Hamworthy Trigon

Solar Thermal Collector Roof Mounting Kits

Installation, Commissioning, Operation & Service Instructions

Models: Trigon Horizontal 2.3 m^2 Solar Collector
Trigon Vertical 2.3 m^2 Solar Collector

IMPORTANT NOTE

THESE INSTRUCTIONS MUST BE READ AND UNDERSTOOD BEFORE INSTALLING, COMMISSIONING, OPERATING OR SERVICING EQUIPMENT

Hamworthy

Heating *at work.*

Customer After Sales Services

Telephone: **01202 662555** E-mail: **service@hamworthy-heating.com** Fax: **01202 662522**

Technical Enquiries

To supplement the detailed technical brochures, technical advice on the application and use of products in the Hamworthy Heating range is available from our technical team in Poole and our accredited agents.

Site Assembly

Hamworthy offer a service of site assembly for many of our products where plant room access is restricted. Using our trained staff we offer a higher quality of build and assurance of a boiler built and tested by the manufacturer.

Commissioning

Commissioning of equipment by our own engineers, accredited agents or specialist sub-contractors will ensure the equipment is operating safely and efficiently.

Service Contracts

Regular routine servicing of equipment by Hamworthy service engineers inspects the safety and integrity of the plant, reducing the risk of failure and improving performance and efficiency. Service contracts enable you to plan and budget more efficiently.

Breakdown service, repair, replacement

Hamworthy provide a rapid response breakdown, repair or replacement service through head office at Poole and accredited agents throughout the UK.

Spare Parts

We offer a comprehensive range of spare parts, providing replacement parts for both current and discontinued products. Delivery options are available to suit you. Please refer to our website for more details.

Hamworthy Trigon

Solar Thermal Collector Roof Mounting Kits

Installation, Commissioning, Operation & Service Instructions

Models: Trigon Horizontal 2.3 m^2 Solar Collector
Trigon Vertical 2.3 m^2 Solar Collector

NOTE: THESE INSTRUCTIONS MUST BE READ AND UNDERSTOOD BEFORE INSTALLING, COMMISSIONING, OPERATING OR SERVICING THIS EQUIPMENT.

THE SOLAR COLLECTOR & INSTALLATION KITS COMPLY WITH ALL RELEVANT EUROPEAN DIRECTIVES.
SOLAR-KEYMARK REGISTRATION No. 011-7S592F & 011-7S260F

PUBLICATION NO. 500001280
ISSUE 'A'
JULY 2012

Hamworthy

Hamworthy Trigon

Installation, service and maintenance instructions

On Roof Installation for Tile; Slate & corrugated Sheet Steel Roof Construction

A-Frame Installation System For Steep & Shallow Inclinement

2.3 m² high performance solar collector:
- Trigon Horizontal
- Trigon Vertical

CE

00DNO0200

Customer Service Centre
Hamworthy Heating Limited
Wessex House, New Fields Business Park
Stinsford Road, Poole, Dorset BH17 0NF

Tel.: 01 202 662 500
Fax: 01 202 662 522
service@hamworthy-heating.com
www.hamworthy-heating.com

Art. no.: 3063123_0811

GB

Table of contents / technical data

Table of contents

Technical data

Collector	Horizontal Collector	Vertical Collector
Casing	Deep-drawn sheet aluminium basin, natural finish, seawater-resistant.	
Dimensions (L x W x H) / (outside edges)	1099x2099x110 mm	2099x1099x110 mm
Gross area / area exposed to wind as per DIN 1055-4	2.3 m²	2.3 m²
Effective absorber area	2.0 m²	2.0 m²
Weight (empty)	41 kg	40 kg
Contents	1.9 litres	1.7 litres
Absorber:	Copper/copper	Aluminium/copper
	Design: Meander, highly selective coating	
Cover	3.2 mm solar safety glass, hail resistant*	
Insulation	Mineral wool	
Connections	flat-sealing with union nut G 3/4	
Angle of installation	15 ° to 90 °	15 ° to 90 °
Optical efficiency *	79.4%	80.4
Heat loss coefficient a_1 *	3.494 W/(m K²)	3.235 W/(m K²)
Heat loss coefficient a_2 *	0.015 W/(m² K²)	0.0117W/(m² K²)
Stagnation temperature * (permissible operating temp.)	198°C	194°C
Irradiation angle correction factor $K_{50°}$ *	95.4%	94%
Heat capacity C *	8.073 kJ/(m² K)	5.85 kJ/(m² K)
Max. operation overpressure	10 bar	10 bar
Heating fluid	Tyfocor L ready-to-use mixture (45 % by vol.)	
Solar-Keymark registration no.	011-7S592F	011-7S260F

* Values according to EN 12975

Standards and Regulations / safety instructions

Standards and Regulations

The following specifications, rules and guidelines are to be observed when installing and operating!

Installation on roofs. Please follow the accident prevention regulations (UVV)

- BS6399:	Loading due to the effects of snow and wind on buildings.
- BS EN 1991-1-3/NA:	'Eurocode 1 - Actions on structures - Parts 1-3: General actions - Snow loads'.
- BS EN 1991-1-4/NA:	'Eurocode 1 - Actions on structures - Parts 1-4: General actions - Wind actions'.
- BRE Digest 489:	Wind loads on roof based solar collector systems.
- DTU 65.12:	'Building works - Plain solar collector installations using heat transfer liquid, used for heating and the production of domestic hot water - Part 1: technical specifications.'
- DTU 43.1:	'Water resistance of flat roofs with a masonry structural member - complete technical specification + supplements'.
- IND G 401:	'HSE work at height regulations 2025'.
- CIS 21:	'Work on flat roofs: Protection against falls'.
- HSG 33:	'Health and safety in roof work'.
- CIS 20:	'Short duration work on pitched roofs: Protection against falls'.
- IND G 284 (Rev 1):	'Working on roofs'.
- AIS 12:	'Safe working on glass roofs'.
- AIS 32:	'Preventing falls from fragile roofs'.

Connection of thermal solar heating systems

- EN 12976	Thermal solar systems and components. Factory made systems. General requirements (containing generally applicable information on planning and execution)
- EN 12977	Thermal solar systems and components. Custom built systems. General requirements (containing generally applicable information on planning and execution)

Electrical connection

- IEC 60364-1:	'Low-voltage installations (including update of June 2005)'.
- BS EN 50164-1:	'Lightning protection systems'

The collectors are tested in accordance with the following standards:

- EN 12975-1	Thermal solar systems and components. Solar collectors. General requirements
- EN 12975-2	Thermal solar systems and components. Solar collectors. Test methods

Safety instructions

The following symbols and signs are used in this description. These important instructions concern personal safety and technical reliability.

"Safety instructions" identify instructions with which you must exactly comply to prevent injury and damage to the equipment.

Example: because of the possibly very high temperatures in the collector there is a danger of being scalded by the hot heating fluid.

Warning "Warning" identifies technical instructions which you must observe to prevent damage and avoid malfunctions.

Notices / pipework examples

Notices

The collectors should be directed toward a point between the south-east and the south-west (optimally: to the south). In the case of a different direction, please contact our technical advisors. Trees, adjacent buildings, chimneys etc. should throw as little shade as possible on the collectors. Consider the different positions of the sun (summer - winter).

The distance between the upper face of the solar collector and the lower edge of the roof ridge should be at least 3 roofing tiles, so that the feed pipe can be installed rising in the roof space.

In areas subject to abundant snowfall, it should be ensured that the snow can slide off the collector. Therefore, there should be no roof superstructures below the collector area. For safety reasons, the cross-battens and the roofing tiles under the roof hooks must not be pre-damaged (cracked, drilled or aged), since they can otherwise break under extreme snow loads. In cases of doubt the battens and/or roofing tiles must be replaced in these areas.
In addition, the battens underneath the roof hooks should be replaced by sheet metal battens in the case of rooftop installation.
Observe snow loads according to BS EN 1991-1-3 and wind loads according to BS EN 1991-1-4.

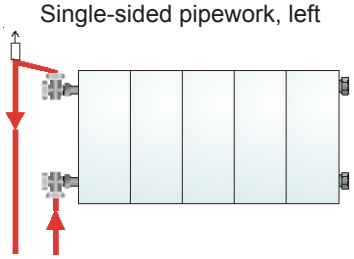
Pipework examples

A collector field consists of max. 5 collectors with single-sided pipework on the left or right and max. 10 collectors with double-sided pipework.

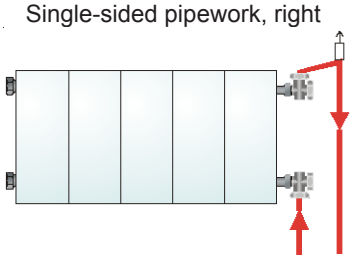
Recommendation:

Vent
(install at the highest point)

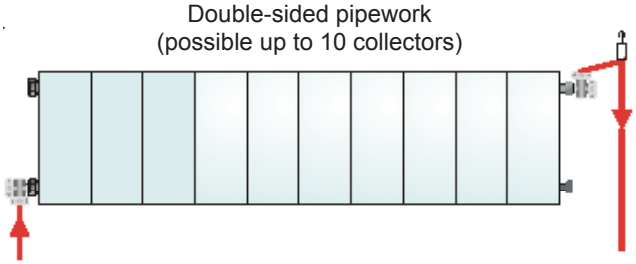
Single-sided pipework, left



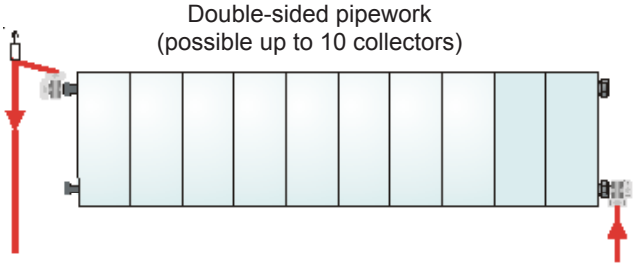
Single-sided pipework, right



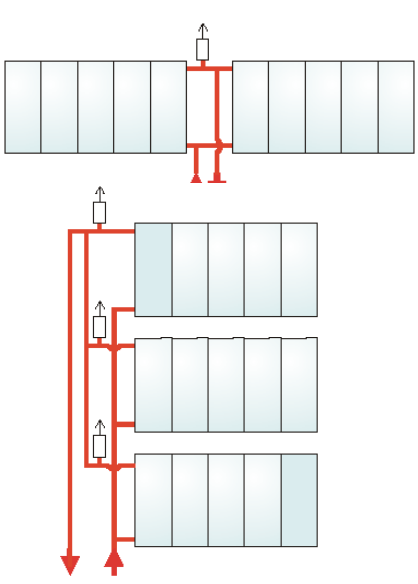
Double-sided pipework
(possible up to 10 collectors)

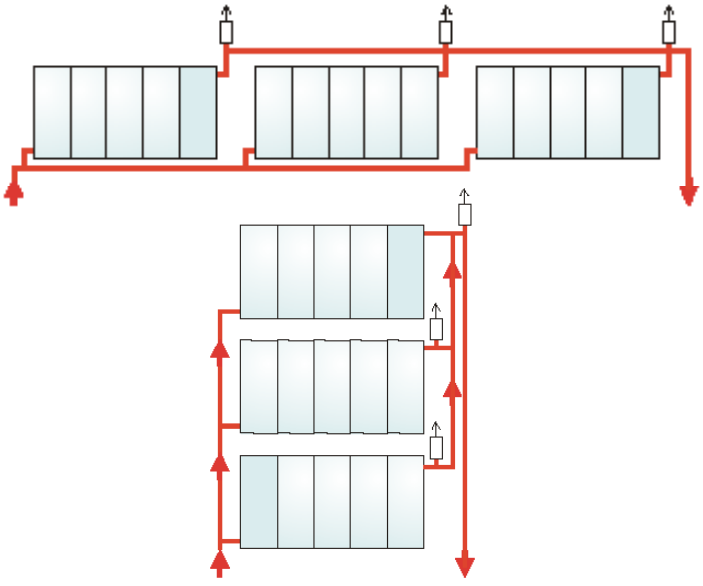


Double-sided pipework
(possible up to 10 collectors)



Pipework of several collector fields according to Tichelmann





Instructions regarding system hydraulics

Copper tubes with copper soldered joints are recommended for the installation of the collectors.

The insulation of outside pipes must be resistant to temperature, UV and birds.

Use only components that are resistant to high temperatures and suitable for solar technology.

Do not install any shut-off valves in the collector or collector field connections.

Regulate the flow rates of the solar medium.

A flow regulator on each collector field enables the regulation of the flow rates of the solar medium. This enables high productivity of the solar heating system and avoids overheating. The flow regulator must never be completely closed.

The flow regulator of the main collector should be installed under the roof or on the terrace, in order to facilitate the flow regulation of the system.

Attention: danger of burning: as soon as the collectors are mounted on a sloping or terraced roof, they must be protected by a sun blind so that they do not heat up. The sun blind can be removed after flushing and filling with heating fluid.

Fill the solar heating system only with Tyflocor L mized to a concentration of 40% with water.

		Pressure losses in fields of 2.3 m² collectors (mbar / mH2O) *		
		up to 5 collectors possible	**6-8 collectors possible**	**Max. 9 to 10 solar collectors**
	Flow rate (l/h/m²)	**20**		
Trigon Vertical	Not Tichelmann	73 0.74	X	X
	Tichelmann		84 0.86	96 0.98
Trigon Horizontal	Not Tichelmann	78 0.80	X	X
	Tichelmann		100 1.02	126 1.28

* In accordance with EN12975-2 Appendix L at a medium temperature of 20 °C.

General preparatory work

Transport and storage

Warning

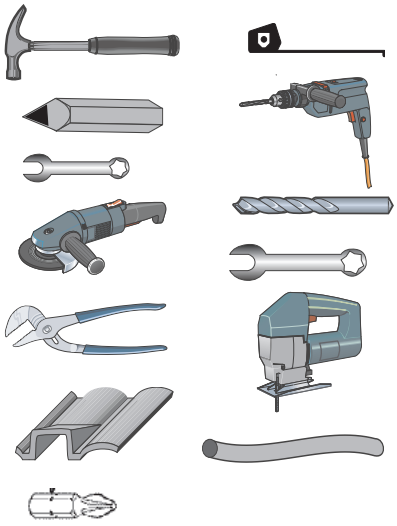
- Transport and store the collector stacks only with the packing strips and pallets.
- Do not transport any more than 16 collectors on top of one another and do not store more than 24 collectors on top of one another.
- Do not transport collectors with the glass facing downwards.
- To avoid damage, do not carry the collectors by the collector supports or set the collectors down on the supports when transporting.
- Do not place the rear side of the collector down on an uneven surface.
- Collectors must be temporarily stored in dry, dust-free places.
- Cover the glass side of the collectors until commissioning.
- We recommend the use of carrying handles (available as accessories).

Installation

The installation and initial commissioning may be carried out only by approved specialist companies. These specialists are responsible for the proper installation and initial commissioning.

The collector connections, even of emptied collectors, can already become very hot when assembling. Wear protective gloves; there is a danger of being burned.

Tools required

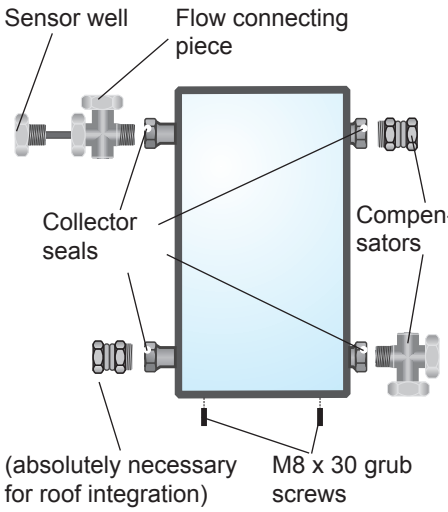


The following tools and auxiliary materials are required for the simple and safe installation of the collectors:

1 hammer
1 tape measure
1 pencil / stick of chalk
2 screwdrivers / wrenches 13 AF
1 wood drill approx. 5 mm (roof integration only)
1 angle grinder with stone disk
2 open-ended spanners 30 AF
1 tongue-and-groove pliers
1 jig saw (in the case of existing roof boarding)
Roof feed-throughs for the solar pipes (e.g. grind exhaust roofing tiles to fit using an angle grinder)
Protective pipes (sensor cable, pipework)
Fall protection
Crosshead bit

Preparatory work for the installation

This work should be carried out **before transporting the collectors up to the roof** (exception: freestanding installation).



Warning: mount the compensators only on the short connecting pieces!

In the case of single-sided pipework on the left (example illustration) the connecting pieces are on the right-hand side.

For single-sided pipework on the right, the collector must be rotated by 180°.

Before screwing on the connectors, check that the collector seals are inside the joints.

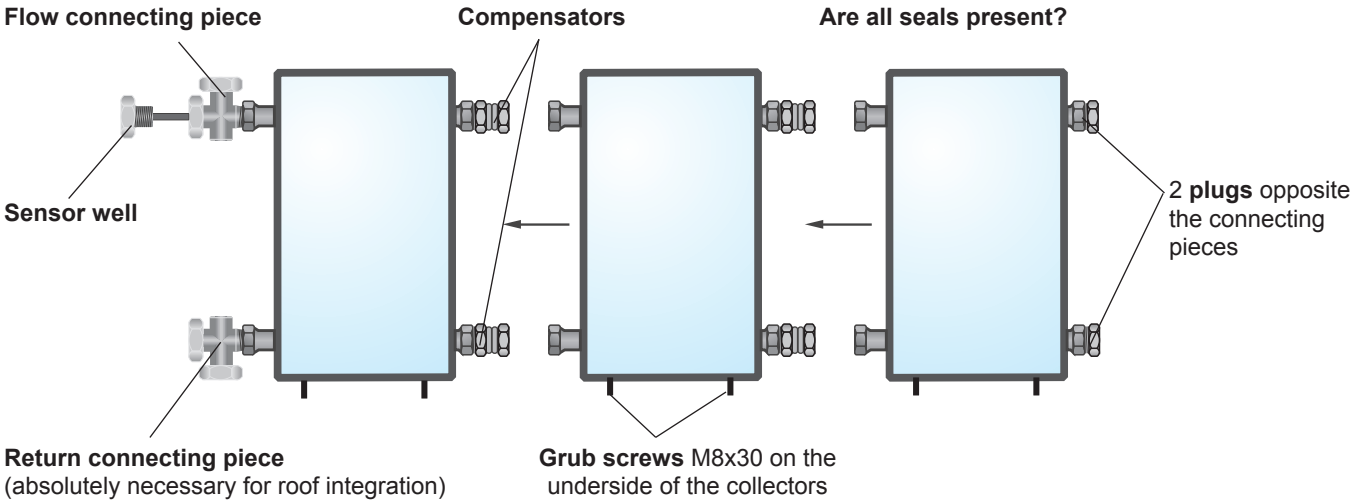
When installing the connecting pieces, compensators and plugs, the union nuts must be held in place on the collectors. The tightening torque may not exceed 20 Nm!

Remove the sensor well from the carton with regulating parts and screw it into the flow connecting piece.

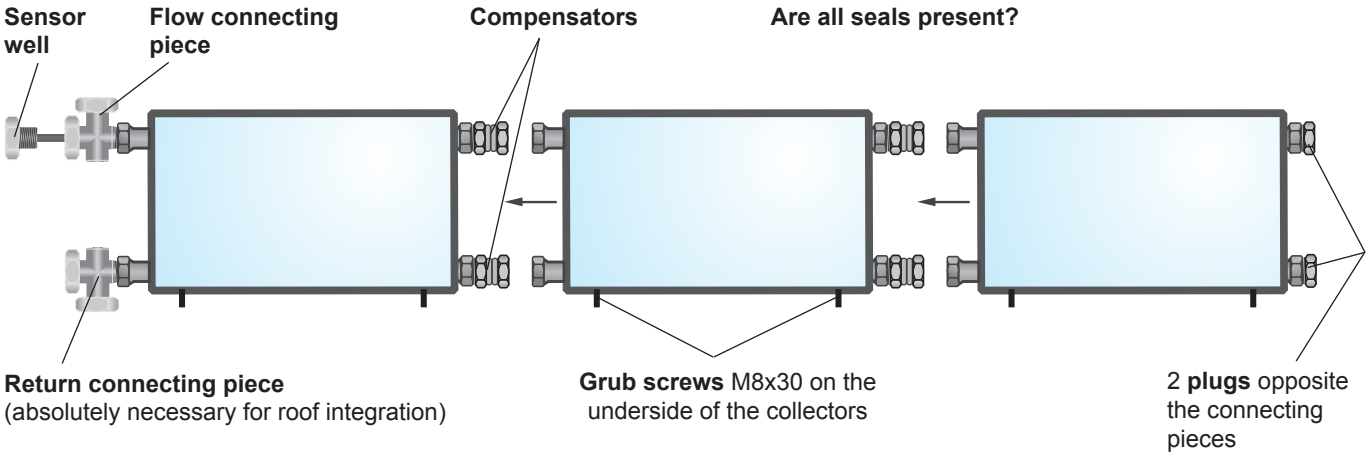
Fully screw in 2 grub screws M8x30 on the lower edge of each basin.

