship with gray lids.											
Data at nominal conditions											
● Standard features    ○ Optional features    — Not available											
Type designation	SB 5000US			SB 6000US			SB 7000US			SB 8000US	

SB 5000US, SB 6000US, SB 7000US, SB 8000US are registered trademarks of SMA Solar Technology AG. Prices may vary due to component availability and other applicable conditions. Subject to technical changes. The company is holding the right to change specifications without notice. Prices in dollars include per unit.



**Accessories**

-  ES485 interface 485/SMB-SMCR
-  Bluetooth® Piggy Back STPB-N+R
-  Control Switch DC disconnect and PV array combine box COMBO-SWITCH
-  Combine Box Simplify wiring for added convenience and safety SBCB-4-3R or SBCB-4



## 13 Energy Certificate



### REScheck Software Version 4.3.0 Compliance Certificate

Project Title: TeamBelgium\_Ecube

Energy Code: 2009 IECC  
 Location: Abbottstown, Pennsylvania  
 Construction Type: Single Family  
 Building Orientation: Bldg. faces 180 deg. from North  
 Glazing Area Percentage: 24%  
 Heating Degree Days: 5359  
 Climate Zone: 5

Construction Site:

Owner/Agent:

Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: Maximum UA: 269 Your UA: 186

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Wall 1: Other Wall Orientation: Front	423			0.039	9
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E SHGC: 0.60 Orientation: Front	188			0.211	40
Wall 2: Other Wall Orientation: Right Side	423			0.039	14
Window 2: Metal Frame with Thermal Break:Double Pane with Low-E SHGC: 0.60 Orientation: Right Side	54			0.211	11
Wall 3: Other Wall Orientation: Left Side	423			0.039	12
Window 3: Metal Frame with Thermal Break:Double Pane with Low-E SHGC: 0.60 Orientation: Left Side	81			0.211	17
Door 1: Solid Orientation: Left Side	22			0.039	1
Wall 4: Other Wall Orientation: Back	423			0.039	12
Window 4: Metal Frame with Thermal Break:Double Pane with Low-E SHGC: 0.60 Orientation: Back	81			0.211	17
Door 2: Solid Orientation: Back	22			0.039	1
Ceiling 1: Other Ceiling	668			0.039	26
Floor 1: Other Floor: Over Outside Air	668			0.039	26

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2009 IECC requirements in REScheck Version 4.3.0 and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

Name - Title Signature Date





## REScheck Software Version 4.3.0 Inspection Checklist

### Ceilings:

- Ceiling 1: Other Ceiling, U-factor: 0.039

Comments: \_\_\_\_\_

### Above-Grade Walls:

- Wall 1: Other Wall, U-factor: 0.039

Comments: \_\_\_\_\_

- Wall 2: Other Wall, U-factor: 0.039

Comments: \_\_\_\_\_

- Wall 3: Other Wall, U-factor: 0.039

Comments: \_\_\_\_\_

- Wall 4: Other Wall, U-factor: 0.039

Comments: \_\_\_\_\_

### Windows:

- Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, U-factor: 0.211

For windows without labeled U-factors, describe features:

#Panels \_\_\_\_\_ Frame Type \_\_\_\_\_ Thermal Break? \_\_\_\_\_ Yes \_\_\_\_\_ No

Comments: \_\_\_\_\_

- Window 2: Metal Frame with Thermal Break:Double Pane with Low-E, U-factor: 0.211

For windows without labeled U-factors, describe features:

#Panels \_\_\_\_\_ Frame Type \_\_\_\_\_ Thermal Break? \_\_\_\_\_ Yes \_\_\_\_\_ No

Comments: \_\_\_\_\_

- Window 3: Metal Frame with Thermal Break:Double Pane with Low-E, U-factor: 0.211

For windows without labeled U-factors, describe features:

#Panels \_\_\_\_\_ Frame Type \_\_\_\_\_ Thermal Break? \_\_\_\_\_ Yes \_\_\_\_\_ No