General preparatory work

Layout example: 3 collectors, Solar Plan 230V, portrait orientation, single-sided connection on the left side

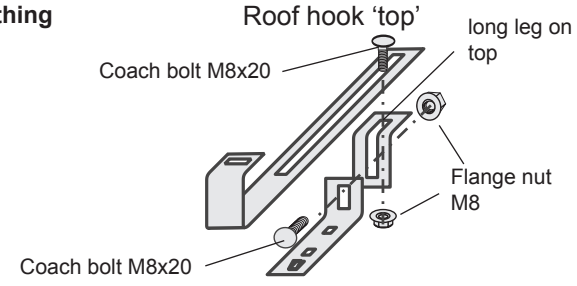


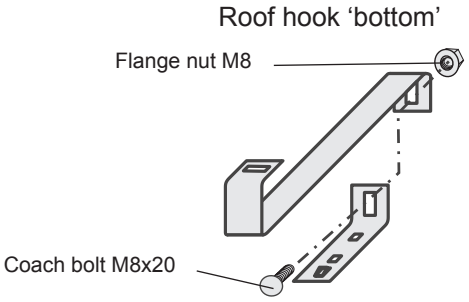
Layout example: 3 collectors, Solerio F3Q, landscape orientation, single-sided connection on the left side



Pre-installation of the roof hooks for rooftop installation

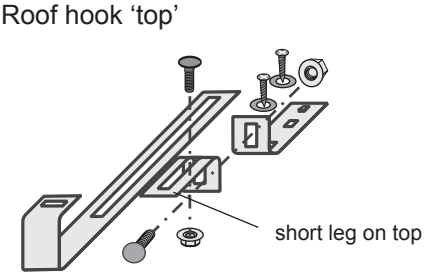
Installation on roof lathing
(pre-mounted)

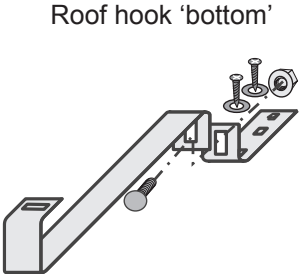




Installation on rafters
(reinstallation)

Screw the roof hooks only hand-tight at first according to the illustration.





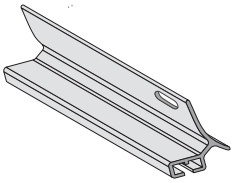
Installing on rafters is absolutely necessary in the case of elevated mounting on a pitched roof!

Rooftop installation (interlocking tiles, beavertail tiles)
Scope of supply / snow loads

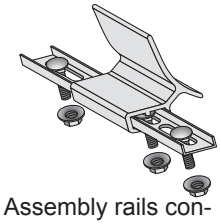
Scope of supply of fastening material - **appropriate number of:**

Roof hook 'top' with fixing bracket

Roof hook 'bottom' with fixing bracket



Assembly rail



Assembly rails connector kit (if necessary)

Bolts, nuts, grub screws, wood screws in bag

Accessories

Adjusting rails kit with wood screws for rafter installation

Positioning of the collector field in the case of rooftop installation

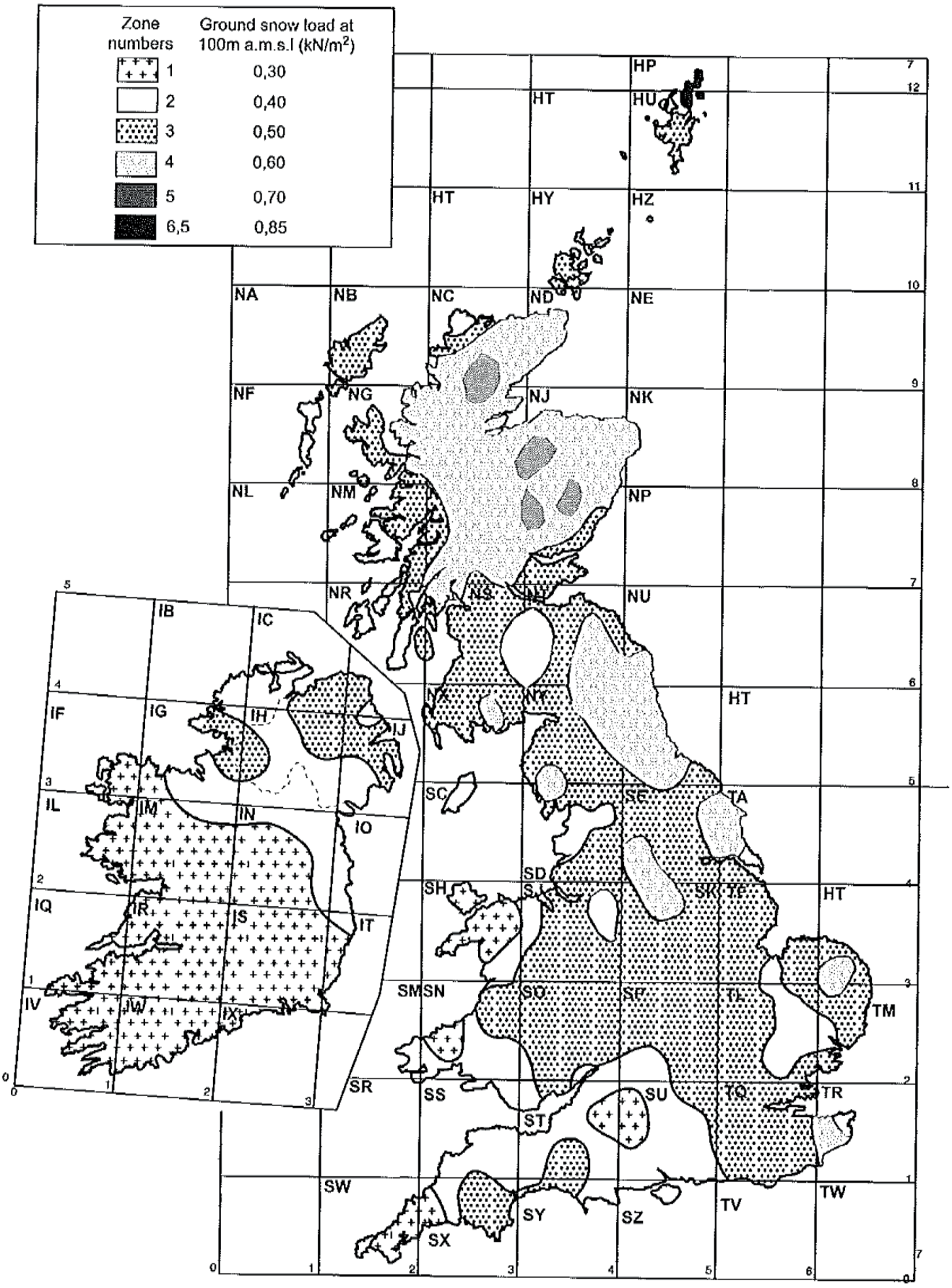
Warning **All roof hooks supplied must be distributed evenly over the width of the collector field in order to distribute the prevailing loads. Position the roof hooks as close as possible to the rafters.**

Reference dimensions for determining the collector field width

Warning: the space required for the installation of the pipe connections is not accounted for.

Collector quantity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Width [m] - Trigon vertical collector	X	2.23	3.36	4.49	5.62	6.75	7.88	9.01	10.14	11.27
Width [m] - Trigon horizontal collector	2.1	4.23	6.36	8.49	10.62	12.75	14.88	17.01	19.14	21.27

Snow loads



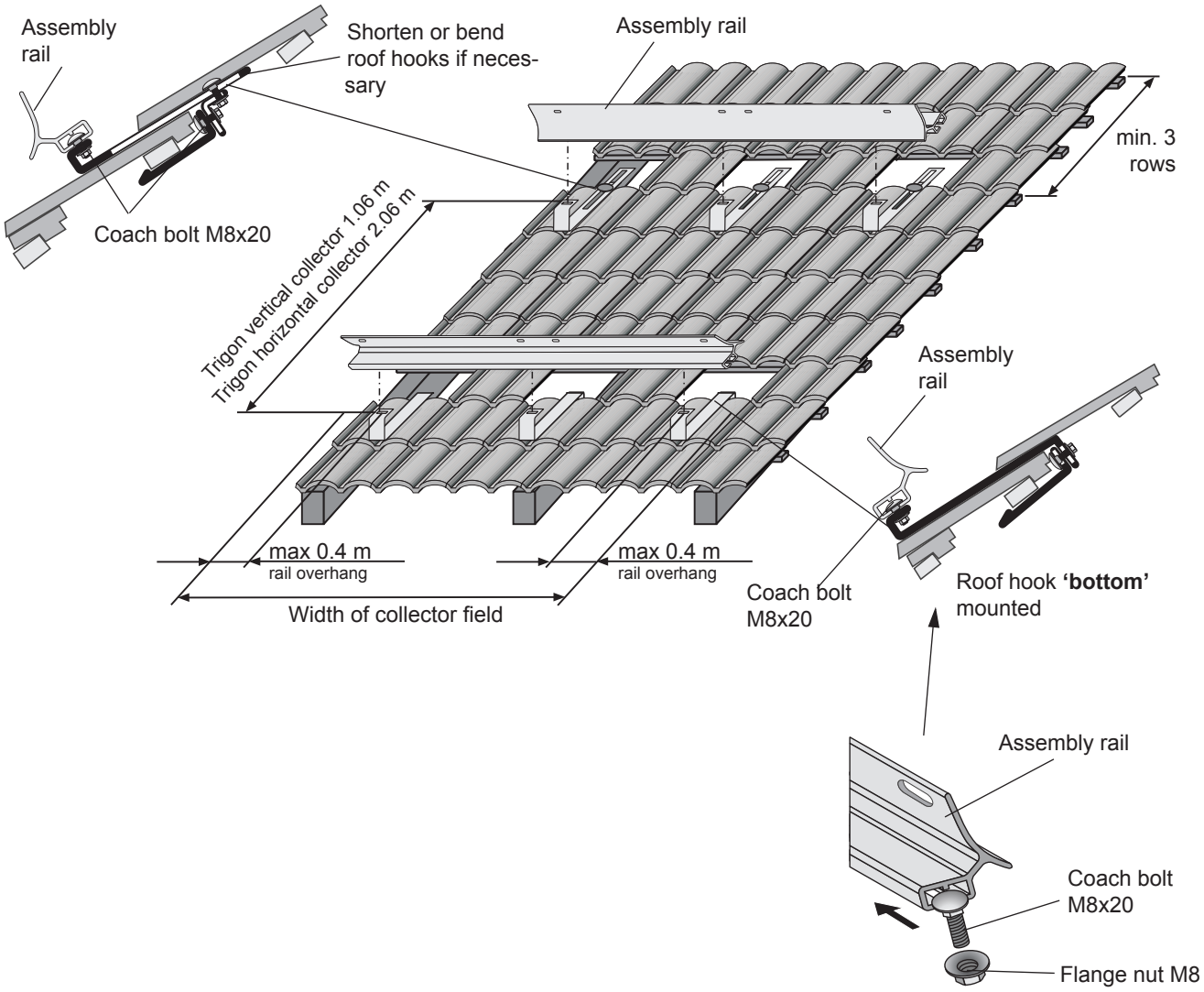
Jersey - Zone 3, 0,50 kN/m² at 100m a.m.s.l, Guernsey - Zone 2, 0,40 kN/M² at 100m a.m.s.l

Characteristics ground snow load map

Rooftop installation (interlocking tiles, beavertail tiles) Roof hooks on roof lathing

Installing the roof hooks on roof lathing (Example for 2 collectors)

Roof hook **'top'** mounted



1. Mount roof hook 'bottom' in accordance with the illustration and hook onto the roof lathing.
2. Assemble roof hook 'top' in accordance with the illustration and hook onto the roof lathing.

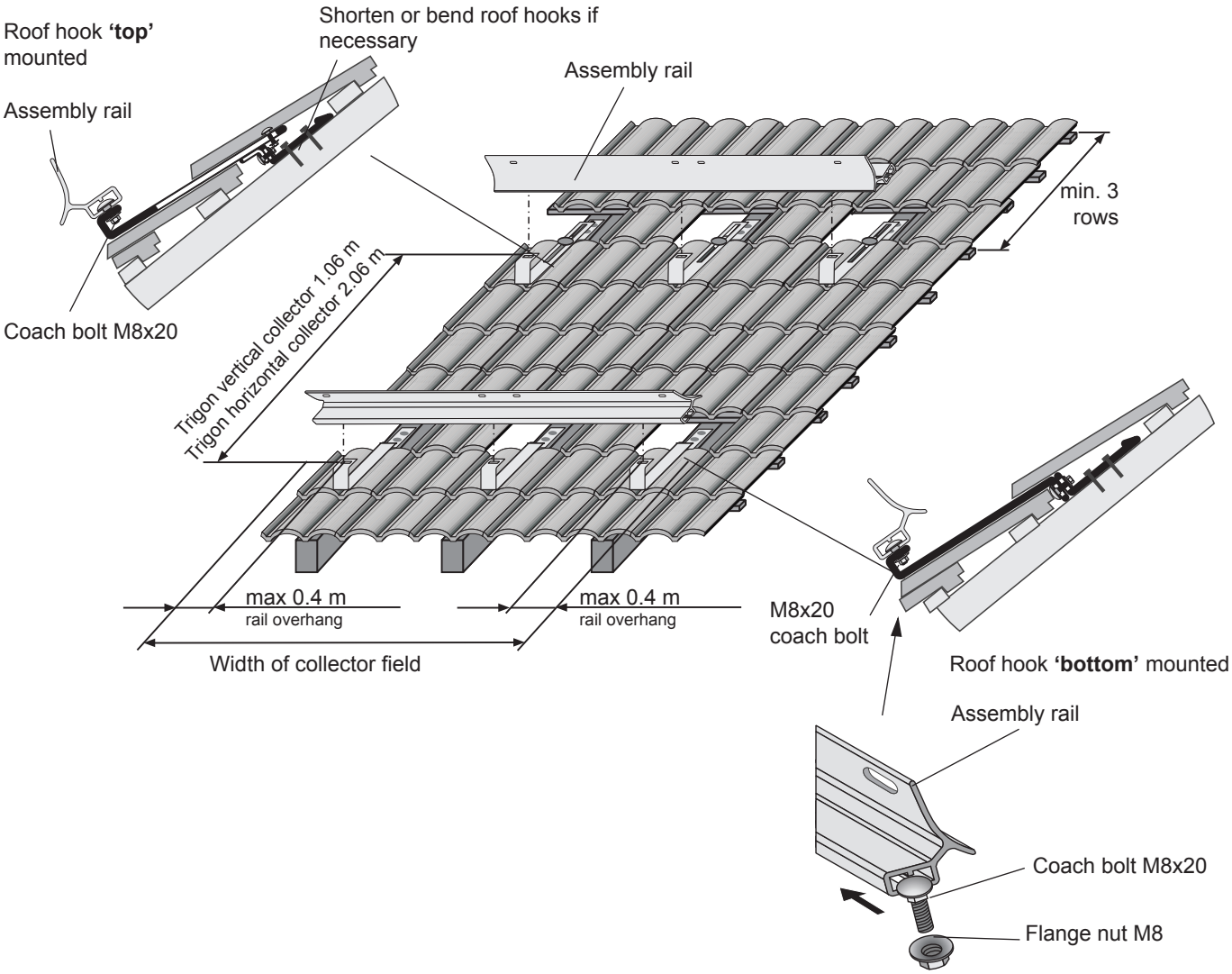
   Set the distance between the two rails to 2.06 m in the case of installation with portrait orientation or to 1.06 m in the case of installation with landscape orientation by adjusting the upper roof hook in the slot as shown in the illustration and fixing with two M8 x 20 coach bolts.
3. Adjust the height of the fixing brackets and fix with two M8 x 20 coach bolts so that the pressure is distributed evenly over the roofing tiles.
4. Thread-up a sufficient number of M8 x 20 coach bolts into the assembly rails.
5. Fasten the assembly rails to the roof hooks using flange nuts.
6. Cover with roofing tiles in the vicinity of the roof hooks.

⚠ Roof lathing must have a thickness of at least 30 mm.

⚠ Roof lathing on which hooks are mounted must be screwed.

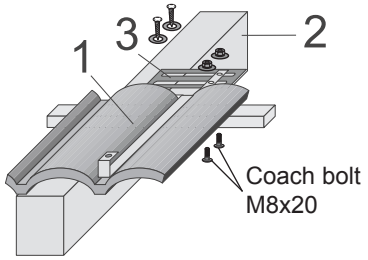
Rooftop installation (interlocking tiles, beavertail tiles) Roof hooks on rafters

Installing the roof hooks on rafters
(Example for 2 collectors)



1. Mount the roof hook 'bottom' in accordance with the illustration and fasten it to the rafter using 6 x 60 wood screws.
2. Mount the roof hook 'top' as shown in the illustration; set the distance between the two rails to 2.06 m when installing the collector with a portrait orientation or to 1.06 m when installing the collector with a landscape orientation by adjusting the hook in the slot as shown in the illustration, fix with two M8 x 20 coach bolts and fasten to the rafter with 6 x 60 wood screws.
3. Adjust the height of the fixing brackets and fix with two M8 x 20 coach bolts so that the pressure is distributed evenly over the roofing tiles.
4. Thread-up a sufficient number of M8 x 20 coach bolts into the assembly rails.
5. Mount the assembly rails on the roof hooks.
6. Cover with roofing tiles in the vicinity of the roof hooks.

Rafter attachment with adjusting rails



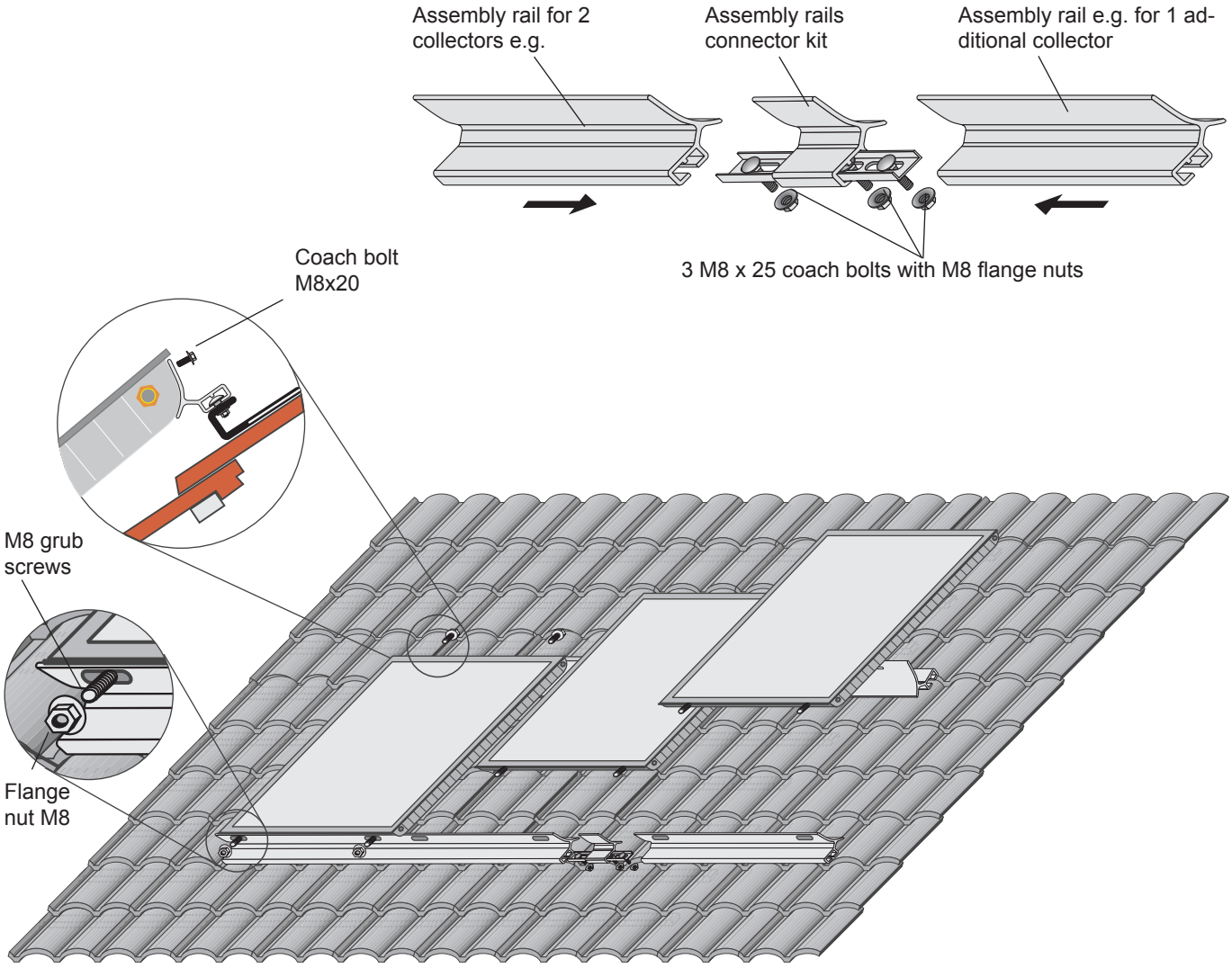
- If the trough of a tile is not above a rafter, the adjusting rails '3' provided are fastened to the rafter '2' and the roof hook '1' is screwed onto the adjusting rail in the trough.
- Fasten the adjusting rails '3' to the rafters '2' with 6 x 60 wood screws and washers.
- Push the M8 x 20 coach bolt through the adjusting rail from underneath.
- Place the roof hook on top and fasten it firmly with the hexagonal nuts.

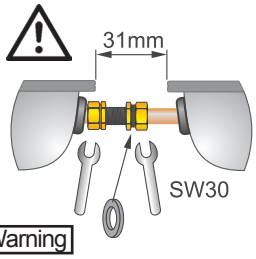
Rooftop installation (interlocking tiles, beavertail tiles) Installation of the collectors

Connection of assembly rails

The assembly rails can be extended with the aid of the assembly rail connector kits.

One of the 3 screws can also be used for fixing to a roof hook. The U rail remains centrally aligned; the screw can be brought into the appropriate position above the hook in the slot.





Warning

- Are the seals available?
- Maintain proper distance
- Align the screw connection parts
- Hold with another open-end spanner
  Maximum tightening torque 20 Nm

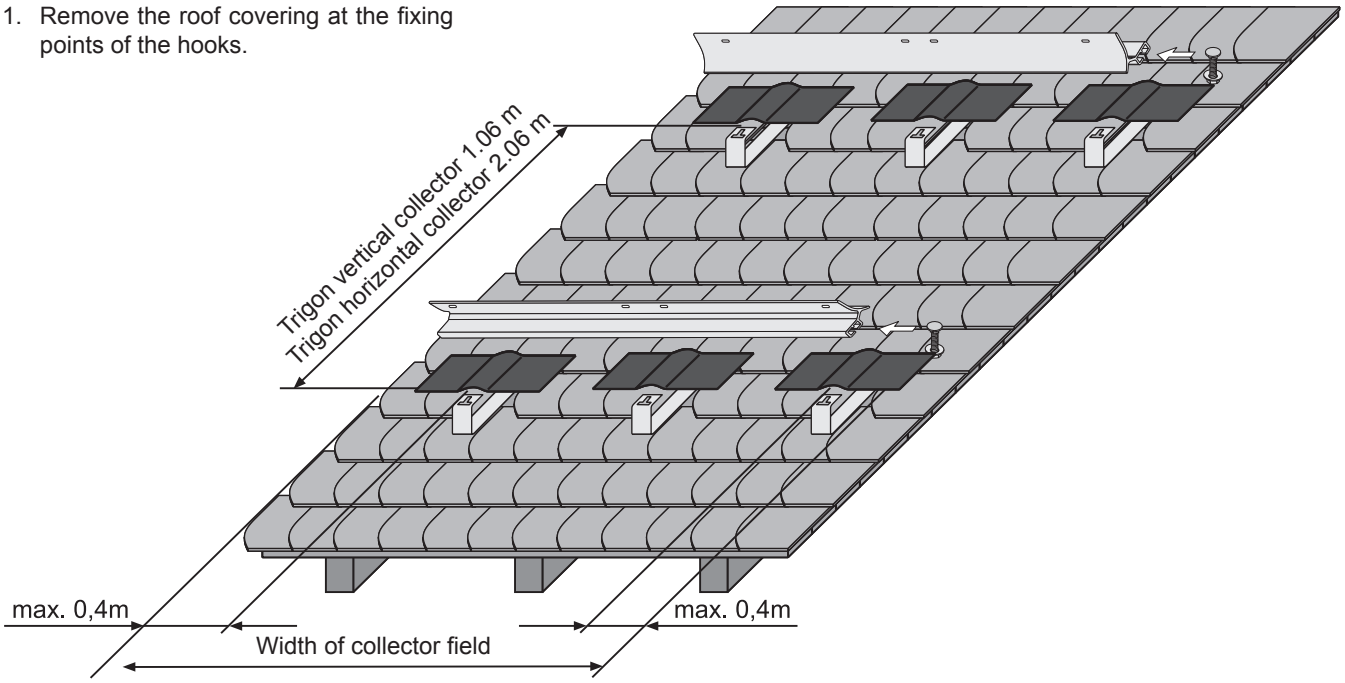
1. First insert the collector with the grub screws into the lower assembly rail as shown in the illustration, then secure with M8 flange nuts, tightening only hand-tight for the time being.
2. Slide the M8 x 20 combination screws through the upper assembly rail and screw into the collector, tightening only hand-tight for the time being.
3. Installing other collectors in the same manner.
4. Screwing the connections for supply and return lines. Checking the seals.
5. Tightening all screws and nuts for fixing the collectors.

Note: some tile forms (e.g. interlocking tiles, which are interlocked above and below) must be ground out in the vicinity of the roof hooks so that the mounted roof hook rests correctly and the tile on top of it does not stand off from it.

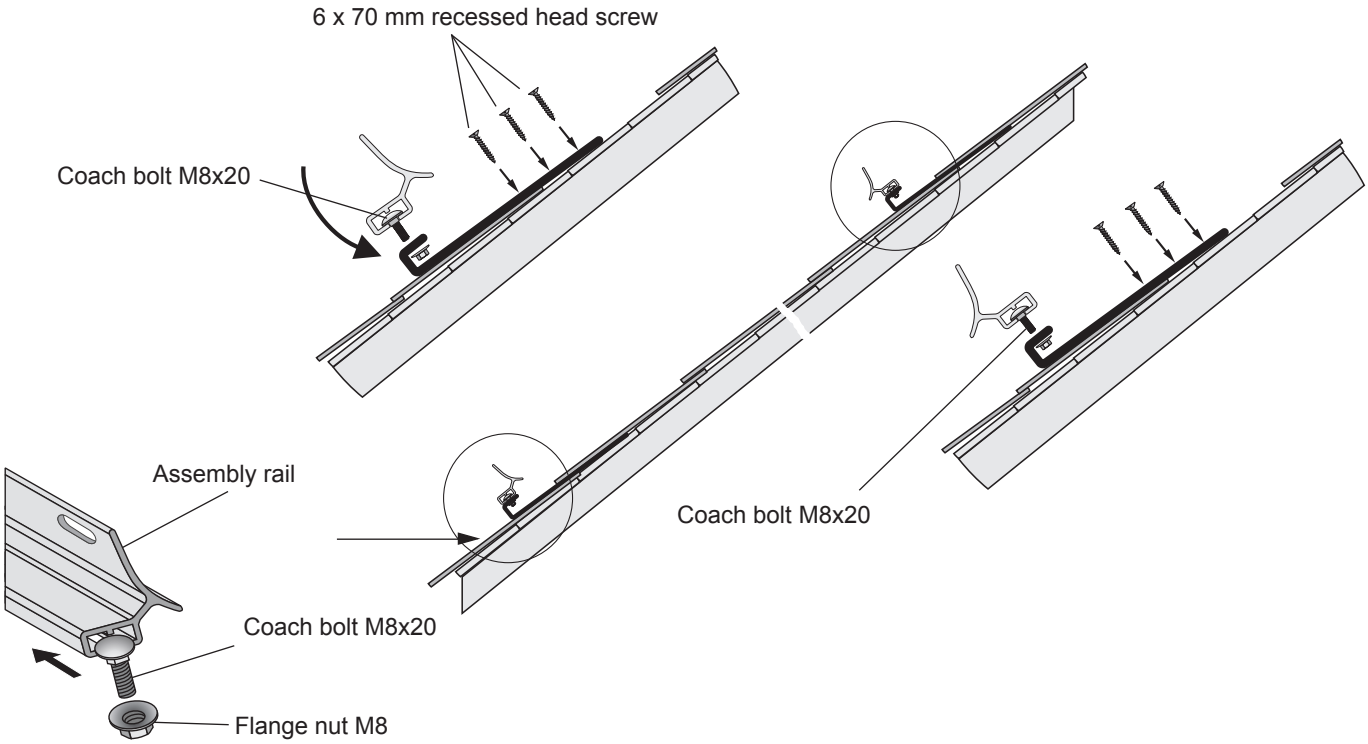
Special features of a rooftop installation on a slate roof with slate hooks

Warning **All roof hooks supplied must be distributed evenly over the width of the collector field in order to distribute the prevailing loads.**

1. Remove the roof covering at the fixing points of the hooks.

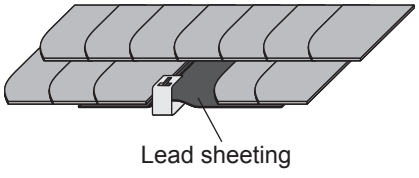


2. Fasten the hook with 6 x 70 mm recessed head screws.



3. Clad the slate hooks with commercially available lead sheeting.

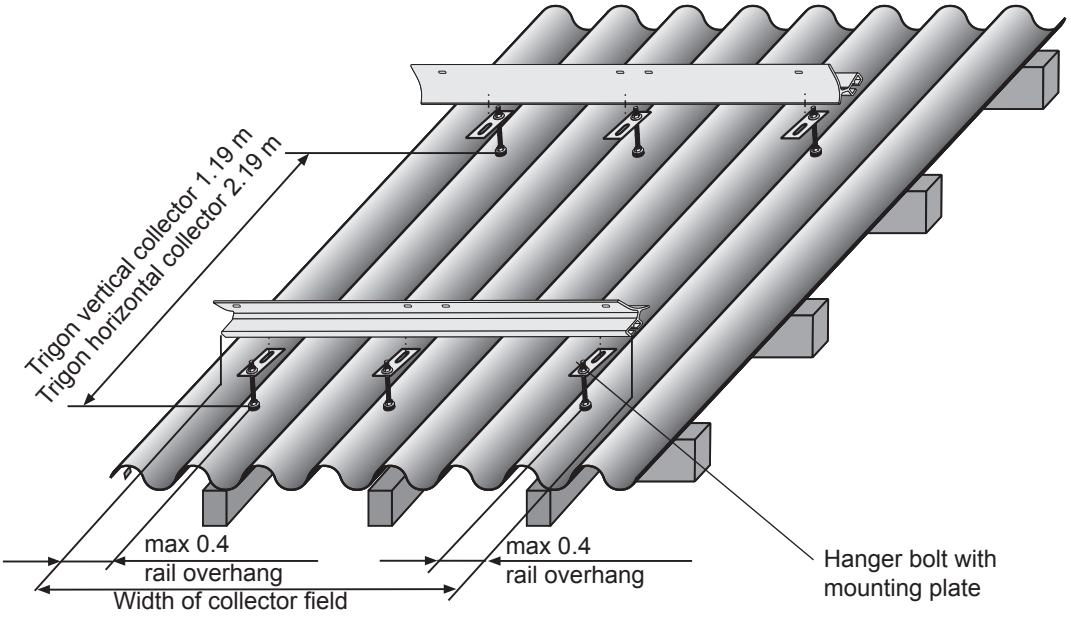
4. Replace the roof covering.



Special features of a rooftop installation on a corrugated roof / sheet metal roof with hanger bolts

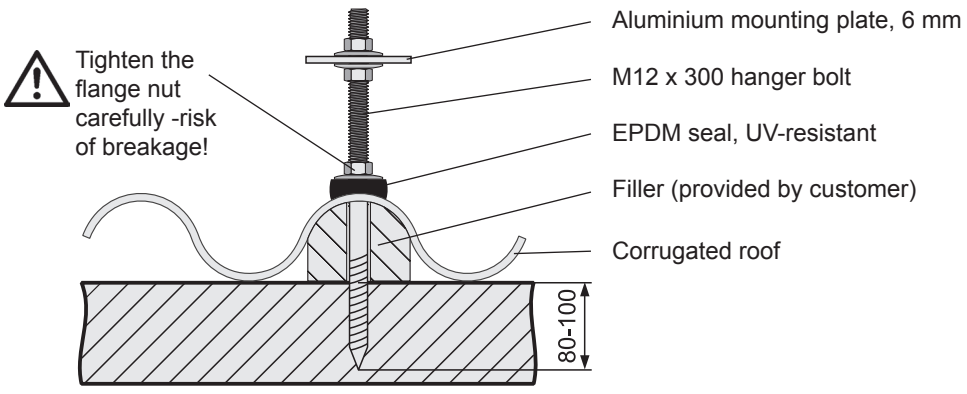
General recommendations

- In the case of corrugated roofs, the holes (Ø 14) in the roof membrane for the hanger bolts are each to be drilled at the highest point of the panel profile.
- The vertical spacing of the holes for the hanger bolts must be maintained so that the spacing of the rails is ensured.
- Secure fastening to the substructure/rafters must be ensured. If necessary, an auxiliary sub-structure must be erected by the customer.
- The fixing holes for the hanger bolts are pre-drilled in the rafters (Ø 8.5). A suitable dowel is to be used in the case of brickwork or masonry.
- The hanger bolts must be screwed in to a depth of 80 - 100 mm. Greasing facilitates screwing in. The smooth area of the shaft serves as a seal seat for the pressing seal. It must lie in the vicinity of the roof membrane.
- The roof membrane is sealed by light and careful tightening of the flange nut. There is otherwise a risk of breakage in the case of corrugated cement asbestos.



Warning **All hanger bolts supplied must be distributed evenly over the width of the collector field in order to distribute the prevailing loads.**

Hanger bolt assembly



Freestanding / wall installation
A-Frame

General instructions

Hamworthy Trigon A-Frames have been designed to take account the following rules and boundary conditions:

- BS EN 1991-1-4:2005 Wind loads
- BS EN 1991-1-3:2007/NA Snow loads
- DIN 18800-2008 Steel constructions
- DIN 4113-1:1980 Aluminium constructions
- DIN 4113-1-A1:2002 Aluminium constructions

Before assembling the A-Frame, its usability for the corresponding location is to be checked in accordance with the following planning document. The load of the triangle stand is a combination of wind and snow loads.

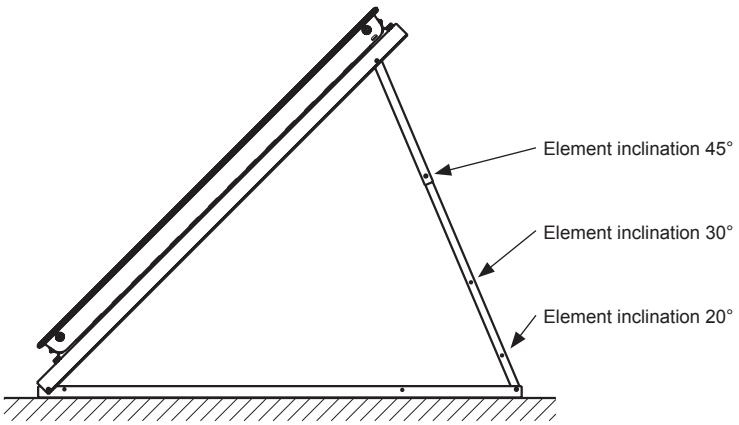
In accordance with DIN 1055-4, flat roofs are roofs that have an inclination of less than ±5°.

Evaluate the usability of the A-Frame for the corresponding location

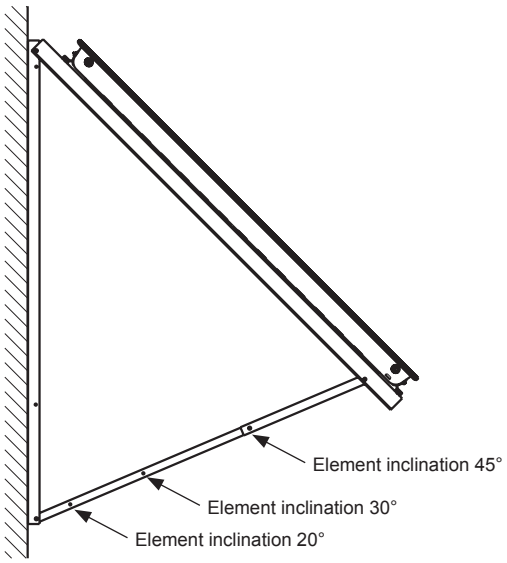
Static application limits given in the following tables are applicable for the inner zone of flat roofs and wall surfaces depending on the element inclination. The usability of the A-Frame is given when the corresponding cell of the respective table contains values for anchoring forces and/or the required ballasting. If the corresponding cell is filled with “Not usable”, the A-Frame cannot be used.
These tables cannot be used for edge and corner areas of flat roofs since these areas are exposed to higher wind and snow loads. Furthermore, the system would be difficult to access for inspection. Widths of edge areas of flat roofs can be estimated in a simplified manner as 1/10 the longer side of the building in the plan or 1/10 of double the building height. In case of wall installation, the edge area width value for a flat roof must be doubled.

Applications of the A-Frame

Freestanding installation:



Wall installation:



Freestanding / wall installation
Anchoring forces and ballasting

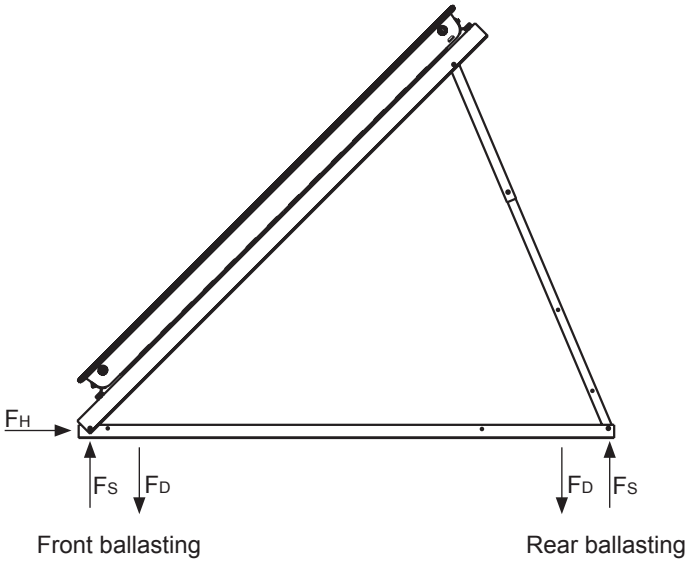
Selecting the anchoring system

Warning

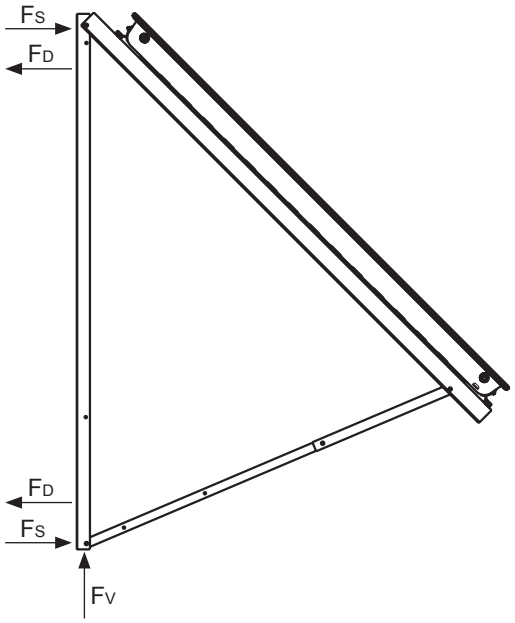
The triangle stands are to be securely connected to the structure. Anchoring elements whose dimensioning complies with a standard or have a valid building inspection approval of the Deutsches Institut für Bautechnik (DIBt) (German Institute for Building Technology) or a valid European technical approval (ETA) are to be used. The selection of the anchoring system mainly depends on the building method of the carrying structure.

Contact point of anchoring forces

Freestanding installation:



Wall installation:



F_D maximum compressive force [kN]
F_S maximum tensile force (suction force) [kN]
F_H maximum horizontal force [kN]
F_V maximum vertical force [kN]

Anchoring forces and ballasting

The following tables summarise the anchoring forces of every triangle stand depending on the element inclination as well as wind and snow loads. The first number represents the maximum rated value of compression force [kN], the second number represents the maximum rated value of tensile force (suction force) [kN], and the third number represents the maximum rated value of horizontal force [kN] for every anchor.
For the freestanding installation, the front and rear ballast of each triangle stand is specified in kilogram in other tables. The coefficient of friction of the roof surface was selected as $\mu = 0.4$. If the coefficient of friction of the roof surface deviates from the coefficient of friction taken as a reference for calculating the values in table, the ballast must be determined on site.

In case of an anchored installation, ensure that the structure has a reserved load-bearing capacity of 0.2 kN/m² and is reinforced and stabilised adequately for the additionally acting wind load. If ballasting is preferred over anchoring, a statical verification must be carried out on an individual basis since the ballast weights may reach the range of planned snow load.

Freestanding installation - vertical orientation

Element inclination 20°

Freestanding installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kN]: maximum vertical compressive force / maximum vertical tensile force / maximum horizontal force

20°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.82 / 0.28 / 0.08	1.05 / 0.81 / 0.17	1.32 / 1.33 / 0.25	1.6 / 1.85 / 0.33	1.88 / 2.37 / 0.41	2.15 / 2.9 / 0.5	2.43 / 3.42 / 0.58	2.71 / 3.94 / 0.66	2.98 / 4.46 / 0.75	3.26 / 4.99 / 0.83	3.54 / 5.51 / 0.91	3.81 / 6.03 / 0.99	4.09 / 6.55 / 1.08	4.37 / 7.08 / 1.16
0.40	1.14 / 0.28 / 0.08	1.31 / 0.81 / 0.17	1.48 / 1.33 / 0.25	1.76 / 1.85 / 0.33	2.04 / 2.37 / 0.41	2.31 / 2.9 / 0.5	2.59 / 3.42 / 0.58	2.87 / 3.94 / 0.66	3.14 / 4.46 / 0.75	3.42 / 4.99 / 0.83	3.7 / 5.51 / 0.91	3.97 / 6.03 / 0.99	4.25 / 6.55 / 1.08	4.53 / 7.08 / 1.16
0.60	1.47 / 0.28 / 0.08	1.63 / 0.81 / 0.17	1.8 / 1.33 / 0.25	1.96 / 1.85 / 0.33	2.2 / 2.37 / 0.41	2.48 / 2.9 / 0.5	2.75 / 3.42 / 0.58	3.03 / 3.94 / 0.66	3.31 / 4.46 / 0.75	3.58 / 4.99 / 0.83	3.86 / 5.51 / 0.91	4.14 / 6.03 / 0.99	4.41 / 6.55 / 1.08	4.69 / 7.08 / 1.16
0.80	1.79 / 0.28 / 0.08	1.95 / 0.81 / 0.17	2.12 / 1.33 / 0.25	2.29 / 1.85 / 0.33	2.45 / 2.37 / 0.41	2.64 / 2.9 / 0.5	2.91 / 3.42 / 0.58	3.19 / 3.94 / 0.66	3.47 / 4.46 / 0.75	3.74 / 4.99 / 0.83	4.02 / 5.51 / 0.91	4.3 / 6.03 / 0.99	4.57 / 6.55 / 1.08	4.85 / 7.08 / 1.16
1.00	2.11 / 0.28 / 0.08	2.28 / 0.81 / 0.17	2.44 / 1.33 / 0.25	2.61 / 1.85 / 0.33	2.78 / 2.37 / 0.41	2.94 / 2.9 / 0.5	3.11 / 3.42 / 0.58	3.35 / 3.94 / 0.66	3.63 / 4.46 / 0.75	3.9 / 4.99 / 0.83	4.18 / 5.51 / 0.91	4.46 / 6.03 / 0.99	4.73 / 6.55 / 1.08	5.01 / 7.08 / 1.16
1.20	2.44 / 0.28 / 0.08	2.6 / 0.81 / 0.17	2.77 / 1.33 / 0.25	2.93 / 1.85 / 0.33	3.1 / 2.37 / 0.41	3.27 / 2.9 / 0.5	3.43 / 3.42 / 0.58	3.6 / 3.94 / 0.66	3.79 / 4.46 / 0.75	4.07 / 4.99 / 0.83	4.34 / 5.51 / 0.91	4.62 / 6.03 / 0.99	4.9 / 6.55 / 1.08	5.17 / 7.08 / 1.16
1.40	2.76 / 0.28 / 0.08	2.92 / 0.81 / 0.17	3.09 / 1.33 / 0.25	3.26 / 1.85 / 0.33	3.42 / 2.37 / 0.41	3.59 / 2.9 / 0.5	3.75 / 3.42 / 0.58	3.92 / 3.94 / 0.66	4.09 / 4.46 / 0.75	4.25 / 4.99 / 0.83	4.5 / 5.51 / 0.91	4.78 / 6.03 / 0.99	5.06 / 6.55 / 1.08	5.33 / 7.08 / 1.16
1.60	3.08 / 0.28 / 0.08	3.25 / 0.81 / 0.17	3.41 / 1.33 / 0.25	3.58 / 1.85 / 0.33	3.75 / 2.37 / 0.41	3.91 / 2.9 / 0.5	4.08 / 3.42 / 0.58	4.24 / 3.94 / 0.66	4.41 / 4.46 / 0.75	4.58 / 4.99 / 0.83	4.74 / 5.51 / 0.91	4.94 / 6.03 / 0.99	5.22 / 6.55 / 1.08	5.5 / 7.08 / 1.16
1.80	3.4 / 0.28 / 0.08	3.57 / 0.81 / 0.17	3.74 / 1.33 / 0.25	3.9 / 1.85 / 0.33	4.07 / 2.37 / 0.41	4.23 / 2.9 / 0.5	4.4 / 3.42 / 0.58	4.57 / 3.94 / 0.66	4.73 / 4.46 / 0.75	4.9 / 4.99 / 0.83	5.06 / 5.51 / 0.91	5.23 / 6.03 / 0.99	5.4 / 6.55 / 1.08	5.66 / 7.08 / 1.16
2.00	3.73 / 0.28 / 0.08	3.89 / 0.81 / 0.17	4.06 / 1.33 / 0.25	4.23 / 1.85 / 0.33	4.39 / 2.37 / 0.41	4.56 / 2.9 / 0.5	4.72 / 3.42 / 0.58	4.89 / 3.94 / 0.66	5.06 / 4.46 / 0.75	5.22 / 4.99 / 0.83	5.39 / 5.51 / 0.91	5.55 / 6.03 / 0.99	5.72 / 6.55 / 1.08	5.89 / 7.08 / 1.16
2.20	4.05 / 0.28 / 0.08	4.22 / 0.81 / 0.17	4.38 / 1.33 / 0.25	4.55 / 1.85 / 0.33	4.72 / 2.37 / 0.41	4.88 / 2.9 / 0.5	5.05 / 3.42 / 0.58	5.21 / 3.94 / 0.66	5.38 / 4.46 / 0.75	5.55 / 4.99 / 0.83	5.71 / 5.51 / 0.91	5.88 / 6.03 / 0.99	6.04 / 6.55 / 1.08	6.21 / 7.08 / 1.16
2.40	4.37 / 0.28 / 0.08	4.54 / 0.81 / 0.17	4.71 / 1.33 / 0.25	4.87 / 1.85 / 0.33	5.04 / 2.37 / 0.41	5.2 / 2.9 / 0.5	5.37 / 3.42 / 0.58	5.54 / 3.94 / 0.66	5.7 / 4.46 / 0.75	5.87 / 4.99 / 0.83	6.03 / 5.51 / 0.91	6.2 / 6.03 / 0.99	6.37 / 6.55 / 1.08	6.53 / 7.08 / 1.16
2.60	4.7 / 0.28 / 0.08	4.86 / 0.81 / 0.17	5.03 / 1.33 / 0.25	5.2 / 1.85 / 0.33	5.36 / 2.37 / 0.41	5.53 / 2.9 / 0.5	5.69 / 3.42 / 0.58	5.86 / 3.94 / 0.66	6.03 / 4.46 / 0.75	6.19 / 4.99 / 0.83	6.36 / 5.51 / 0.91	6.52 / 6.03 / 0.99	6.69 / 6.55 / 1.08	6.86 / 7.08 / 1.16
2.80	5.02 / 0.28 / 0.08	5.19 / 0.81 / 0.17	5.35 / 1.33 / 0.25	5.52 / 1.85 / 0.33	5.68 / 2.37 / 0.41	5.85 / 2.9 / 0.5	6.02 / 3.42 / 0.58	6.18 / 3.94 / 0.66	6.35 / 4.46 / 0.75	6.51 / 4.99 / 0.83	6.68 / 5.51 / 0.91	6.85 / 6.03 / 0.99	7.01 / 6.55 / 1.08	7.18 / 7.08 / 1.16
3.00	5.34 / 0.28 / 0.08	5.51 / 0.81 / 0.17	5.68 / 1.33 / 0.25	5.84 / 1.85 / 0.33	6.01 / 2.37 / 0.41	6.17 / 2.9 / 0.5	6.34 / 3.42 / 0.58	6.51 / 3.94 / 0.66	6.67 / 4.46 / 0.75	6.84 / 4.99 / 0.83	7 / 5.51 / 0.91	7.17 / 6.03 / 0.99	7.34 / 6.55 / 1.08	7.5 / 7.08 / 1.16
3.20	5.67 / 0.28 / 0.08	5.83 / 0.81 / 0.17	6 / 1.33 / 0.25	6.17 / 1.85 / 0.33	6.33 / 2.37 / 0.41	6.5 / 2.9 / 0.5	6.66 / 3.42 / 0.58	6.83 / 3.94 / 0.66	7 / 4.46 / 0.75	7.16 / 4.99 / 0.83	7.33 / 5.51 / 0.91	7.49 / 6.03 / 0.99	Not usable	Not usable
3.40	5.99 / 0.28 / 0.08	6.16 / 0.81 / 0.17	6.32 / 1.33 / 0.25	6.49 / 1.85 / 0.33	6.65 / 2.37 / 0.41	6.82 / 2.9 / 0.5	6.99 / 3.42 / 0.58	7.15 / 3.94 / 0.66	7.32 / 4.46 / 0.75	7.48 / 4.99 / 0.83	7.65 / 5.51 / 0.91	Not usable	Not usable	Not usable
3.60	6.31 / 0.28 / 0.08	6.48 / 0.81 / 0.17	6.65 / 1.33 / 0.25	6.81 / 1.85 / 0.33	6.98 / 2.37 / 0.41	7.14 / 2.9 / 0.5	7.31 / 3.42 / 0.58	7.48 / 3.94 / 0.66	7.64 / 4.46 / 0.75	Not usable	Not usable	Not usable	Not usable	Not usable
3.80	6.64 / 0.28 / 0.08	6.8 / 0.81 / 0.17	6.97 / 1.33 / 0.25	7.13 / 1.85 / 0.33	7.3 / 2.37 / 0.41	7.47 / 2.9 / 0.5	7.63 / 3.42 / 0.58	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	6.96 / 0.28 / 0.08	7.13 / 0.81 / 0.17	7.29 / 1.33 / 0.25	7.46 / 1.85 / 0.33	7.62 / 2.37 / 0.41	7.79 / 2.9 / 0.5	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kg]: front ballast weight / rear ballast weight

Safety coefficients are taken into account in these tables. Ballast materials must be applied with their characteristic value (e.g. normal concrete: 2400 kg/m³)

20°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
0.40	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
0.60	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
0.80	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
1.00	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
1.20	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
1.40	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
1.60	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
1.80	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
2.00	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
2.20	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
2.40	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
2.60	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
2.80	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
3.00	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	573 / 728	618 / 786
3.20	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	527 / 670	Not usable	Not usable
3.40	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	435 / 554	481 / 612	Not usable	Not usable	Not usable
3.60	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	344 / 438	390 / 496	Not usable	Not usable	Not usable	Not usable	Not usable
3.80	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	298 / 380	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	25 / 32	70 / 90	115 / 148	161 / 206	207 / 264	253 / 322	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation - vertical orientation

Element inclination 30°

Freestanding installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kN]: Maximum vertical compressive force / maximum vertical tensile force / maximum horizontal force

30°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.84 / 0.44 / 0.16	1.25 / 1.11 / 0.31	1.66 / 1.77 / 0.47	2.07 / 2.43 / 0.62	2.48 / 3.09 / 0.78	2.89 / 3.76 / 0.94	3.3 / 4.42 / 1.09	3.71 / 5.08 / 1.25	4.12 / 5.75 / 1.4	4.53 / 6.41 / 1.56	4.94 / 7.07 / 1.71	Not usable	Not usable	Not usable
0.40	1.06 / 0.44 / 0.16	1.38 / 1.11 / 0.31	1.79 / 1.77 / 0.47	2.2 / 2.43 / 0.62	2.6 / 3.09 / 0.78	3.01 / 3.76 / 0.94	3.42 / 4.42 / 1.09	3.83 / 5.08 / 1.25	4.24 / 5.75 / 1.4	4.65 / 6.41 / 1.56	5.06 / 7.07 / 1.71	Not usable	Not usable	Not usable
0.60	1.31 / 0.44 / 0.16	1.55 / 1.11 / 0.31	1.91 / 1.77 / 0.47	2.32 / 2.43 / 0.62	2.73 / 3.09 / 0.78	3.14 / 3.76 / 0.94	3.55 / 4.42 / 1.09	3.96 / 5.08 / 1.25	4.37 / 5.75 / 1.4	4.78 / 6.41 / 1.56	5.19 / 7.07 / 1.71	Not usable	Not usable	Not usable
0.80	1.56 / 0.44 / 0.16	1.81 / 1.11 / 0.31	2.05 / 1.77 / 0.47	2.45 / 2.43 / 0.62	2.86 / 3.09 / 0.78	3.27 / 3.76 / 0.94	3.68 / 4.42 / 1.09	4.09 / 5.08 / 1.25	4.5 / 5.75 / 1.4	4.91 / 6.41 / 1.56	5.32 / 7.07 / 1.71	Not usable	Not usable	Not usable
1.00	1.82 / 0.44 / 0.16	2.06 / 1.11 / 0.31	2.31 / 1.77 / 0.47	2.57 / 2.43 / 0.62	2.98 / 3.09 / 0.78	3.39 / 3.76 / 0.94	3.8 / 4.42 / 1.09	4.21 / 5.08 / 1.25	4.62 / 5.75 / 1.4	5.03 / 6.41 / 1.56	5.44 / 7.07 / 1.71	Not usable	Not usable	Not usable
1.20	2.07 / 0.44 / 0.16	2.31 / 1.11 / 0.31	2.56 / 1.77 / 0.47	2.81 / 2.43 / 0.62	3.11 / 3.09 / 0.78	3.52 / 3.76 / 0.94	3.93 / 4.42 / 1.09	4.34 / 5.08 / 1.25	4.75 / 5.75 / 1.4	5.16 / 6.41 / 1.56	5.57 / 7.07 / 1.71	Not usable	Not usable	Not usable
1.40	2.32 / 0.44 / 0.16	2.57 / 1.11 / 0.31	2.81 / 1.77 / 0.47	3.06 / 2.43 / 0.62	3.3 / 3.09 / 0.78	3.65 / 3.76 / 0.94	4.06 / 4.42 / 1.09	4.47 / 5.08 / 1.25	4.88 / 5.75 / 1.4	5.29 / 6.41 / 1.56	5.69 / 7.07 / 1.71	Not usable	Not usable	Not usable
1.60	2.57 / 0.44 / 0.16	2.82 / 1.11 / 0.31	3.07 / 1.77 / 0.47	3.31 / 2.43 / 0.62	3.56 / 3.09 / 0.78	3.8 / 3.76 / 0.94	4.18 / 4.42 / 1.09	4.59 / 5.08 / 1.25	5 / 5.75 / 1.4	5.41 / 6.41 / 1.56	5.82 / 7.07 / 1.71	Not usable	Not usable	Not usable
1.80	2.83 / 0.44 / 0.16	3.07 / 1.11 / 0.31	3.32 / 1.77 / 0.47	3.56 / 2.43 / 0.62	3.81 / 3.09 / 0.78	4.06 / 3.76 / 0.94	4.31 / 4.42 / 1.09	4.72 / 5.08 / 1.25	5.13 / 5.75 / 1.4	5.54 / 6.41 / 1.56	5.95 / 7.07 / 1.71	Not usable	Not usable	Not usable
2.00	3.08 / 0.44 / 0.16	3.33 / 1.11 / 0.31	3.57 / 1.77 / 0.47	3.82 / 2.43 / 0.62	4.06 / 3.09 / 0.78	4.31 / 3.76 / 0.94	4.55 / 4.42 / 1.09	4.85 / 5.08 / 1.25	5.26 / 5.75 / 1.4	5.66 / 6.41 / 1.56	6.07 / 7.07 / 1.71	Not usable	Not usable	Not usable
2.20	3.33 / 0.44 / 0.16	3.58 / 1.11 / 0.31	3.82 / 1.77 / 0.47	4.07 / 2.43 / 0.62	4.32 / 3.09 / 0.78	4.56 / 3.76 / 0.94	4.81 / 4.42 / 1.09	5.05 / 5.08 / 1.25	5.38 / 5.75 / 1.4	5.79 / 6.41 / 1.56	6.2 / 7.07 / 1.71	Not usable	Not usable	Not usable
2.40	3.59 / 0.44 / 0.16	3.83 / 1.11 / 0.31	4.08 / 1.77 / 0.47	4.32 / 2.43 / 0.62	4.57 / 3.09 / 0.78	4.81 / 3.76 / 0.94	5.06 / 4.42 / 1.09	5.31 / 5.08 / 1.25	5.55 / 5.75 / 1.4	5.92 / 6.41 / 1.56	6.33 / 7.07 / 1.71	Not usable	Not usable	Not usable
2.60	3.84 / 0.44 / 0.16	4.09 / 1.11 / 0.31	4.33 / 1.77 / 0.47	4.58 / 2.43 / 0.62	4.82 / 3.09 / 0.78	5.07 / 3.76 / 0.94	5.31 / 4.42 / 1.09	5.56 / 5.08 / 1.25	5.8 / 5.75 / 1.4	6.05 / 6.41 / 1.56	6.45 / 7.07 / 1.71	Not usable	Not usable	Not usable
2.80	4.09 / 0.44 / 0.16	4.34 / 1.11 / 0.31	4.58 / 1.77 / 0.47	4.83 / 2.43 / 0.62	5.08 / 3.09 / 0.78	5.32 / 3.76 / 0.94	5.57 / 4.42 / 1.09	5.81 / 5.08 / 1.25	6.06 / 5.75 / 1.4	6.3 / 6.41 / 1.56	6.58 / 7.07 / 1.71	Not usable	Not usable	Not usable
3.00	4.35 / 0.44 / 0.16	4.59 / 1.11 / 0.31	4.84 / 1.77 / 0.47	5.08 / 2.43 / 0.62	5.33 / 3.09 / 0.78	5.57 / 3.76 / 0.94	5.82 / 4.42 / 1.09	6.07 / 5.08 / 1.25	6.31 / 5.75 / 1.4	6.56 / 6.41 / 1.56	6.8 / 7.07 / 1.71	Not usable	Not usable	Not usable
3.20	4.6 / 0.44 / 0.16	4.84 / 1.11 / 0.31	5.09 / 1.77 / 0.47	5.34 / 2.43 / 0.62	5.58 / 3.09 / 0.78	5.83 / 3.76 / 0.94	6.07 / 4.42 / 1.09	6.32 / 5.08 / 1.25	6.56 / 5.75 / 1.4	6.81 / 6.41 / 1.56	7.06 / 7.07 / 1.71	Not usable	Not usable	Not usable
3.40	4.85 / 0.44 / 0.16	5.1 / 1.11 / 0.31	5.34 / 1.77 / 0.47	5.59 / 2.43 / 0.62	5.83 / 3.09 / 0.78	6.08 / 3.76 / 0.94	6.33 / 4.42 / 1.09	6.57 / 5.08 / 1.25	6.82 / 5.75 / 1.4	7.06 / 6.41 / 1.56	7.31 / 7.07 / 1.71	Not usable	Not usable	Not usable
3.60	5.1 / 0.44 / 0.16	5.35 / 1.11 / 0.31	5.6 / 1.77 / 0.47	5.84 / 2.43 / 0.62	6.09 / 3.09 / 0.78	6.33 / 3.76 / 0.94	6.58 / 4.42 / 1.09	6.82 / 5.08 / 1.25	7.07 / 5.75 / 1.4	7.32 / 6.41 / 1.56	Not usable	Not usable	Not usable	Not usable
3.80	5.36 / 0.44 / 0.16	5.6 / 1.11 / 0.31	5.85 / 1.77 / 0.47	6.09 / 2.43 / 0.62	6.34 / 3.09 / 0.78	6.59 / 3.76 / 0.94	6.83 / 4.42 / 1.09	7.08 / 5.08 / 1.25	7.32 / 5.75 / 1.4	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	5.61 / 0.44 / 0.16	5.86 / 1.11 / 0.31	6.1 / 1.77 / 0.47	6.35 / 2.43 / 0.62	6.59 / 3.09 / 0.78	6.84 / 3.76 / 0.94	7.08 / 4.42 / 1.09	7.33 / 5.08 / 1.25	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kg]: front ballast weight / rear ballast weight

Safety coefficients are taken into account in these tables. Ballast materials must be applied with their characteristic value (e.g. normal concrete: 2400 kg/m³)

30°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
0.40	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
0.60	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
0.80	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
1.00	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
1.20	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
1.40	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
1.60	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
1.80	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
2.00	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
2.20	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
2.40	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
2.60	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
2.80	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
3.00	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
3.20	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
3.40	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	786 / 786	Not usable	Not usable	Not usable
3.60	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	713 / 713	Not usable	Not usable	Not usable	Not usable
3.80	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	640 / 640	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	53 / 53	126 / 126	200 / 200	273 / 273	346 / 346	420 / 420	493 / 493	566 / 566	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation - vertical orientation

Element inclination 45°

Freestanding installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kN]: Maximum vertical compressive force / maximum vertical tensile force / maximum horizontal force

45°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.72 / 0.47 / 0.22	1.16 / 1.11 / 0.44	1.61 / 1.76 / 0.66	2.05 / 2.41 / 0.88	2.49 / 3.05 / 1.1	2.93 / 3.7 / 1.32	3.37 / 4.34 / 1.54	3.81 / 4.99 / 1.76	4.25 / 5.64 / 1.98	4.69 / 6.28 / 2.2	5.13 / 6.93 / 2.42	Not usable	Not usable	Not usable
0.40	0.76 / 0.47 / 0.22	1.2 / 1.11 / 0.44	1.64 / 1.76 / 0.66	2.08 / 2.41 / 0.88	2.52 / 3.05 / 1.1	2.96 / 3.7 / 1.32	3.4 / 4.34 / 1.54	3.84 / 4.99 / 1.76	4.28 / 5.64 / 1.98	4.72 / 6.28 / 2.2	5.17 / 6.93 / 2.42	Not usable	Not usable	Not usable
0.60	0.82 / 0.47 / 0.22	1.23 / 1.11 / 0.44	1.67 / 1.76 / 0.66	2.11 / 2.41 / 0.88	2.56 / 3.05 / 1.1	3 / 3.7 / 1.32	3.44 / 4.34 / 1.54	3.88 / 4.99 / 1.76	4.32 / 5.64 / 1.98	4.76 / 6.28 / 2.2	5.2 / 6.93 / 2.42	Not usable	Not usable	Not usable
0.80	0.92 / 0.47 / 0.22	1.27 / 1.11 / 0.44	1.71 / 1.76 / 0.66	2.15 / 2.41 / 0.88	2.59 / 3.05 / 1.1	3.03 / 3.7 / 1.32	3.47 / 4.34 / 1.54	3.91 / 4.99 / 1.76	4.35 / 5.64 / 1.98	4.79 / 6.28 / 2.2	5.23 / 6.93 / 2.42	Not usable	Not usable	Not usable
1.00	1.02 / 0.47 / 0.22	1.3 / 1.11 / 0.44	1.74 / 1.76 / 0.66	2.18 / 2.41 / 0.88	2.62 / 3.05 / 1.1	3.07 / 3.7 / 1.32	3.51 / 4.34 / 1.54	3.95 / 4.99 / 1.76	4.39 / 5.64 / 1.98	4.83 / 6.28 / 2.2	5.27 / 6.93 / 2.42	Not usable	Not usable	Not usable
1.20	1.12 / 0.47 / 0.22	1.34 / 1.11 / 0.44	1.78 / 1.76 / 0.66	2.22 / 2.41 / 0.88	2.66 / 3.05 / 1.1	3.1 / 3.7 / 1.32	3.54 / 4.34 / 1.54	3.98 / 4.99 / 1.76	4.42 / 5.64 / 1.98	4.86 / 6.28 / 2.2	5.3 / 6.93 / 2.42	Not usable	Not usable	Not usable
1.40	1.21 / 0.47 / 0.22	1.39 / 1.11 / 0.44	1.81 / 1.76 / 0.66	2.25 / 2.41 / 0.88	2.69 / 3.05 / 1.1	3.13 / 3.7 / 1.32	3.57 / 4.34 / 1.54	4.02 / 4.99 / 1.76	4.46 / 5.64 / 1.98	4.9 / 6.28 / 2.2	5.34 / 6.93 / 2.42	Not usable	Not usable	Not usable
1.60	1.31 / 0.47 / 0.22	1.49 / 1.11 / 0.44	1.85 / 1.76 / 0.66	2.29 / 2.41 / 0.88	2.73 / 3.05 / 1.1	3.17 / 3.7 / 1.32	3.61 / 4.34 / 1.54	4.05 / 4.99 / 1.76	4.49 / 5.64 / 1.98	4.93 / 6.28 / 2.2	5.37 / 6.93 / 2.42	Not usable	Not usable	Not usable
1.80	1.41 / 0.47 / 0.22	1.59 / 1.11 / 0.44	1.88 / 1.76 / 0.66	2.32 / 2.41 / 0.88	2.76 / 3.05 / 1.1	3.2 / 3.7 / 1.32	3.64 / 4.34 / 1.54	4.08 / 4.99 / 1.76	4.53 / 5.64 / 1.98	4.97 / 6.28 / 2.2	5.41 / 6.93 / 2.42	Not usable	Not usable	Not usable
2.00	1.51 / 0.47 / 0.22	1.69 / 1.11 / 0.44	1.92 / 1.76 / 0.66	2.36 / 2.41 / 0.88	2.8 / 3.05 / 1.1	3.24 / 3.7 / 1.32	3.68 / 4.34 / 1.54	4.12 / 4.99 / 1.76	4.56 / 5.64 / 1.98	5 / 6.28 / 2.2	5.44 / 6.93 / 2.42	Not usable	Not usable	Not usable
2.20	1.6 / 0.47 / 0.22	1.78 / 1.11 / 0.44	1.96 / 1.76 / 0.66	2.39 / 2.41 / 0.88	2.83 / 3.05 / 1.1	3.27 / 3.7 / 1.32	3.71 / 4.34 / 1.54	4.15 / 4.99 / 1.76	4.59 / 5.64 / 1.98	5.03 / 6.28 / 2.2	5.48 / 6.93 / 2.42	Not usable	Not usable	Not usable
2.40	1.7 / 0.47 / 0.22	1.88 / 1.11 / 0.44	2.06 / 1.76 / 0.66	2.42 / 2.41 / 0.88	2.87 / 3.05 / 1.1	3.31 / 3.7 / 1.32	3.75 / 4.34 / 1.54	4.19 / 4.99 / 1.76	4.63 / 5.64 / 1.98	5.07 / 6.28 / 2.2	5.51 / 6.93 / 2.42	Not usable	Not usable	Not usable
2.60	1.8 / 0.47 / 0.22	1.98 / 1.11 / 0.44	2.16 / 1.76 / 0.66	2.46 / 2.41 / 0.88	2.9 / 3.05 / 1.1	3.34 / 3.7 / 1.32	3.78 / 4.34 / 1.54	4.22 / 4.99 / 1.76	4.66 / 5.64 / 1.98	5.1 / 6.28 / 2.2	5.54 / 6.93 / 2.42	Not usable	Not usable	Not usable
2.80	1.9 / 0.47 / 0.22	2.08 / 1.11 / 0.44	2.26 / 1.76 / 0.66	2.49 / 2.41 / 0.88	2.93 / 3.05 / 1.1	3.38 / 3.7 / 1.32	3.82 / 4.34 / 1.54	4.26 / 4.99 / 1.76	4.7 / 5.64 / 1.98	5.14 / 6.28 / 2.2	5.58 / 6.93 / 2.42	Not usable	Not usable	Not usable
3.00	1.99 / 0.47 / 0.22	2.17 / 1.11 / 0.44	2.35 / 1.76 / 0.66	2.53 / 2.41 / 0.88	2.97 / 3.05 / 1.1	3.41 / 3.7 / 1.32	3.85 / 4.34 / 1.54	4.29 / 4.99 / 1.76	4.73 / 5.64 / 1.98	5.17 / 6.28 / 2.2	5.61 / 6.93 / 2.42	Not usable	Not usable	Not usable
3.20	2.09 / 0.47 / 0.22	2.27 / 1.11 / 0.44	2.45 / 1.76 / 0.66	2.63 / 2.41 / 0.88	3 / 3.05 / 1.1	3.44 / 3.7 / 1.32	3.88 / 4.34 / 1.54	4.33 / 4.99 / 1.76	4.77 / 5.64 / 1.98	5.21 / 6.28 / 2.2	5.65 / 6.93 / 2.42	Not usable	Not usable	Not usable
3.40	2.19 / 0.47 / 0.22	2.37 / 1.11 / 0.44	2.55 / 1.76 / 0.66	2.73 / 2.41 / 0.88	3.04 / 3.05 / 1.1	3.48 / 3.7 / 1.32	3.92 / 4.34 / 1.54	4.36 / 4.99 / 1.76	4.8 / 5.64 / 1.98	5.24 / 6.28 / 2.2	5.68 / 6.93 / 2.42	Not usable	Not usable	Not usable
3.60	2.29 / 0.47 / 0.22	2.47 / 1.11 / 0.44	2.65 / 1.76 / 0.66	2.83 / 2.41 / 0.88	3.07 / 3.05 / 1.1	3.51 / 3.7 / 1.32	3.95 / 4.34 / 1.54	4.39 / 4.99 / 1.76	4.84 / 5.64 / 1.98	5.28 / 6.28 / 2.2	5.72 / 6.93 / 2.42	Not usable	Not usable	Not usable
3.80	2.38 / 0.47 / 0.22	2.56 / 1.11 / 0.44	2.74 / 1.76 / 0.66	2.92 / 2.41 / 0.88	3.11 / 3.05 / 1.1	3.55 / 3.7 / 1.32	3.99 / 4.34 / 1.54	4.43 / 4.99 / 1.76	4.87 / 5.64 / 1.98	5.31 / 6.28 / 2.2	5.75 / 6.93 / 2.42	Not usable	Not usable	Not usable
4.00	2.48 / 0.47 / 0.22	2.66 / 1.11 / 0.44	2.84 / 1.76 / 0.66	3.02 / 2.41 / 0.88	3.2 / 3.05 / 1.1	3.58 / 3.7 / 1.32	4.02 / 4.34 / 1.54	4.46 / 4.99 / 1.76	4.9 / 5.64 / 1.98	5.35 / 6.28 / 2.2	5.79 / 6.93 / 2.42	Not usable	Not usable	Not usable

Freestanding installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kg]: Front ballast weight / rear ballast weight

Safety coefficients are taken into account in these tables. Ballast materials must be applied with their characteristic value (e.g. normal concrete: 2400 kg/m³)

45°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
0.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
0.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
0.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
4.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable

Freestanding installation - horizontal orientation

Element inclination 20°

Freestanding installation of elements in horizontal orientation - statical application limits and anchoring forces

Specified values [kN]: Maximum vertical compressive force / maximum vertical tensile force / maximum horizontal force

20°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.88 / 0.31 / 0.08	1.11 / 0.89 / 0.17	1.4 / 1.48 / 0.25	1.69 / 2.06 / 0.33	1.98 / 2.65 / 0.41	2.27 / 3.23 / 0.5	2.56 / 3.82 / 0.58	2.85 / 4.4 / 0.66	3.13 / 4.99 / 0.75	3.42 / 5.58 / 0.83	3.71 / 6.16 / 0.91	4 / 6.75 / 0.99	4.29 / 7.33 / 1.08	Not usable
0.40	1.23 / 0.31 / 0.08	1.41 / 0.89 / 0.17	1.58 / 1.48 / 0.25	1.87 / 2.06 / 0.33	2.15 / 2.65 / 0.41	2.44 / 3.23 / 0.5	2.73 / 3.82 / 0.58	3.02 / 4.4 / 0.66	3.31 / 4.99 / 0.75	3.6 / 5.58 / 0.83	3.89 / 6.16 / 0.91	4.18 / 6.75 / 0.99	4.47 / 7.33 / 1.08	Not usable
0.60	1.59 / 0.31 / 0.08	1.76 / 0.89 / 0.17	1.93 / 1.48 / 0.25	2.11 / 2.06 / 0.33	2.33 / 2.65 / 0.41	2.62 / 3.23 / 0.5	2.91 / 3.82 / 0.58	3.2 / 4.4 / 0.66	3.49 / 4.99 / 0.75	3.77 / 5.58 / 0.83	4.06 / 6.16 / 0.91	4.35 / 6.75 / 0.99	4.64 / 7.33 / 1.08	Not usable
0.80	1.94 / 0.31 / 0.08	2.11 / 0.89 / 0.17	2.28 / 1.48 / 0.25	2.46 / 2.06 / 0.33	2.63 / 2.65 / 0.41	2.8 / 3.23 / 0.5	3.08 / 3.82 / 0.58	3.37 / 4.4 / 0.66	3.66 / 4.99 / 0.75	3.95 / 5.58 / 0.83	4.24 / 6.16 / 0.91	4.53 / 6.75 / 0.99	4.82 / 7.33 / 1.08	Not usable
1.00	2.29 / 0.31 / 0.08	2.46 / 0.89 / 0.17	2.64 / 1.48 / 0.25	2.81 / 2.06 / 0.33	2.98 / 2.65 / 0.41	3.16 / 3.23 / 0.5	3.33 / 3.82 / 0.58	3.55 / 4.4 / 0.66	3.84 / 4.99 / 0.75	4.13 / 5.58 / 0.83	4.41 / 6.16 / 0.91	4.7 / 6.75 / 0.99	4.99 / 7.33 / 1.08	Not usable
1.20	2.64 / 0.31 / 0.08	2.81 / 0.89 / 0.17	2.99 / 1.48 / 0.25	3.16 / 2.06 / 0.33	3.33 / 2.65 / 0.41	3.51 / 3.23 / 0.5	3.68 / 3.82 / 0.58	3.85 / 4.4 / 0.66	4.03 / 4.99 / 0.75	4.3 / 5.58 / 0.83	4.59 / 6.16 / 0.91	4.88 / 6.75 / 0.99	5.17 / 7.33 / 1.08	Not usable
1.40	2.99 / 0.31 / 0.08	3.16 / 0.89 / 0.17	3.34 / 1.48 / 0.25	3.51 / 2.06 / 0.33	3.68 / 2.65 / 0.41	3.86 / 3.23 / 0.5	4.03 / 3.82 / 0.58	4.2 / 4.4 / 0.66	4.38 / 4.99 / 0.75	4.55 / 5.58 / 0.83	4.77 / 6.16 / 0.91	5.05 / 6.75 / 0.99	5.34 / 7.33 / 1.08	Not usable
1.60	3.34 / 0.31 / 0.08	3.52 / 0.89 / 0.17	3.69 / 1.48 / 0.25	3.86 / 2.06 / 0.33	4.04 / 2.65 / 0.41	4.21 / 3.23 / 0.5	4.38 / 3.82 / 0.58	4.56 / 4.4 / 0.66	4.73 / 4.99 / 0.75	4.9 / 5.58 / 0.83	5.08 / 6.16 / 0.91	5.25 / 6.75 / 0.99	5.52 / 7.33 / 1.08	Not usable
1.80	3.69 / 0.31 / 0.08	3.87 / 0.89 / 0.17	4.04 / 1.48 / 0.25	4.21 / 2.06 / 0.33	4.39 / 2.65 / 0.41	4.56 / 3.23 / 0.5	4.73 / 3.82 / 0.58	4.91 / 4.4 / 0.66	5.08 / 4.99 / 0.75	5.25 / 5.58 / 0.83	5.43 / 6.16 / 0.91	5.6 / 6.75 / 0.99	5.77 / 7.33 / 1.08	Not usable
2.00	4.05 / 0.31 / 0.08	4.22 / 0.89 / 0.17	4.39 / 1.48 / 0.25	4.57 / 2.06 / 0.33	4.74 / 2.65 / 0.41	4.91 / 3.23 / 0.5	5.09 / 3.82 / 0.58	5.26 / 4.4 / 0.66	5.43 / 4.99 / 0.75	5.61 / 5.58 / 0.83	5.78 / 6.16 / 0.91	5.95 / 6.75 / 0.99	6.13 / 7.33 / 1.08	Not usable
2.20	4.4 / 0.31 / 0.08	4.57 / 0.89 / 0.17	4.74 / 1.48 / 0.25	4.92 / 2.06 / 0.33	5.09 / 2.65 / 0.41	5.26 / 3.23 / 0.5	5.44 / 3.82 / 0.58	5.61 / 4.4 / 0.66	5.78 / 4.99 / 0.75	5.96 / 5.58 / 0.83	6.13 / 6.16 / 0.91	6.3 / 6.75 / 0.99	Not usable	Not usable
2.40	4.75 / 0.31 / 0.08	4.92 / 0.89 / 0.17	5.09 / 1.48 / 0.25	5.27 / 2.06 / 0.33	5.44 / 2.65 / 0.41	5.61 / 3.23 / 0.5	5.79 / 3.82 / 0.58	5.96 / 4.4 / 0.66	6.13 / 4.99 / 0.75	Not usable	Not usable	Not usable	Not usable	Not usable
2.60	5.1 / 0.31 / 0.08	5.27 / 0.89 / 0.17	5.45 / 1.48 / 0.25	5.62 / 2.06 / 0.33	5.79 / 2.65 / 0.41	5.97 / 3.23 / 0.5	6.14 / 3.82 / 0.58	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.80	5.45 / 0.31 / 0.08	5.62 / 0.89 / 0.17	5.8 / 1.48 / 0.25	5.97 / 2.06 / 0.33	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.00	5.8 / 0.31 / 0.08	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.20	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.40	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.60	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.80	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation of elements in horizontal orientation - static application limits and anchoring forces

Specified values [kg]: Front ballast weight / rear ballast weight

Safety coefficients are taken into account in these tables. Ballast materials must be applied with their characteristic value (e.g. normal concrete: 2400 kg/m³)

20°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
0.40	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
0.60	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
0.80	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
1.00	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
1.20	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
1.40	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
1.60	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
1.80	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
2.00	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	573 / 815	Not usable
2.20	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	436 / 619	482 / 685	527 / 750	Not usable	Not usable
2.40	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	344 / 489	390 / 554	Not usable	Not usable	Not usable	Not usable	Not usable
2.60	25 / 34	70 / 99	116 / 164	162 / 229	207 / 294	253 / 359	299 / 424	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.80	25 / 34	70 / 99	116 / 164	162 / 229	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.00	25 / 34	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.20	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.40	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.60	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.80	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation - horizontal orientation

Element inclination 30°

Freestanding installation of elements in horizontal orientation - statical application limits and anchoring forces

Specified values [kN]: Maximum vertical compressive force / maximum vertical tensile force / maximum horizontal force

30°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.89 / 0.48 / 0.16	1.31 / 1.21 / 0.31	1.74 / 1.95 / 0.47	2.16 / 2.68 / 0.62	2.58 / 3.42 / 0.78	3.01 / 4.15 / 0.94	3.43 / 4.89 / 1.09	3.85 / 5.62 / 1.25	4.28 / 6.36 / 1.4	4.7 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
0.40	1.13 / 0.48 / 0.16	1.45 / 1.21 / 0.31	1.87 / 1.95 / 0.47	2.3 / 2.68 / 0.62	2.72 / 3.42 / 0.78	3.14 / 4.15 / 0.94	3.57 / 4.89 / 1.09	3.99 / 5.62 / 1.25	4.41 / 6.36 / 1.4	4.84 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
0.60	1.41 / 0.48 / 0.16	1.66 / 1.21 / 0.31	2.01 / 1.95 / 0.47	2.44 / 2.68 / 0.62	2.86 / 3.42 / 0.78	3.28 / 4.15 / 0.94	3.7 / 4.89 / 1.09	4.13 / 5.62 / 1.25	4.55 / 6.36 / 1.4	4.97 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
0.80	1.68 / 0.48 / 0.16	1.94 / 1.21 / 0.31	2.19 / 1.95 / 0.47	2.57 / 2.68 / 0.62	3 / 3.42 / 0.78	3.42 / 4.15 / 0.94	3.84 / 4.89 / 1.09	4.26 / 5.62 / 1.25	4.69 / 6.36 / 1.4	5.11 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
1.00	1.96 / 0.48 / 0.16	2.21 / 1.21 / 0.31	2.47 / 1.95 / 0.47	2.72 / 2.68 / 0.62	3.13 / 3.42 / 0.78	3.56 / 4.15 / 0.94	3.98 / 4.89 / 1.09	4.4 / 5.62 / 1.25	4.83 / 6.36 / 1.4	5.25 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
1.20	2.24 / 0.48 / 0.16	2.49 / 1.21 / 0.31	2.74 / 1.95 / 0.47	3 / 2.68 / 0.62	3.27 / 3.42 / 0.78	3.69 / 4.15 / 0.94	4.12 / 4.89 / 1.09	4.54 / 5.62 / 1.25	4.96 / 6.36 / 1.4	5.39 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
1.40	2.51 / 0.48 / 0.16	2.76 / 1.21 / 0.31	3.02 / 1.95 / 0.47	3.27 / 2.68 / 0.62	3.53 / 3.42 / 0.78	3.83 / 4.15 / 0.94	4.25 / 4.89 / 1.09	4.68 / 5.62 / 1.25	5.1 / 6.36 / 1.4	5.52 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
1.60	2.79 / 0.48 / 0.16	3.04 / 1.21 / 0.31	3.29 / 1.95 / 0.47	3.55 / 2.68 / 0.62	3.8 / 3.42 / 0.78	4.05 / 4.15 / 0.94	4.39 / 4.89 / 1.09	4.82 / 5.62 / 1.25	5.24 / 6.36 / 1.4	5.66 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
1.80	3.06 / 0.48 / 0.16	3.31 / 1.21 / 0.31	3.57 / 1.95 / 0.47	3.82 / 2.68 / 0.62	4.08 / 3.42 / 0.78	4.33 / 4.15 / 0.94	4.58 / 4.89 / 1.09	4.95 / 5.62 / 1.25	5.38 / 6.36 / 1.4	5.8 / 7.09 / 1.56	Not usable	Not usable	Not usable	Not usable
2.00	3.34 / 0.48 / 0.16	3.59 / 1.21 / 0.31	3.84 / 1.95 / 0.47	4.1 / 2.68 / 0.62	4.35 / 3.42 / 0.78	4.6 / 4.15 / 0.94	4.86 / 4.89 / 1.09	5.11 / 5.62 / 1.25	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.20	3.61 / 0.48 / 0.16	3.86 / 1.21 / 0.31	4.12 / 1.95 / 0.47	4.37 / 2.68 / 0.62	4.63 / 3.42 / 0.78	4.88 / 4.15 / 0.94	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.40	3.89 / 0.48 / 0.16	4.14 / 1.21 / 0.31	4.39 / 1.95 / 0.47	4.65 / 2.68 / 0.62	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.60	4.16 / 0.48 / 0.16	4.41 / 1.21 / 0.31	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.80	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.00	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.20	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.40	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.60	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.80	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation of elements in horizontal orientation - static application limits and anchoring forces

Specified values [kg]: Front ballast weight / rear ballast weight

Safety coefficients are taken into account in these tables. Ballast materials must be applied with their characteristic value (e.g. normal concrete: 2400 kg/m³)

30°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
0.40	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
0.60	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
0.80	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
1.00	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
1.20	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
1.40	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
1.60	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
1.80	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	573 / 706	638 / 788	Not usable	Not usable	Not usable	Not usable
2.00	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	443 / 543	508 / 625	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.20	53 / 53	118 / 135	183 / 217	248 / 298	313 / 380	378 / 461	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.40	53 / 53	118 / 135	183 / 217	248 / 298	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.60	53 / 53	118 / 135	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
2.80	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.00	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.20	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.40	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.60	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
3.80	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation - horizontal orientation

Element inclination 45°

Freestanding installation of elements in horizontal orientation - statical application limits and anchoring forces

Specified values [kN]: Maximum vertical compressive force / maximum vertical tensile force / maximum horizontal force

45°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.75 / 0.49 / 0.22	1.2 / 1.19 / 0.44	1.64 / 1.9 / 0.66	2.09 / 2.6 / 0.88	2.54 / 3.3 / 1.1	2.98 / 4 / 1.32	3.43 / 4.7 / 1.54	3.87 / 5.4 / 1.76	4.32 / 6.1 / 1.98	4.77 / 6.8 / 2.2	5.21 / 7.5 / 2.42	Not usable	Not usable	Not usable
0.40	0.79 / 0.49 / 0.22	1.24 / 1.19 / 0.44	1.68 / 1.9 / 0.66	2.13 / 2.6 / 0.88	2.57 / 3.3 / 1.1	3.02 / 4 / 1.32	3.47 / 4.7 / 1.54	3.91 / 5.4 / 1.76	4.36 / 6.1 / 1.98	4.8 / 6.8 / 2.2	5.25 / 7.5 / 2.42	Not usable	Not usable	Not usable
0.60	0.83 / 0.49 / 0.22	1.27 / 1.19 / 0.44	1.72 / 1.9 / 0.66	2.17 / 2.6 / 0.88	2.61 / 3.3 / 1.1	3.06 / 4 / 1.32	3.5 / 4.7 / 1.54	3.95 / 5.4 / 1.76	4.39 / 6.1 / 1.98	4.84 / 6.8 / 2.2	5.29 / 7.5 / 2.42	Not usable	Not usable	Not usable
0.80	0.87 / 0.49 / 0.22	1.31 / 1.19 / 0.44	1.76 / 1.9 / 0.66	2.2 / 2.6 / 0.88	2.65 / 3.3 / 1.1	3.09 / 4 / 1.32	3.54 / 4.7 / 1.54	3.99 / 5.4 / 1.76	4.43 / 6.1 / 1.98	4.88 / 6.8 / 2.2	5.32 / 7.5 / 2.42	Not usable	Not usable	Not usable
1.00	0.96 / 0.49 / 0.22	1.35 / 1.19 / 0.44	1.79 / 1.9 / 0.66	2.24 / 2.6 / 0.88	2.69 / 3.3 / 1.1	3.13 / 4 / 1.32	3.58 / 4.7 / 1.54	4.02 / 5.4 / 1.76	4.47 / 6.1 / 1.98	4.92 / 6.8 / 2.2	5.36 / 7.5 / 2.42	Not usable	Not usable	Not usable
1.20	1.05 / 0.49 / 0.22	1.39 / 1.19 / 0.44	1.83 / 1.9 / 0.66	2.28 / 2.6 / 0.88	2.72 / 3.3 / 1.1	3.17 / 4 / 1.32	3.62 / 4.7 / 1.54	4.06 / 5.4 / 1.76	4.51 / 6.1 / 1.98	4.95 / 6.8 / 2.2	5.4 / 7.5 / 2.42	Not usable	Not usable	Not usable
1.40	1.14 / 0.49 / 0.22	1.42 / 1.19 / 0.44	1.87 / 1.9 / 0.66	2.32 / 2.6 / 0.88	2.76 / 3.3 / 1.1	3.21 / 4 / 1.32	3.65 / 4.7 / 1.54	4.1 / 5.4 / 1.76	4.54 / 6.1 / 1.98	4.99 / 6.8 / 2.2	5.44 / 7.5 / 2.42	Not usable	Not usable	Not usable
1.60	1.23 / 0.49 / 0.22	1.46 / 1.19 / 0.44	1.91 / 1.9 / 0.66	2.35 / 2.6 / 0.88	2.8 / 3.3 / 1.1	3.24 / 4 / 1.32	3.69 / 4.7 / 1.54	4.14 / 5.4 / 1.76	4.58 / 6.1 / 1.98	5.03 / 6.8 / 2.2	5.47 / 7.5 / 2.42	Not usable	Not usable	Not usable
1.80	1.32 / 0.49 / 0.22	1.5 / 1.19 / 0.44	1.94 / 1.9 / 0.66	2.39 / 2.6 / 0.88	2.84 / 3.3 / 1.1	3.28 / 4 / 1.32	3.73 / 4.7 / 1.54	4.17 / 5.4 / 1.76	4.62 / 6.1 / 1.98	5.06 / 6.8 / 2.2	5.51 / 7.5 / 2.42	Not usable	Not usable	Not usable
2.00	1.42 / 0.49 / 0.22	1.59 / 1.19 / 0.44	1.98 / 1.9 / 0.66	2.43 / 2.6 / 0.88	2.87 / 3.3 / 1.1	3.32 / 4 / 1.32	3.77 / 4.7 / 1.54	4.21 / 5.4 / 1.76	4.66 / 6.1 / 1.98	5.1 / 6.8 / 2.2	5.55 / 7.5 / 2.42	Not usable	Not usable	Not usable
2.20	1.51 / 0.49 / 0.22	1.68 / 1.19 / 0.44	2.02 / 1.9 / 0.66	2.47 / 2.6 / 0.88	2.91 / 3.3 / 1.1	3.36 / 4 / 1.32	3.8 / 4.7 / 1.54	4.25 / 5.4 / 1.76	4.69 / 6.1 / 1.98	5.14 / 6.8 / 2.2	5.59 / 7.5 / 2.42	Not usable	Not usable	Not usable
2.40	1.6 / 0.49 / 0.22	1.77 / 1.19 / 0.44	2.06 / 1.9 / 0.66	2.5 / 2.6 / 0.88	2.95 / 3.3 / 1.1	3.39 / 4 / 1.32	3.84 / 4.7 / 1.54	4.29 / 5.4 / 1.76	4.73 / 6.1 / 1.98	5.18 / 6.8 / 2.2	5.62 / 7.5 / 2.42	Not usable	Not usable	Not usable
2.60	1.69 / 0.49 / 0.22	1.86 / 1.19 / 0.44	2.09 / 1.9 / 0.66	2.54 / 2.6 / 0.88	2.99 / 3.3 / 1.1	3.43 / 4 / 1.32	3.88 / 4.7 / 1.54	4.32 / 5.4 / 1.76	4.77 / 6.1 / 1.98	5.21 / 6.8 / 2.2	5.66 / 7.5 / 2.42	Not usable	Not usable	Not usable
2.80	1.78 / 0.49 / 0.22	1.95 / 1.19 / 0.44	2.13 / 1.9 / 0.66	2.58 / 2.6 / 0.88	3.02 / 3.3 / 1.1	3.47 / 4 / 1.32	3.91 / 4.7 / 1.54	4.36 / 5.4 / 1.76	4.81 / 6.1 / 1.98	5.25 / 6.8 / 2.2	5.7 / 7.5 / 2.42	Not usable	Not usable	Not usable
3.00	1.87 / 0.49 / 0.22	2.04 / 1.19 / 0.44	2.21 / 1.9 / 0.66	2.61 / 2.6 / 0.88	3.06 / 3.3 / 1.1	3.51 / 4 / 1.32	3.95 / 4.7 / 1.54	4.4 / 5.4 / 1.76	4.84 / 6.1 / 1.98	5.29 / 6.8 / 2.2	5.74 / 7.5 / 2.42	Not usable	Not usable	Not usable
3.20	1.96 / 0.49 / 0.22	2.13 / 1.19 / 0.44	2.3 / 1.9 / 0.66	2.65 / 2.6 / 0.88	3.1 / 3.3 / 1.1	3.54 / 4 / 1.32	3.99 / 4.7 / 1.54	4.44 / 5.4 / 1.76	4.88 / 6.1 / 1.98	5.33 / 6.8 / 2.2	5.77 / 7.5 / 2.42	Not usable	Not usable	Not usable
3.40	2.06 / 0.49 / 0.22	2.23 / 1.19 / 0.44	2.4 / 1.9 / 0.66	2.69 / 2.6 / 0.88	3.14 / 3.3 / 1.1	3.58 / 4 / 1.32	4.03 / 4.7 / 1.54	4.47 / 5.4 / 1.76	4.92 / 6.1 / 1.98	5.36 / 6.8 / 2.2	Not usable	Not usable	Not usable	Not usable
3.60	2.15 / 0.49 / 0.22	2.32 / 1.19 / 0.44	2.49 / 1.9 / 0.66	2.73 / 2.6 / 0.88	3.17 / 3.3 / 1.1	3.62 / 4 / 1.32	4.06 / 4.7 / 1.54	4.51 / 5.4 / 1.76	4.96 / 6.1 / 1.98	5.4 / 6.8 / 2.2	Not usable	Not usable	Not usable	Not usable
3.80	2.24 / 0.49 / 0.22	2.41 / 1.19 / 0.44	2.58 / 1.9 / 0.66	2.76 / 2.6 / 0.88	3.21 / 3.3 / 1.1	3.66 / 4 / 1.32	4.1 / 4.7 / 1.54	4.55 / 5.4 / 1.76	4.99 / 6.1 / 1.98	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	2.33 / 0.49 / 0.22	2.5 / 1.19 / 0.44	2.67 / 1.9 / 0.66	2.84 / 2.6 / 0.88	3.25 / 3.3 / 1.1	3.69 / 4 / 1.32	4.14 / 4.7 / 1.54	4.59 / 5.4 / 1.76	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Freestanding installation of elements in horizontal orientation - static application limits and anchoring forces

Specified values [kg]: Front ballast weight / rear ballast weight

Safety coefficients are taken into account in these tables. Ballast materials must be applied with their characteristic value (e.g. normal concrete: 2400 kg/m³)

45°	Gust velocity pressure [kN/m²]												
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
0.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
0.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
0.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
1.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
2.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.20	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	923 / 923	Not usable	Not usable	Not usable
3.40	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	Not usable	Not usable	Not usable	Not usable
3.60	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	837 / 837	Not usable	Not usable	Not usable	Not usable
3.80	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	751 / 751	Not usable	Not usable	Not usable	Not usable	Not usable
4.00	66 / 66	151 / 151	237 / 237	323 / 323	408 / 408	494 / 494	580 / 580	666 / 666	Not usable	Not usable	Not usable	Not usable	Not usable	Not usable

Wall installation - vertical orientation

Element inclination 20°

Wall installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kN]: maximum horizontal compressive force / maximum horizontal tensile force / maximum vertical force

20°

Snow load on the bottom [kN/m²]	Gust velocity pressure [kN/m²]													
	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
0.40	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
0.60	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
0.80	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
1.00	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
1.20	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
1.40	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
1.60	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
1.80	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
2.00	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
2.20	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
2.40	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
2.60	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
2.80	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
3.00	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
3.20	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
3.40	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
3.60	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
3.80	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3
4.00	0.28 / 0.35 / 0.65	0.45 / 0.58 / 0.7	0.63 / 0.81 / 0.75	0.81 / 1.04 / 0.8	0.98 / 1.28 / 0.85	1.16 / 1.55 / 0.9	1.33 / 1.82 / 0.95	1.51 / 2.09 / 1	1.68 / 2.36 / 1.05	1.86 / 2.63 / 1.1	2.03 / 2.9 / 1.15	2.21 / 3.17 / 1.2	2.38 / 3.44 / 1.25	2.56 / 3.71 / 1.3

Wall installation - vertical orientation

Element inclination 30°

Wall installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kN]: maximum horizontal compressive force / maximum horizontal tensile force / maximum vertical force

30°

Snow load on the bottom [kN/m²]	Gust velocity pressure [kN/m²]													
	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
0.40	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
0.60	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
0.80	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
1.00	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
1.20	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
1.40	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
1.60	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
1.80	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
2.00	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
2.20	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
2.40	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
2.60	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
2.80	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
3.00	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
3.20	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
3.40	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
3.60	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
3.80	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62
4.00	0.33 / 0.35 / 0.67	0.5 / 0.54 / 0.75	0.68 / 0.73 / 0.82	0.85 / 0.97 / 0.89	1.03 / 1.24 / 0.96	1.2 / 1.51 / 1.04	1.38 / 1.78 / 1.11	1.55 / 2.06 / 1.18	1.73 / 2.33 / 1.26	1.91 / 2.6 / 1.33	2.08 / 2.87 / 1.4	2.26 / 3.14 / 1.47	2.43 / 3.41 / 1.55	2.61 / 3.68 / 1.62

Wall installation - vertical orientation

Element inclination 45°

Wall installation of elements in vertical orientation - static application limits and anchoring forces

Specified values [kN]: maximum horizontal compressive force / maximum horizontal tensile force / maximum vertical force

45°	Gust velocity pressure [kN/m²]																			
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.39 / 0.38 / 0.74	0.54 / 0.5 / 0.82	0.69 / 0.82 / 0.91	0.84 / 1.14 / 0.99	0.99 / 1.47 / 1.08	1.15 / 1.79 / 1.17	1.3 / 2.12 / 1.26	1.45 / 2.44 / 1.35	1.6 / 2.77 / 1.44	1.75 / 3.09 / 1.52	1.9 / 3.42 / 1.61	2.05 / 3.74 / 1.7	2.2 / 4.07 / 1.79	2.35 / 4.39 / 1.88
0.40	0.42 / 0.43 / 0.82	0.57 / 0.52 / 0.87	0.72 / 0.82 / 0.95	0.87 / 1.14 / 1.04	1.02 / 1.47 / 1.12	1.17 / 1.79 / 1.21	1.33 / 2.12 / 1.3	1.48 / 2.44 / 1.39	1.63 / 2.77 / 1.48	1.78 / 3.09 / 1.57	1.93 / 3.42 / 1.65	2.08 / 3.74 / 1.74	2.23 / 4.07 / 1.83	2.38 / 4.39 / 1.92
0.60	0.48 / 0.49 / 0.9	0.6 / 0.56 / 0.96	0.75 / 0.82 / 1.01	0.9 / 1.14 / 1.08	1.05 / 1.47 / 1.17	1.2 / 1.79 / 1.25	1.35 / 2.12 / 1.34	1.51 / 2.44 / 1.43	1.66 / 2.77 / 1.52	1.81 / 3.09 / 1.61	1.96 / 3.42 / 1.7	2.11 / 3.74 / 1.78	2.26 / 4.07 / 1.87	2.41 / 4.39 / 1.96
0.80	0.54 / 0.56 / 0.99	0.63 / 0.62 / 1.04	0.78 / 0.82 / 1.09	0.93 / 1.14 / 1.14	1.08 / 1.47 / 1.21	1.23 / 1.79 / 1.3	1.38 / 2.12 / 1.38	1.53 / 2.44 / 1.47	1.69 / 2.77 / 1.56	1.84 / 3.09 / 1.65	1.99 / 3.42 / 1.74	2.14 / 3.74 / 1.83	2.29 / 4.07 / 1.91	2.44 / 4.39 / 2
1.00	0.6 / 0.62 / 1.07	0.69 / 0.69 / 1.12	0.81 / 0.82 / 1.18	0.96 / 1.14 / 1.23	1.11 / 1.47 / 1.28	1.26 / 1.79 / 1.34	1.41 / 2.12 / 1.43	1.56 / 2.44 / 1.51	1.71 / 2.77 / 1.6	1.87 / 3.09 / 1.69	2.02 / 3.42 / 1.78	2.17 / 3.74 / 1.87	2.32 / 4.07 / 1.96	2.47 / 4.39 / 2.04
1.20	0.66 / 0.69 / 1.15	0.75 / 0.75 / 1.21	0.84 / 0.82 / 1.26	0.99 / 1.14 / 1.31	1.14 / 1.47 / 1.36	1.29 / 1.79 / 1.42	1.44 / 2.12 / 1.47	1.59 / 2.44 / 1.56	1.74 / 2.77 / 1.64	1.89 / 3.09 / 1.73	2.05 / 3.42 / 1.82	2.2 / 3.74 / 1.91	2.35 / 4.07 / 2	2.5 / 4.39 / 2.09
1.40	0.72 / 0.75 / 1.24	0.81 / 0.82 / 1.29	0.9 / 0.88 / 1.34	1.02 / 1.14 / 1.39	1.17 / 1.47 / 1.45	1.32 / 1.79 / 1.5	1.47 / 2.12 / 1.55	1.62 / 2.44 / 1.61	1.77 / 2.77 / 1.69	1.92 / 3.09 / 1.77	2.07 / 3.42 / 1.86	2.23 / 3.74 / 1.95	2.38 / 4.07 / 2.04	2.53 / 4.39 / 2.13
1.60	0.78 / 0.81 / 1.32	0.87 / 0.88 / 1.37	0.96 / 0.95 / 1.42	1.05 / 1.14 / 1.48	1.2 / 1.47 / 1.53	1.35 / 1.79 / 1.58	1.5 / 2.12 / 1.64	1.65 / 2.44 / 1.69	1.8 / 2.77 / 1.74	1.95 / 3.09 / 1.82	2.1 / 3.42 / 1.9	2.25 / 3.74 / 1.99	2.41 / 4.07 / 2.08	2.56 / 4.39 / 2.17
1.80	0.84 / 0.88 / 1.4	0.93 / 0.95 / 1.46	1.02 / 1.01 / 1.51	1.11 / 1.14 / 1.56	1.23 / 1.47 / 1.61	1.38 / 1.79 / 1.67	1.53 / 2.12 / 1.72	1.68 / 2.44 / 1.77	1.83 / 2.77 / 1.83	1.98 / 3.09 / 1.88	2.13 / 3.42 / 1.95	2.28 / 3.74 / 2.03	2.43 / 4.07 / 2.12	2.59 / 4.39 / 2.21
2.00	0.89 / 0.94 / 1.49	0.99 / 1.01 / 1.54	1.08 / 1.08 / 1.59	1.17 / 1.14 / 1.64	1.26 / 1.47 / 1.7	1.41 / 1.79 / 1.75	1.56 / 2.12 / 1.8	1.71 / 2.44 / 1.86	1.86 / 2.77 / 1.91	2.01 / 3.09 / 1.96	2.16 / 3.42 / 2.01	2.31 / 3.74 / 2.08	2.46 / 4.07 / 2.16	2.61 / 4.39 / 2.25
2.20	0.95 / 1.01 / 1.57	1.04 / 1.07 / 1.62	1.13 / 1.14 / 1.67	1.22 / 1.21 / 1.73	1.32 / 1.47 / 1.78	1.44 / 1.79 / 1.83	1.59 / 2.12 / 1.89	1.74 / 2.44 / 1.94	1.89 / 2.77 / 1.99	2.04 / 3.09 / 2.05	2.19 / 3.42 / 2.1	2.34 / 3.74 / 2.15	2.49 / 4.07 / 2.21	2.64 / 4.39 / 2.29
2.40	1.01 / 1.07 / 1.65	1.1 / 1.14 / 1.7	1.19 / 1.21 / 1.76	1.28 / 1.27 / 1.81	1.37 / 1.47 / 1.86	1.47 / 1.79 / 1.92	1.62 / 2.12 / 1.97	1.77 / 2.44 / 2.02	1.92 / 2.77 / 2.08	2.07 / 3.09 / 2.13	2.22 / 3.42 / 2.18	2.37 / 3.74 / 2.23	2.52 / 4.07 / 2.29	2.67 / 4.39 / 2.34
2.60	1.07 / 1.14 / 1.74	1.16 / 1.2 / 1.79	1.25 / 1.27 / 1.84	1.34 / 1.34 / 1.89	1.43 / 1.47 / 1.95	1.52 / 1.79 / 2	1.65 / 2.12 / 2.05	1.8 / 2.44 / 2.11	1.95 / 2.77 / 2.16	2.1 / 3.09 / 2.21	2.25 / 3.42 / 2.26	2.4 / 3.74 / 2.32	2.55 / 4.07 / 2.37	2.7 / 4.39 / 2.42
2.80	1.13 / 1.2 / 1.82	1.22 / 1.27 / 1.87	1.31 / 1.33 / 1.92	1.4 / 1.4 / 1.98	1.49 / 1.47 / 2.03	1.58 / 1.79 / 2.08	1.68 / 2.12 / 2.14	1.83 / 2.44 / 2.19	1.98 / 2.77 / 2.24	2.13 / 3.09 / 2.29	2.28 / 3.42 / 2.35	2.43 / 3.74 / 2.4	2.58 / 4.07 / 2.45	2.73 / 4.39 / 2.51
3.00	1.19 / 1.27 / 1.9	1.28 / 1.33 / 1.95	1.37 / 1.4 / 2.01	1.46 / 1.47 / 2.06	1.55 / 1.53 / 2.11	1.64 / 1.79 / 2.17	1.73 / 2.12 / 2.22	1.86 / 2.44 / 2.27	2.01 / 2.77 / 2.33	2.16 / 3.09 / 2.38	2.31 / 3.42 / 2.43	2.46 / 3.74 / 2.48	2.61 / 4.07 / 2.54	2.76 / 4.39 / 2.59
3.20	1.25 / 1.33 / 1.98	1.34 / 1.4 / 2.04	1.43 / 1.46 / 2.09	1.52 / 1.53 / 2.14	1.61 / 1.6 / 2.2	1.7 / 1.79 / 2.25	1.79 / 2.12 / 2.3	1.89 / 2.44 / 2.36	2.04 / 2.77 / 2.41	2.19 / 3.09 / 2.46	2.34 / 3.42 / 2.51	2.49 / 3.74 / 2.57	2.64 / 4.07 / 2.62	2.79 / 4.39 / 2.67
3.40	1.31 / 1.39 / 2.07	1.4 / 1.46 / 2.12	1.49 / 1.53 / 2.17	1.58 / 1.59 / 2.23	1.67 / 1.66 / 2.28	1.76 / 1.79 / 2.33	1.85 / 2.12 / 2.39	1.94 / 2.44 / 2.44	2.07 / 2.77 / 2.49	2.22 / 3.09 / 2.54	2.37 / 3.42 / 2.6	2.52 / 3.74 / 2.65	2.67 / 4.07 / 2.7	2.82 / 4.39 / 2.76
3.60	1.37 / 1.46 / 2.15	1.46 / 1.53 / 2.2	1.55 / 1.59 / 2.26	1.64 / 1.66 / 2.31	1.73 / 1.72 / 2.36	1.82 / 1.79 / 2.42	1.91 / 2.12 / 2.47	2 / 2.44 / 2.52	2.1 / 2.77 / 2.57	2.25 / 3.09 / 2.63	2.4 / 3.42 / 2.68	2.55 / 3.74 / 2.73	2.7 / 4.07 / 2.79	2.85 / 4.39 / 2.84
3.80	1.43 / 1.52 / 2.23	1.52 / 1.59 / 2.29	1.61 / 1.66 / 2.34	1.7 / 1.72 / 2.39	1.79 / 1.79 / 2.45	1.88 / 1.86 / 2.5	1.97 / 2.12 / 2.55	2.06 / 2.44 / 2.61	2.15 / 2.77 / 2.66	2.28 / 3.09 / 2.71	2.43 / 3.42 / 2.76	2.58 / 3.74 / 2.82	2.73 / 4.07 / 2.87	2.88 / 4.39 / 2.92
4.00	1.49 / 1.59 / 2.32	1.58 / 1.65 / 2.37	1.67 / 1.72 / 2.42	1.76 / 1.79 / 2.48	1.85 / 1.85 / 2.53	1.94 / 1.92 / 2.58	2.03 / 2.12 / 2.64	2.12 / 2.44 / 2.69	2.21 / 2.77 / 2.74	2.31 / 3.09 / 2.79	2.46 / 3.42 / 2.85	2.61 / 3.74 / 2.9	2.76 / 4.07 / 2.95	2.91 / 4.39 / 3.01

Wall installation - horizontal orientation

Element inclination 20°

Wall installation of elements in horizontal orientation - static application limits and anchoring forces

Specified values [kN]: maximum horizontal compressive force / maximum horizontal tensile force / maximum vertical force

20°	Gust velocity pressure [kN/m²]													
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
0.40	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
0.60	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
0.80	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
1.00	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
1.20	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
1.40	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
1.60	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
1.80	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
2.00	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
2.20	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
2.40	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
2.60	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
2.80	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
3.00	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
3.20	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
3.40	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
3.60	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
3.80	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3
4.00	0.27 / 0.38 / 0.65	0.44 / 0.64 / 0.7	0.6 / 0.9 / 0.75	0.77 / 1.16 / 0.8	0.94 / 1.42 / 0.85	1.11 / 1.68 / 0.9	1.28 / 1.94 / 0.95	1.45 / 2.2 / 1	1.61 / 2.46 / 1.05	1.78 / 2.72 / 1.1	1.95 / 2.99 / 1.15	2.12 / 3.26 / 1.2	2.29 / 3.54 / 1.25	2.45 / 3.82 / 1.3

Wall installation - horizontal orientation

Element inclination 30°

Wall installation of elements in horizontal orientation - static application limits and anchoring forces

Specified values [kN]: maximum horizontal compressive force / maximum horizontal tensile force / maximum vertical force

30°	Gust velocity pressure [kN/m²]													
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
0.40	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
0.60	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
0.80	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
1.00	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
1.20	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
1.40	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
1.60	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
1.80	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
2.00	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
2.20	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
2.40	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
2.60	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
2.80	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
3.00	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
3.20	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
3.40	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
3.60	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
3.80	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62
4.00	0.31 / 0.38 / 0.67	0.48 / 0.59 / 0.75	0.65 / 0.81 / 0.82	0.82 / 1.02 / 0.89	0.99 / 1.28 / 0.96	1.15 / 1.56 / 1.04	1.32 / 1.84 / 1.11	1.49 / 2.12 / 1.18	1.66 / 2.39 / 1.26	1.83 / 2.67 / 1.33	2 / 2.95 / 1.4	2.16 / 3.23 / 1.47	2.33 / 3.51 / 1.55	2.5 / 3.79 / 1.62

Wall installation - horizontal orientation

Element inclination 45°

Wall installation of elements in horizontal orientation - static application limits and anchoring forces

Specified values [kN]: maximum horizontal compressive force / maximum horizontal tensile force / maximum vertical force

45°	Gust velocity pressure [kN/m²]														
Snow load on the bottom [kN/m²]	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
0.20	0.38 / 0.41 / 0.74	0.52 / 0.54 / 0.82	0.67 / 0.84 / 0.91	0.81 / 1.18 / 0.99	0.95 / 1.51 / 1.08	1.1 / 1.85 / 1.17	1.24 / 2.18 / 1.26	1.39 / 2.51 / 1.35	1.53 / 2.85 / 1.44	1.68 / 3.18 / 1.52	1.82 / 3.52 / 1.61	1.96 / 3.85 / 1.7	2.11 / 4.18 / 1.79	2.25 / 4.52 / 1.88
0.40	0.41 / 0.45 / 0.82	0.55 / 0.57 / 0.87	0.69 / 0.84 / 0.95	0.84 / 1.18 / 1.04	0.98 / 1.51 / 1.12	1.13 / 1.85 / 1.21	1.27 / 2.18 / 1.3	1.42 / 2.51 / 1.39	1.56 / 2.85 / 1.48	1.7 / 3.18 / 1.57	1.85 / 3.52 / 1.65	1.99 / 3.85 / 1.74	2.14 / 4.18 / 1.83	2.28 / 4.52 / 1.92
0.60	0.46 / 0.52 / 0.9	0.58 / 0.61 / 0.96	0.72 / 0.84 / 1.01	0.87 / 1.18 / 1.08	1.01 / 1.51 / 1.17	1.16 / 1.85 / 1.25	1.3 / 2.18 / 1.34	1.44 / 2.51 / 1.43	1.59 / 2.85 / 1.52	1.73 / 3.18 / 1.61	1.88 / 3.52 / 1.7	2.02 / 3.85 / 1.78	2.16 / 4.18 / 1.87	2.31 / 4.52 / 1.96
0.80	0.52 / 0.59 / 0.99	0.61 / 0.67 / 1.04	0.75 / 0.84 / 1.09	0.89 / 1.18 / 1.14	1.04 / 1.51 / 1.21	1.18 / 1.85 / 1.3	1.33 / 2.18 / 1.38	1.47 / 2.51 / 1.47	1.62 / 2.85 / 1.56	1.76 / 3.18 / 1.65	1.9 / 3.52 / 1.74	2.05 / 3.85 / 1.83	2.19 / 4.18 / 1.91	2.34 / 4.52 / 2
1.00	0.57 / 0.66 / 1.07	0.66 / 0.74 / 1.12	0.78 / 0.84 / 1.18	0.92 / 1.18 / 1.23	1.07 / 1.51 / 1.28	1.21 / 1.85 / 1.34	1.36 / 2.18 / 1.43	1.5 / 2.51 / 1.51	1.64 / 2.85 / 1.6	1.79 / 3.18 / 1.69	1.93 / 3.52 / 1.78	2.08 / 3.85 / 1.87	2.22 / 4.18 / 1.96	2.37 / 4.52 / 2.04
1.20	0.63 / 0.72 / 1.15	0.72 / 0.8 / 1.21	0.81 / 0.88 / 1.26	0.95 / 1.18 / 1.31	1.1 / 1.51 / 1.36	1.24 / 1.85 / 1.42	1.38 / 2.18 / 1.47	1.53 / 2.51 / 1.56	1.67 / 2.85 / 1.64	1.82 / 3.18 / 1.73	1.96 / 3.52 / 1.82	2.11 / 3.85 / 1.91	2.25 / 4.18 / 2	2.39 / 4.52 / 2.09
1.40	0.69 / 0.79 / 1.24	0.77 / 0.87 / 1.29	0.86 / 0.95 / 1.34	0.98 / 1.18 / 1.39	1.12 / 1.51 / 1.45	1.27 / 1.85 / 1.5	1.41 / 2.18 / 1.55	1.56 / 2.51 / 1.61	1.7 / 2.85 / 1.69	1.85 / 3.18 / 1.77	1.99 / 3.52 / 1.86	2.13 / 3.85 / 1.95	2.28 / 4.18 / 2.04	2.42 / 4.52 / 2.13
1.60	0.74 / 0.86 / 1.32	0.83 / 0.94 / 1.37	0.92 / 1.02 / 1.42	1.01 / 1.18 / 1.48	1.15 / 1.51 / 1.53	1.3 / 1.85 / 1.58	1.44 / 2.18 / 1.64	1.59 / 2.51 / 1.69	1.73 / 2.85 / 1.74	1.87 / 3.18 / 1.82	2.02 / 3.52 / 1.9	2.16 / 3.85 / 1.99	2.31 / 4.18 / 2.08	2.45 / 4.52 / 2.17
1.80	0.8 / 0.92 / 1.4	0.89 / 1 / 1.46	0.97 / 1.08 / 1.51	1.06 / 1.18 / 1.56	1.18 / 1.51 / 1.61	1.33 / 1.85 / 1.67	1.47 / 2.18 / 1.72	1.61 / 2.51 / 1.77	1.76 / 2.85 / 1.83	1.9 / 3.18 / 1.88	2.05 / 3.52 / 1.95	2.19 / 3.85 / 2.03	2.33 / 4.18 / 2.12	2.48 / 4.52 / 2.21
2.00	0.86 / 0.99 / 1.49	0.94 / 1.07 / 1.54	1.03 / 1.15 / 1.59	1.12 / 1.23 / 1.64	1.21 / 1.51 / 1.7	1.35 / 1.85 / 1.75	1.5 / 2.18 / 1.8	1.64 / 2.51 / 1.86	1.79 / 2.85 / 1.91	1.93 / 3.18 / 1.96	2.07 / 3.52 / 2.01	2.22 / 3.85 / 2.08	2.36 / 4.18 / 2.16	2.51 / 4.52 / 2.25
2.20	0.91 / 1.06 / 1.57	1 / 1.14 / 1.62	1.09 / 1.22 / 1.67	1.17 / 1.3 / 1.73	1.26 / 1.51 / 1.78	1.38 / 1.85 / 1.83	1.53 / 2.18 / 1.89	1.67 / 2.51 / 1.94	1.81 / 2.85 / 1.99	1.96 / 3.18 / 2.05	2.1 / 3.52 / 2.1	2.25 / 3.85 / 2.15	2.39 / 4.18 / 2.21	2.54 / 4.52 / 2.29
2.40	0.97 / 1.12 / 1.65	1.06 / 1.2 / 1.7	1.14 / 1.28 / 1.76	1.23 / 1.36 / 1.81	1.32 / 1.51 / 1.86	1.41 / 1.85 / 1.92	1.55 / 2.18 / 1.97	1.7 / 2.51 / 2.02	1.84 / 2.85 / 2.08	1.99 / 3.18 / 2.13	2.13 / 3.52 / 2.18	2.28 / 3.85 / 2.23	2.42 / 4.18 / 2.29	2.56 / 4.52 / 2.34
2.60	1.03 / 1.19 / 1.74	1.11 / 1.27 / 1.79	1.2 / 1.35 / 1.84	1.29 / 1.43 / 1.89	1.37 / 1.51 / 1.95	1.46 / 1.85 / 2	1.58 / 2.18 / 2.05	1.73 / 2.51 / 2.11	1.87 / 2.85 / 2.16	2.02 / 3.18 / 2.21	2.16 / 3.52 / 2.26	2.3 / 3.85 / 2.32	2.45 / 4.18 / 2.37	2.59 / 4.52 / 2.42
2.80	1.09 / 1.26 / 1.82	1.17 / 1.34 / 1.87	1.26 / 1.42 / 1.92	1.34 / 1.5 / 1.98	1.43 / 1.58 / 2.03	1.52 / 1.85 / 2.08	1.61 / 2.18 / 2.14	1.76 / 2.51 / 2.19	1.9 / 2.85 / 2.24	2.04 / 3.18 / 2.29	2.19 / 3.52 / 2.35	2.33 / 3.85 / 2.4	2.48 / 4.18 / 2.45	2.62 / 4.52 / 2.51
3.00	1.14 / 1.32 / 1.9	1.23 / 1.4 / 1.95	1.31 / 1.48 / 2.01	1.4 / 1.56 / 2.06	1.49 / 1.64 / 2.11	1.57 / 1.85 / 2.17	1.66 / 2.18 / 2.22	1.78 / 2.51 / 2.27	1.93 / 2.85 / 2.33	2.07 / 3.18 / 2.38	2.22 / 3.52 / 2.43	2.36 / 3.85 / 2.48	2.51 / 4.18 / 2.54	2.65 / 4.52 / 2.59
3.20	1.2 / 1.39 / 1.98	1.28 / 1.47 / 2.04	1.37 / 1.55 / 2.09	1.46 / 1.63 / 2.14	1.54 / 1.71 / 2.2	1.63 / 1.85 / 2.25	1.72 / 2.18 / 2.3	1.81 / 2.51 / 2.36	1.96 / 2.85 / 2.41	2.1 / 3.18 / 2.46	2.24 / 3.52 / 2.51	2.39 / 3.85 / 2.57	2.53 / 4.18 / 2.62	2.68 / 4.52 / 2.67
3.40	1.26 / 1.46 / 2.07	1.34 / 1.54 / 2.12	1.43 / 1.62 / 2.17	1.51 / 1.7 / 2.23	1.6 / 1.78 / 2.28	1.69 / 1.86 / 2.33	1.77 / 2.18 / 2.39	1.86 / 2.51 / 2.44	1.98 / 2.85 / 2.49	2.13 / 3.18 / 2.54	2.27 / 3.52 / 2.6	2.42 / 3.85 / 2.65	2.56 / 4.18 / 2.7	2.71 / 4.52 / 2.76
3.60	1.31 / 1.53 / 2.15	1.4 / 1.61 / 2.2	1.48 / 1.68 / 2.26	1.57 / 1.76 / 2.31	1.66 / 1.84 / 2.36	1.74 / 1.92 / 2.42	1.83 / 2.18 / 2.47	1.92 / 2.51 / 2.52	2.01 / 2.85 / 2.57	2.16 / 3.18 / 2.63	2.3 / 3.52 / 2.68	2.45 / 3.85 / 2.73	2.59 / 4.18 / 2.79	2.73 / 4.52 / 2.84
3.80	1.37 / 1.59 / 2.23	1.46 / 1.67 / 2.29	1.54 / 1.75 / 2.34	1.63 / 1.83 / 2.39	1.71 / 1.91 / 2.45	1.8 / 1.99 / 2.5	1.89 / 2.18 / 2.55	1.97 / 2.51 / 2.61	2.06 / 2.85 / 2.66	2.19 / 3.18 / 2.71	2.33 / 3.52 / 2.76	2.47 / 3.85 / 2.82	2.62 / 4.18 / 2.87	2.76 / 4.52 / 2.92
4.00	1.43 / 1.66 / 2.32	1.51 / 1.74 / 2.37	1.6 / 1.82 / 2.42	1.68 / 1.9 / 2.48	1.77 / 1.98 / 2.53	1.86 / 2.06 / 2.58	1.94 / 2.18 / 2.64	2.03 / 2.51 / 2.69	2.12 / 2.85 / 2.74	2.21 / 3.18 / 2.79	2.36 / 3.52 / 2.85	2.5 / 3.85 / 2.9	2.65 / 4.18 / 2.95	2.79 / 4.52 / 3.01

Freestanding installation

General instructions

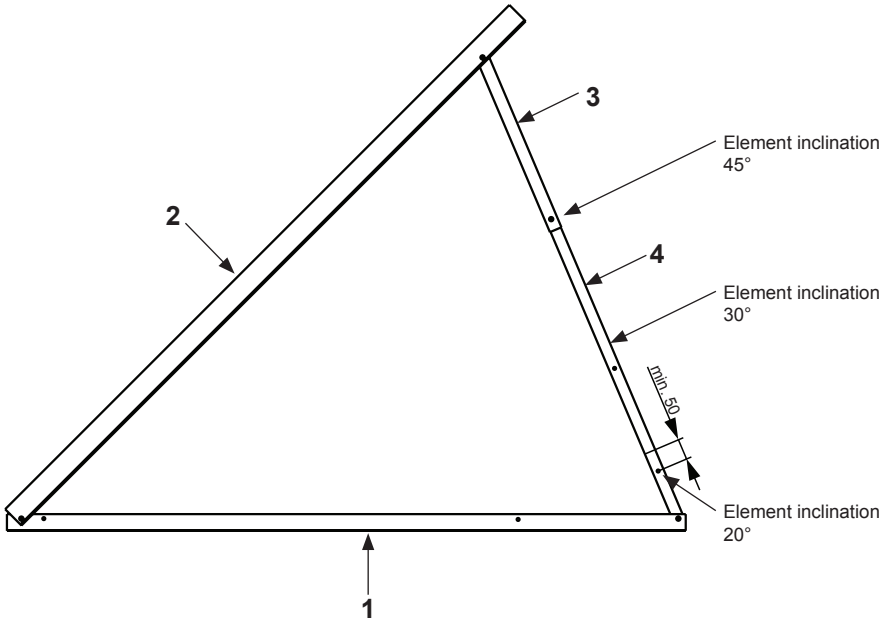
Before assembling the static capability of the roof and/or the wall surface is to be checked and, if required, a structural engineer to be consulted.

Warning

Only authorised experts are permitted to carry out the installation. These experts are responsible for the proper installation.

All screws of the triangle stand in the delivery state are hand-tight. The screws are to be tightened on site such that the screw locking reliability is ensured.

Setting options of the triangle stand

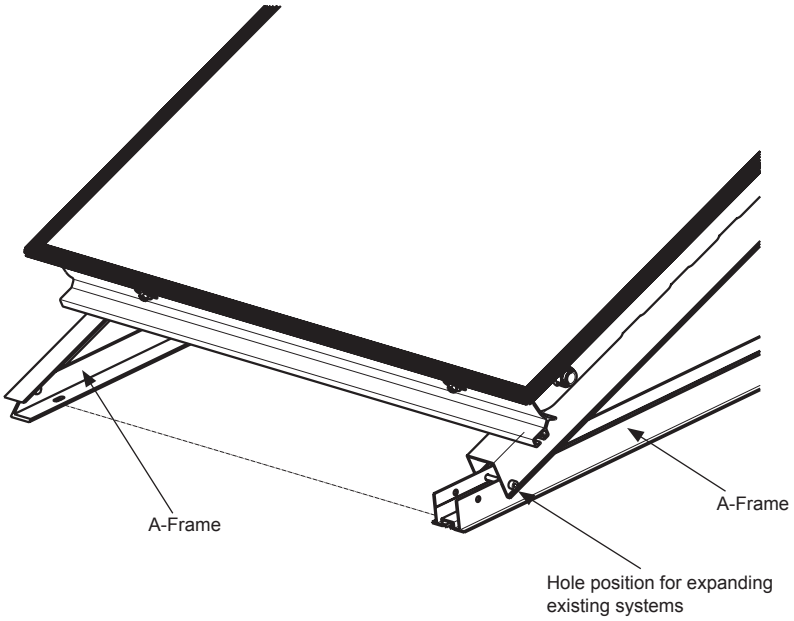


In the delivery state, the triangle stand is pre-mounted. It comprises the *base rail (1)*, *bearing rail (2)*, *upper support rail (3)* and *lower support rail (4)*. The lower support rail has preset holes for setting the inclination angles of 20°, 30° and 45°. The desired inclination angle of the triangle stand is set by inserting the setting screw into the corresponding hole. At the angle setting of 20°, the support rail must be cut to length at least 50 mm above the corresponding setting hole.

Freestanding installation

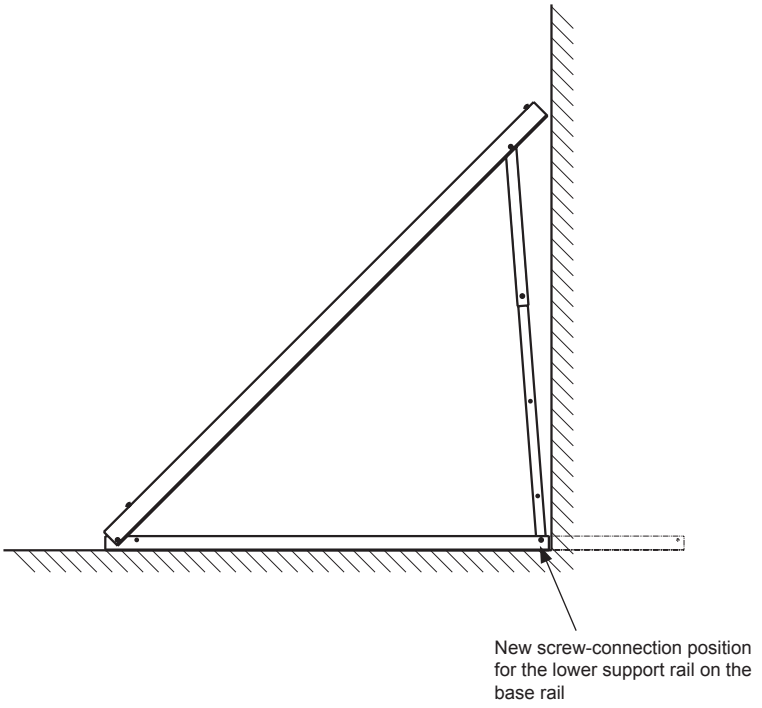
Compatibility with already installed Trigon solar thermal A-Frames"

The screw-connection position of the *bearing rail* on the *base rail* can be adapted using a pre-bored hole to expand existing systems.



Installation against a wall

It is also possible to change the screw-connection position of the *lower support rail* on the *base rail* so that the A-Frame can be mounted directly against a wall during the freestanding installation. The *base rail* must be shortened. Holes for the desired element inclination must be drilled in the *lower support rail* on site.



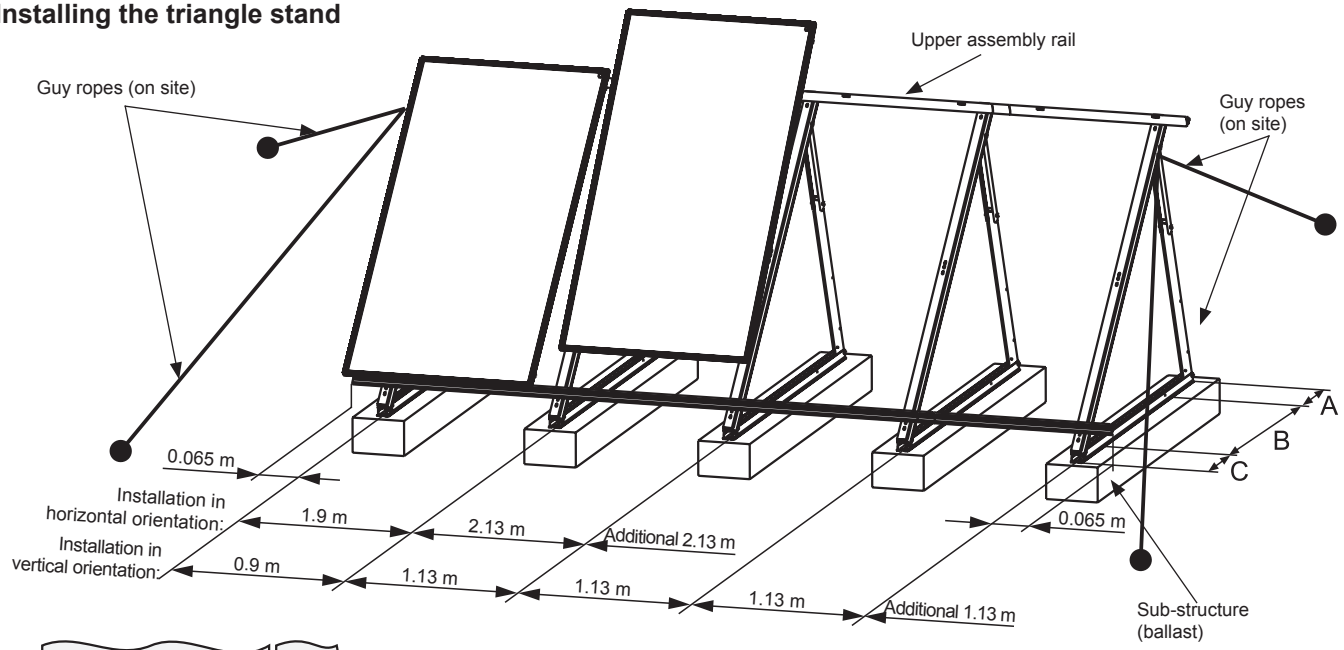
Reference dimensions for determining the collector field width

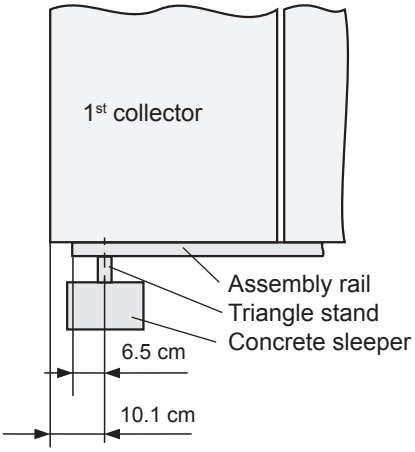
Warning: without the space required for mounting the pipe connections.

Collector quantity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Width [m] vertical orientation	-	2.23	3.36	4.49	5.62	6.75	7.88	9.01	10.14	11.27
Width [m] horizontal orientation	2.1	4.23	6.36	8.49	10.62	12.75	14.88	17.01	19.14	21.27

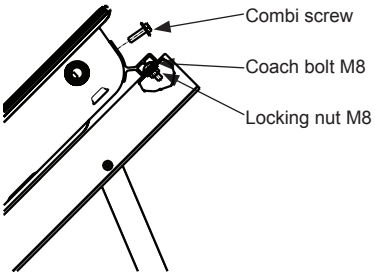
Freestanding installation

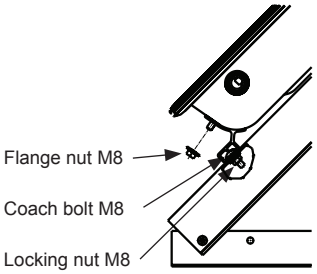
Installing the triangle stand

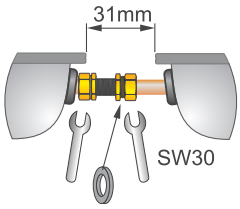




Fastening holes Ø 10 mm	A	B	C
Trigon horizontal collectors	150 mm	862 mm	168 mm
Trigon vertical collectors	150 mm	1800 mm	168 mm



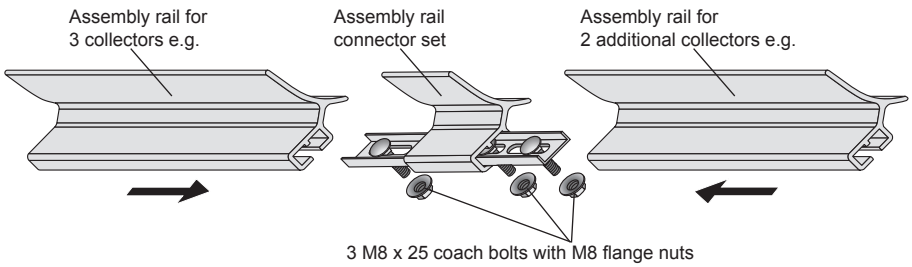




Warning

- Are the seals available?
- Maintain proper distance
- Align the screw connection parts
- **Hold up** with another open-end spanner.
  Maximum tightening torque 20 Nm

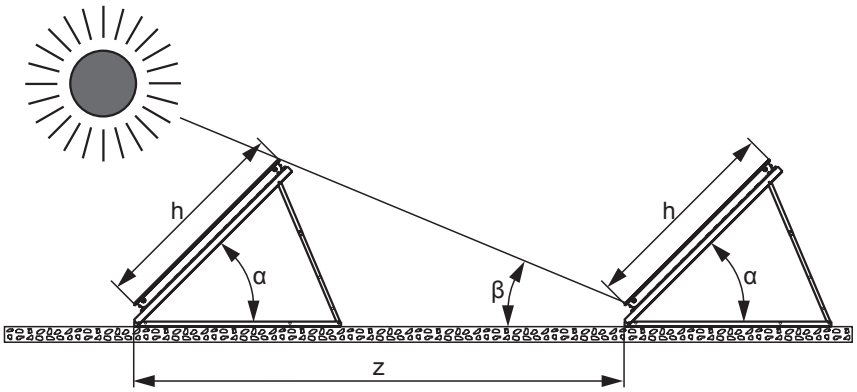
1. Preparation of adequate sub-structure as described in the planning document (e.g. using concrete sleepers) (on site).
2. Screwing the triangle stand to the sub-structure.
   Securing the triangle stand using guy ropes if required (on site).
3. Fixing the lower/upper assembly rails on the triangle stand using M8 coach bolts.
4. Inserting the collector and threaded pins into the lower assembly rail as shown in the figure, then securing using M8 locking nuts such that they are hand-tight.
5. Sliding the M8 x 20 combi screws through the upper assembly rail and turning into the collector such that they are hand-tight.
6. Installing other collectors in the same manner.
7. Screwing the connections for supply and return lines. Checking the seals.
8. Tightening all screws and nuts for fixing the collectors.



Freestanding installation

Determining the collector row spacing "z" for freestanding installation

To avoid undesired shading of the collector surface, a specific spacing (dimension z) must be maintained when installing multiple collector rows. The shading angle β in UK is between 16° (Plymouth) and 9° (Aberdeen) depending on the latitude.



$$\frac{z}{h} = \frac{\sin(180° - (\alpha + \beta))}{\sin \beta}$$

z = collector row spacing
h = collector height
α = collector inclination angle
β = angle of the sun position

Collector height for the horizontal orientation = 1100 mm
Collector height for the vertical orientation = 2105 mm

Example of an installation site in Plymouth:
The latitude of Plymouth is approximately 50.
Angle β = 90° - 23.5° - latitude
(23.5° must be assumed as constant)
90° - 23.5° - 50° = 16.5°

Installation in vertical orientation:

Trigon vertical collector
h = 2100 mm
Collector inclination α = 45°
β = 16,5°

$$z = \frac{h \bullet \sin(180° - (\alpha + \beta))}{\sin \beta}$$

$$z = \frac{2100\ mm \bullet \sin(180° - 61.5°)}{\sin 16.5°}$$

z = 6500 mm

Installation in horizontal orientation:

Trigon horizontal collector
h = 1100mm
Collector inclination α = 45°
β = 16,5°

$$z = \frac{h \bullet \sin(180° - (\alpha + \beta))}{\sin \beta}$$

$$z = \frac{1100\ mm \bullet \sin(180° - 61.5°)}{\sin 16.5°}$$

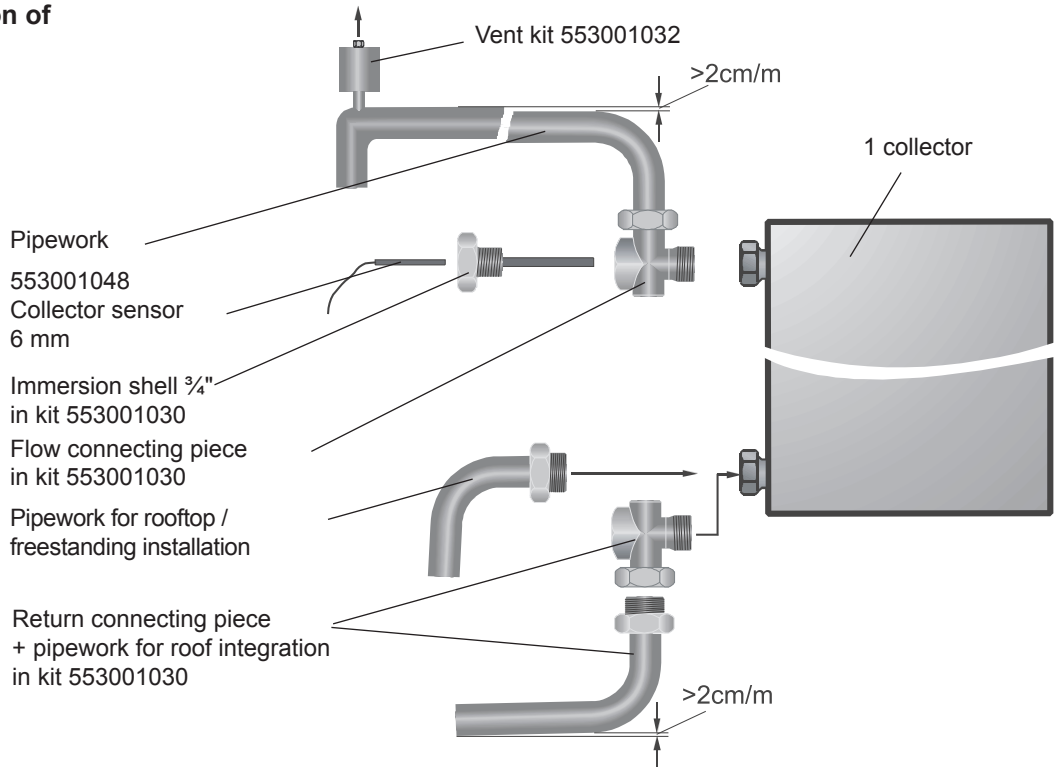
z = 3400 mm

Pipework / installation of collector sensor / filling the system / safety data sheet

Instructions regarding system hydraulics

- The collectors can be connected single-sided (up to 5 collectors next to each other) or alternating diagonally (up to 10 collectors next to each other).
- The pipes reach very high temperatures close to the collectors.
- Only the seals provided may be used.
- Insulating materials must be temperature-resistant (>175 °C) and must also be UV-resistant and weatherproof in the outdoor area.
- Do not use galvanised pipes, fittings etc.
- Installation of the vents
- Install an automatic vent suitable for solar heating systems at the highest point of each collector field. The shut-off valves of the vents must be manually closed after completely venting the system.

Pipework and installation of the sensor



Filling the system

For flushing and filling the solar heating system we recommend the use of a filling and flushing pump for at least 30 to 60 minutes! Manual venting can then be dispensed with.

Except from the safety data sheet:

Trade name: Company: Emergency information	Tyfocor L heating fluid (frost protection to -17°C) TYFOCOR Chemie GmbH, AntonRée-Weg 7, D-20537 Hamburg; Phone: 49 040 20 94 97 0; Fax: 49 040 20 949 7 20; E-mail: info@tyfo.de Tel.: 49 040 20 94 97 0
Chemical characterisation:	1,2-propylene glycol with corrosion inhibitors, 40 % by vol. mixed with 60 % by vol. drinking water, coloured blue
Special hazard information for humans and environment:	not necessary
After eye contact: After skin contact: After swallowing:	Rinse out for 15 minutes under running water with eyelids spread Wash off with soap and water. Rinse out mouth and drink plenty of water.
Transport: Water hazard class:	Not a hazardous material within the meaning of the transport regulations WHC1; weakly hazardous to water.

Leak test / commissioning

Leak test

In the case of strong sunlight, the test is to be performed only with the collectors covered over. There is otherwise a danger of being scalded.

For the leak test with Tyfocor L, a 6 bar relief valve and a manometer must be incorporated into the solar pipes.

Test at 5-6 bar over a period of at least 45 minutes.

When testing with water, very small leaks can remain undiscovered because of the higher surface tension.

Testing with air is not permissible. The failure of components under high air pressure can give rise to potentially fatal situations.

Following the leak test or commissioning, the system pressure is lowered to 3.0 bar.

Note about lightning protection

If a lightning protection system as per BS EN 50164-1 already exists, the collector system must be properly integrated into it. If no lightning protection system exists, the solar feed and return pipes must normally be connected to the potential equalisation in the cellar. The local regulations are to be observed. Electrical and lightning protection work may be carried out only by approved specialist companies.

Start-up

Commissioning is to be carried out in accordance with the checklist.

Requirements:

- Leak test has been carried out.
- System is filled with Tyfocor L. The system pressure in a cold condition is set so there is a static pressure of 0.5 bar in the collectors.
- The entire solar heating circuit has been vented; all shut-off devices and non-return valves are to be opened for complete venting.
- Activate the circulation pump(s) in manual mode; repeat this procedure several times if necessary. Close the non-return valves after venting.
- Controller is ready for operation.

Warning: the respective instructions for the heat exchanger, pump and controller are to be observed separately.

Return of collectors

Collectors surplus to requirement can be returned to Hamworthy Heating Ltd, subject to a restocking charge. They must be clearly marked and delivered to the company's office during office hours.

Should collectors be damaged during transit these may not be returned until they have been inspected by a Hamworthy Heating Ltd representative.

Packaging

For environmental reasons, please take the polystyrene packaging to suitable recycling collection points.

Dispose of heating liquid, for example, at the recycling centre.

Start-up

See document 'Commissioning protocol for solar collector hot water systems'.

Operation / servicing

Operation

- Due to the temperature difference between the outside air and the collector, a thin mist may be generated particularly in the early morning hours. This disappears again as the collector heats up.
- If possible, do not switch the system off electrically during exposure to the sun. After possible steam formation in the case of very high solar yield, the system starts up again automatically after cooling down.
- It is not necessary to switch on the overheating protection function in the controller with flat plate collectors.
- No particular precautions need to be taken if no hot water is needed, for example when on holiday.
- If the system pressure varies strongly, or if Tyfocor L heating fluid escapes from the safety valve, the system must be checked by a specialist.

Servicing

- Service work may be carried out only by a specialist.
- The high-performance flat plate collectors require little maintenance. An annual inspection and need-based servicing are recommended for the complete system. Therefore, we recommend that you take out a service contract.
- If the system pressure fluctuates or there are loud pump noises, the system must be vented at the highest point.
- The system pressure must be checked.

Warning

- Depending upon operating conditions, the heating fluid consisting of 40 % Tyfocor L is to be checked annually in order to prevent decomposition and, hence, damage to the pipework.
- Remove a small quantity of heating fluid at the safety valve or the filling and drain valve
- Check the colour.
- No action is required if coloured blue.
- If coloured brown, perform a pH test. If the pH value is less than pH 7, the entire heating fluid must be exchanged by a specialist.
- Check frost protection
- Frost protection must be ensured in accordance with the climate zone. We recommend the exchange of the heating fluid from frost protection of less than 25 °C.
- Water must not be used to top up in the event of a shortfall. There is otherwise a danger of the loss of frost protection, leading to frost damage to the system in the case of snow and very low temperatures.

Warning

- Heat exchangers and thermostatic mixing valves are to be checked for limescale and function.
- After restarting, the flow rate is to be checked on the flow meter.
- It is recommended to check the control parameters for inadvertent misadjustment.

Servicing:

The following checks and maintenance measures should be performed regularly (once per year):

- Clean the glass surface of the solar collectors.
- Check and, if necessary, replace the seals and connections.
- Check pipe insulation for damage and replace if necessary.
- Check the pressure in the primary circuit.
- Check the freezing point of the heating fluid (preferably at the beginning of winter).
- Check the pH value of the heating fluid (pH reference value 7.5) to prevent corrosion in the primary circuit.

See document ‘Servicing instructions for solar collector hot water systems’

Notes

Notes

Hamworthy Heating Accredited Agents

Southern Ireland (Sales & Service)
HEVAC Limited
Naas Road, Dublin 12, Ireland
tel: **00 353 141 91919** fax: **00 353 145 84806**
email: **info@hevac.ie**

Northern Ireland (Sales & Service)
HVAC Supplies Limited
Unit A6, Dargan Court, Dargan Crescent, Belfast BT3 9JP
tel: **028 9077 7737**
email: **hvacsupplies@btconnect.com**

Scotland (Sales & Service)
McDowall Modular Services
2 Penson Road, Queenslie Industrial Estate, Glasgow, G33 4AG
tel: **0141 336 8795** fax: **0141 336 8954**
email:
MMS.McDowallModularServices@hamworthy-heating.com

North East England (Service)
Allison Heating Products
12 Sunnyside Lane, Cleadon Village, Sunderland SR6 7XB
tel: **0191 536 8833** fax: **0191 536 9933**
email: **allison.heating@gmail.com**

Hamworthy Heating Customer Service Centre

Sales
tel: **01202 662552**
email: **sales@hamworthy-heating.com**

Technical Enquiries
tel: **01202 662505**
email: **technical@hamworthy-heating.com**

Servicing
tel: **01202 662555**
email: **service@hamworthy-heating.com**

Spares
tel: **01202 662525**
email: **spares@hamworthy-heating.com**

British engineering excellence from Hamworthy Heating;
the commercial heating and hot water specialists.

Hamworthy

Customer Service Centre
Hamworthy Heating Limited,
Wessex House,
New Fields Business Park,
Stinsford Road,
Poole,
Dorset,
BH17 0NF

Telephone: **01202 662500**
Fax: **01202 662522**
Email: **service@hamworthy-heating.com**
Website: **www.hamworthy-heating.com**