Comments: \_\_\_\_\_

- Window 4: Metal Frame with Thermal Break:Double Pane with Low-E, U-factor: 0.211

For windows without labeled U-factors, describe features:

#Panels \_\_\_\_\_ Frame Type \_\_\_\_\_ Thermal Break? \_\_\_\_\_ Yes \_\_\_\_\_ No

Comments: \_\_\_\_\_

### Doors:

- Door 1: Solid, U-factor: 0.039

Comments: \_\_\_\_\_

- Door 2: Solid, U-factor: 0.039

Comments: \_\_\_\_\_

### Floors:

- Floor 1: Other Floor: Over Outside Air, U-factor: 0.039

Comments: \_\_\_\_\_

Floor insulation is installed in permanent contact with the underside of the subfloor decking.

### Air Leakage:

- Joints (including rim joist junctions), attic access openings, penetrations, and all other such openings in the building envelope that are sources of air leakage are sealed with caulk, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.



- Air barrier and sealing exists on common walls between dwelling units, on exterior walls behind tubs/showers, and in openings between window/door jambs and framing.
- Recessed lights in the building thermal envelope are 1) type IC rated and ASTM E283 labeled and 2) sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.
- Access doors separating conditioned from unconditioned space are weather-stripped and insulated (without insulation compression or damage) to at least the level of insulation on the surrounding surfaces. Where loose fill insulation exists, a baffle or retainer is installed to maintain insulation application.
- Wood-burning fireplaces have gasketed doors and outdoor combustion air.

**Air Sealing and Insulation:**

- Building envelope air tightness and insulation installation complies by either 1) a post rough-in blower door test result of less than 7 ACH at 33.5 psf OR 2) the following items have been satisfied:
  - (a) Air barriers and thermal barrier: Installed on outside of air-permeable insulation and breaks or joints in the air barrier are filled or repaired.
  - (b) Ceiling/attic: Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed.
  - (c) Above-grade walls: Insulation is installed in substantial contact and continuous alignment with the building envelope air barrier.
  - (d) Floors: Air barrier is installed at any exposed edge of insulation.
  - (e) Plumbing and wiring: Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
  - (f) Corners, headers, narrow framing cavities, and rim joists are insulated.
  - (g) Shower/tub on exterior wall: Insulation exists between showers/tubs and exterior wall.

**Sunrooms:**

- Sunrooms that are thermally isolated from the building envelope have a maximum fenestration U-factor of 0.50 and the maximum skylight U-factor of 0.75. New windows and doors separating the sunroom from conditioned space meet the building thermal envelope requirements.

**Vapor Retarder:**

- Vapor retarder is installed on the warm-in-winter side of all non-vented framed ceilings, walls, and floors; or it has been determined that moisture or its freezing will not damage the materials; or other approved means to avoid condensation are provided.  
Comments: \_\_\_\_\_

**Materials Identification and Installation:**

- Materials and equipment are installed in accordance with the manufacturer's installation instructions.
- Insulation is installed in substantial contact with the surface being insulated and in a manner that achieves the rated R-value.
- Materials and equipment are identified so that compliance can be determined.
- Manufacturer manuals for all installed heating and cooling equipment and service water heating equipment have been provided.
- Insulation R-values and glazing U-factors are clearly marked on the building plans or specifications.

**Duct Insulation:**

- Supply ducts in attics are insulated to a minimum of R-8. All other ducts in unconditioned spaces or outside the building envelope are insulated to at least R-6.

**Duct Construction and Testing:**

- Building framing cavities are not used as supply ducts.
- All joints and seams of air ducts, air handlers, filter boxes, and building cavities used as return ducts are substantially airtight by means of tapes, mastics, liquid sealants, gasketing or other approved closure systems. Tapes, mastics, and fasteners are rated UL 181A or UL 181B and are labeled according to the duct construction. Metal duct connections with equipment and/or fittings are mechanically fastened. Crimp joints for round metal ducts have a contact lap of at least 1 1/2 inches and are fastened with a minimum of three equally spaced sheet-metal screws.  
Exceptions:
  - Joint and seams covered with spray polyurethane foam.
  - Where a partially inaccessible duct connection exists, mechanical fasteners can be equally spaced on the exposed portion of the joint so as to prevent a hinge effect.
  - Continuously welded and locking-type longitudinal joints and seams on ducts operating at less than 2 in. w.g. (500 Pa).
- Duct tightness test has been performed and meets one of the following test criteria:
  - (1) Postconstruction leakage to outdoors test: Less than or equal to 8 cfm per 100 ft<sup>2</sup> of conditioned floor area.
  - (2) Postconstruction total leakage test (including air handler enclosure): Less than or equal to 12 cfm per 100 ft<sup>2</sup> pressure differential of 0.1 inches w.g.



(3) Rough-in total leakage test with air handler installed: Less than or equal to 6 cfm per 100 ft2 of conditioned floor area when tested at a pressure differential of 0.1 inches w.g.

(4) Rough-in total leakage test without air handler installed: Less than or equal to 4 cfm per 100 ft2 of conditioned floor area.

**Heating and Cooling Equipment Sizing:**

- Additional requirements for equipment sizing are included by an inspection for compliance with the International Residential Code.
- For systems serving multiple dwelling units documentation has been submitted demonstrating compliance with 2009 IECC Commercial Building Mechanical and/or Service Water Heating (Sections 503 and 504).

**Circulating Service Hot Water Systems:**

- Circulating service hot water pipes are insulated to R-2.
- Circulating service hot water systems include an automatic or accessible manual switch to turn off the circulating pump when the system is not in use.

**Heating and Cooling Piping Insulation:**

- HVAC piping conveying fluids above 105 degrees F or chilled fluids below 55 degrees F are insulated to R-3.

**Swimming Pools:**

- Heated swimming pools have an on/off heater switch.
- Pool heaters operating on natural gas or LPG have an electronic pilot light.
- Timer switches on pool heaters and pumps are present.  
 Exceptions:  
     Where public health standards require continuous pump operation.  
     Where pumps operate within solar- and/or waste-heat-recovery systems.
- Heated swimming pools have a cover on or at the water surface. For pools heated over 90 degrees F (32 degrees C) the cover has a minimum insulation value of R-12.  
 Exceptions:  
     Covers are not required when 60% of the heating energy is from site-recovered energy or solar energy source.

**Lighting Requirements:**

- A minimum of 50 percent of the lamps in permanently installed lighting fixtures can be categorized as one of the following:
  - (a) Compact fluorescent
  - (b) T-8 or smaller diameter linear fluorescent
  - (c) 40 lumens per watt for lamp wattage <= 15
  - (d) 50 lumens per watt for lamp wattage > 15 and <= 40
  - (e) 60 lumens per watt for lamp wattage > 40

**Other Requirements:**

- Snow- and ice-melting systems with energy supplied from the service to a building shall include automatic controls capable of shutting off the system when a) the pavement temperature is above 50 degrees F, b) no precipitation is falling, and c) the outdoor temperature is above 40 degrees F (a manual shutoff control is also permitted to satisfy requirement 'c').

**Certificate:**

- A permanent certificate is provided on or in the electrical distribution panel listing the predominant insulation R-values; window U-factors; type and efficiency of space-conditioning and water heating equipment. The certificate does not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels.

NOTES TO FIELD: (Building Department Use Only)

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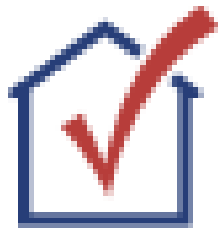
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# 2009 IECC Energy Efficiency Certificate

Insulation Rating	R-Value
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Ceiling / Roof	0.00
Wall	0.00
Floor / Foundation	0.00
Ductwork (unconditioned spaces):	_____

Glass & Door Rating	U-Factor	SHGC
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Window	0.21	0.60
Door	0.04	NA

Heating & Cooling Equipment	Efficiency
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Heating System: _____	_____
Cooling System: _____	_____
Water Heater: _____	_____

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Comments: