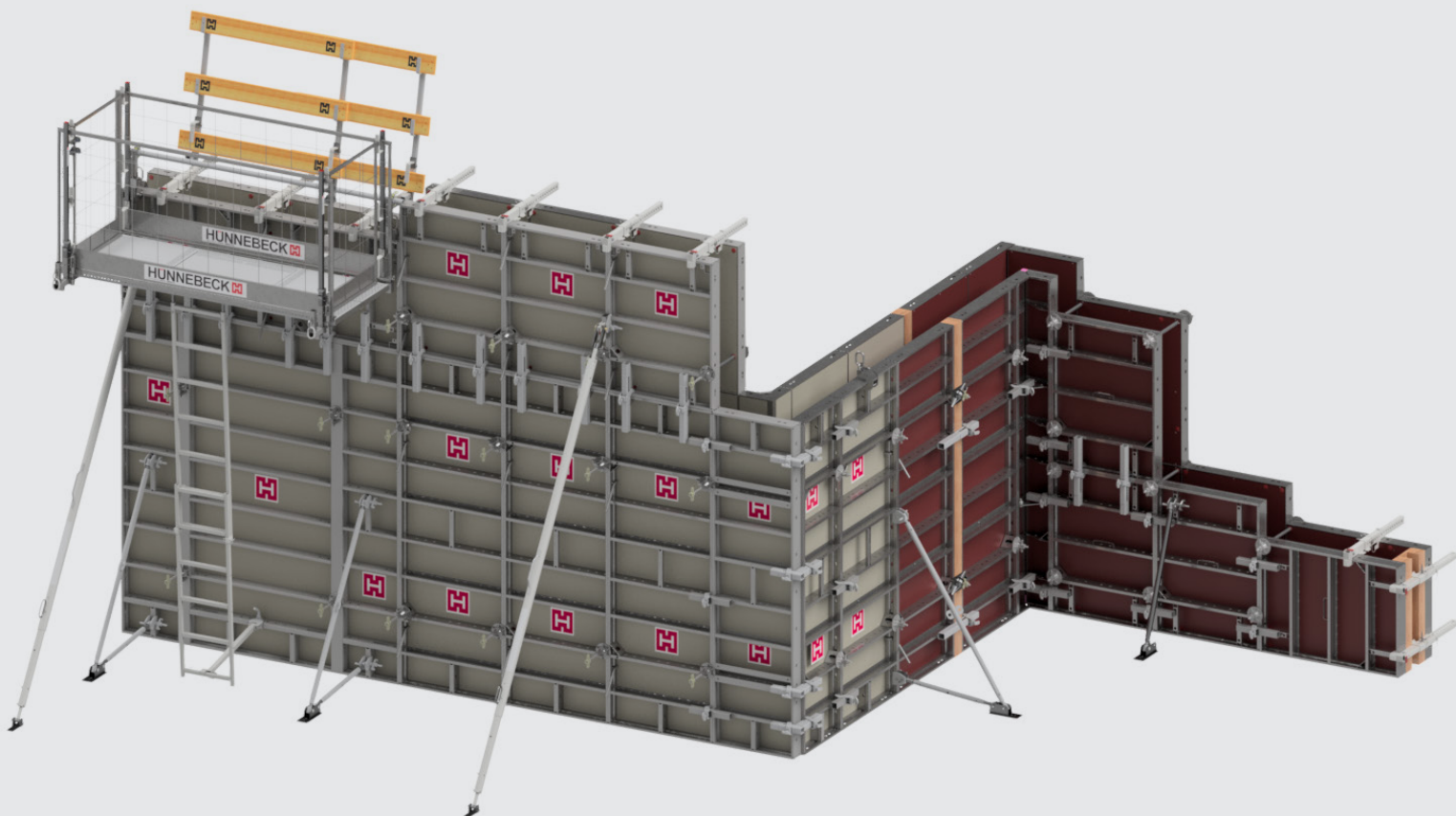


RASTO[®]-TAKKO[®]

Frame panel formwork

User guide



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1 Product description

1.1 Introduction

RASTO/TAKKO is frame panel formwork that can be assembled manually without a crane or, in the event of a large-scale installation, with a crane. TAKKO Panels up to 90 cm wide can be assembled by hand.

A crane has to be used to move large RASTO XXL panels or panel assemblies.

RASTO/TAKKO formwork has hot-dip galvanized steel profiles equipped with high grade 15 mm plastic form linings or 14 mm plywood sheets.

The permitted fresh concrete pressure for RASTO and TAKKO is up to 60 kN/m² for non-stacked use as well as when the panels are stacked. The flatness tolerance specified in table 3 of the standard DIN 18202 2013-04, line 6 is thus complied with.

The seven different panel widths available, from 30 cm to 240 cm, make it easy to adapt the formwork to nearly any type of structure.

And the desired height can be easily achieved by combining the various panel heights: 120 cm (TAKKO) and 150 cm and 270 cm (RASTO).

All vertical, horizontal and stacked formwork elements are secured to one another with the RASTO Aligning Panel Clamp. The panels fit tightly together and are properly aligned, and the joints are resistant to tension.

1.2 Intended use

The standard assembly of the RASTO/TAKKO concrete formwork shown in this user guide is intended to be used to mould concrete elements and to divert the resulting loads.

The RASTO/TAKKO formwork and its accessories may be used for the following purposes:

- Moulding vertical concrete elements such as foundations, walls and columns
- Moulding horizontal concrete elements such as ceilings and beams
- Bearing the load of components, accessories, equipment, reinforcement and assembly
- Absorbing the load of freshly poured concrete until the structure itself reaches a sufficient load capacity.

Always observe the permissible loads of the individual components.

HÜNNEBECK products are intended to be used only by properly trained persons and only for commercial purposes.

2 General information

2.1 Safety instructions

Notes on intended and safe use of formwork and falsework

The contractor is obligated to compile a risk assessment and assembly instructions.

Assembly instructions are not the same thing as a user guide.

Risk assessment

The contractor is responsible for the compilation, documentation, implementation and revision of a risk assessment for each construction site. His employees are required to implement the resulting measures in accordance with applicable law.

Assembly instructions

The contractor is responsible for compiling a written set of assembly instructions. The user guide is a fundamental aspect of the assembly instructions.

User guide

Formwork is work equipment which is intended for commercial use only. The equipment may be used only by properly trained personnel under the authority of qualified supervisors.

The user guide is an essential component of the formwork. It contains, at a minimum, safety notes, information on the standard configuration, the intended use and a description of the system.

Carefully follow the instructions on use and assembly of the equipment (standard configuration) contained in the user guide. Extensions, deviations or changes pose a potential risk that requires separate certification (with the aid of a risk assessment and proof of structural integrity) or assembly instructions that take into account the relevant laws, standards and safety regulations. The same applies in cases where formwork and falsework components are provided on site.

Availability of the user guide

The contractor has to ensure that site personnel are familiar with the user guide provided by the manufacturer or the formwork supplier and that it is readily accessible at all times. The user guide must be legible and complete. A replacement user guide can be obtained from HÜNNEBECK.

Illustrations

Some of the illustrations in the assembly instructions are various states of assembly and not always complete in terms of safety considerations. Safety devices may not always appear in the illustrations, but they are nevertheless mandatory.

Storage and transportation

The special requirements of the respective formwork and falsework constructions regarding transportation procedures as well as storage must be complied with. An example of such a requirement is the use of slings.

Material check

Formwork and falsework material deliveries are to be checked on arrival at the construction site/place of destination as well as before each use to ensure that they are in perfect condition and function correctly. Modifications to the formwork materials are not permitted.

Spare parts and repairs

Only original components may be used as spare parts. Repairs may be performed only by the manufacturer or authorised facilities.

Use of other products

Combining formwork components from different manufacturers carries certain risks. Examine such components individually for suitability; they may require a separate user guide.

Miscellaneous

We explicitly reserve the right to make changes resulting from technical improvements. For the safety-related application and use of the products, all current country-specific laws, standards as well as other safety regulations are to be complied with, without exception. They are an essential component of the employer's and employees' obligations in regard to occupational health and safety. This results in, among other things, the responsibility of the contractor to ensure the stability of the formwork and falsework constructions as well as the structure during all stages of construction. This also includes the basic assembly, dismantling and transport of the formwork and falsework along with their components. Inspect the entire structure during and upon completion of assembly.

2.2 Special safety instructions

Transporting loads

Never exceed the maximum safe working load of the lifting accessories!

Always comply with the operating instructions for the lifting accessory! The operating instructions describe in detail how to use the lifting accessory.

The lifting accessory may be used to transport only the loads expressly permitted by the operating instructions!

Before beginning transport, always check that the lifting accessory is properly attached to the load!

Verify that there are no persons under suspended loads!


Verify that no persons within the swivel range of the crane are in danger.


2.3 About this user guide


This user guide contains important information on how to work safely and effectively with RASTO/TAKKO. It is essential that you carefully read the entire user guide before erecting and using the RASTO/TAKKO formwork system. Keep the user guide nearby and save it as a reference.

This user guide is designed for commercial users with proper professional training. The information and procedures described here comply with the laws and the occupational health and safety regulations of Germany and Austria. Hünnebeck assumes no liability for deviations from the contents and processes described or for use outside this area of application.


2.3.1 Warnings and notes

 DANGER	Danger! Danger indicates a hazardous situation that, if not avoided, will cause death or serious injury.
---	--


 WARNING	Warning! Warning indicates a hazardous situation that, if not avoided, can cause death or serious injury.
--	---


 CAUTION	Caution! Caution indicates a hazardous situation that, if not avoided, can cause minor or moderate injury.
--	--

NOTE	Note! Note indicates a hazard that can cause property damage.
-------------	---

	This note indicates that an additional inspection is required.
---	--

	This note shares practical experience with the user, e.g. how to perform a task more easily or quickly.
---	---

	This note indicates particularly important information, e.g. that a requirement has to be fulfilled.
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	This symbol indicates that additional information from other documents is required. These documents could be user guides or operating instructions for other products.
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2.3.2 Instructions

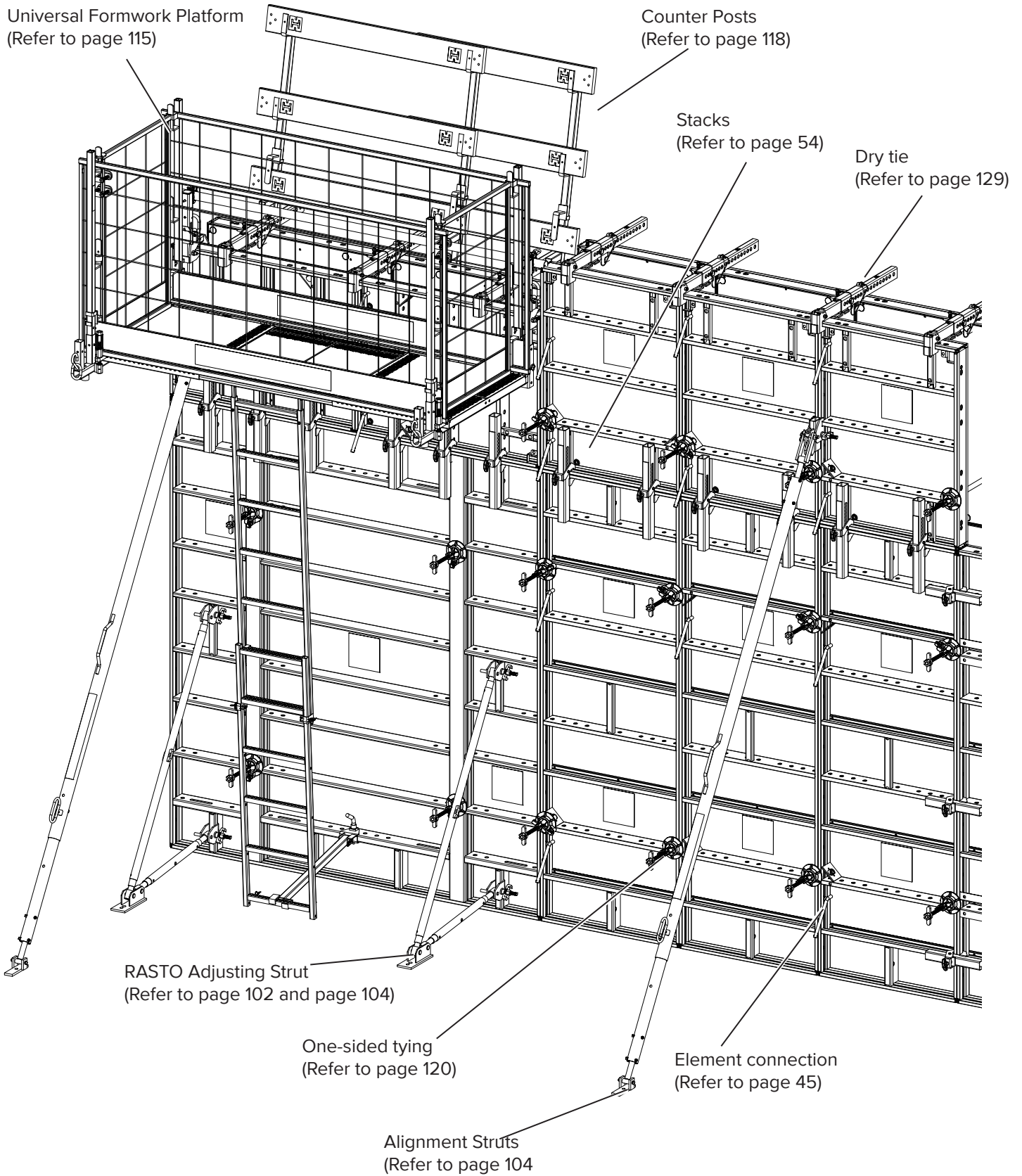
Instructions are always identified with the word **Step** e.g.

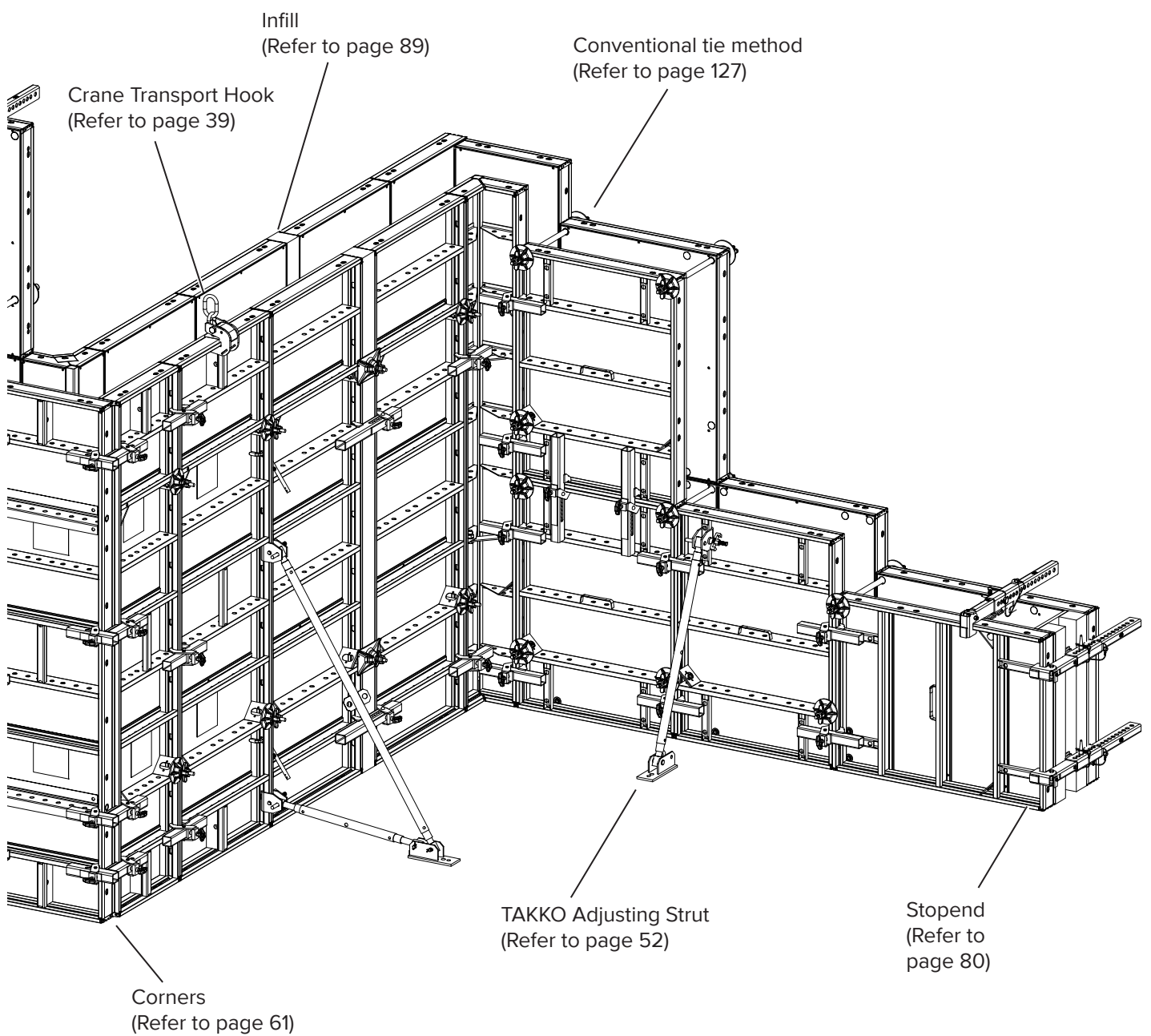
Step 1 Insert the locking pin into the hole from the outside.

Step 2 Secure the pin with the spring cotter pin.

3 Overview

These illustrations provide an overview of the various ways in which the components of the RASTO/TAKKO system can be combined.





4 Components

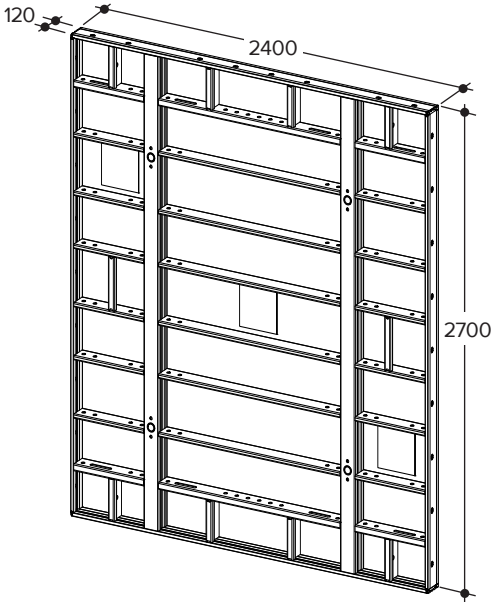
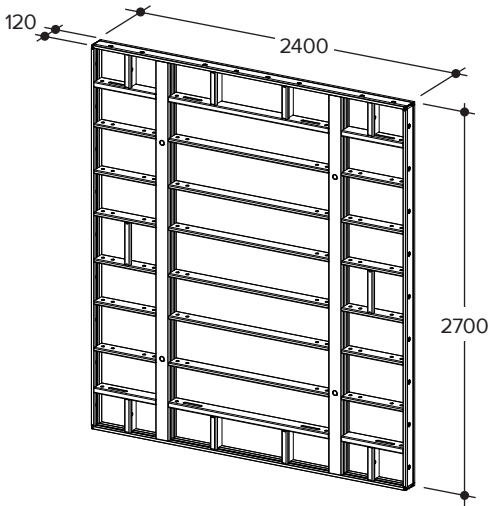
4.1 RASTO Panels

The new RASTO G2 Panels have an optimised frame with additional connection points, e.g. for Alignment Struts. The RASTO G2 Panels also allow the one-sided RASTO/TAKKO tie system to be used. And the RASTO G2 Panels are fully compatible with the previous RASTO Panels and RASTO Panels E.

The RASTO G2 Panels are covered with the 15 mm plastic form lining ECOPLY. The tie hole reinforcers on the RASTO G2 Panels are made of stainless steel. This reduces the damage caused by Tie Rods and ensures that the form lining lasts longer.

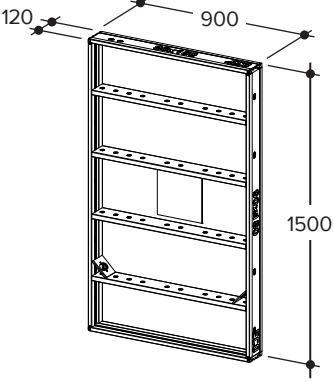
RASTO Panels E have the proven RASTO frame and are covered with the 15 mm plastic form lining ECOPLY.

RASTO Panels also have the proven RASTO frame, but they are covered with a 14 mm form lining made of plywood coated with phenolic resin.

	Component	Part code	Weight [kg]
	RASTO G2 Panel XXL 240/270 The largest RASTO formwork element with a 6,5 m ² surface for large-scale formwork applications. The panel can be used upright or lying flat. When the panel is used in single-sided formwork, the 4no. tie holes have to be closed with A-plugs (code:602578).	607470	303.61
	RASTO Panel E XXL 240/270 RASTO Panel XXL 240/270 The largest RASTO formwork element with a 6,5 m ² surface for large-scale formwork applications. The panel can be used upright or lying flat. When the panel is used in single-sided formwork, the 4no. tie holes have to be closed with A-plugs (code:602578).	604108 600016	302.52 284.23

	Component	Part code	Weight [kg]
	RASTO G2 Panel 90/270	607330	81.43
	RASTO G2 Panel 75/270	607340	72.19
	RASTO G2 Panel 60/270	607350	63.05
	RASTO G2 Panel 45/270	607360	50.18
	RASTO G2 Panel 30/270	607370	41.01

	RASTO Panel E 90/270	604109	79.04
	RASTO Panel E 75/270	604110	68.17
	RASTO Panel E 65/270 ¹⁾	604111	62.16
	RASTO Panel E 60/270	604112	58.88
	RASTO Panel E 55/270 ¹⁾	604113	56.16
	RASTO Panel E 50/270 ¹⁾	604114	53.11
	RASTO Panel E 45/270	604115	49.84
	RASTO Panel E 30/270	604116	42.40
	RASTO Panel 90/270	531312	69.21
	RASTO Panel 75/270	470002	60.01
	RASTO Panel 65/270 ¹⁾	482431	55.97
	RASTO Panel 60/270	470013	53.22
	RASTO Panel 55/270 ¹⁾	482420	50.97
	RASTO Panel 50/270 ¹⁾	482410	48.45
	RASTO Panel 45/270	470024	45.58
RASTO Panel 30/270	575603	39.25	

	Component	Part code	Weight [kg]
	RASTO Panel E 90/150 ¹⁾	604117	46.26
	RASTO Panel E 75/150 ¹⁾	604118	39.89
	RASTO Panel E 65/150 ¹⁾	604119	36.28
	RASTO Panel E 60/150 ¹⁾	604120	34.34
	RASTO Panel E 55/150 ¹⁾	604121	32.68
	RASTO Panel E 50/150 ¹⁾	604122	30.86
	RASTO Panel E 45/150 ¹⁾	604123	28.95
	RASTO Panel E 30/150 ¹⁾	604124	24.32
	RASTO Panel 90/150 ¹⁾	531551	41.49
	RASTO Panel 75/150 ¹⁾	470035	35.92
RASTO Panel 65/150 ¹⁾	482464	32.85	
RASTO Panel 60/150 ¹⁾	470046	31.18	
RASTO Panel 55/150 ¹⁾	482453	29.87	
RASTO Panel 50/150 ¹⁾	482442	28.23	
RASTO Panel 45/150 ¹⁾	470057	26.57	
RASTO Panel 30/150 ¹⁾	575614	22.78	

4.2 TAKKO Panels

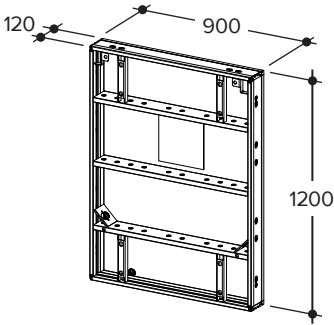
The new TAKKO G2 Panels have an optimised frame with additional connection points. The TAKKO G2 Panels also allow the one-sided RASTO/TAKKO tie system to be used. And the TAKKO G2 Panels are fully compatible with the previous RASTO/TAKKO Panels and RASTO/TAKKO Panels E.

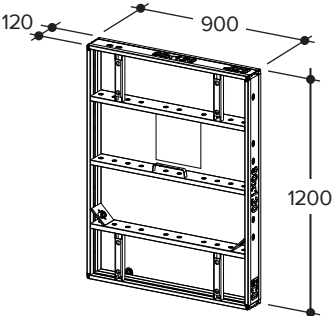
The TAKKO G2 Panels are covered with the 15 mm plastic form lining ECOPLY. The tie hole reinforcers on the TAKKO G2 Panels are made of stainless steel. This reduces the damage caused by Tie Rods and ensures that the form lining lasts longer.

TAKKO Panels E have the proven TAKKO frame and are covered with the 15 mm plastic form lining ECOPLY.

TAKKO Panels also have the proven TAKKO frame, but they are covered with a form lining made of plywood coated with phenolic resin.

All TAKKO Panels have 7no. tie holes. Whether they are used vertically or horizontally, there are always 2no. tie holes far enough off the ground where Tie Rods can be used to secure the structure.

	Component	Part code	Weight [kg]
	TAKKO G2 Panel 90/120	607380	40.00
	TAKKO G2 Panel 75/120	607390	35.36
	TAKKO G2 Panel 60/120	607400	30.81
	TAKKO G2 Panel 45/120	607410	25.35
	TAKKO G2 Panel 30/120	607420	19.78

	Component	Part code	Weight [kg]
	TAKKO Panel E 90/120	604134	40.34
	TAKKO Panel E 75/120	604135	34.97
	TAKKO Panel E 60/120	604136	30.37
	TAKKO Panel E 45/120	604137	24.93
	TAKKO Panel E 30/120	604138	19.63
	TAKKO Panel 90/120	583508	38.47
	TAKKO Panel 75/120	583519	33.45
	TAKKO Panel 60/120	583520	29.12
	TAKKO Panel 45/120	583530	23.99
	TAKKO Panel 30/120	583541	19.01

4.3 Corners

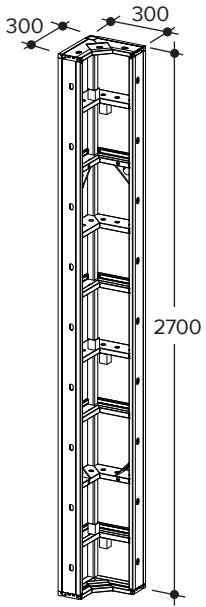
Formwork elements for use in corner sections and shafts.

The new Corners G2 have an enhanced frame and can be used with the one-sided RASTO/TAKKO tie system. And the Corners G2 are fully compatible with the previous RASTO/TAKKO Panels and RASTO/TAKKO Panels E.

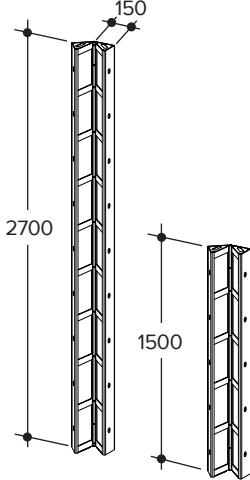
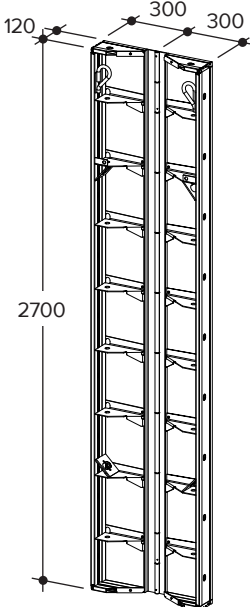
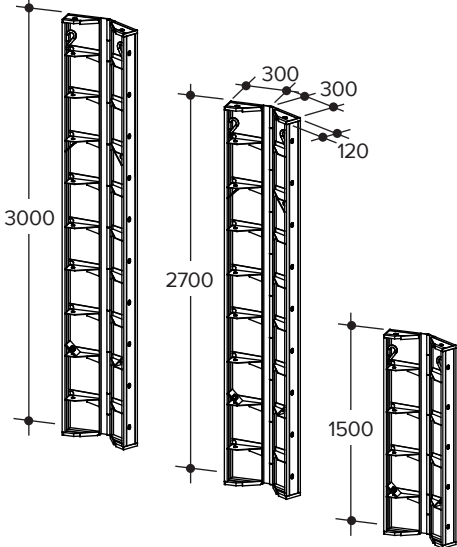
Corners G2 are covered with the 15 mm plastic form lining ECOPLY. The tie hole reinforcers are made of stainless steel. This reduces the damage caused by Tie Rods and ensures that the form lining lasts longer.

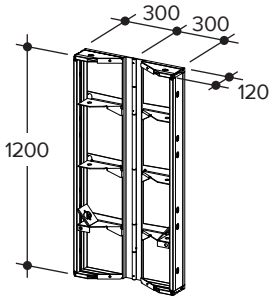
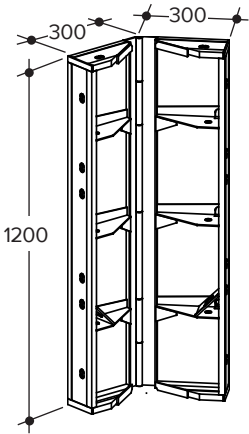
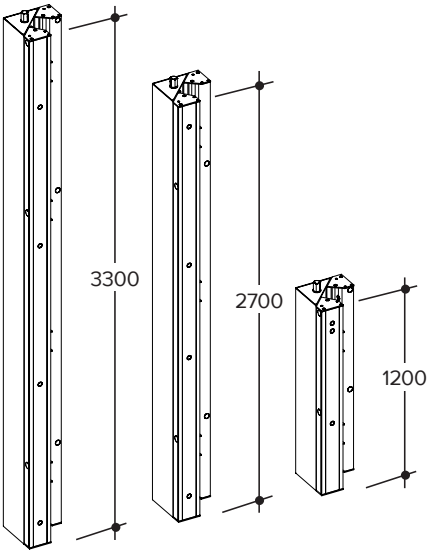
Corners E have the proven TAKKO frame and are covered with the 15 mm plastic form lining ECOPLY.

The conventional corners also have the proven TAKKO frame, but they are covered with a form lining made of plywood coated with phenolic resin.

	Component	Part code	Weight [kg]
	RASTO G2 Inner Corner 30/270	607430	64.56
	Rigid 90° inner corner with plastic form lining ECOPLY.		

	Component	Part code	Weight [kg]
	RASTO Inner Corner E 30/270	604129	67.50
	RASTO Inner Corner E 30/150	604130	38.61
	RASTO Inner Corner 30/270	470068	62.65
	RASTO Inner Corner 30/150	470079	35.88
	90° inner corner with 2° clearance.		
	TAKKO G2 Inner Corner 30/120	607440	30.97
	Rigid 90° inner corner. The RASTO G2 Transport Hook can be fastened to the upper edge profile of the corner.		
	TAKKO E Inner Corner 30/120	604140	31.84
	TAKKO Inner Corner 30/120	583552	30.79
	90° inner corner with 2° clearance.		
	TAKKO Inner Corner 25	600042	33.47
	Rigid inner corner with a leg length of 25 cm. An inexpensive alternative, particularly for foundations with lots of corners. The TAKKO Inner Corner 25 is made completely of steel and does not have a separate form lining.		

	Component	Part code	Weight [kg]
	RASTO Hinged Corner 15/270	481963	49.16
	RASTO Hinged Corner 15/150	482203	27.83
<p>For obtuse angles between 90° and 300°. To be used as an outer corner on sharp-angled corners. It is connected to the RASTO panels with Centring Tension Bolts and Centring Nuts.</p>			
	RASTO G2 Hinged Corner 30/270	607310	67.28
	<p>For sharp angles between 60° and 150°. It is connected to the RASTO Panels with RASTO Aligning Panel Clamps or with Centring Tension Bolts and Centring Nuts.</p>		
	RASTO Hinged Corner E 30/270	604132	76.09
	RASTO Hinged Corner E 30/150	604133	43.78
	RASTO Hinged Corner 30/270	536050	71.73
	RASTO Hinged Corner 30/150	536040	41.37

	Component	Part code	Weight [kg]
	TAKKO G2 Hinged Corner 30/120 For oblique angles between 60° and 150°. The adjustable legs are 30 cm long. When the corners have sharp angles, the corners are connected with Centring Tension Bolts and Centring Nuts.	607320	34.95
	TAKKO Hinged Corner E 30/120 TAKKO Hinged Corner 30/120	604141 583563	34.82 33.83
	MANTO Shaft Corner 330 MANTO Shaft Corner 270 MANTO Shaft Corner 120 The RASTO Shaft Corner Connector and the Spacer Tie Plate 20 are required for connecting to RASTO panels (Refer to page 22 and page 143).	602402 602400 602401	195.14 157.12 76.89

4.4 MP Panels

Multi-purpose Panels with a 5 cm tie hole grid running horizontally. These panels make it easy to create wall offsets, corners with oblique angles and pilasters.

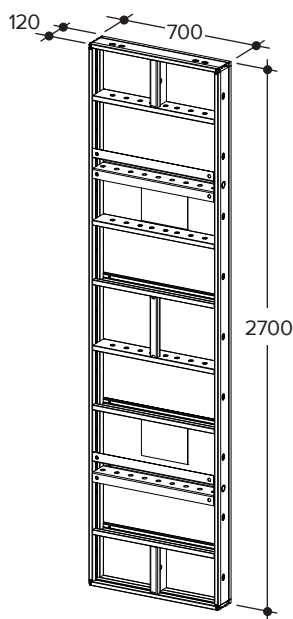
Especially suitable as formwork for columns with edge lengths up to 55 cm (rectangular or square) (Refer to page 135).

The new MP G2 Panels have an optimised frame with additional connection points, e.g. for Alignment Struts. The MP G2 Panels also allow the one-sided RASTO/TAKKO tie system to be used along the edges. And the MP G2 Panels are fully compatible with the previous RASTO/TAKKO Panels E and RASTO/TAKKO Panels.

The MP G2 Panels are covered with the 15 mm plastic form lining ECOPLY. The tie hole reinforcers on the MP G2 Panels are made of stainless steel. This reduces the damage caused by Tie Rods and ensures that the form lining lasts longer.

MP Panels E have the proven frame and are covered with the 15 mm plastic form lining ECOPLY.

MP Panels also have the proven frame, but they are covered with a form lining made of plywood coated with phenolic resin.



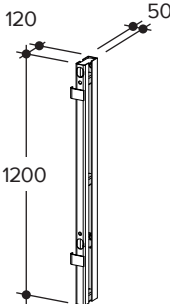
Component	Part code	Weight [kg]
RASTO G2 MP Panel 70/270	607450	72.88

	Component	Part code	Weight [kg]
	RASTO MP Panel E 70/270	604126	72.08
	RASTO MP Panel E 70/150	604127	44.27
	RASTO MP Panel 70/270	601418	64.58
	RASTO MP Panel 70/150	601419	41.20
	TAKKO G2 MP Panel 70/120	607460	37.10
	TAKKO MP Panel E 70/120	604139	37.40
	TAKKO MP Panel 70/120	583574	36.13

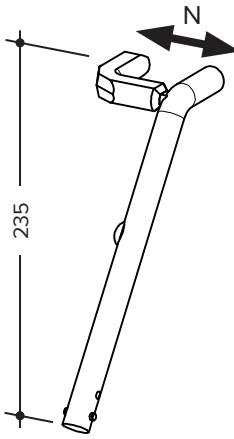
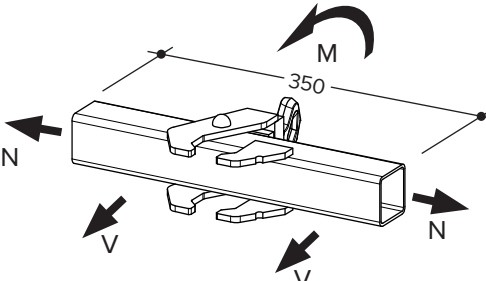
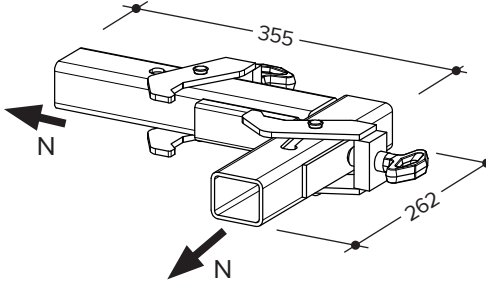
4.5 Infills

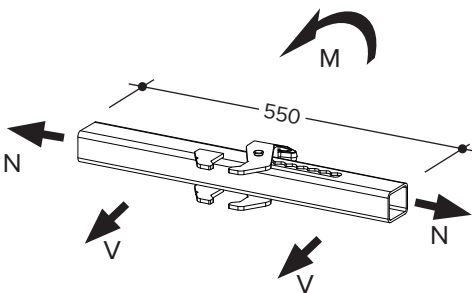
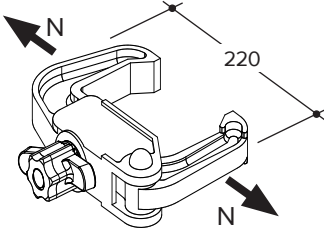
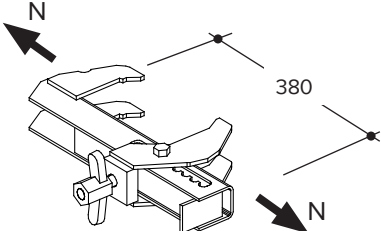
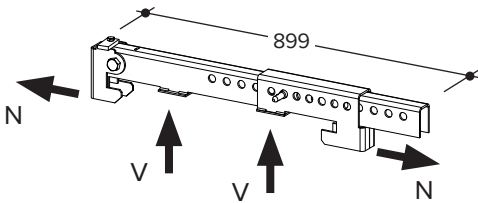
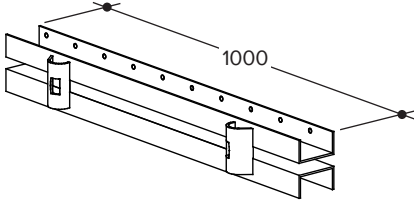
Steel corner Infills (also called Adjustments) are used to adapt the wall thickness in increments of 5 cm.

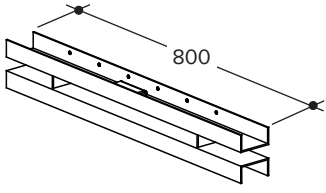
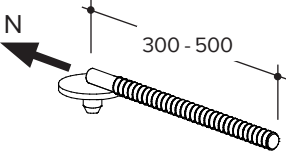
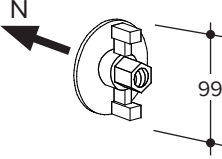
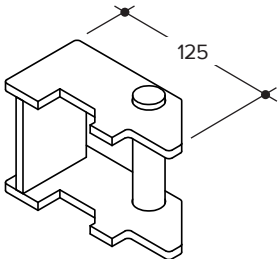
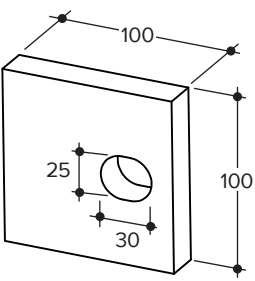
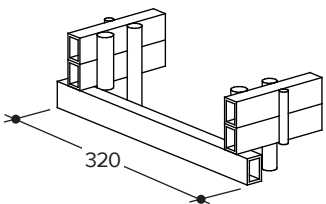
	Component	Part code	Weight [kg]
	RASTO G2 Corner Adjustment 5/270 Like the RASTO Corner Adjustment, but with holes to enable use of the one-sided RASTO G2 MR tie system.	607555	19.71
	RASTO Corner Adjustment 5/270 RASTO Corner Adjustment 5/150¹⁾	479540 479573	19.40 13.90
	TAKKO G2 Corner Adjustment 5/120 Like the TAKKO Corner Adjustment, but with holes to enable use of the one-sided RASTO G2 MR tie system.	607560	11.95

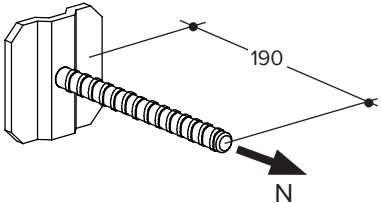
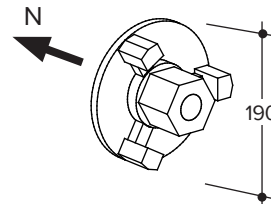
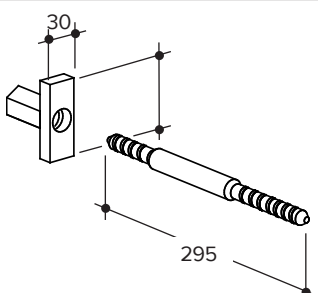
	Component	Part code	Weight [kg]
	TAKKO Corner Adjustment 5/120	584009	11.38

4.6 Connectors

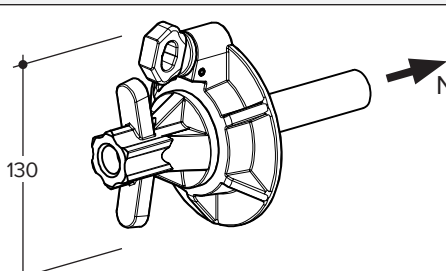
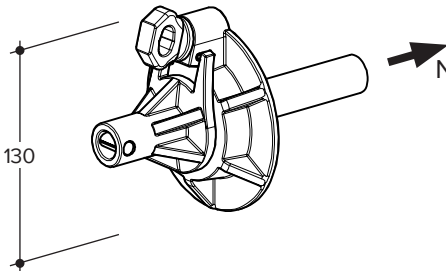
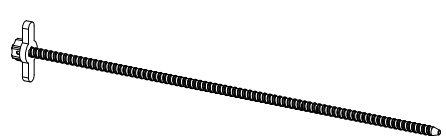
	Component	Part code	Weight [kg]
	RASTO Clip The RASTO Clip is used to quickly connect RASTO and TAKKO formwork elements standing next to one another such that they fit tightly together and the joints are resistant to tension. The formwork elements are aligned flush without offset. This component is not intended to be used in conjunction with formwork elements at a horizontal joint. It also should not be used in sections exposed to greater loads, such as corners and stopends. Also serves as a tool to extract the Sealing Cones OST. Permissible N: 4.0 kN	602645	0.76
	RASTO Aligning Panel Clamp The RASTO Aligning Panel Clamp is used to quickly connect RASTO and TAKKO formwork elements such that they fit tightly together and the joints are resistant to tension. The formwork elements are aligned flush without offset. Permissible M: 0.57 kNm Permissible N: 8.0 kN Permissible V: 8.0 kN	489000	2.92
	RASTO Outer Corner Clamp N Outer corners are formed with the RASTO Outer Corner Clamp N and RASTO Panels. It can also be used for column formwork. And with Outer Corners it allows infills of 50 mm to be used. Permissible N: 12.8 kN	488900	6.19

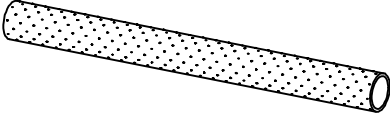
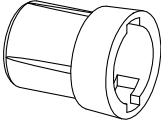
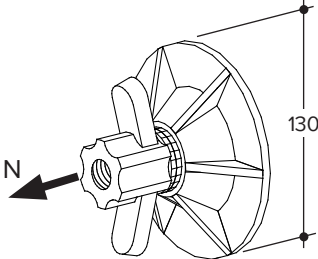
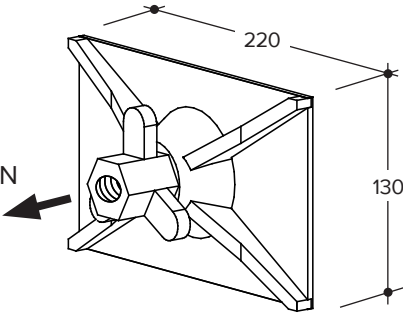
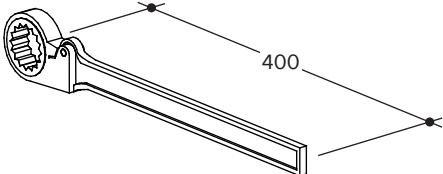
	Component	Part code	Weight [kg]
 <p>The diagram shows a long, narrow metal clamp with a central adjustment mechanism. A curved arrow labeled 'M' indicates a bending moment. Two horizontal arrows labeled 'N' point outwards from the ends, representing tension. Two vertical arrows labeled 'V' point downwards from the bottom, representing shear force. A dimension line indicates a length of 550 mm.</p>	<p>RASTO Adjustable Aligning Clamp</p> <p>Allows infills up to 150 mm to be used. The panels fit tightly together and are aligned flush, and the joints are resistant to tension.</p> <p>Used at horizontal joints to align stacked formwork.</p> <p>Permissible -M: 0.57 kNm Permissible +M: 0.95 kNm Permissible N: 8.0 kN Permissible V: 8.0 kN</p>	<p>488910</p>	<p>5.08</p>
 <p>The diagram shows a U-shaped metal clamp with a locking mechanism. Two horizontal arrows labeled 'N' point outwards from the ends, representing tension. A dimension line indicates a length of 220 mm.</p>	<p>Panel Clamp</p> <p>Used to connect a MANTO shaft corner to a RASTO panel. The RASTO Shaft Corner Connector is also needed.</p> <p>Permissible N: 8.0 kN</p>	<p>448010</p>	<p>3.01</p>
 <p>The diagram shows a complex metal connector with a locking mechanism. Two horizontal arrows labeled 'N' point outwards from the ends, representing tension. A dimension line indicates a length of 380 mm.</p>	<p>Element Connector</p> <p>Used to connect the MANTO Shaft Corner to the RASTO Panel near infills. The maximum width that can be bridged with infills is 80 mm. The RASTO Shaft Corner Connector is also needed.</p> <p>Permissible N: 8 kN</p>	<p>526000</p>	<p>5.50</p>
 <p>The diagram shows a long metal clamp with multiple holes along its length. Two horizontal arrows labeled 'N' point outwards from the ends, representing tension. Two vertical arrows labeled 'V' point upwards from the bottom, representing shear force. A dimension line indicates a length of 899 mm.</p>	<p>RASTO Bulkhead Clamp</p> <p>Connector that is resistant to tensile and compressive forces, used to create bulkheads and as dry ties (Refer to page 81 and page 129).</p> <p>The wall thickness can be set between 15 and 45 cm, in increments of 0.5 cm. Wall thicknesses of 50 cm and 60 cm are possible as well for foundation formwork up to 1.50 m in height.</p> <p>Permissible N: 21.6 kN Permissible V: 12.4 kN</p>	<p>606300</p>	<p>8.42</p>
 <p>The diagram shows a long metal waler with a locking mechanism. A horizontal arrow labeled 'N' points outwards from the end, representing tension. A dimension line indicates a length of 1000 mm.</p>	<p>Multipurpose Waler 100</p> <p>Used as an infill to compensate for spaces of 15–30 cm. Secured with two Waler Spanners. The connection is tension-resistant and the panels are properly aligned (Refer to page 94).</p>	<p>450764</p>	<p>13.10</p>

	Component	Part code	Weight [kg]
	<p>Waler 80</p> <p>Used as an infill to compensate for spaces of 150–300 mm. Secured with two Waler Spanners. This process aligns the panels. Can be used to construct a stopend (Refer to page 88). The nail holes make it easier to erect the formwork.</p> <p>When the Waler is positioned vertically, an Adjusting Strut can be connected to act as a brace.</p>	586980	6.30
	<p>Waler Spanner (300 mm)</p> <p>Waler Spanner Long (500 mm)</p> <p>Used in conjunction with the Tension Nut to connect the Waler 80 or the MANTO Waler 100.</p> <p>Permissible N: 16 kN</p>	452053	0.76
	<p>Tension Nut (DW 15)</p> <p>One Tension Nut per Waler Spanner.</p> <p>Permissible N: 40.0 kN</p>	197332	0.65
	<p>RASTO Shaft Corner Connector</p> <p>Adapter for the MANTO Shaft Corner (Refer to page 143).</p>	603437	1.01
	<p>Spacer Tie Plate 20</p> <p>Compensates for the difference between the frame of the RASTO Panels and the frame of the MANTO Shaft Corner (Refer to page 144).</p>	603441	1.51
	<p>RASTO/MANTO Adapter</p> <p>Enables the MANTO formwork to be connected to a RASTO panel (in conjunction with the MANTO Aligning Panel Clamp, part code: 467898). Refer to page 150.</p>	478708	2.32

	Component	Part code	Weight [kg]
	Centring Tension Bolt Used in conjunction with the Centring Nut to connect RASTO/TAKKO Panels or Corners at the holes along the edge profiles. The joint is inside of the panels, making it easier to stack panel assemblies. The Centring Tension Bolt is also used for extensions up to 150 mm on site as well as for stopends. Permissible N: 25 kN	479264	0.91
	Centring Nut 100 Used in conjunction with the Centring Tension Bolt. Also used for tying in conjunction with a Tie Rod when infills are used. Permissible N: 40 kN	469566	0.80
	RASTO MP Bolt RASTO MP Nut Connects MP Panels to column formwork. The MANTO Tie Nut is needed for this purpose and has to be ordered separately.	485435 485457	0.60 0.45

4.7 Tying components

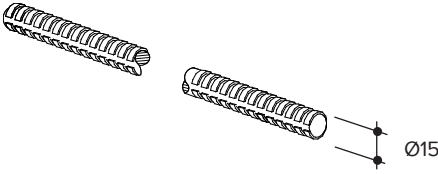
	Component	Part code	Weight [kg]
	RASTO G2 Operating Nut For one-sided tying of RASTO G2 Panels. Operated from the advancing side of the formwork. Permissible N: 90 kN	607210	2.16
	RASTO G2 Counter Nut For one-sided tying of RASTO G2 Panels. Secured to the opposite side of the formwork. Permissible N: 90 kN	607220	2.09
	MR Tie Rod DW 15 Special Tie Rod for one-sided tying of RASTO G2 Panels. For wall thicknesses up to 45 cm. With a grip to facilitate insertion and extraction.	607250	1.71

	Component	Part code	Weight [kg]
	Tie Sleeve 22/26, 25 pieces Inner diameter: 22 mm Outer diameter: 26 mm Length: 2.0 m	605915	11.63
	MR Sealing Cone, 500 pieces Special cone for one-sided tying of RASTO G2 Panels. Used to seal both ends of the Cladding Tube, preventing concrete from seeping out of the tie hole.	607123	3.00
	MANTO Tie Nut (DW 15) To tie conventional DW 15 Tie Rods. Because of the special sliding disk, the Tie Nut can easily be released with the MANTO Ratchet or a hammer (Refer to page 127). Permissible N: 90.0 kN	464600	1.26
	Tie Nut 230 (DW 15) To tie conventional DW 15 Tie Rods. With a large plate for infills (Refer to page 92). The crowned nut allows a Tie Rod angle of up to 10° (Refer to page 45). Permissible N: 90.0 kN	48344	2.40
	MANTO Ratchet With the MANTO Ratchet (w.a.f. 36), the connectors and Tie Nuts can be adjusted quickly and quietly, without exertion or damage to the material.	408780	1.00

NOTE

Components can be damaged!

If you extend the lever on the MANTO Ratchet, you will exert too much force when operating the Ratchet. This can cause damage to components. Do not extend the lever of the MANTO Ratchet!

	Component	Part code	Weight [kg]
	Tie Rod 1.75 m ¹⁾ (DW 15)	20470	2.52
	Tie Rod 1.30 m ¹⁾ (DW 15)	20481	1.87
	Tie Rod 1.00 m ¹⁾ (DW 15)	24387	1.44
	Tie Rod 0.75 m ¹⁾ (DW 15)	437660	1.08
	Permissible N: 90 kN.		

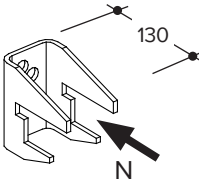
CAUTION

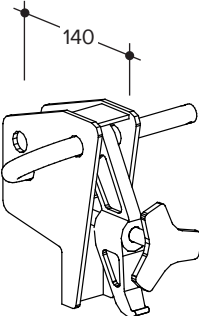
Tie Rods can break!

Heating or welding Tie Rods can damage them or cause them to break!

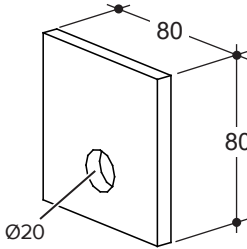
Formwork elements can burst, resulting in injuries!

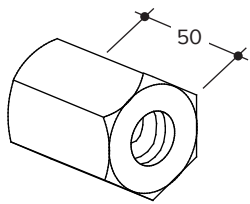
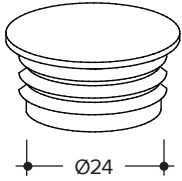
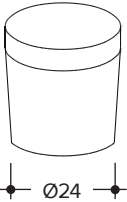
Never weld or heat Tie Rods!

	Edge Tie Fastener MR For tying outside the RASTO formwork panel. For Tie DW15 (Refer to page 130). Permissible N: 10.0 kN	566667	2.40
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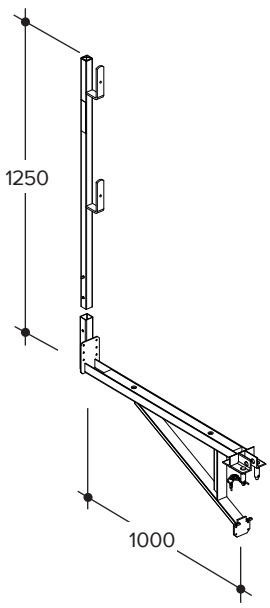
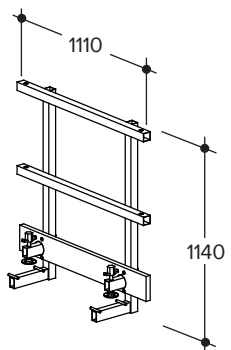
	FU Tightener Used for foundation formwork in place of the lowest tie position, when tying is not possible due to the size of the Tie Nuts. Fastened to both sides of the formwork to tense the Punched Steel Tape. Permissible load: 12.0 kN (Refer to page 130)	568357	3.60
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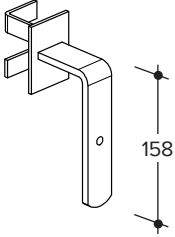
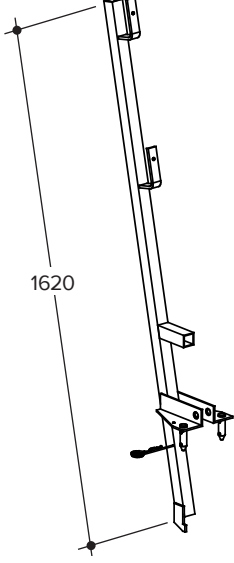
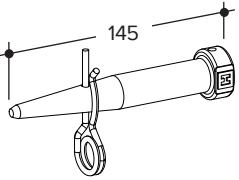
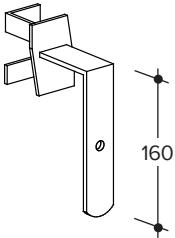
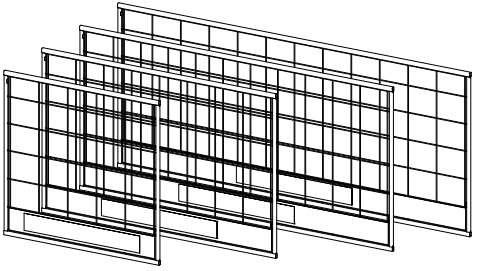
	Punched Steel Tape 25 m¹⁾ Used in conjunction with the FU Tightener for foundation formwork (Refer to page 130). Permissible load: 15.0 kN	568081	17.20
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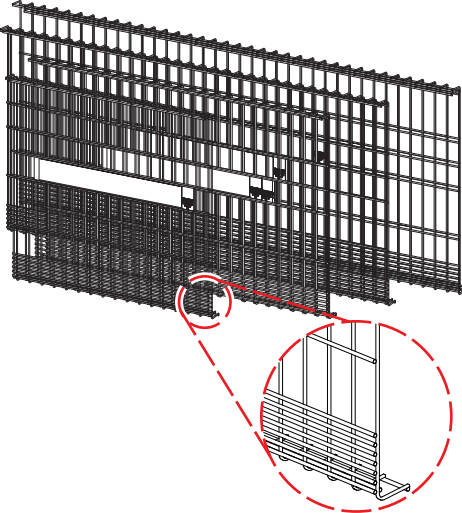
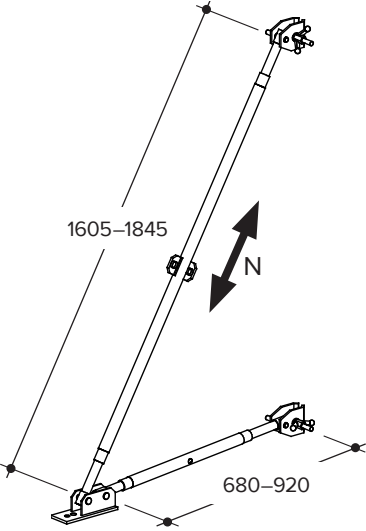
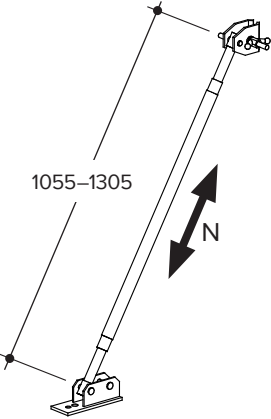
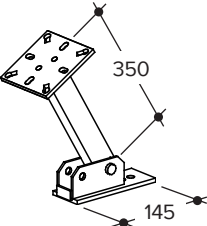
	Plate 8/8¹⁾ Used for tying through the holes on the bottom of panels lying flat (e.g. for foundations). Use in conjunction with a Tie Rod and Hexagon Nut 15/50 (Refer to page 132).	400214	0.40
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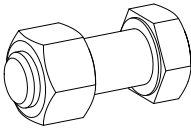
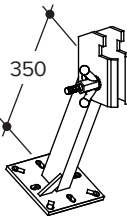


	Component	Part code	Weight [kg]
	Hexagon Nut 15/50¹⁾ This Hexagon Nut serves as a Tie Nut for rigid panels without threads. It is operated with a spanner w.a.f. 30 (Refer to page 132). Permissible load: 90.0 kN	164535	0.22
	A-plug, 100 pieces Bag of 100 A-plugs to seal unused tie holes.	602578	0.20
	MANTO Plugs, 10 pieces Bag of 100 A-plugs to seal unused tie holes in MP Panels.	453253	0.20

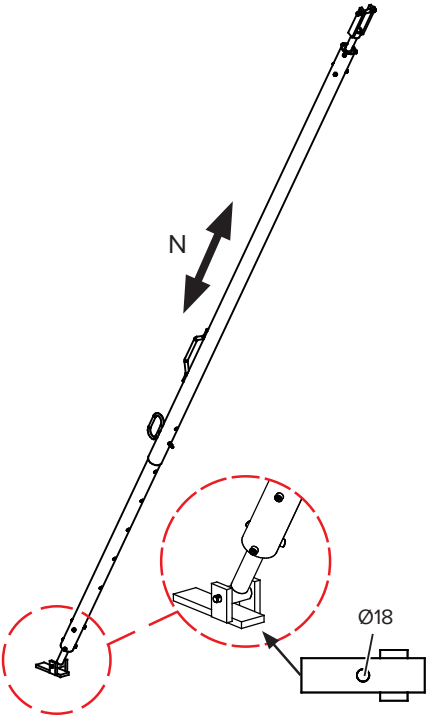
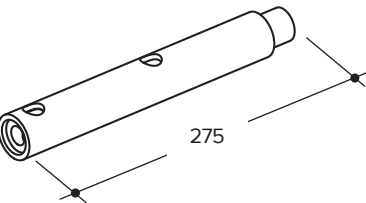
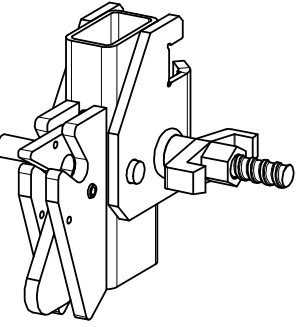
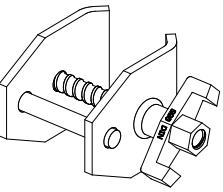
4.8 Brackets, struts

	Component	Part code	Weight [kg]
	RASTO P-walkway Bracket	606245	12.42
	PROTECTO Railing Post The RASTO P-walkway Bracket (usable width 900 mm) is connected to the rib profiles of upright RASTO/TAKKO Panels or Panels lying flat. The PROTECTO Railing Post is inserted into the Walkway Bracket. The Counter Post can be fastened to panels lying flat when an additional Waler Bolt D 20 is used.	601225	3.67
	Platform Railing Serves as side protection at the ends of the RASTO Walkway Brackets (Refer to page 118). It is fixed to the platform using the integrated clamping screws.	587252	24.23

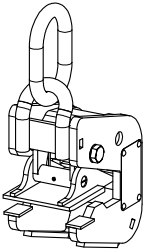

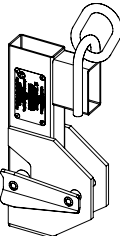

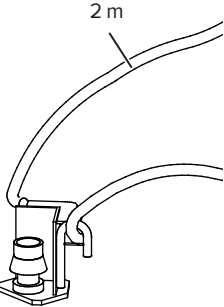

	Component	Part code	Weight [kg]
	<p>PROTECTO Toe Board Retainer Secures the Toe Board to the PROTECTO Railing Post.</p>	601227	0.69
	<p>RASTO Counter Post The Counter Post is connected to the highest horizontal rib of the panel and secured with the integrated spring cotter pin. The Counter Post can be fastened to panels lying flat when an additional Waler Bolt D 20 is used (Refer to 118).</p>	600814	9.20
	<p>Waler Bolt D20 Spring Cotter Pin 4 If the RASTO P-Walkway Bracket is to be connected to a panel lying flat, additionally order a Waler Bolt D 20.</p>	420000 173776	0.32 0.02
	<p>Toe Board Retainer Secures the Toe Board to the RASTO Counter Post. The Toe Board Retainer has a red mark to differentiate it from the PROTECTO Toe Board Retainer.</p>	603609	0.71
	<p>Universal Protection Mesh 270 Universal Protection Mesh 240 Universal Protection Mesh 180 Universal Protection Mesh 120 Galvanised mesh panel, 1.15 m high with a lightweight frame. The bars are positioned such that the panel cannot be unintentionally lifted out of the structure. But at the same time the bars are spaced far enough apart that it is easy to reach between them (Refer to page 118). Also available powder-coated in any RAL colour.</p>	607945 607940 607985 607955	18.59 16.88 13.28 9.69

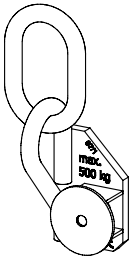

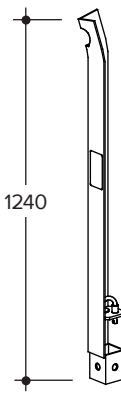

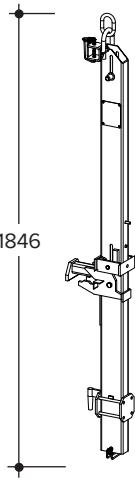

	Component	Part code	Weight [kg]
	PROTECTO Mesh Panel 263*	601231	22.20
	PROTECTO Mesh Panel 240*	604730	20.14
	PROTECTO Mesh Panel 180*	604731	15.31
	PROTECTO Mesh Panel 130*	604733	11.09
	<p>Mesh panel, 1.15 m high, to be used along with PROTECTO Railing Posts. Allows Railing Posts to be spaced up to 2.40 m apart. An alternative to board railings (Refer to page 118).</p> <p>No longer produced.</p>		
	RASTO Adjusting Strut	564381	20.50
<p>To support and align the RASTO/TAKKO formwork. Refer to page 99 ff.</p> <p>All connection parts are integrated.</p> <p>Permissible N: Refer to page 103</p>			
	TAKKO Adjusting Strut	588110	10.94
<p>For bracing TAKKO formwork < 1.20 m (Refer to page 99). All connection parts are integrated.</p> <p>Permissible N: Refer to page 100</p>			
	Strut Base	566369	7.70
<p>For modifying Hünnebeck steel props to make them alignment struts (Refer to page 112).</p>			

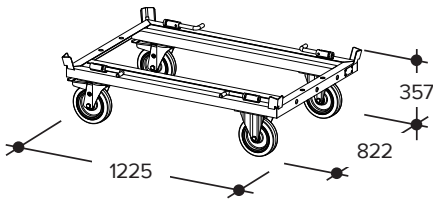
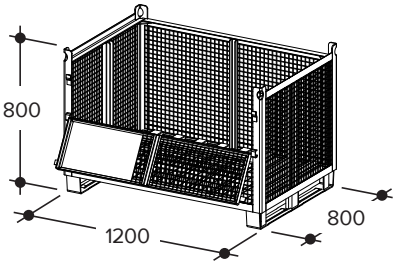
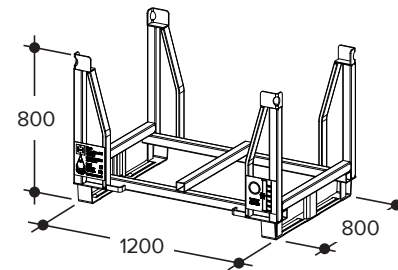
	Component	Part code	Weight [kg]
	<p>Bolt M12/30 (with nut) 4.6¹⁾</p> <p>To attach the Strut Base and the RASTO strut connector to the props. Four bolts are needed for each connection.</p>	<p>5210</p>	<p>0.06</p>
	<p>RASTO Strut Connector</p> <p>For modifying Hünnebeck steel props to make them alignment struts (Refer to page 112).</p>	<p>567135</p>	<p>7.80</p>
	<p>EUROPLUS^{new} 30-150</p> <p>EUROPLUS^{new} 20-250</p> <p>EUROPLUS^{new} 30-250</p> <p>EUROPLUS^{new} 20-300</p> <p>EUROPLUS^{new} 30-300</p> <p>EUROPLUS^{new} 20-350</p> <p>EUROPLUS^{new} 30-350</p> <p>EUROPLUS^{new} 20-400</p> <p>EUROPLUS^{new} 30-400</p> <p>EUROPLUS^{new} 20-550</p>	<p>601460</p> <p>601390</p> <p>601430</p> <p>601400</p> <p>601440</p> <p>601410</p> <p>601445</p> <p>601415</p> <p>601450</p> <p>601425</p>	<p>10.68</p> <p>13.15</p> <p>16.19</p> <p>16.82</p> <p>19.17</p> <p>20.52</p> <p>24.24</p> <p>23.79</p> <p>28.75</p> <p>36.07</p>
 <p>N_{perm.} = 15.0 kN</p>	<p>Counter Nut A/DB 260/300</p> <p>For EUROPLUS[®] 260, 300 DB/DIN, EUROPLUS^{®new} 20-250, 20-300, EUROPLUS^{®new} 30-150</p> <p>Counter Nut AS/DB 350/410</p> <p>For EUROPLUS[®] 350 DB/DIN, EUROPLUS^{®new} 20-350, 20-400, EUROPLUS^{®new} 30-250, 30-300, 30-350</p> <p>Counter Nut EC 350/DB 450</p> <p>For EUROPLUS[®] 350 EC and 450 DB</p> <p>Counter Nut EC 400/DC 550</p> <p>For EUROPLUS[®] 400 EC, 550 DC, EUROPLUS^{®new} 20-550, 30-400</p> <p>Reinforces EUROPLUS^{new} Props to absorb tensile loads. Must be attached when EUROPLUS^{new} Props are to serve as wind bracing (Refer to page 112).</p>	<p>107107</p> <p>107118</p> <p>562051</p> <p>587675</p>	<p>0.92</p> <p>1.00</p> <p>1.50</p> <p>1.39</p>

	Component	Part code	Weight [kg]
	<p>Alignment Strut K440 Permissible N (length 3.25 m): 20 kN With Adapter for Alignment Struts (length 3.35 m): 19.2 kN Permissible N (length 4.40 m): 11 kN With Adapter for Alignment Struts (length 4.50 m): 9.9 kN</p>	<p>601208</p>	<p>23.42</p>
	<p>Alignment Strut K600 Permissible N (length 4.80 m): 20 kN With Adapter for Alignment Struts (length 4.90 m): 17.3 kN Permissible N (length 6.00 m): 14 kN With Adapter for Alignment Struts (length 6.10 m): 11.6 kN</p>	<p>601210</p>	<p>35.79</p>
<p>Refer to page 104.</p>			
	<p>Adapter for Alignment Struts Used to connect Alignment Struts to stacked RASTO formwork (Refer to page 110).</p>	<p>601733</p>	<p>1.31</p>
	<p>RASTO Quick-Action Strut Connector Used to attach Alignment Struts to RASTO Panels. Can be attached to the V-rib or vertical panel joint on RASTO G2 Panels, or to the vertical joint on conventional RASTO Panels. For maximum permissible load, refer to page 106 ff.</p>	<p>607205</p>	<p>4.86</p>
	<p>RASTO Adjustment Head Used to connect Alignment Struts to the RASTO formwork (Refer to page 110). Maximum permissible load: 10.0 kN</p>	<p>563582</p>	<p>2.27</p>

4.9 Lifting accessories and transport equipment

	Component	Part code	Weight [kg]
 	<p>RASTO G2 Transport Hook</p> <p>To transport single or connected RASTO Panels as well as Corners. Working Load Limit: 500 kg</p>	<p>607550</p>	<p>5.93</p>
 	<p>RASTO/TAKKO Transport Hook</p> <p>Used to transport RASTO panel assemblies and RASTO Panels XXL. Working Load Limit: 500 kg</p>	<p>602460</p>	<p>7.69</p>
 	<p>RASTO Tackle</p> <p>Using four of these Tackles makes it safe to move stacks of RASTO/TAKKO Panels with a crane. Length of loop: 2.00 m Working Load Limit (using 4no.): 2100 kg</p>	<p>600917</p>	<p>3.25</p>

	Component	Part code	Weight [kg]
 <p data-bbox="215 593 343 683">  </p>	<p data-bbox="603 280 1125 313">TOPMAX Crane Suspension</p> <p data-bbox="603 324 1125 436">Used to transport single or stacked RASTO Panels and TOPMAX Table Forms by crane. Working Load Limit: 500 kg</p>	<p data-bbox="1133 280 1332 313">603050</p>	<p data-bbox="1348 280 1492 313">1.87</p>
 <p data-bbox="223 1209 343 1288">  </p>	<p data-bbox="603 739 1125 772">RASTO/TAKKO Stacking Angle</p> <p data-bbox="603 784 1125 963">Used for stacking and transporting RASTO/ TAKKO Panels. One transport unit is made up of 4no. Stacking Angles. Working Load Limit per transport unit: 400 kg</p>	<p data-bbox="1133 739 1332 772">587734</p>	<p data-bbox="1348 739 1492 772">8.60</p>
 <p data-bbox="215 1960 343 2038">  </p>	<p data-bbox="603 1422 1125 1456">RASTO Lifting Waler</p> <p data-bbox="603 1467 1125 1545">Working Load Limit as a factor of the formwork elements to be moved: 900 kg</p>	<p data-bbox="1133 1422 1332 1456">607650</p>	<p data-bbox="1348 1422 1492 1456">21.02</p>

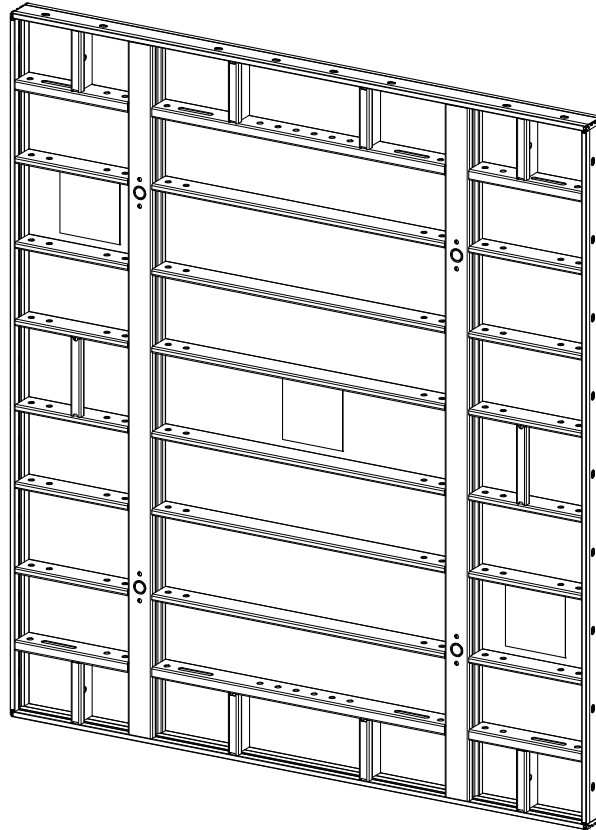
	Component	Part code	Weight [kg]
	<p>Euro Trolley</p> <p>Used to manually manoeuvre approved Hünnebeck transport equipment.</p> <p>The Euro Trolley has two lockable swivel castors.</p> <p>Safe Working Load: 1300 kg</p>	<p>607610</p>	<p>39.57</p>
	<p>Euro Lattice Box</p> <p>Used to store and transport small items.</p> <p>Can be moved using the Euro Trolley.</p> <p>Safe Working Load: 1200 kg.</p>	<p>548480</p>	<p>68.79</p>
	<p>Euro Stacking Frame 120/80</p> <p>Used to store and transport e.g. Europlusnew Props, Du-Al Beams, H 20 K-beams.</p> <p>Can be moved using the Euro Trolley.</p> <p>Safe Working Load: 1200 kg.</p>	<p>553689</p>	<p>54.47</p>

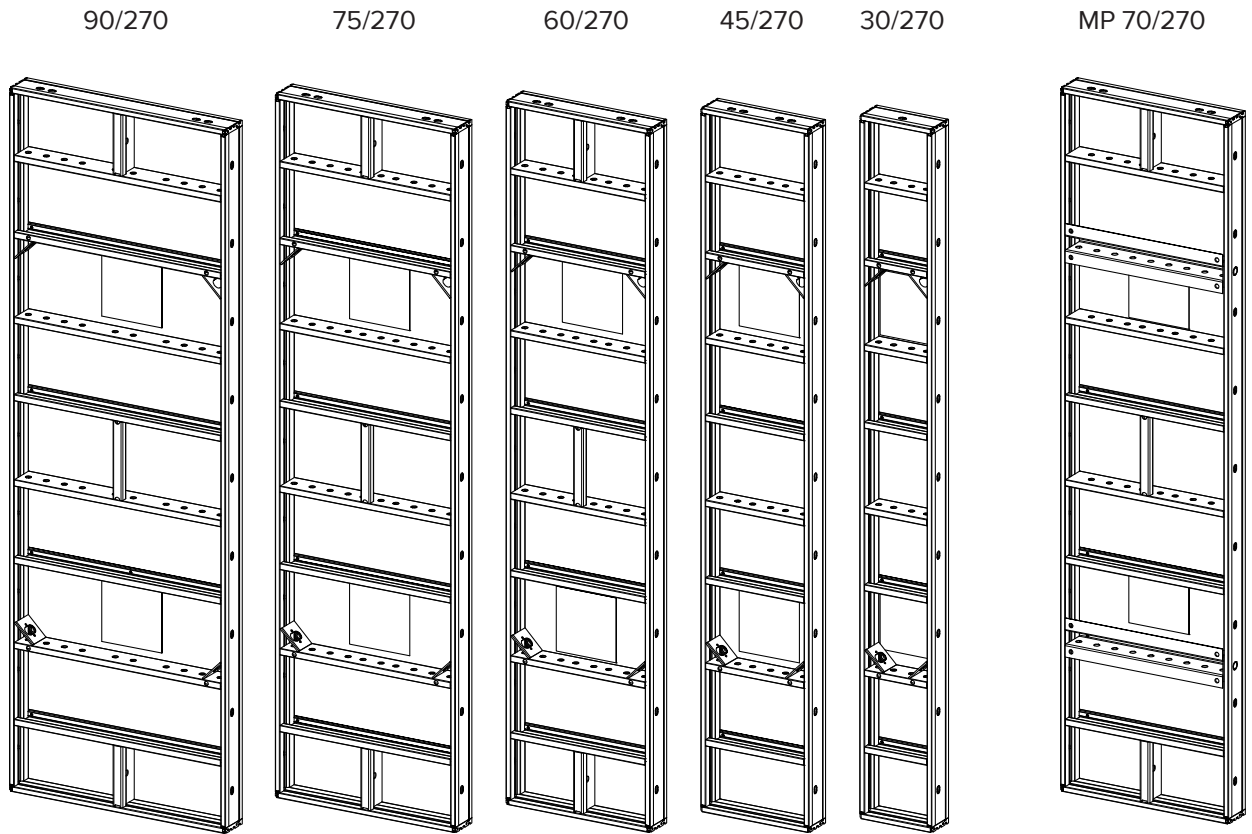
5 RASTO/TAKKO Panels – Overview

There are two generations of RASTO Panels available. The new generation RASTO G2 has a distinctive optimised frame design that offers a wide range of new possibilities. These include e.g. one-sided tying or the connection of Alignment Struts in the centre of panels.

5.1 RASTO G2 Panels

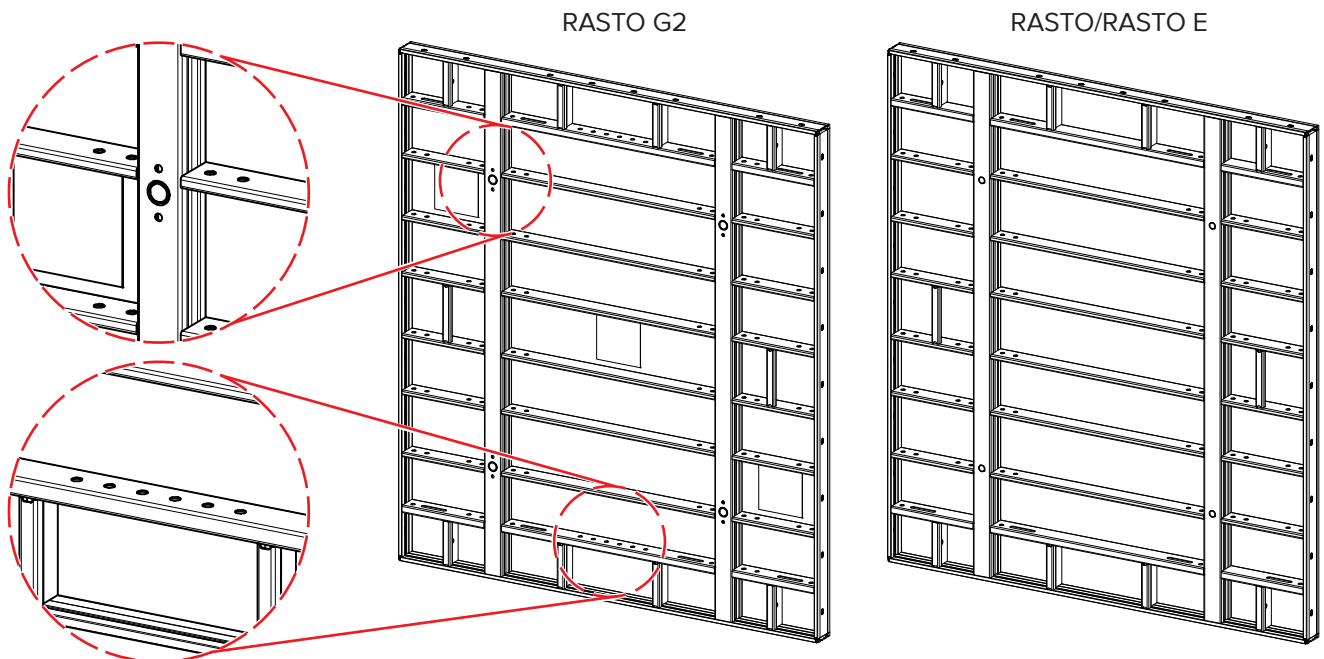
XXL 240/270





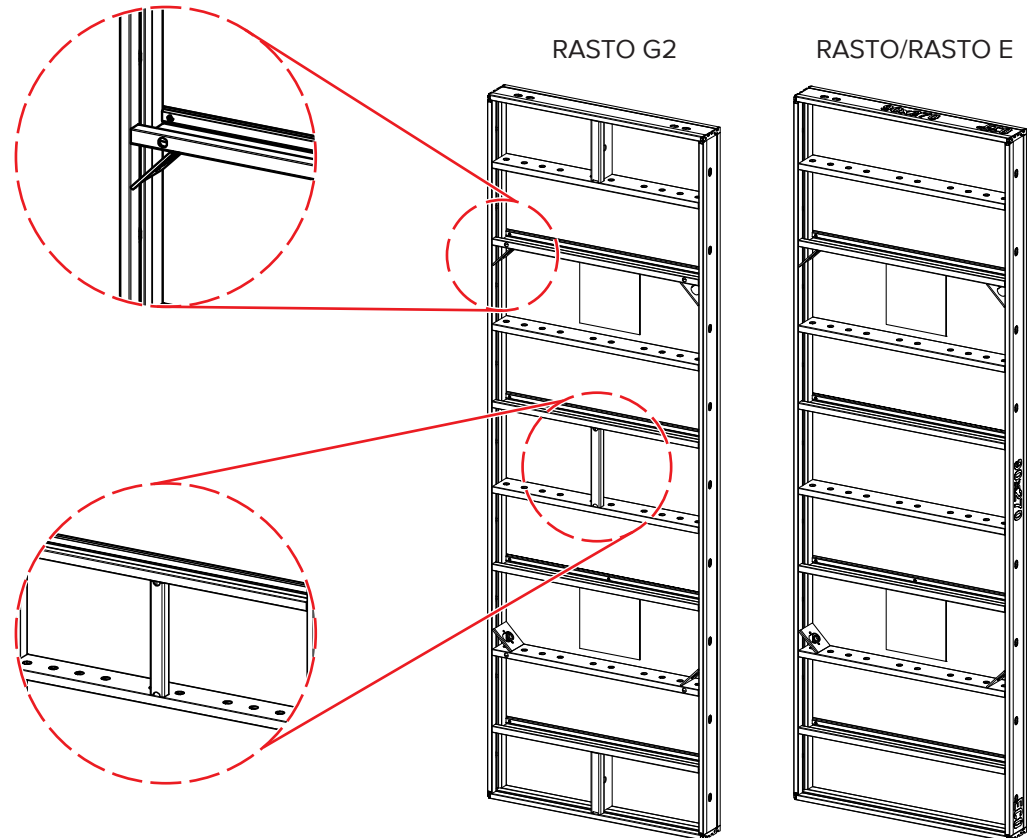
5.11 RASTO G2 XXL vs. RASTO/RASTO E XXL

The new RASTO G2 XXL Panels are compatible with the one-sided RASTO G2 MR tie system. This is possible due to the holes next to the tie holes in which the Tie Nuts can be secured. The new RASTO G2 XXL Panels also have additional holes on the lower and upper H-ribs for attaching various components to the panels.



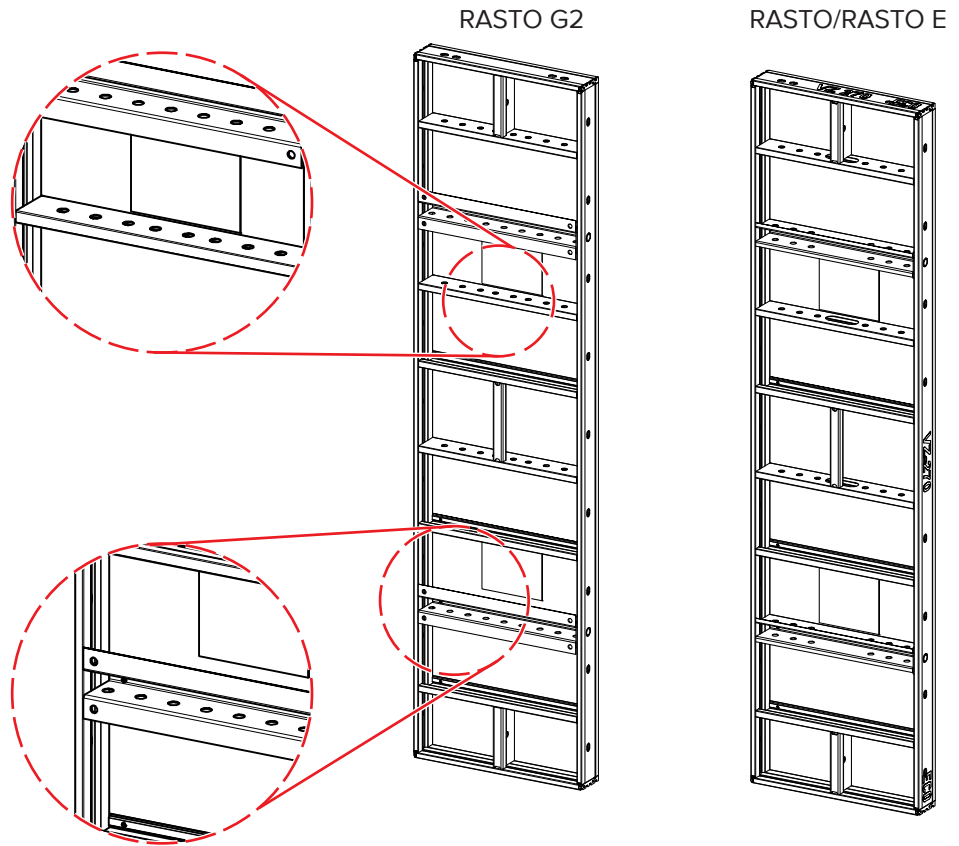
5.1.2 RASTO G2 vs. RASTO/RASTO E

Just like the RASTO XXL Panels, the RASTO G2 Panels have additional holes for connecting the Tie Nuts that are part of the one-sided RASTO G2 MR tie system. Another innovation is that the V-ribs like those used with MP Panels have been added to the frame. The V-ribs ensure a high degree of stability and, in conjunction with the new RASTO Quick-Action Strut Connector, allow Alignment Struts to be connected. The recessed grips in the H-ribs on panels < 75 cm have been removed and replaced with a continuous row of holes. This offers greater versatility when connecting elements, e.g. the platform system.

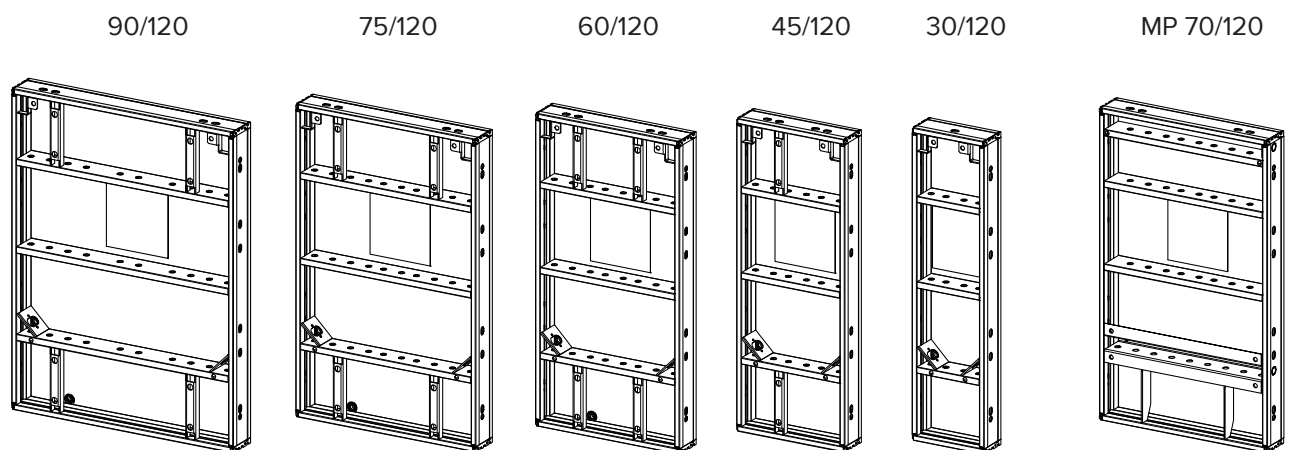


5.1.3 RASTO G2 MP Panels vs. RASTO/RASTO E MP Panels

Just like the other RASTO G2 Panels, the RASTO G2 MP Panels have additional holes for connecting the Tie Nuts that are part of the one-sided RASTO G2 MR tie system. The recessed grips in the H-ribs have been removed and replaced with a continuous row of holes. This offers greater versatility when connecting elements, e.g. the platform system.

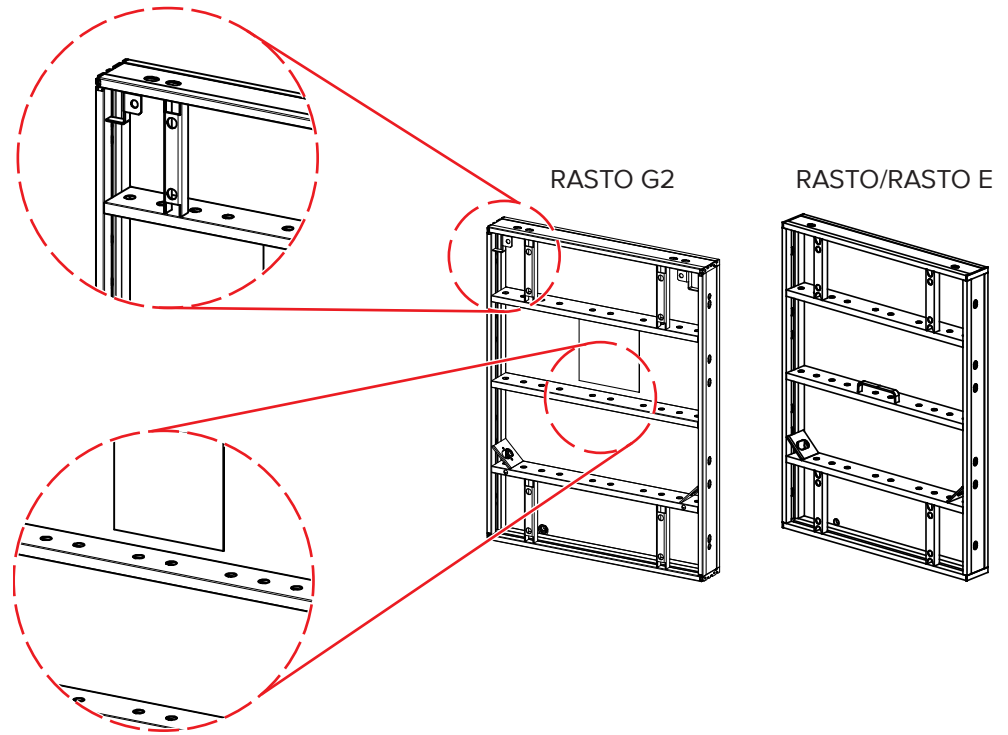


5.2 TAKKO G2 Panels



5.2.1 TAKKO G2 Panels vs. TAKKO/TAKKO E Panels

Just like the RASTO G2 Panels, the TAKKO G2 Panels have additional holes for connecting the Tie Nuts that are part of the one-sided RASTO G2 MR tie system. And the grips in the H-ribs have been removed, making the connecting holes in the H-ribs more easily accessible.



6 Transporting formwork elements

6.1 Transporting stacks of panels

Stacks of panels can be transported with 4no. RASTO Tackles or 4no. RASTO Stacking Angles.

6.1.1 With Tackles

Stacks of RASTO formwork panels can be transported with a crane using 4no. RASTO Tackles. Up to 10no. RASTO Panels or 5no. RASTO XXL Panels can be transported at the same time.

The separate Tackle user guide contains instructions on how to use the Tackle to transport stacks of panels with a crane.



WARNING

Formwork panels can slip and drop!

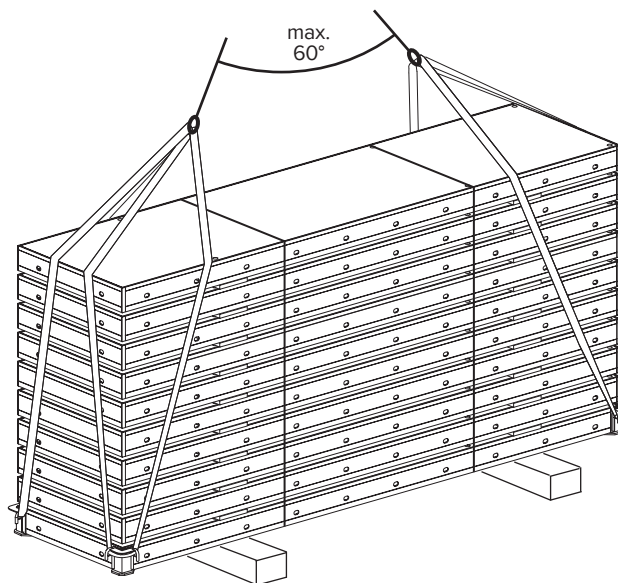
If you attempt to transport too many panels at once, the panels can slip and drop! Never transport more than 10no. RASTO Panels or 5no. RASTO XXL Panels at the same time!



WARNING

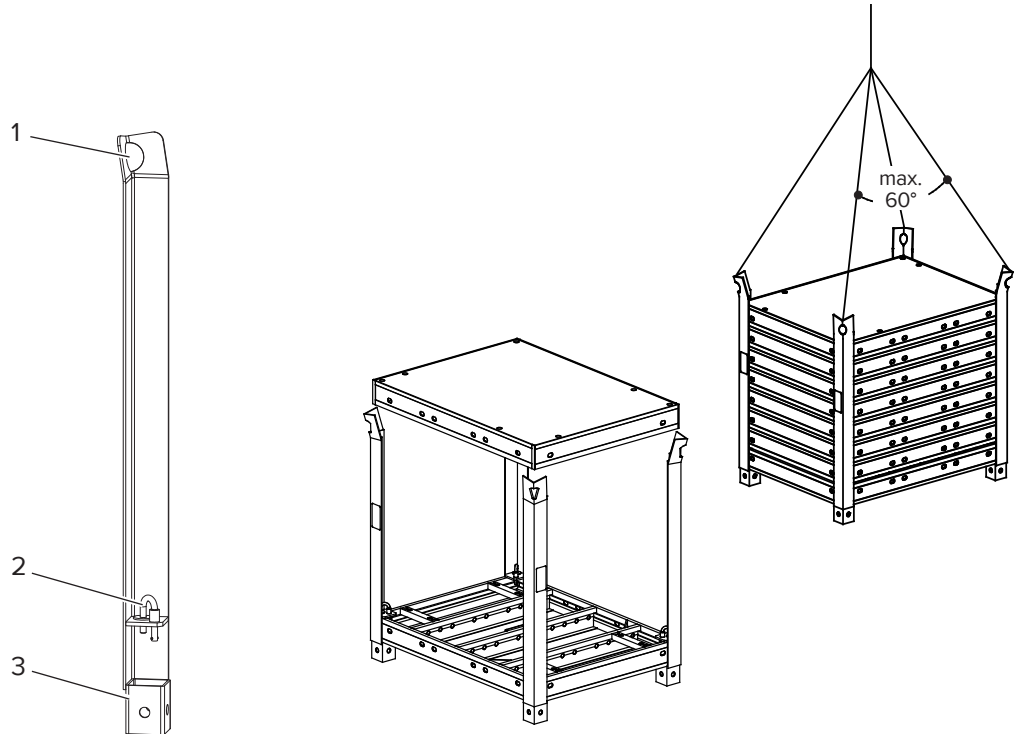
Formwork panels can drop!

If the Tackle is operated incorrectly, formwork panels can drop! This can cause personal injury or death! Refer to the separate user guide for the Tackle!



6.1.2 With Stacking Angles

The RASTO/TAKKO Stacking Angles can be used to transport and store at least 2no. and no more than 8no. RASTO/TAKKO Panels. The maximum capacity of a single load unit consisting of 4no. Stacking Angles is 400 kg.



- 1 Lifting eye
- 2 Locking pin
- 3 Base

At least 4no. Stacking Angles are needed for a stack of panels. Once the stack of panels has been connected with Stacking Angles, it can be transported either with a crane or a forklift. The Stacking Angle base provides enough space above the floor to enable a forklift to lift the stack. The base also prevents the bottom panel from touching the floor.



WARNING

Formwork panels can drop!

If Stacking Angles are operated incorrectly, formwork panels can drop! This can cause personal injury or death!
Refer to the separate user guide for the Stacking Angle!

NOTE

Form lining can be damaged!

The form lining on the bottom panel touches the Stacking Angles.
Coarse dirt or rocks on the forks of the forklift could damage the form lining on the bottom panel as the stack is lifted.
Before lifting, remove any dirt from the forklift forks!



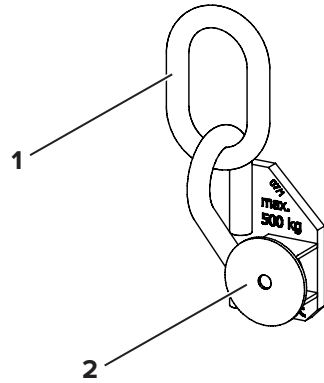
The separate Stacking Angle user guide contains instructions on how to use the Stacking Angle to transport stacks of panels with a crane.

6.1.3 With TOPMAX Crane Suspensions

Stacks of RASTO formwork Panels can be transported with a crane using 4no. TOPMAX Crane Suspensions. Up to 10no. RASTO Panels or 5no. RASTO XXL Panels can be transported at the same time.



The separate Crane Suspension user guide contains instructions on how to use the Crane Suspension to transport stacks of panel with a crane.



- 1 Suspension link
- 2 Locking pin



WARNING

Formwork panels can drop!

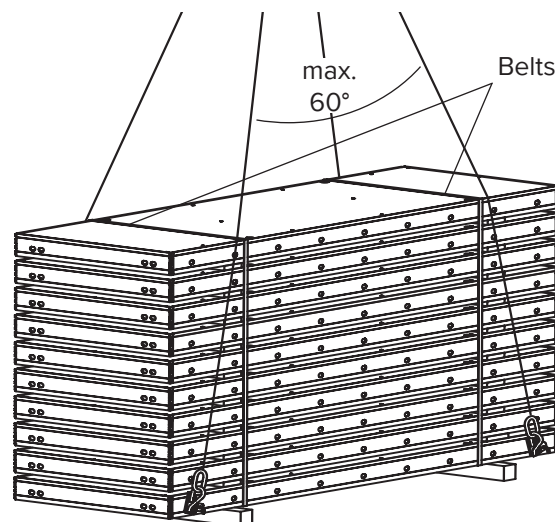
If the Crane Suspension is operated incorrectly, formwork elements can drop! This can cause personal injury or death!
Refer to the separate user guide for the Crane Suspension!



WARNING

Formwork panels can drop!

When stacks of formwork elements are hoisted, pieces can slip and drop! This can cause personal injury or death!
Always use suitable belts to secure panel elements!



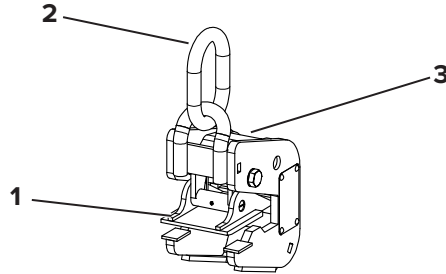
6.2 Transporting single formwork elements by hand

Single formwork elements weighing up to 50 kg can be transported manually by two people. Always wear suitable personal protective equipment - which means at least safety footwear and gloves - when transporting formwork elements by hand.

6.3 Transporting single or connected formwork elements with a crane

6.3.1 With the RASTO G2 Transport Hook

Use the new RASTO G2 Transport Hook to hoist, align and move single or connected formwork elements by crane.



- 1 Profile lock; locks the Transport Hook to the edge profile of the panel.
- 2 Suspension link; for attaching a suitable sling
- 3 Lever; for releasing the profile lock



WARNING

Formwork panels can drop!

If the Transport Hook is operated incorrectly, formwork elements can drop! This can cause personal injury or death!
Refer to the separate user guide for the Transport Hook!



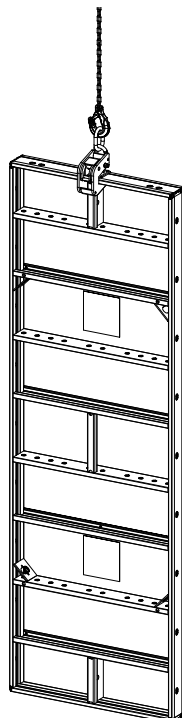
The separate operating instructions for the Transport Hook explain how to use the Transport Hook to move panels by crane.

The following illustrations show examples of how the Transport Hook is used.

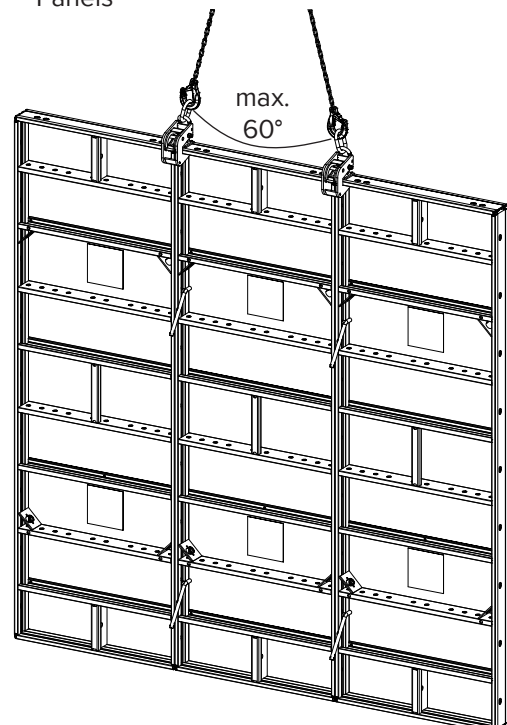
Single formwork elements can be moved with a single Transport Hook. Always attach the Transport Hook to the centre of the panel.

Always use 2no. Transport Hooks to move panel assemblies. Always attach the Transport Hooks over a panel joint.

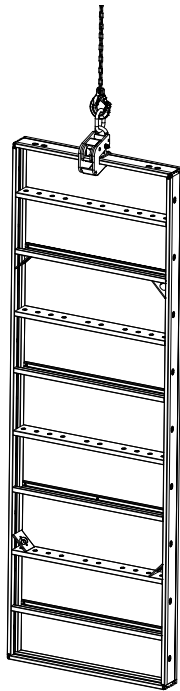
Single RASTO G2 Panels



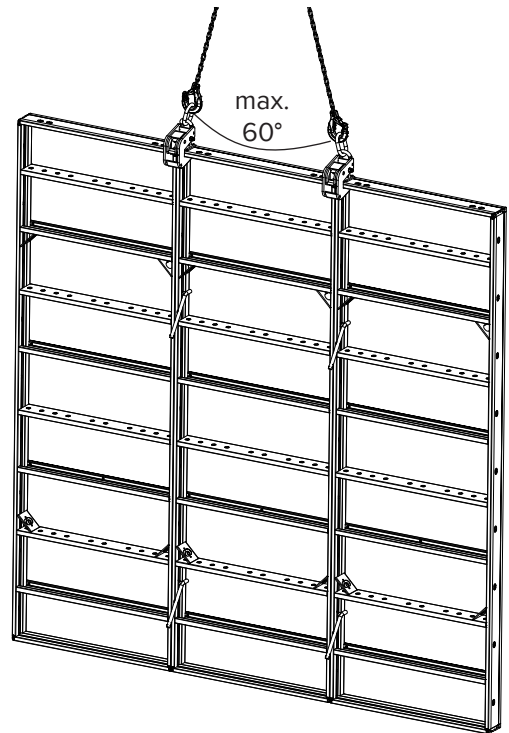
Panel assembly made of RASTO G2 Panels



Single conventional RASTO Panel

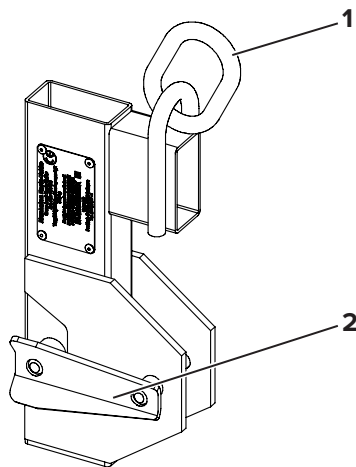


Panel assembly made of conventional RASTO Panels

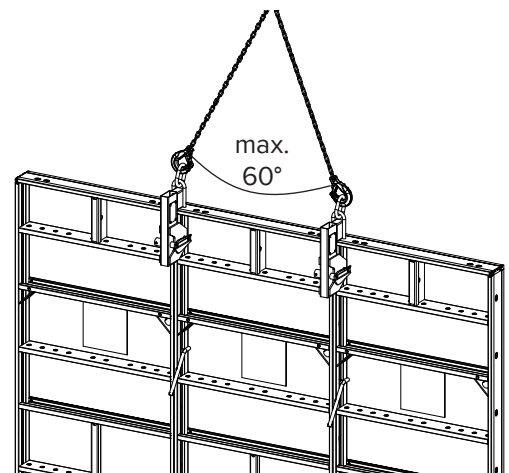


6.3.2 With the RASTO Transport Hook

Use 2no. RASTO Transport Hooks to hoist, align and move single or connected formwork elements. The Transport Hooks must always be used in pairs.



- 1 Suspension link
- 2 Locking pin



! WARNING

Formwork panels can drop!

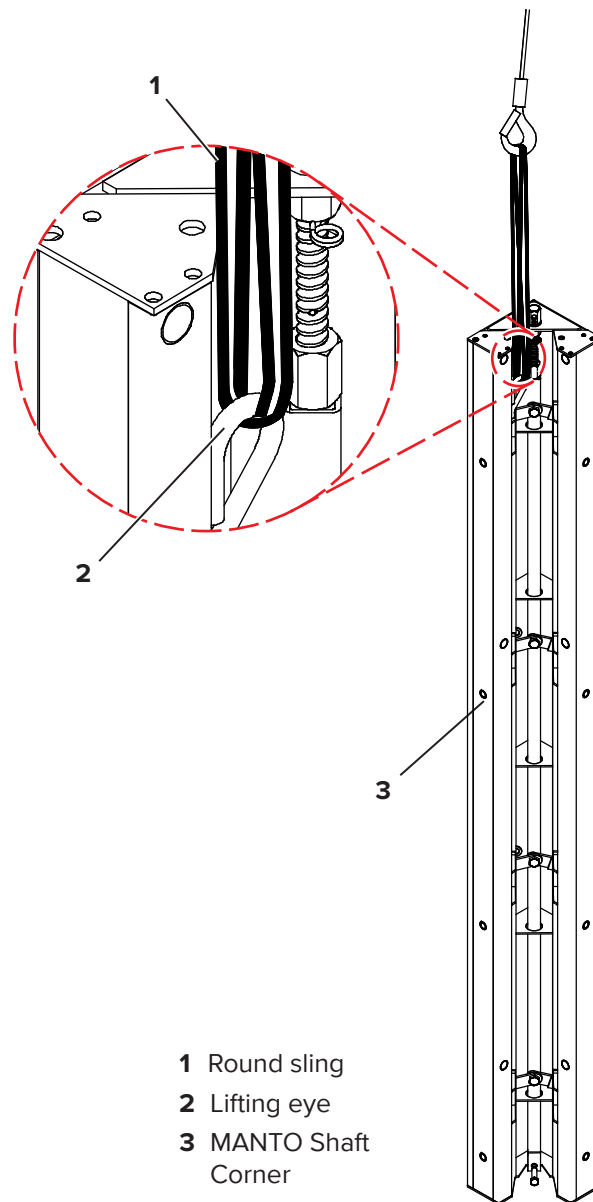
If the Transport Hook is operated incorrectly, formwork elements can drop! This can cause personal injury or death!
Refer to the separate user guide for the Transport Hook!



The separate operating instructions for the Transport Hook explain how to use the Transport Hook to move panels by crane.

6.4 Transporting MANTO Shaft Corner

Every MANTO Shaft Corner has a built-in lifting ring. A round sling can be passed through the ring to transport individual elements.



- 1 Round sling
- 2 Lifting eye
- 3 MANTO Shaft Corner



WARNING

Warning!

Do not attach the crane hook directly to the lifting ring on the MANTO Shaft Corner! Always use a round sling to connect the MANTO Shaft Corner to the crane hook! The lifting ring is intended to be used only to transport a single MANTO Shaft Corner, not to transport the entire shaft formwork!

7 Preparing formwork elements

Before setting up the formwork, remove any concrete residue stuck to the components. Concrete residue on the frame makes it impossible to fit the formwork elements together tightly. Concrete residue on the form lining will distort the concrete finish.

Use formwork oil to thoroughly clean the form lining and the edge profiles on the panels. This prevents the formwork from sticking to the concrete, thus producing a better concrete finish.

The best way to clean and oil the formwork elements is to rest them on square timbers on the ground.

- Step 1** Place the formwork elements on the square timbers with the form lining side on top.
- Step 2** Remove any concrete residue.
- Step 3** Apply a very thin film of formwork oil.

8 Connecting formwork elements

The formwork elements can be connected in an upright position or lying flat. If you intend to transport the formwork elements after connecting them to one another, keep in mind the weight of the joined elements and the maximum load capacity of the selected lifting accessory.

Depending on the planned application, there are various connectors available for joining formwork elements. The following table helps to select the proper connector. Information on how to use the various connectors can be found on the next few pages. How to use the Outer Corner Clamp is described on page 70.

Use	Clip	Aligning Panel Clamp	Adjustable Aligning Clamp	Outer Corner Clamp*
Vertical joint	✓	✓	✓	—
Vertical joint with infill	—	—	✓	—
Vertical joint with height offset	—	✓	✓	—
Vertical joint when panels are aligned horizontally	✓	✓	✓	—
Horizontal joint (stacking)	—	✓	✓	—
Vertical joints with increased tensile loads at corners or stopends	—	✓	✓	—
Outer corners	—	—	—	✓

* How to use the Outer Corner Clamp is described in Section *Creating corners* on page 61.

8.1 With the RASTO Clip

RASTO Panels can be connected vertically quickly and such that they fit together tightly with joints that are resistant to tension in just one step using the RASTO Clip. No other tools are required to operate the RASTO Clip.

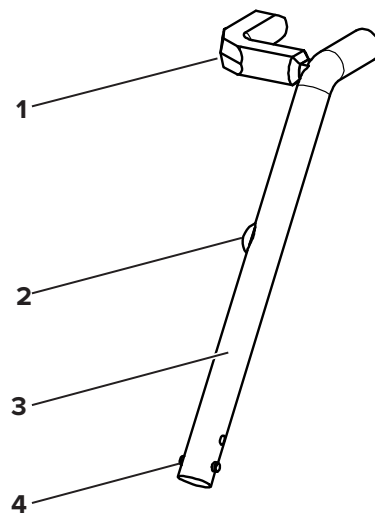
The RASTO Clip is normally installed with the grip pointing down diagonally when the RASTO Clip is in the end position. In exceptional cases this position may not be possible because the grip would collide with another component, e.g. the Tie Nut. In this case the RASTO Clip can be installed the other way around, with the grip pointing up when it is in the end position.

NOTE

Risk of formwork collapsing!

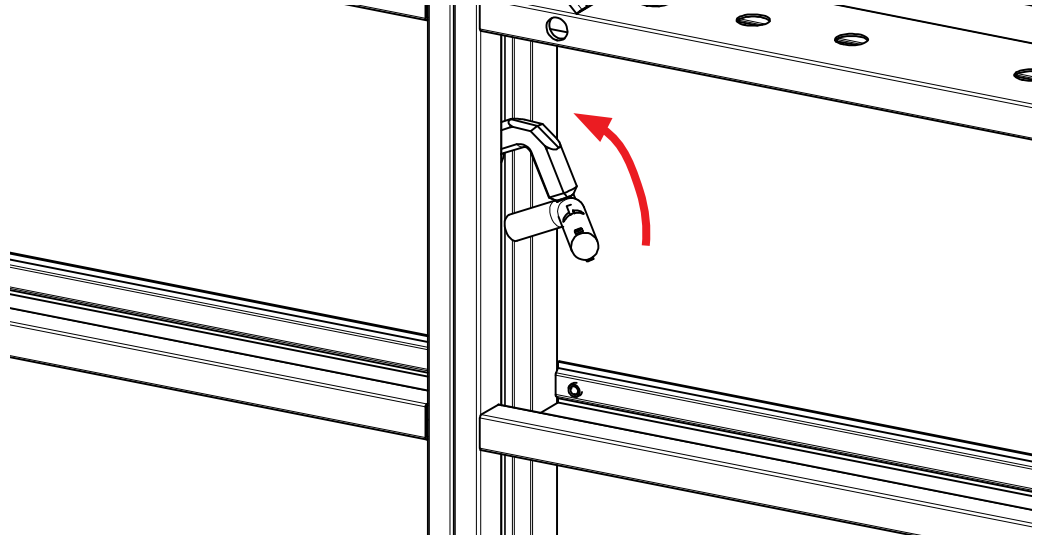
When the RASTO Clip (code:602645) is used in sections of the formwork that are subjected to higher tensile loads, e.g. outer corners and stopends, the RASTO Clip may be overloaded when concrete is poured! This can cause the formwork to open and concrete to escape!

Do not use the RASTO Clip in sections subjected to higher tensile loads!

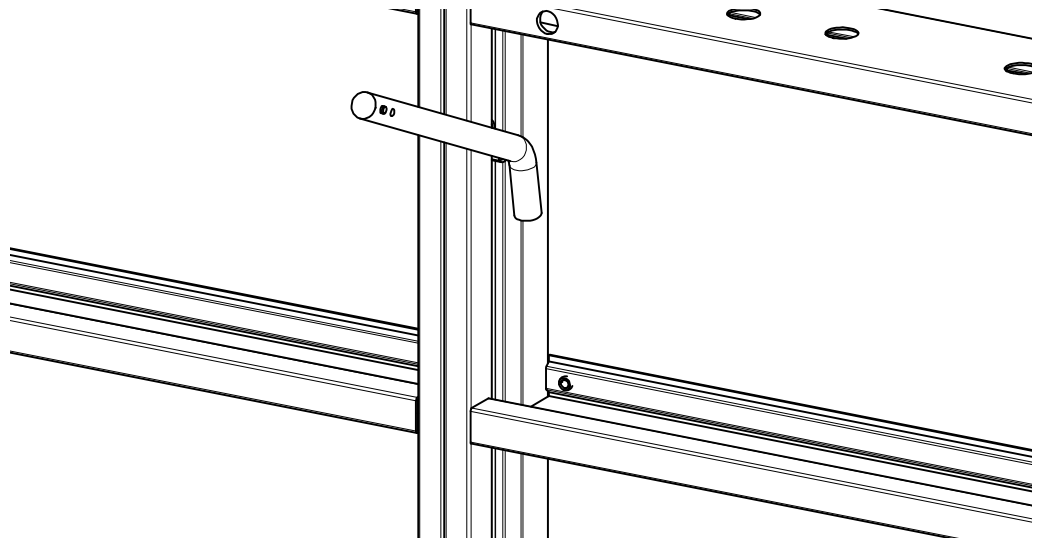


- 1 Bent profile
- 2 Limit stop; rests against the edge profile when installed
- 3 Grip
- 4 End of grip with pin; for unscrewing the Sealing Cone from the one-sided tie system.

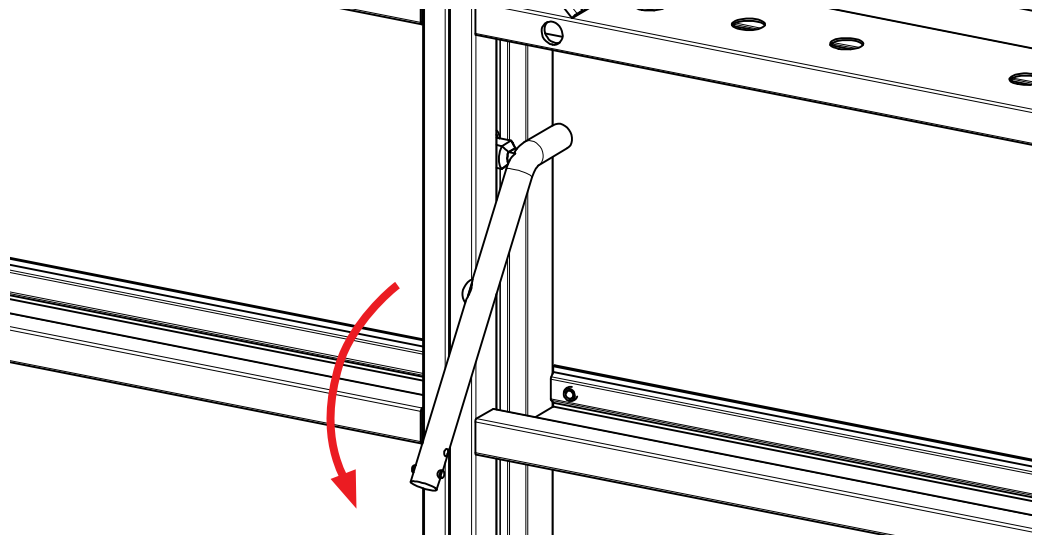
Step 1 Pass the bent profile of the RASTO Clip through the slots in the edge profiles of the RASTO Panels.



Step 2 Turn the RASTO Clip such that both ends point down.



Step 3 Press the grip down until the limit stop rests against the edge profile.

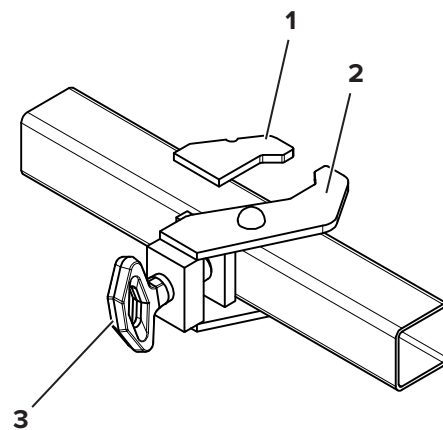


8.2 With the RASTO Aligning Panel Clamp

All RASTO Panels can be vertically connected such that they fit together tightly with joints that are resistant to tension in just one step using the RASTO Aligning Panel Clamp. Vertical joints can be created in places where the RASTO Aligning Panel Clamp can be supported by a vertical profile. The Panels are properly aligned without offset at the same time. Depending on what is needed for the specific application, vertical offsets of any size can be created with the RASTO Aligning Panel Clamp.

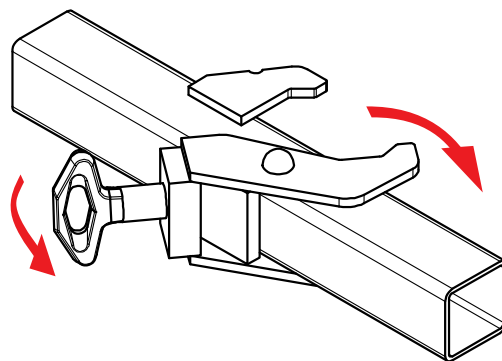
Large sections of connected formwork elements can then be moved, deposited and erected again with a crane (Refer to page 44).

Use a carpenter's hammer to operate the RASTO Aligning Panel Clamp. Insert the pointed end of the hammer head in the screw head to tighten or loosen the tensioning screw. This procedure is quiet, requires minimal effort, and does not damage the material.

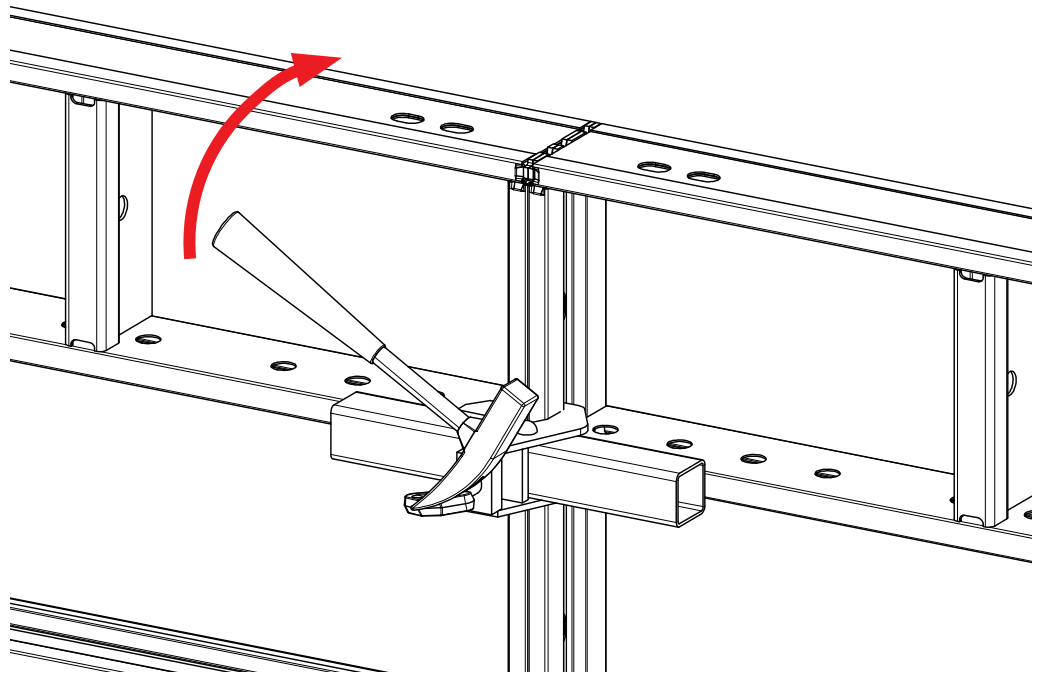


- 1 Fixed claw
- 2 Moveable claw
- 3 Tensioning screw

Step 1 Release the tensioning screw on the RASTO Aligning Panel Clamp and unscrew it far enough that the claws can be pushed around the panel joint.



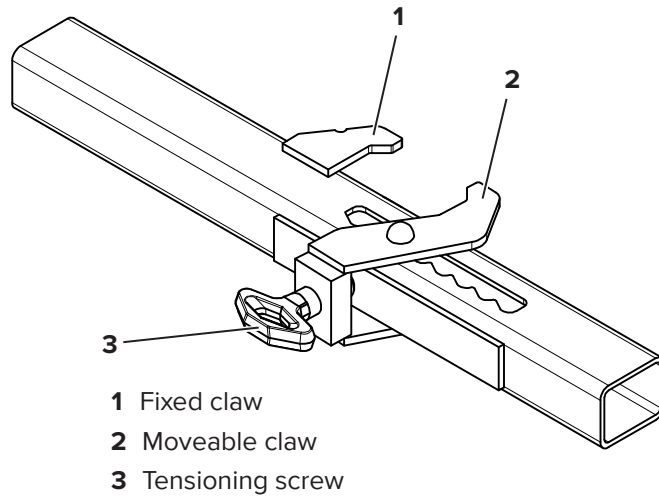
Step 2 Push the Aligning Panel Clamp onto the panel joint and tighten the tensioning screw.



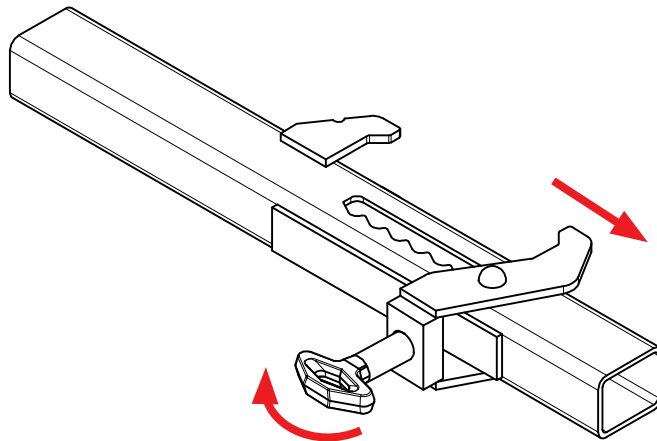
8.3 With the RASTO Adjustable Aligning Clamp

The RASTO Adjustable Aligning Clamp connects RASTO/TAKKO Panels to one another in the same way as the RASTO Aligning Panel Clamp.

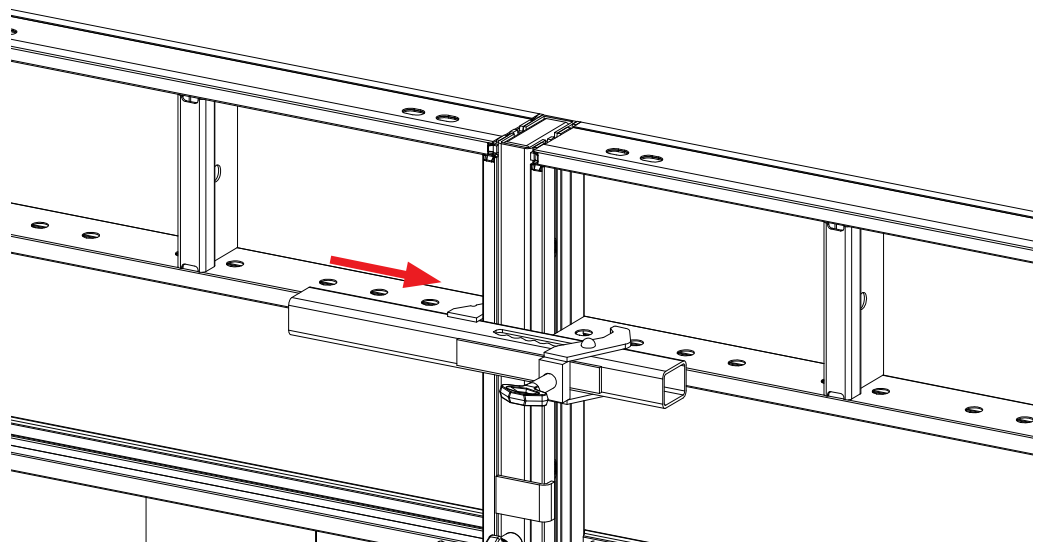
But this connector has an adjustable claw that can accommodate an infill of up to 150 mm in the panel joint.



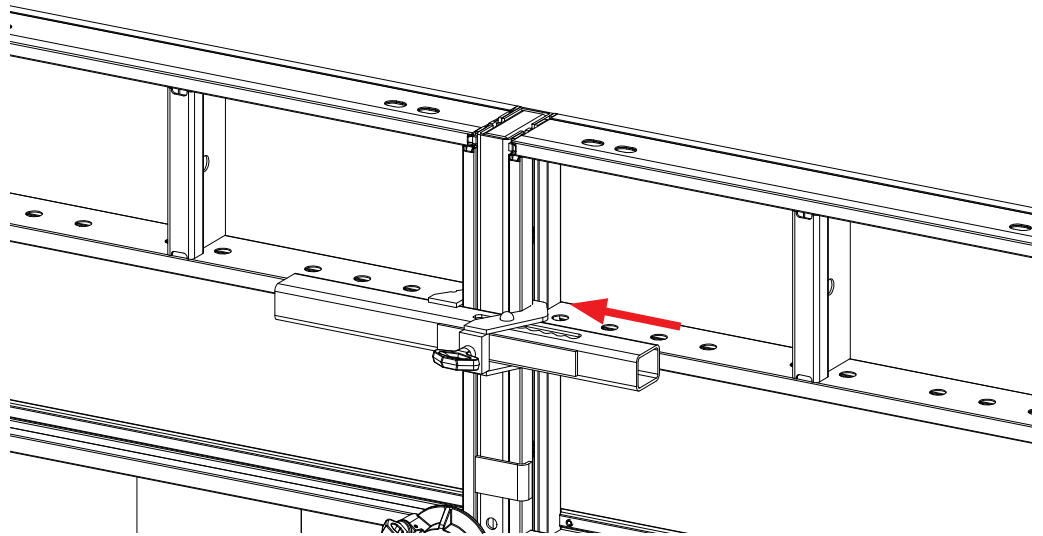
Step 1 Release the tensioning screw on the RASTO Adjustable Aligning Clamp and unscrew it far enough that the moveable claw can be repositioned.



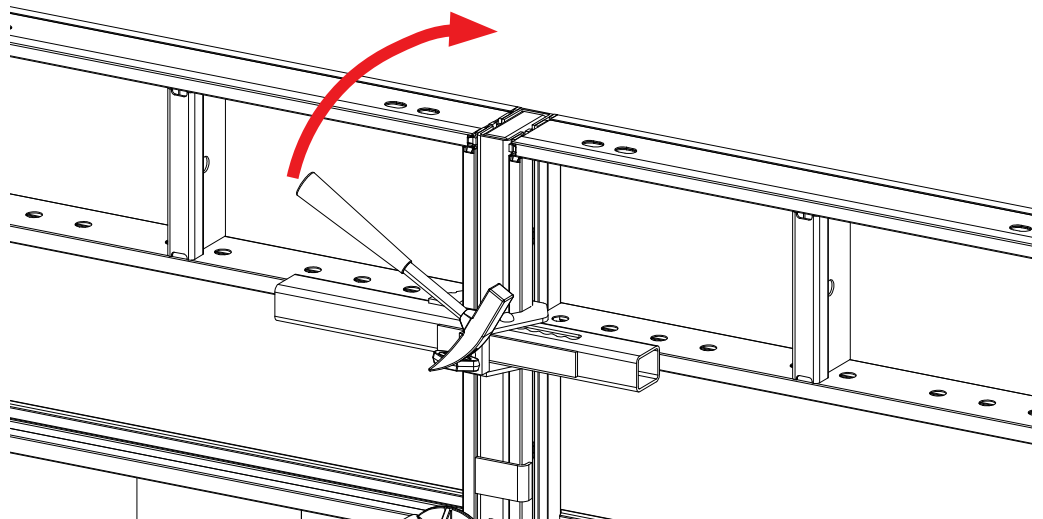
Step 2 Place the Adjustable Aligning Clamp on the panel joint such that the fixed claw rests against the edge profile of one of the panels.



Step 3 Slide the moveable claw onto the edge profile of the other panel.



Step 4 Tighten the tensioning screw in the Adjustable Aligning Clamp.



9 Erecting straight walls

The RASTO Panels can be connected to one another in an upright position or lying flat to erect straight walls with or without stacking. Special rules apply to creating corners and stopends. The quantity of connectors needed can be found in the respective sections of the user guide.

The following illustrations provide an overview of the quantity and position of the required connectors at vertical and horizontal joints. When the panels are assembled in the configurations shown here, they can be moved, stood upright and placed on the ground with a crane. Always take into consideration the panel combinations and the load capacity of the lifting accessory.



WARNING

Warning!

The following illustrations indicate the quantity of connectors needed for the panel combinations shown, without additional components. If components are added to the panels, e.g. struts or platforms, the number of connectors may need to be increased.

Symbols



RASTO Clip



RASTO Aligning Panel Clamp



RASTO Adjustable Aligning Clamp



MANTO Tie Nut



RASTO Bulkhead Clamp

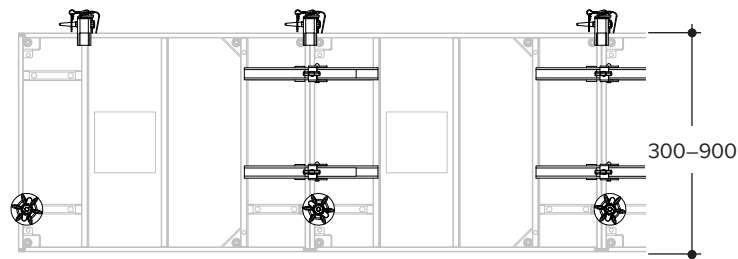


FU Tightener

9.1 Horizontally aligned panels

9.1.1 TAKKO Panels

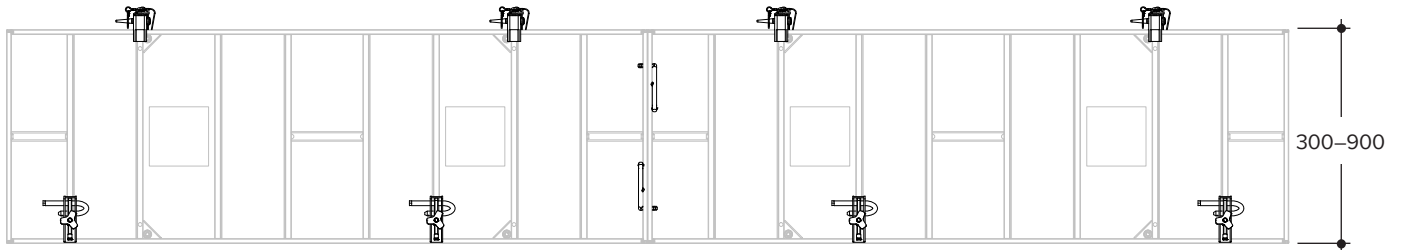
Use the RASTO Aligning Panel Clamp to join horizontally aligned TAKKO Panels. Connecting horizontally aligned TAKKO Panels with a RASTO Clip is not possible due to the profile geometry of the Panels.



- 3no. ties
- 2no. RASTO Clips to connect vertical joints
- 3no. Bulkhead Clamps as dry ties

9.1.2 RASTO Panels

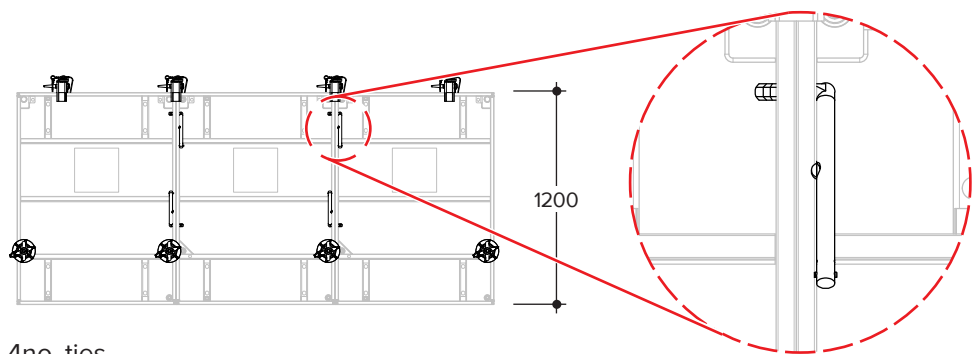
Use the RASTO Clip to join horizontally aligned RASTO Panels.



- 4no. FU Tighteners for tying near the ground
- 2no. RASTO Clips to connect vertical joint
- 4no. Bulkhead Clamps as dry ties

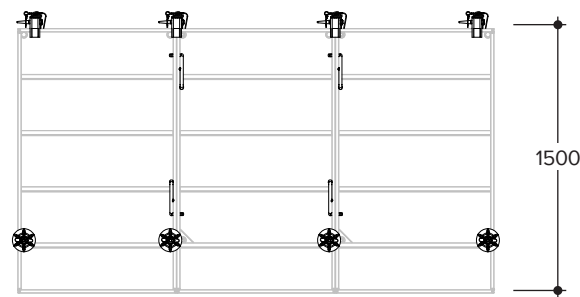
9.2 Vertically aligned Panels

9.2.1 TAKKO Panels



- 4no. ties
- 4no. RASTO Clips to connect vertical joints
- 4no. Bulkhead Clamps as dry ties

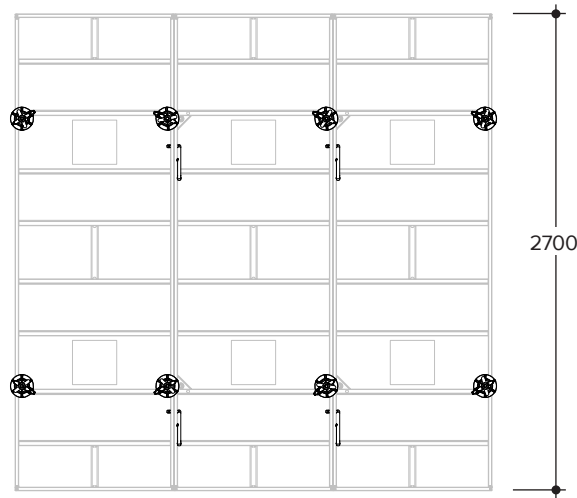
9.2.2 RASTO Panels 150



- 4no. ties
- 4no. RASTO Clips to connect vertical joints
- 4no. Bulkhead Clamps as dry ties

Erecting straight walls

9.2.3 RASTO Panels 270

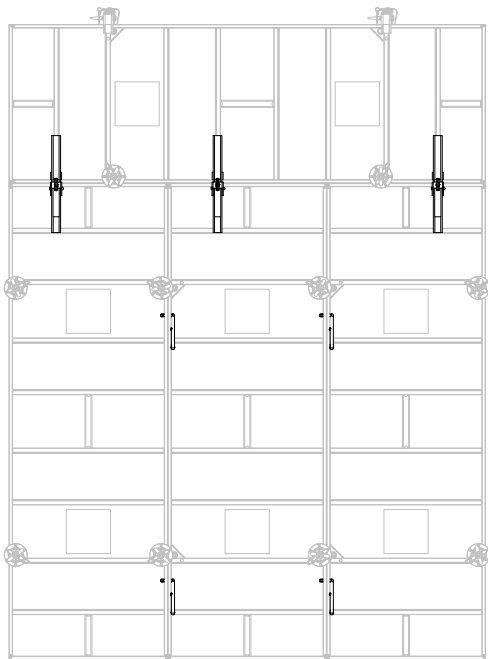


8no. ties
4no. RASTO Clips to connect vertical joints

9.3 Stacking on Panel 270

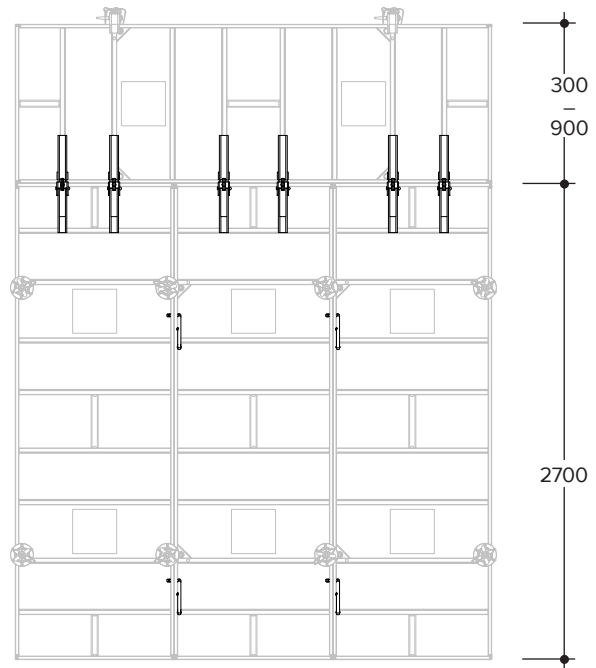
Formwork height 3.00–3.60 m

Option with 3rd tie position



10no. ties
4no. RASTO Clips to connect vertical joints
3no. Adjustable Aligning Clamps to connect horizontal joint
2no. Bulkhead Clamps as dry tie

Option without 3rd tie position

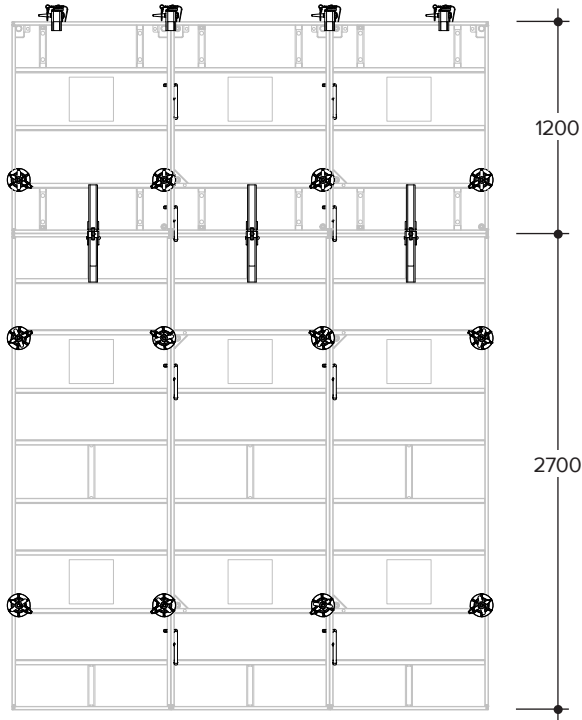


8no. ties
4no. RASTO Clips to connect vertical joints
6no. Adjustable Aligning Clamps to connect horizontal joint
2no. Bulkhead Clamps as dry tie

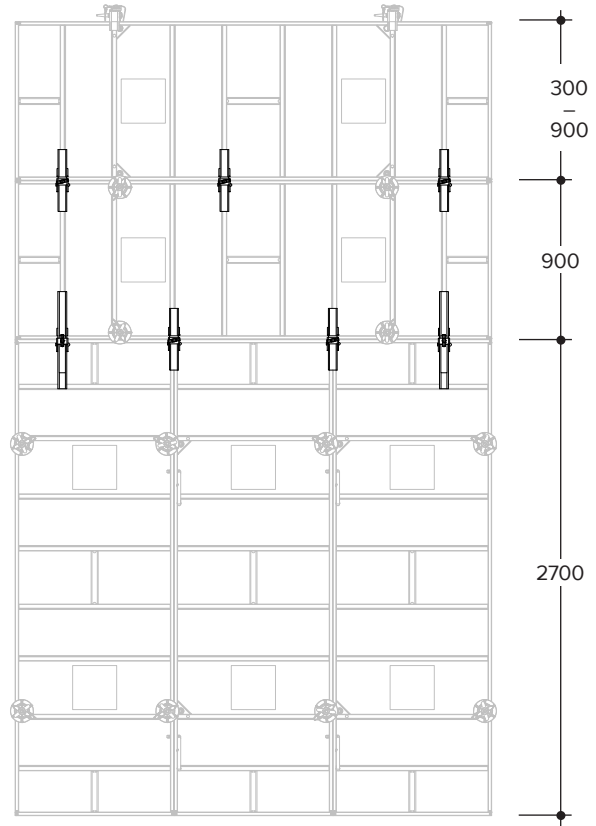
The option without the 3rd tie position is possible only in the arrangement shown here! Extension only on panels 270.
Maximum height of extension 900 mm!

Formwork height 3.90–4.50 m

Formwork height 3.90 m



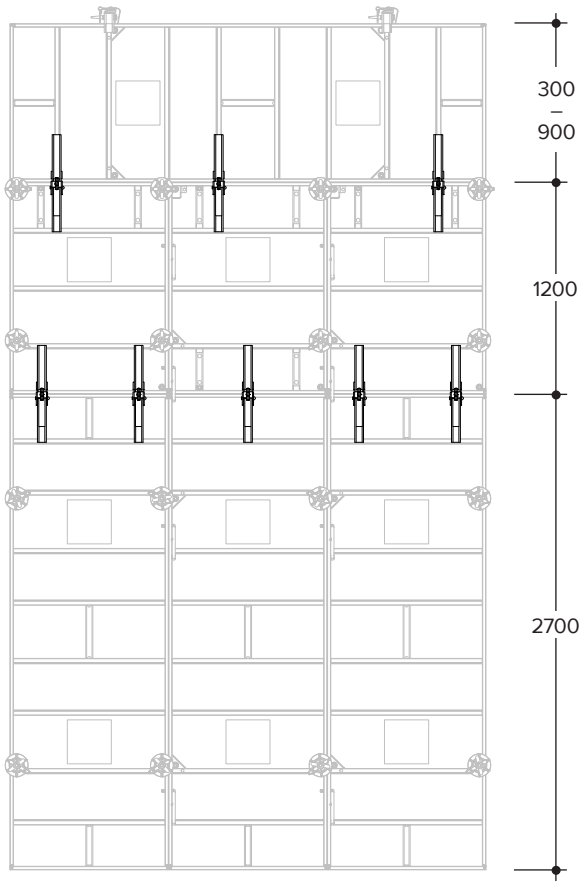
- 12no. ties
- 8no. RASTO Clips to connect vertical joints
- 3no. Adjustable Aligning Clamps to connect horizontal joint
- 4no. Bulkhead Clamps as dry ties



- 12no. ties
- 4no. RASTO Clips to connect vertical joints
- 5no. RASTO Aligning Panel Clamp to connect horizontal joints
- 2no. Adjustable Aligning Clamps to connect horizontal joints
- 2no. Bulkhead Clamps as dry tie

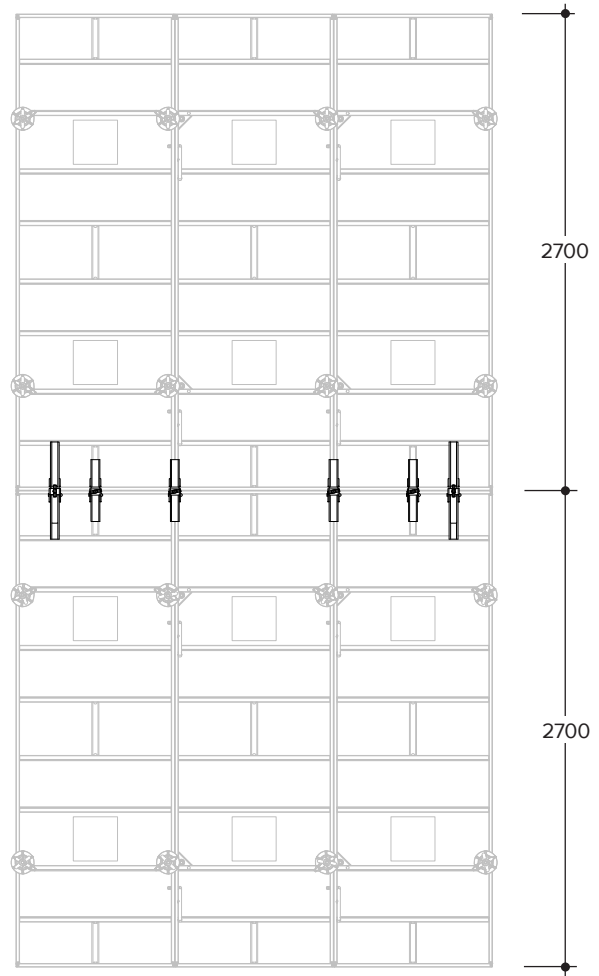
Erecting straight walls

Formwork height 4.20–4.80 m



- 16no. ties
- 8no. RASTO Clips to connect vertical joints
- 8no. Adjustable Aligning Clamps to connect horizontal joints
- 2no. Bulkhead Clamps as dry tie

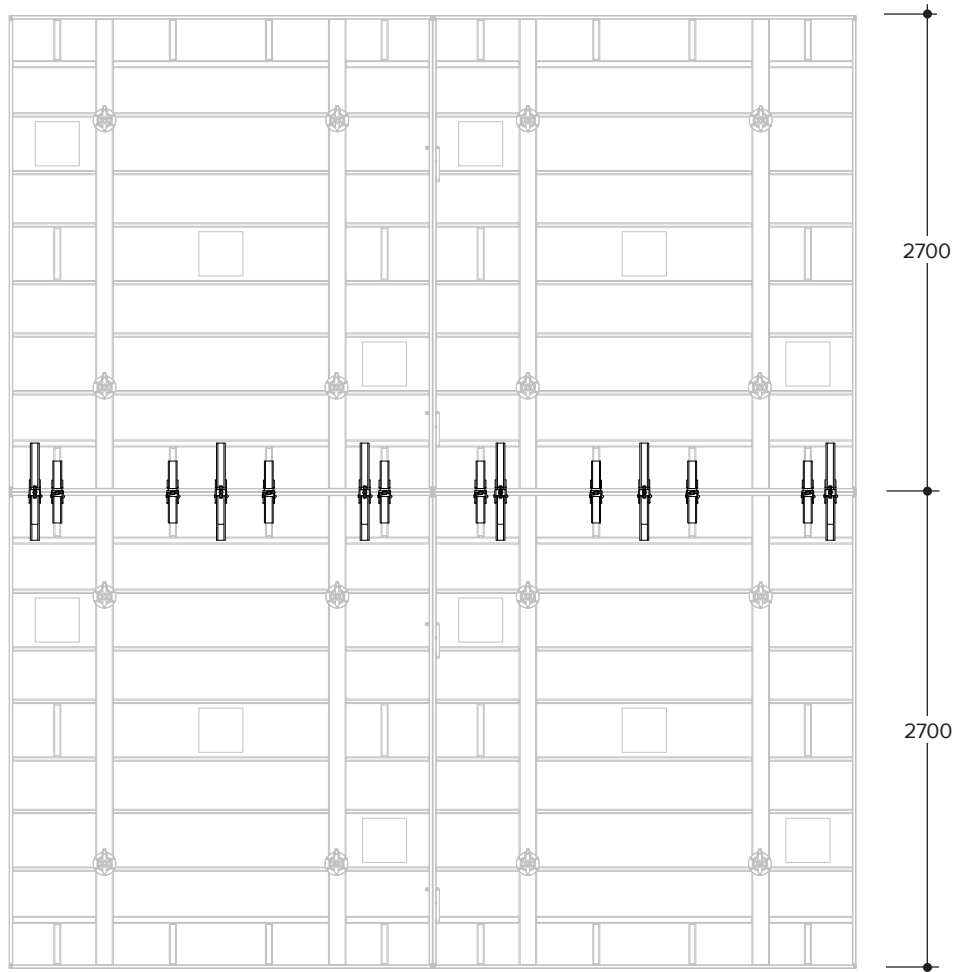
Formwork height 5.40 m



- 16no. ties
- 8no. RASTO Clips to connect vertical joints
- 4no. RASTO Aligning Panel Clamps to connect horizontal joint
- 2no. Adjustable Aligning Clamps to connect horizontal joint

9.4 Stacking with RASTO XXL

Formwork height 5.40 m



12no. ties

4no. RASTO Clips to connect vertical joints

8no. RASTO Aligning Panel Clamps to connect horizontal joints

6no. Adjustable Aligning Clamps to connect horizontal joints



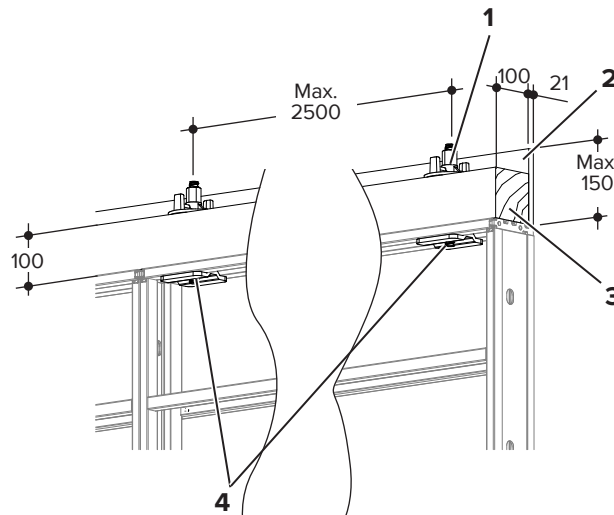
Lifting Devices have to be used to move this panel combination by crane! If the RASTO Transport Hook is used to move this panel combination, the Transport Hook will be overloaded!

9.5 On-site extensions

Extensions up to 400 mm can be created using materials available on site. Extensions up to 150 mm and up to 400 mm are created differently.

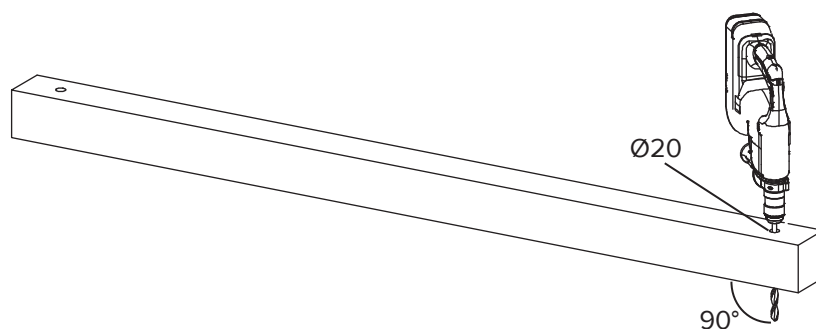
9.5.1 Extensions up to 150 mm

For extensions up to 150 mm, use a 100 mm square timber and a 21 mm strip of form lining. Use Centring Tension Bolts and Tension Nuts to secure the extensions to the edge profile of the panels. The maximum space permitted between two Centring Tension Bolts is 2.50 m.

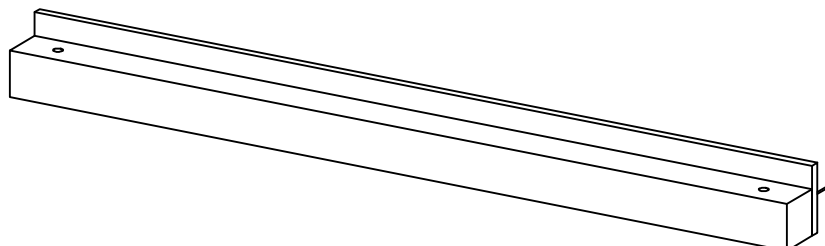


- 1 Tension Nut
- 2 Strip of form lining
- 3 Square timber, 100 mm thick
- 4 Centring Tension Bolt

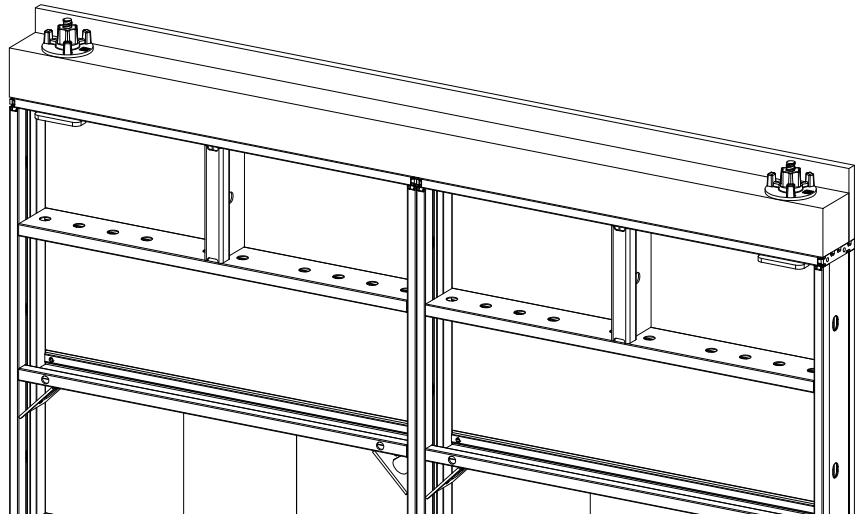
Step 1 Drill the required number of holes $\text{Ø}20$ mm in the square timber for the Centring Tension Bolts, spacing them as required. Observe the spacing of the holes in the edge profile of the panel!



Step 2 Nail on the strip of form lining such that it is flush with the square timber.

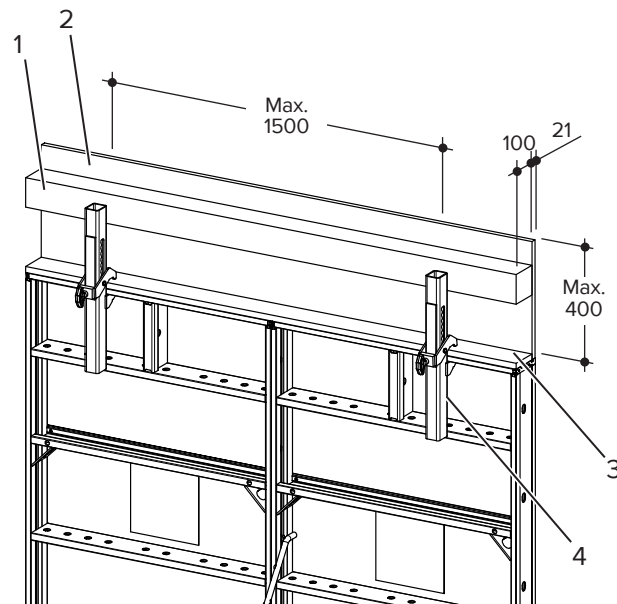


Step 3 Use Centring Tension Bolts and Tension Nuts to secure the square timber to the upper edge profile on the panels.



9.5.2 Extensions up to 400 mm

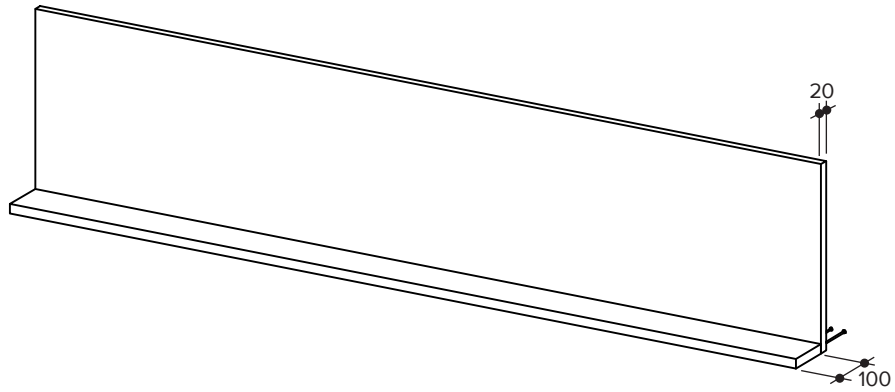
For extensions up to 400 mm, use a 100 mm square timber, a 21 mm strip of form lining and an approx. 20 mm thick board. Use Adjustable Aligning Clamps to secure the extension to the edge profile of the panels. The maximum space permitted between two Adjustable Aligning Clamps is 1.50 m. Always attach the Adjustable Aligning Clamps to on-site extensions such that the moveable claw is on top. This ensures that the Adjustable Aligning Clamps are always above the extension and above the H-rib on the panel.



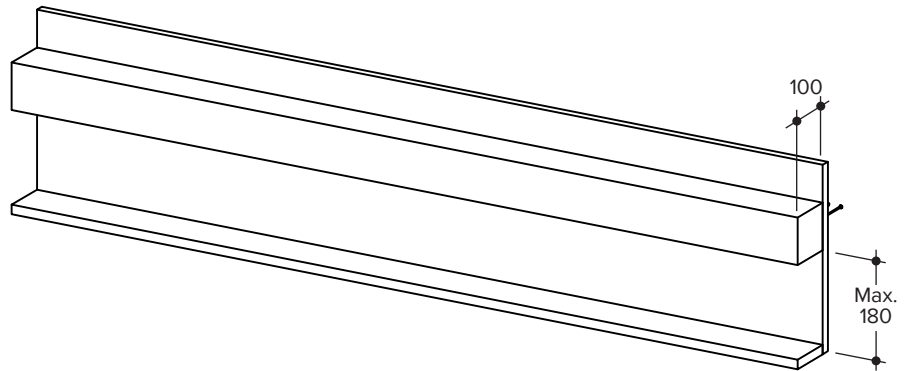
- 1 Square timber, 100 mm thick
- 2 Strip of form lining, 21 mm thick
- 3 Board, approx. 20 mm thick
- 4 Adjustable Aligning Clamp

Erecting straight walls

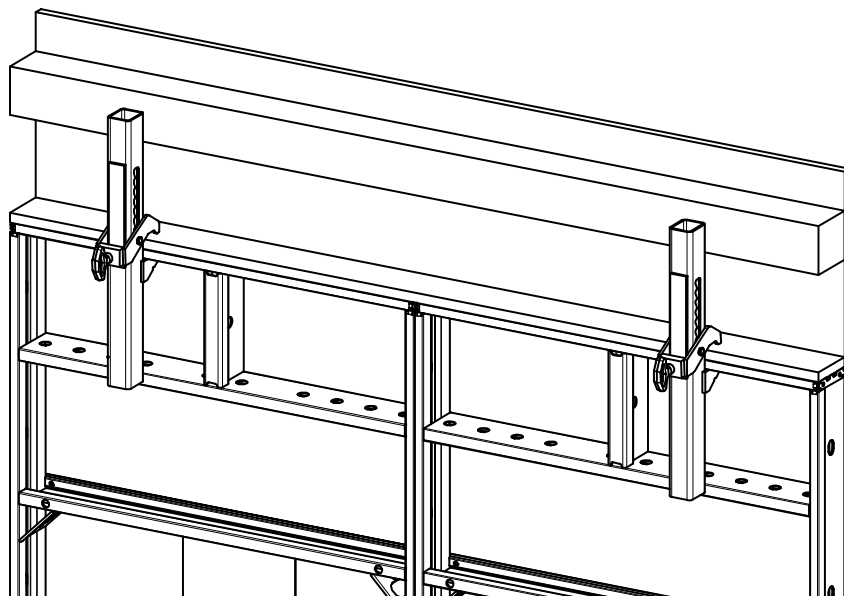
Step 1 Nail a board, approx. 20 mm thick, to the form lining such that it is vertically flush.



Step 2 Nail a square timber onto the form lining no more than about 180 mm away from the board (smallest space between square timber and board).



Step 3 Use Adjustable Aligning Clamps to secure the extension to the upper edge profile on the panels. Remember to attach the Adjustable Aligning Clamps such that the moveable claw is on top.



10 Creating corners

Many different constellations of corners can be built with the RASTO system components. In general, there is more strain on the formwork near the outer corners than along straight sections. This is why more connectors are needed near corners (Refer to page 62). This applies to the corners themselves as well as to the nearby panels:

- Up to 1.05 m from the corner when the wall is no more than 30 cm thick
- Up to 1.30 m from the corner when the wall is up to 50 cm thick.



CAUTION

Risk of formwork collapsing!

If the permitted pressure is exceeded (Refer to the table on page 152), the formwork can collapse! Never exceed the permitted concrete pressure! If necessary, decrease the pouring rate!

NOTE

Risk of formwork collapsing!

When the RASTO Clip (code:602645) is used in sections of the formwork that are subjected to higher tensile loads, e.g. outer corners and stopends, the RASTO Clip may be overloaded when concrete is poured! This can cause the formwork to open and concrete to escape!

For the RASTO Clip, the length of section 1 is 2.30 m at corners and 1.15 m at stopends. Do not use the RASTO Clip in this section!



Proof of structural stability has been provided separately for walls that are more than 50 cm thick!

10.1 Creating 90° corners

Create the interiors of 90° corners using the RASTO G2 or RASTO Inner Corner. Create the outer corners using RASTO G2 or RASTO Panels and, when needed, the Corner Adjustment.

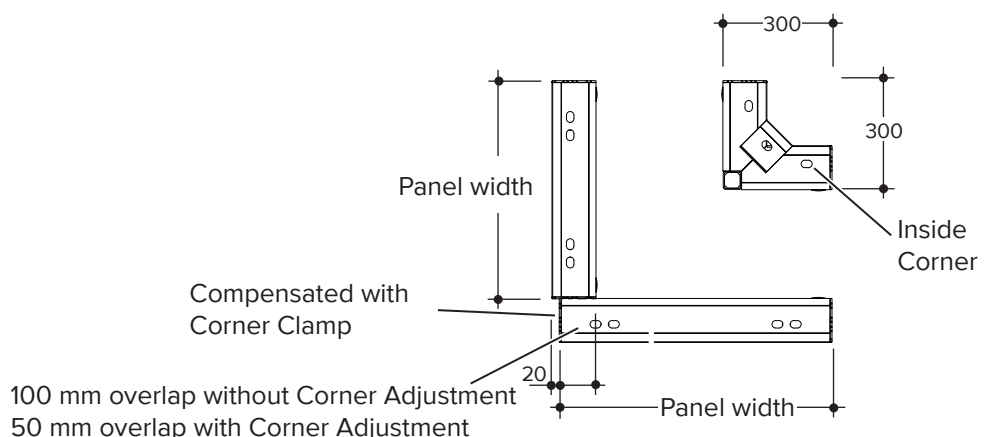
10.1.1 Planning corner

The following aspects are particularly important when planning the corners:

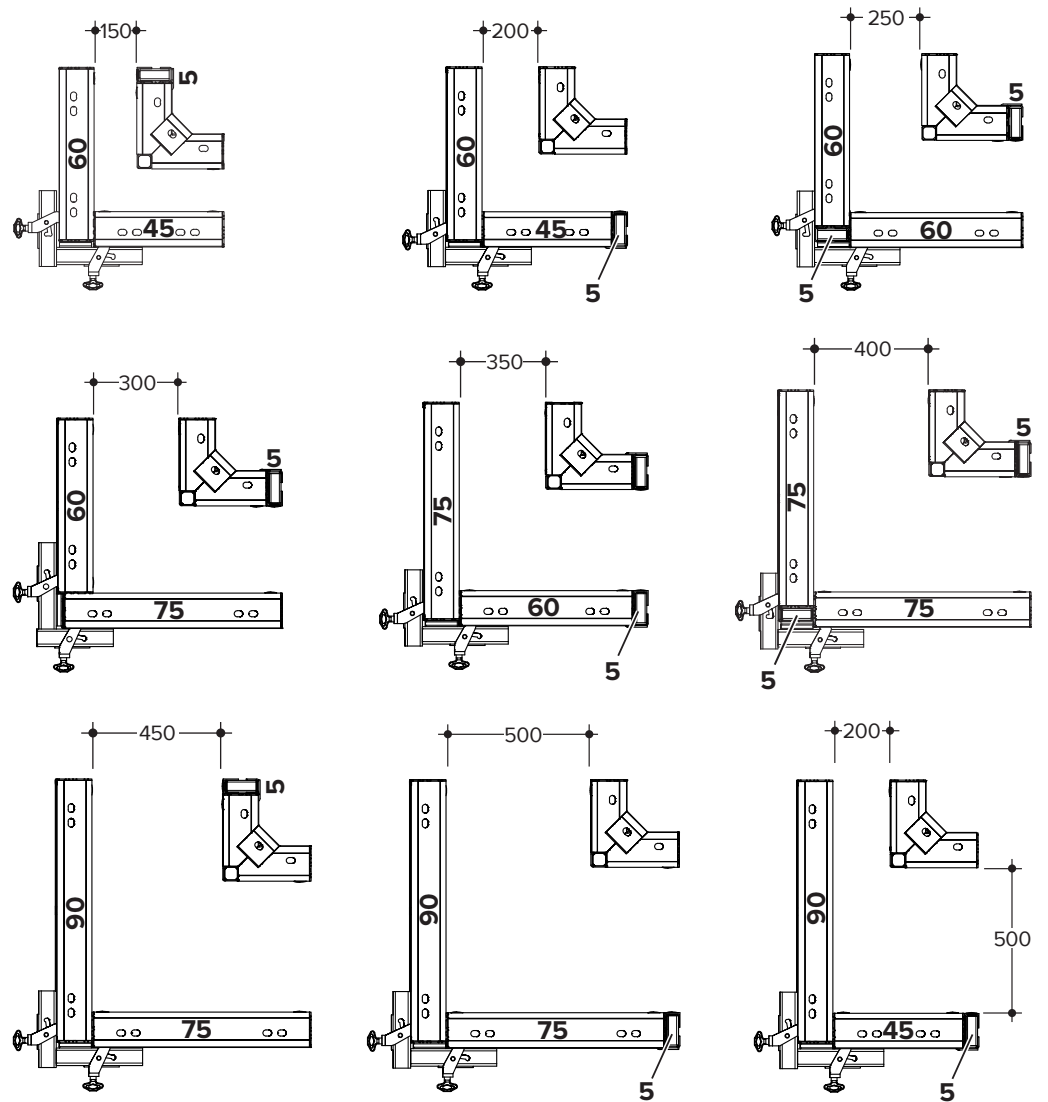
- The thickness of the wall to be concreted
- The panel widths available
- The position of the tie holes

The following illustrations are intended to help plan the corners and select the proper components.

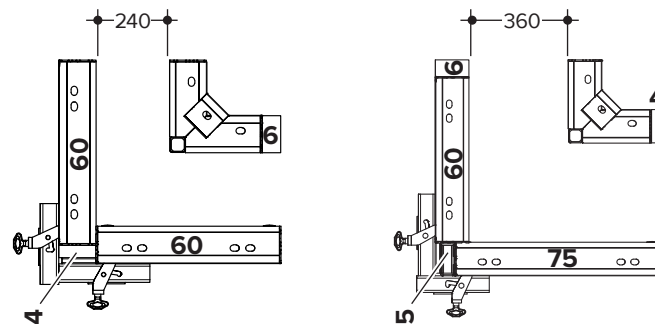
Typical 90° corner



Arrangement of RASTO/TAKKO Panels and of Corner Adjustment 5 for wall thicknesses of 15 to 50 cm in 5 cm increments

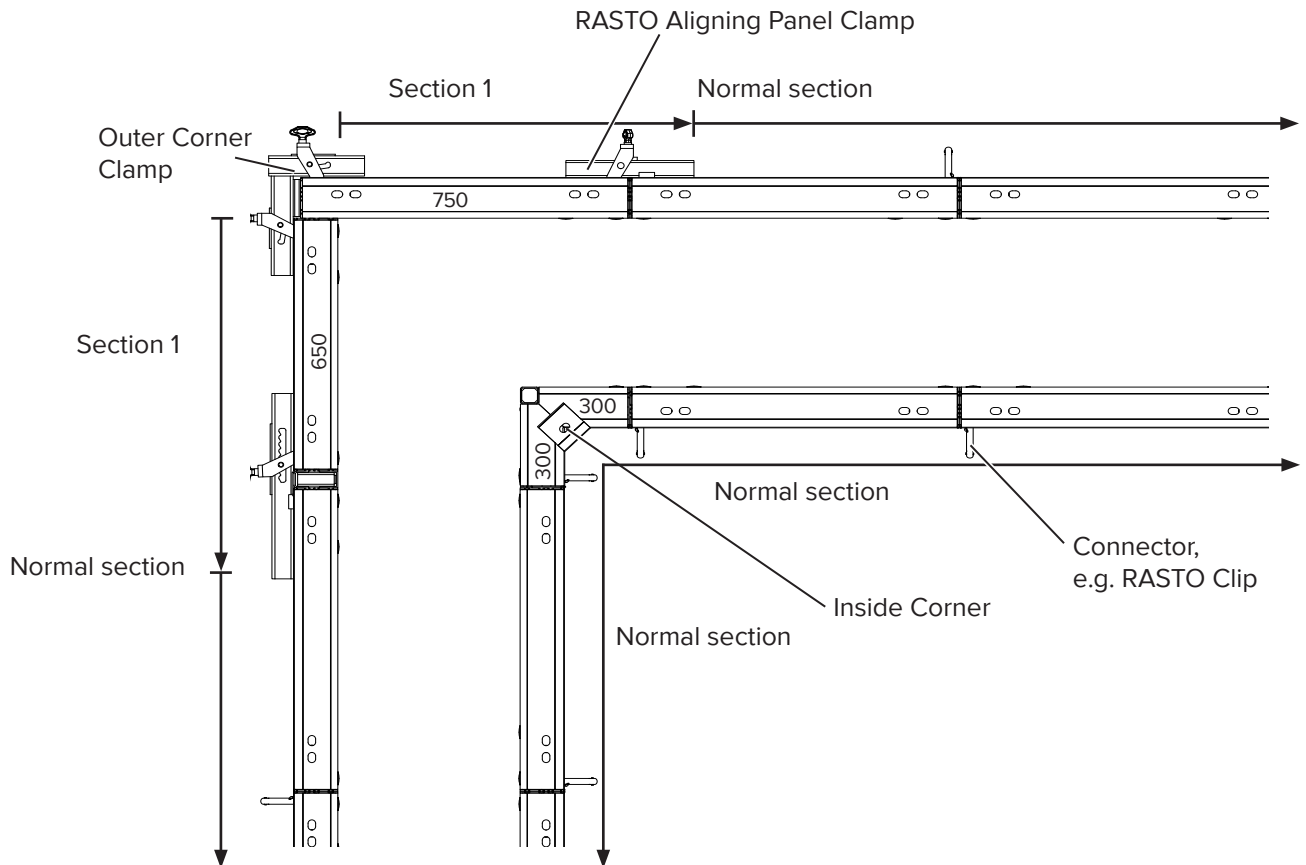


Arrangement of RASTO/TAKKO Panels and on-site infills for wall thicknesses of 24 cm and 36 cm




Quantity and distribution of Outer Corner Clamps at 90° outer corners

The load to which the corner and the adjacent panels (section 1 in the illustration below) are subjected is greater than in the normal sections along straight walls. This is why more Aligning Corner Clamps are needed at the corners and in section 1. The following table and the illustrations are intended to help you connect the panels properly.



NOTE **Risk of formwork collapsing!**
 When the RASTO Clip (code:602645) is used in sections of the formwork that are subjected to higher tensile loads, e.g. outer corners and stopends, the RASTO Clip may be overloaded when concrete is poured! This can cause the formwork to open and concrete to escape!
 For the RASTO Clip, the length of section 1 is 2.30 m at corners and 1.15 m at stopends. Do not use the RASTO Clip in this section!

 Depending on the conditions on site, we recommend avoiding vertical joints in section 1 whenever possible, e.g. by using RASTO panels XXL adjacent to the panels in the corner arrangement.

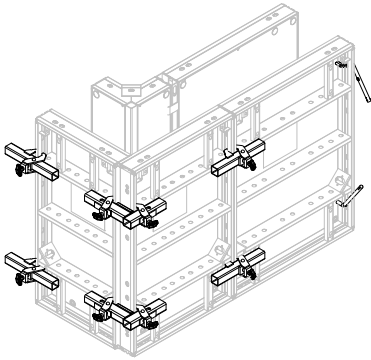
Panel height	Wall thickness ≤ 50 cm		Wall thickness ≤ 30 cm		Wall thickness ≤ 40 cm		Wall thickness ≤ 50 cm	
	Normal section		Corner	Section 1 < 1.05 m	Corner	Section 1 < 1.30 m	Corner	Section 1 < 1.30 m
	Req. no. of connectors		Req. no. of Corner Clamps	Req. no. of Al. Panel Clamps	Req. no. of Corner Clamps	Req. no. of Al. Panel Clamps	Req. no. of Corner Clamps	Req. no. of Al. Panel Clamps
120	2		2	2	2	2	2	2
150	2		2	2	2	2	2	2
270	2		3	3	4	3	4	4
150 150 ^{*)}	2	2	2 2 ^{*)}	3 2 ^{*)}	3 2 ^{*)}	3 2 ^{*)}	3 2 ^{*)}	3 2 ^{*)}
270 120 ^{*)}	2	2	4 2 ^{*)}	4 2 ^{*)}	4 2 ^{*)}	5 2 ^{*)}	6 2 ^{*)}	6 2 ^{*)}
270 150 ^{*)}	2	2	4 2 ^{*)}	5 3 ^{*)}	4 2 ^{*)}	5 3 ^{*)}	6 2 ^{*)}	6 2 ^{*)}
270 270 ^{*)}	2	2	5 3 ^{*)}	5 3 ^{*)}	5 4 ^{*)}	4 5 ^{*)}	6 4 ^{*)}	7 4 ^{*)}

^{*)} Stacked panels

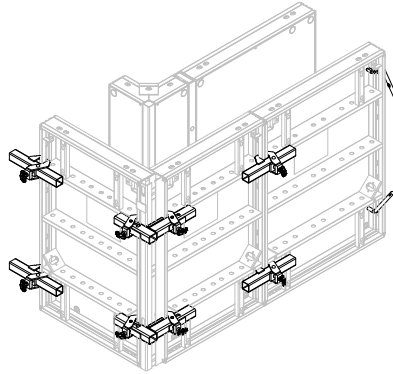
All values stated here apply to concrete of a normal consistency and assuming a coefficient of friction of $\mu = 0.20$ between the concrete and the formwork. Special records must be kept for liquid concrete and concrete of a thinner consistency!

Example: Panels ≤ 150

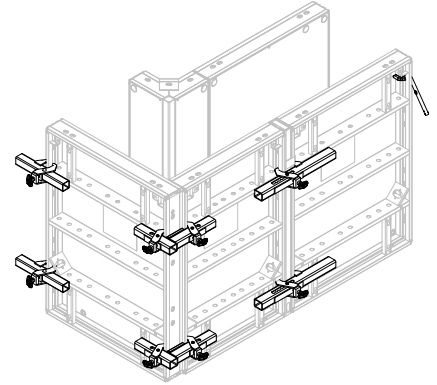
Wall thickness ≤ 30 cm



Wall thickness ≤ 40 cm

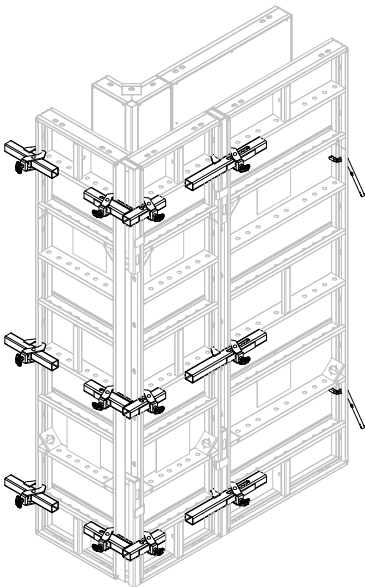


Wall thickness ≤ 50 cm

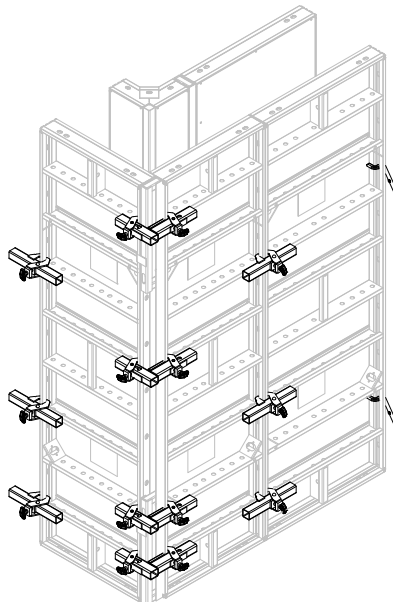


Example: Panels 270

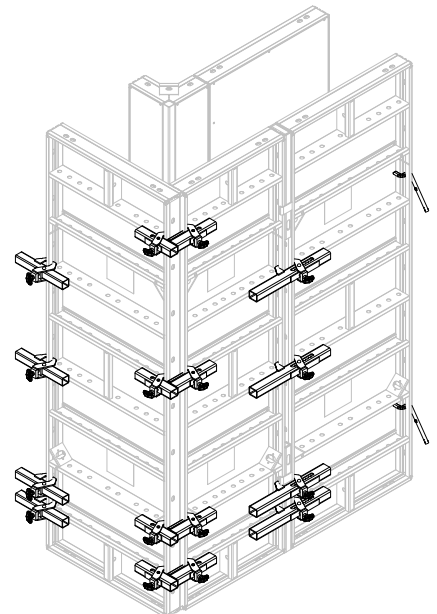
Wall thickness ≤ 30 cm



Wall thickness ≤ 40 cm

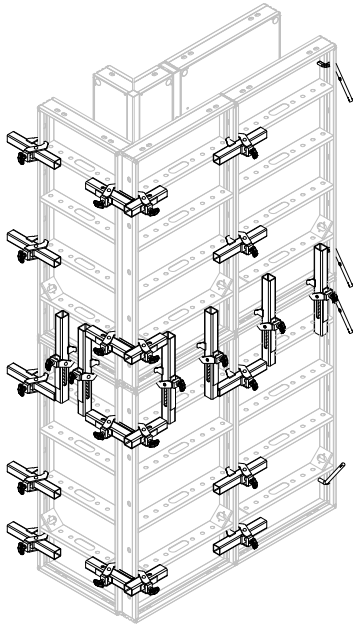


Wall thickness ≤ 50 cm

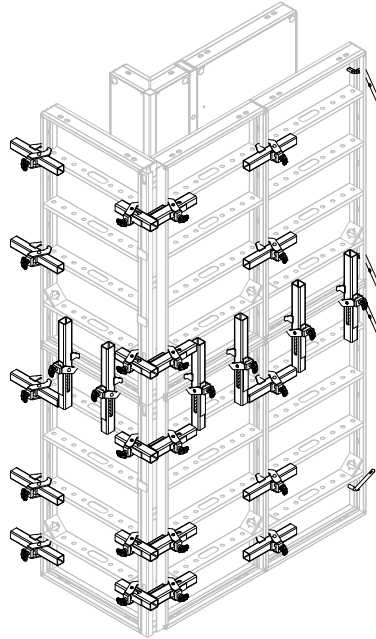


Example: Panels 150/150

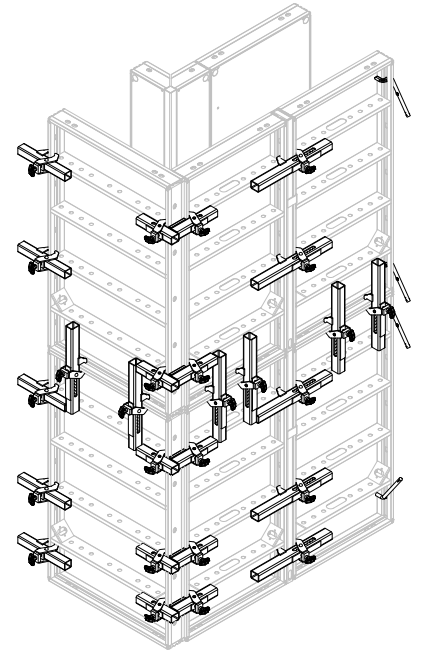
Wall thickness ≤ 30 cm



Wall thickness ≤ 40 cm

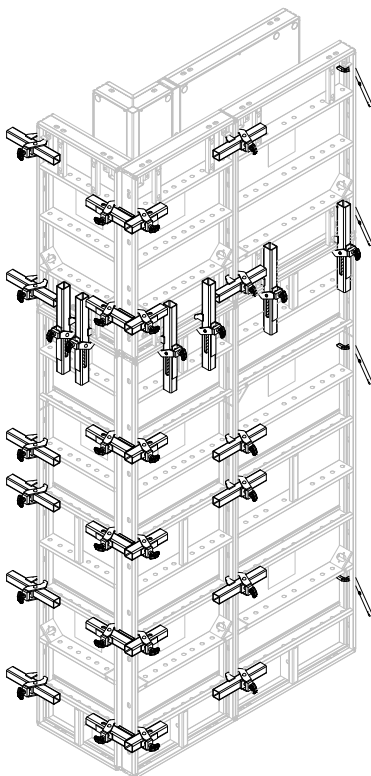


Wall thickness ≤ 50 cm

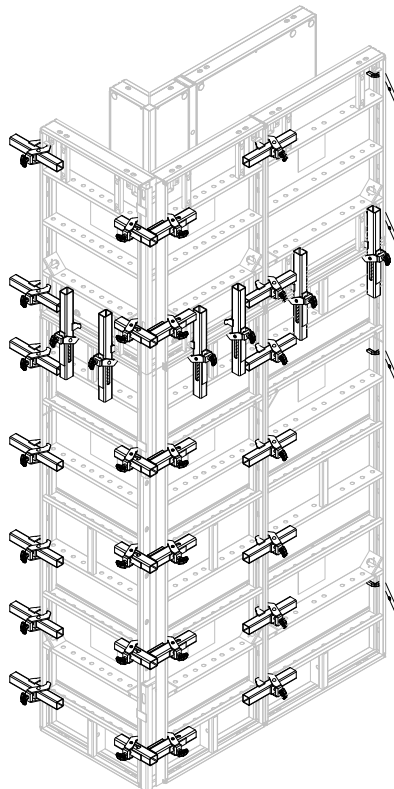


Example: Panels 270/120

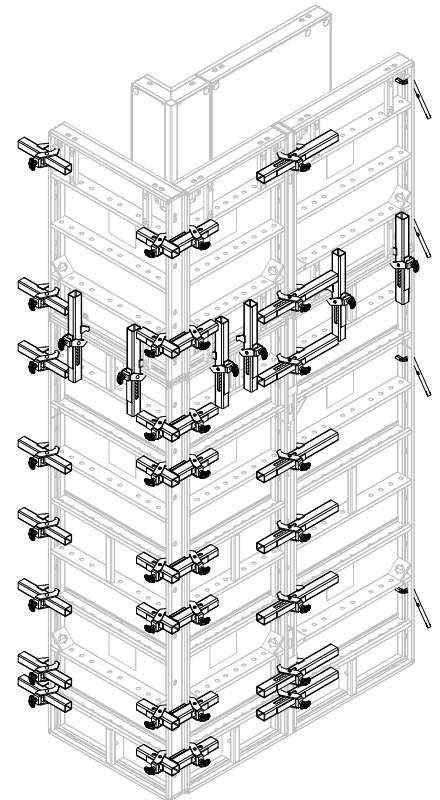
Wall thickness ≤ 30 cm



Wall thickness ≤ 40 cm

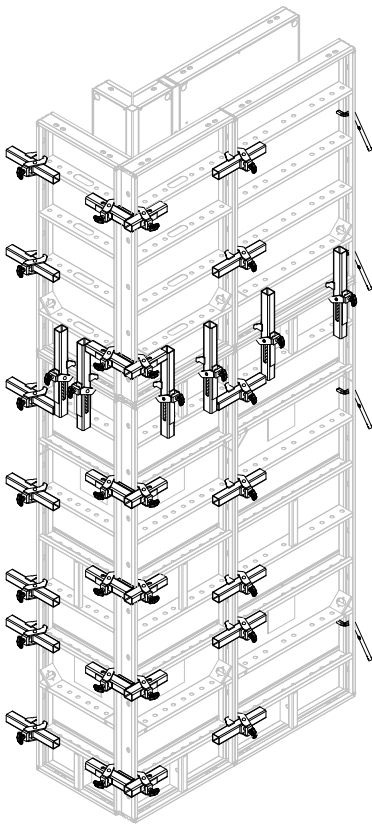


Wall thickness ≤ 50 cm

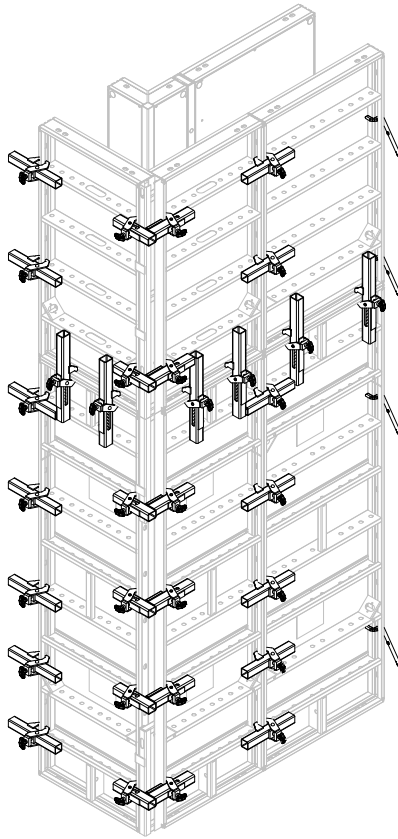


Example: Panels 270/150

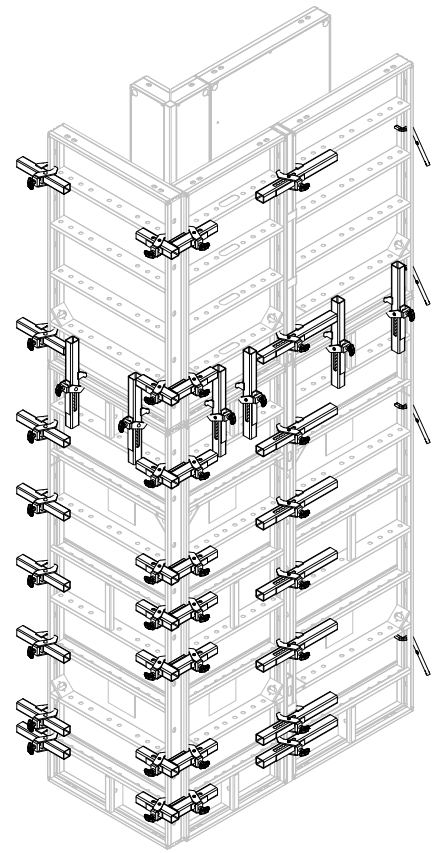
Wall thickness ≤ 30 cm



Wall thickness ≤ 40 cm

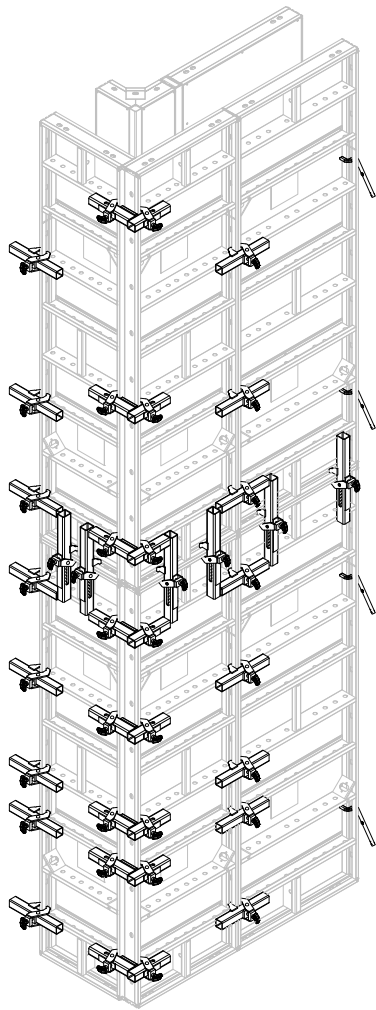


Wall thickness ≤ 50 cm

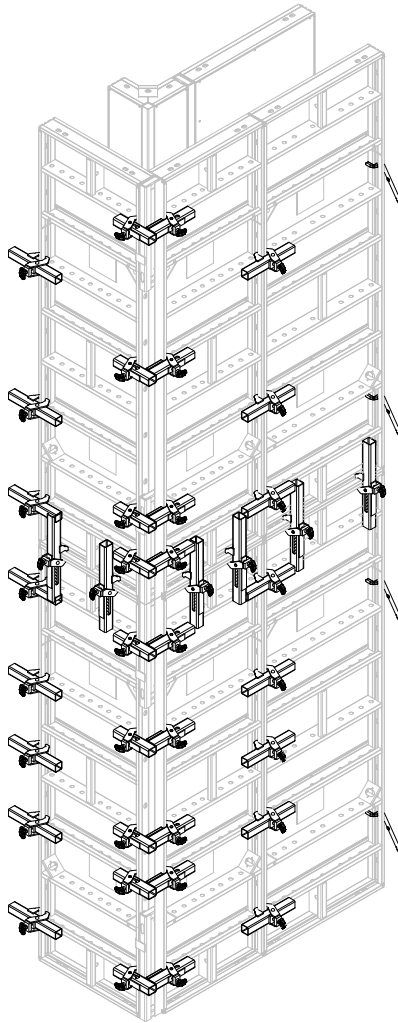


Example: Panels 270/270

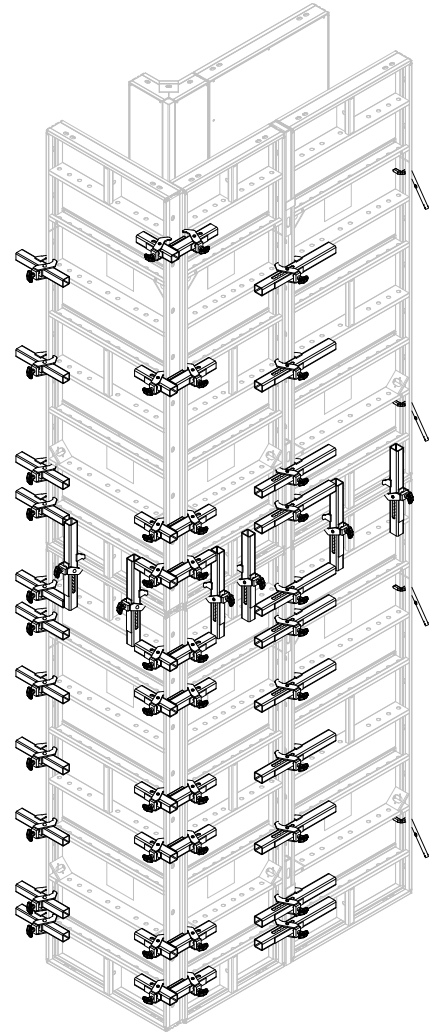
Wall thickness ≤ 30 cm



Wall thickness ≤ 40 cm



Wall thickness ≤ 50 cm

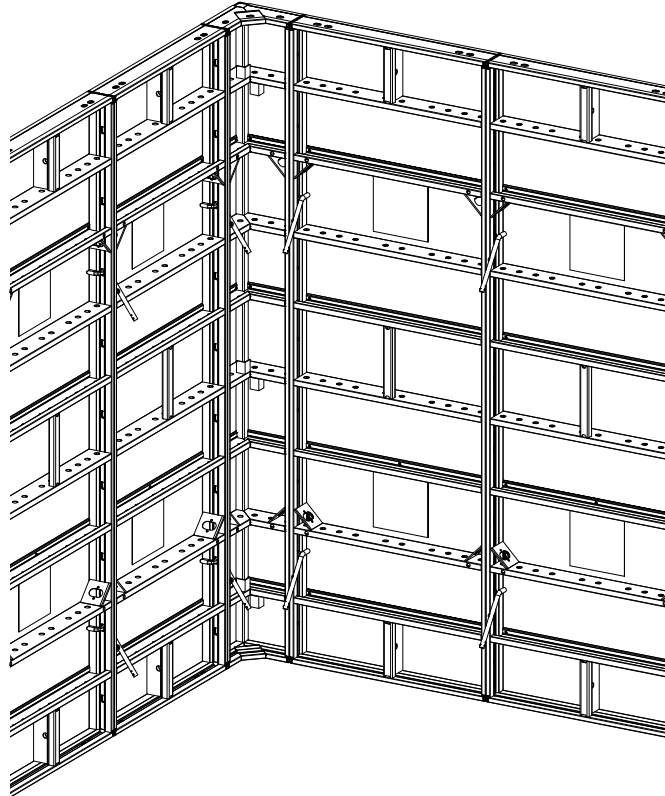


10.1.2 Creating 90° inner corners

With the RASTO G2 Inner Corner

The RASTO G2 Inner Corner is a rigid 90° corner. It is connected to the adjacent RASTO Panels just like a normal panel, using the RASTO Clip, the RASTO Aligning Panel Clamp or, if an infill is required, the RASTO Adjustable Aligning Clamp.

- Step 1** Use the required number of connectors to secure the Inner Corner to the adjacent panels.



With the RASTO Inner Corner

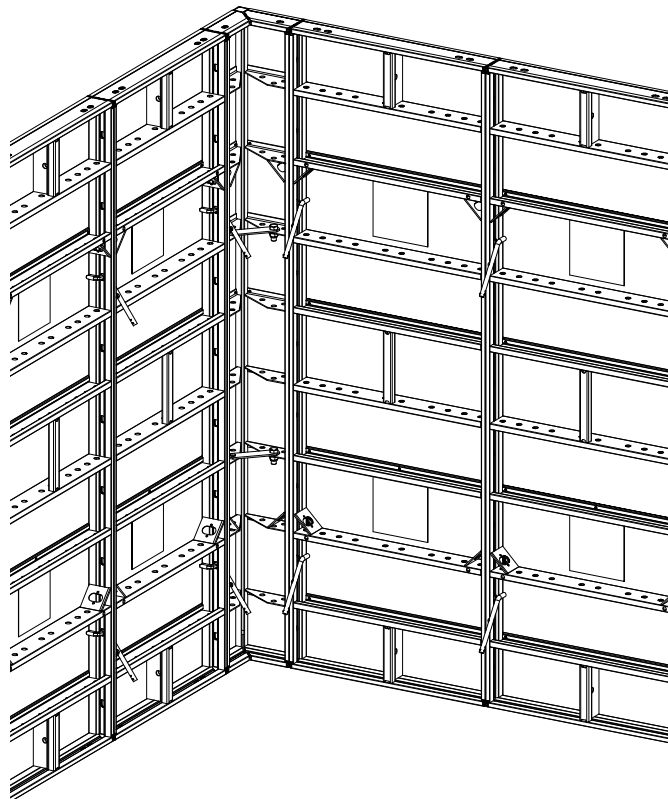
The conventional RASTO Inner Corner has a clearance of 2°. While the concrete is being poured and is hardening, the inner corner is braced at an angle of 90° with a corner stiffener. Before the formwork is removed, the corner stiffener can be disengaged and the angle of the Inner Corner reduced slightly.

The RASTO Inner Corner is connected to the adjacent RASTO Panels just like a normal panel, using the RASTO Clip, the RASTO Aligning Panel Clamp or, if an infill is required, the RASTO Adjustable Aligning Clamp.

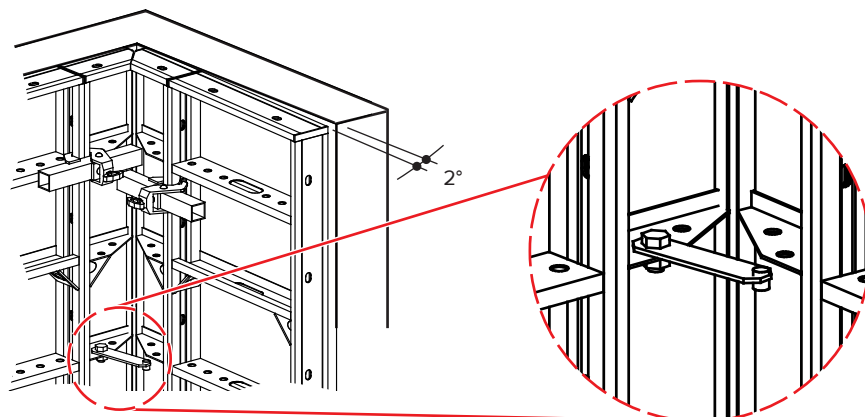
Step 1 Engage the corner stiffener.



Step 2 Use the required number of connectors to secure the Inner Corner to the adjacent panels.



Step 3 Before removing the formwork, disengage the corner stiffener and press the corner legs together slightly.

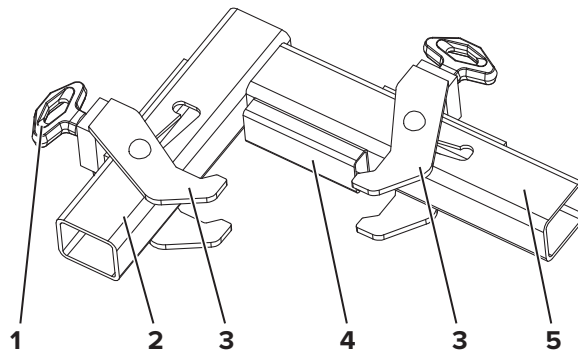


10.1.3 Creating 90° outer corners

Use 2no. RASTO Panels to create a 90° outer corner. Connect the Panels to one another with the Outer Corner Clamp N. The formwork can be adapted to the desired wall thickness using the available panel widths of 300 mm to 900 mm and the 50 mm RASTO Corner Adjustment (infill), along with infills available on site. The quantity and arrangement of the RASTO Outer Corner Clamps N and of the connectors to the adjacent panels are a factor of the thickness and height of the wall to be formed (Refer to page 72).

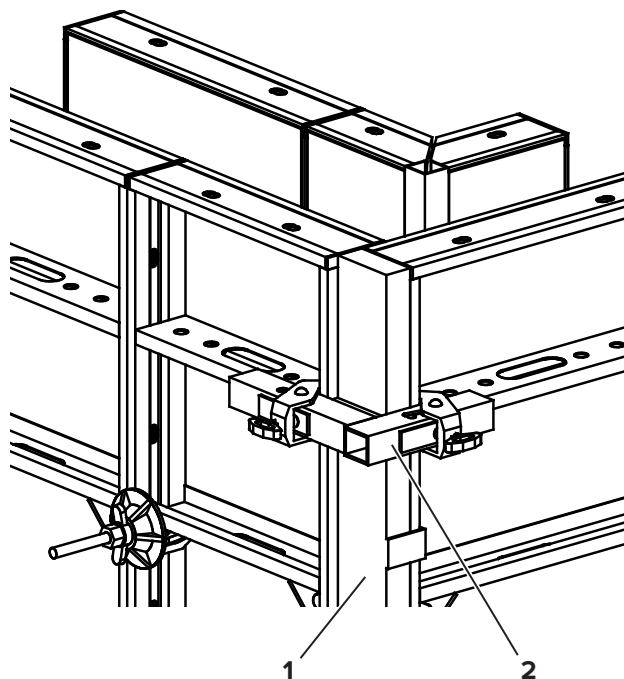
Outer Corner Clamp N

The Outer Corner Clamp N connects the RASTO Panels at 90° corners. The 20 mm integrated infill ensures that, although the edge profiles on the RASTO panels are 120 mm thick, the panels overlap only 100 mm.



- 1 Tensioning screw
- 2 Short leg
- 3 Claw
- 4 Integrated infill
- 5 Long leg

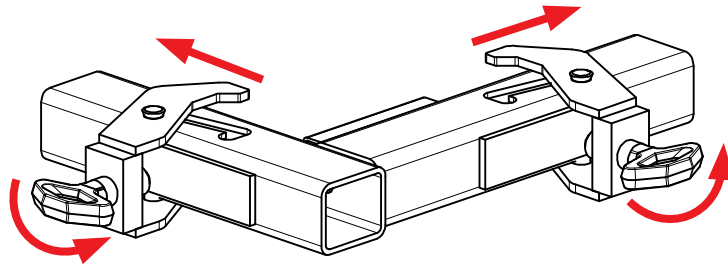
When the Outer Corner Clamp is used, infills of 50 mm can be placed directly in the outer corner. An infill can be placed along the long leg as well as the short leg of the Outer Corner Clamp.



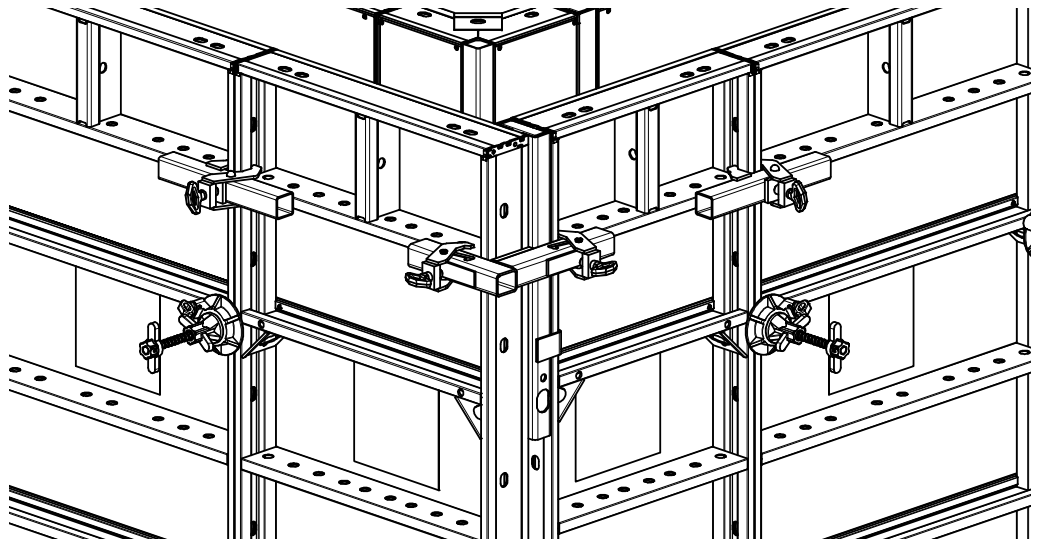
- 1 Corner Adjustment (infill) 5
- 2 Outer Corner Clamp N

Joining panels with the Outer Corner Clamp N

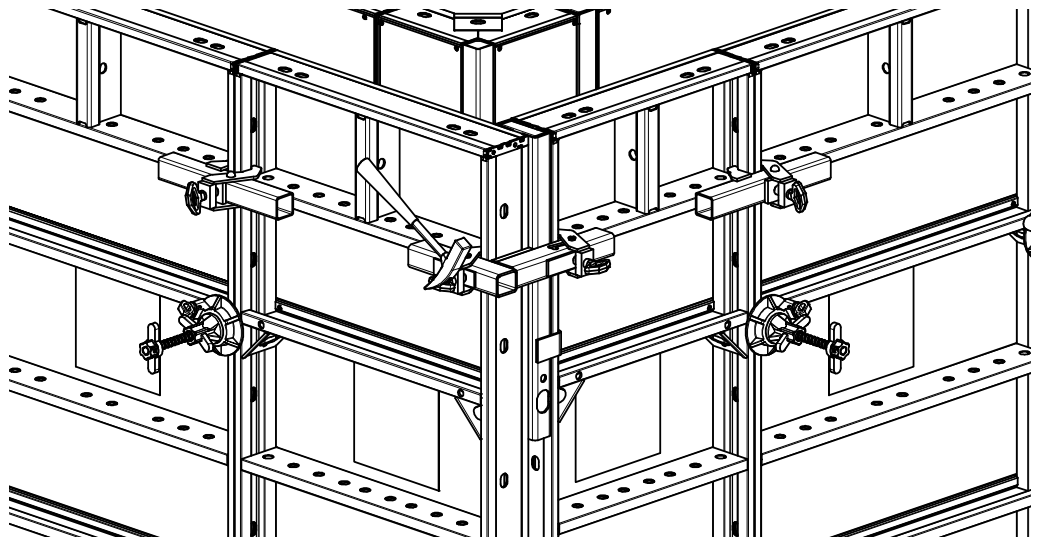
Step 1 Release both tensioning screws on the Outer Corner Clamp and slide the claws outward.



Step 2 Slide the Outer Corner Clamp onto the panels aligned to another at a 90° angle. Verify that the infill in the Outer Corner Clamp is in the right place.



Step 3 Tighten both tensioning screws.



10.2 Creating oblique-angled corners

NOTE

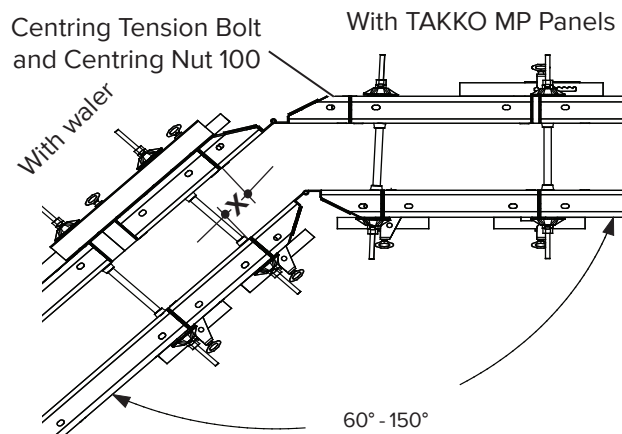
Risk of formwork collapsing!

When the RASTO Clip (code:602645) is used in sections of the formwork that are subjected to higher tensile loads, e.g. outer corners and stopends, the RASTO Clip may be overloaded when concrete is poured! This can cause the formwork to open and concrete to escape!

Do not use the RASTO Clip in sections subjected to higher tensile loads!

10.2.1 Using the TAKKO Hinged Corner

Sharp and obtuse angles can be formed easily with the TAKKO Hinged Corner using the provided system components. The adjustment and application range extends from 60° to 150°. The TAKKO Hinged Corner can be used as an outer corner or as an inner corner. Always use two connectors at each panel joint to connect the Inner Corner to the adjacent formwork element. The Outer Corner usually has to be connected to the adjacent panel with 2no. Centring Tension Bolts and Centring Nuts per panel joint (Refer to the illustration below, right side). If you use a Waler (Refer to illustration below, left side), the Hinged Corner can be connected on the outside to the adjacent panel using conventional connectors. For more details on this example, refer to page 73.



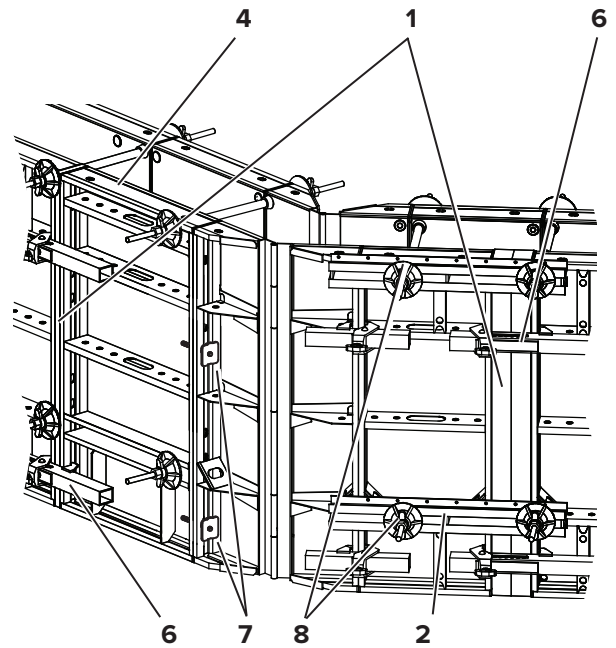
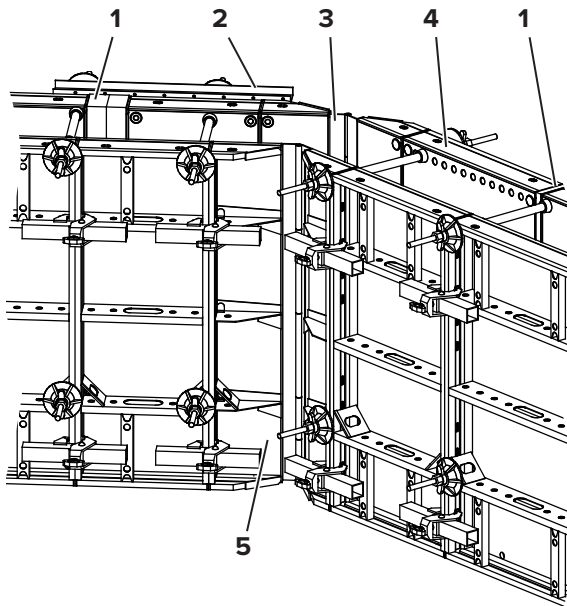
When creating oblique-angled corners, the lengths of the interior and exterior formwork always have to be adapted to one another. This ensures that the panel joints and tie holes are lined up with one another. There are two ways to adjust the length:

- With an MP Panel
- With a Waler 80

With the continuous tie hole grid of a TAKKO MP Panel it is possible to compensate the offset dimension X (Refer to illustration above) between the panel joints of the interior and exterior formwork. The ties can be attached to the panels through the tie holes. As an alternative, a Waler 80 can be used as the tie position on the exterior formwork. It also distributes the loads from the infill into the ties. Additional tie holes have to be drilled in the form lining on the panel for this purpose.

The following illustration shows the two ways to adapt the length.

Sharp angles can be created with the aid of TAKKO Panels, a spacer and Multipurpose Walers. How to do this with RASTO Panels is described on page 76.



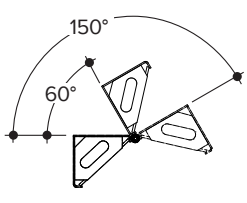
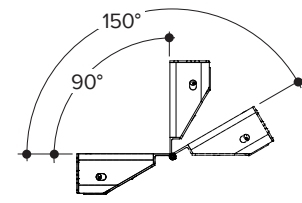
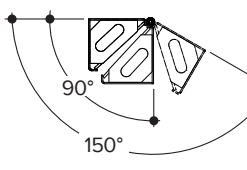
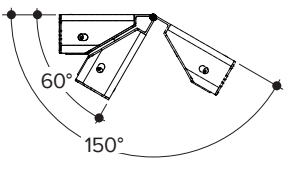
- 1 Infill
- 2 Waler 80
- 3 TAKKO outer Hinged Corner
- 4 TAKKO MP Panel
- 5 TAKKO inner Hinged Corner
- 6 RASTO Adjustable Aligning Clamp
- 7 Centring Tension Bolt with Centring Nut 100
- 8 Additional holes drilled for tying

Step 1 Use 2no. connectors to secure the TAKKO Hinged Corner to the adjacent panels.

Step 2 Use infills to adapt to the adjacent panels.

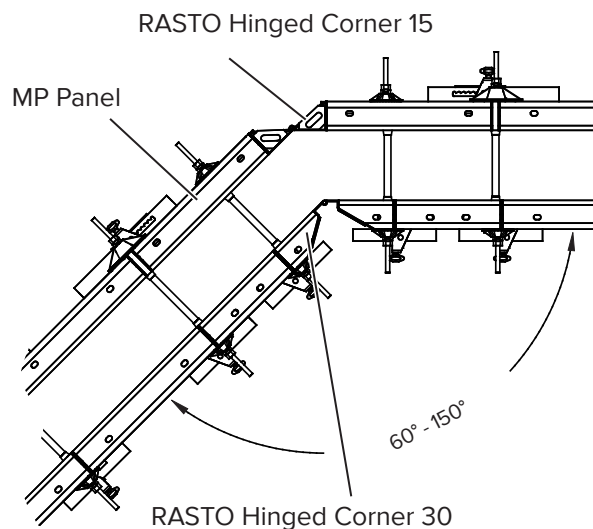
10.2.2 With RASTO Hinged Corners 15 and 30

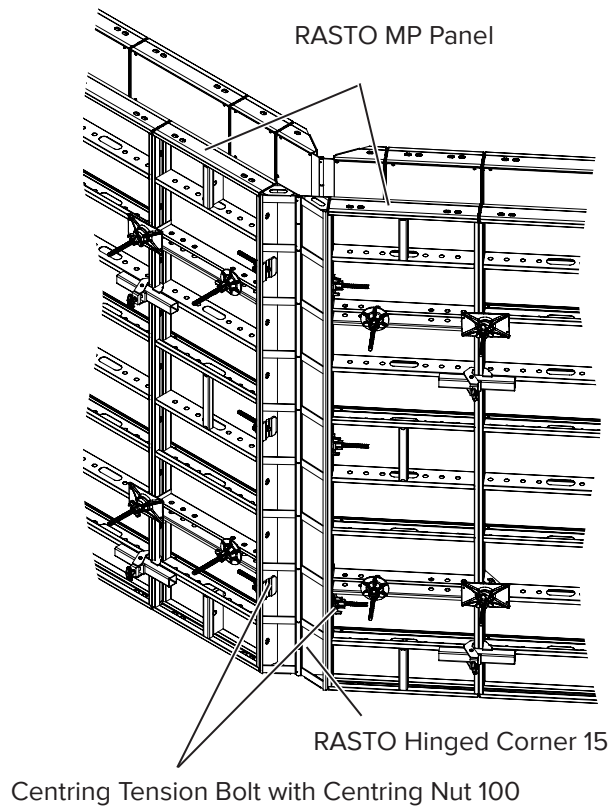
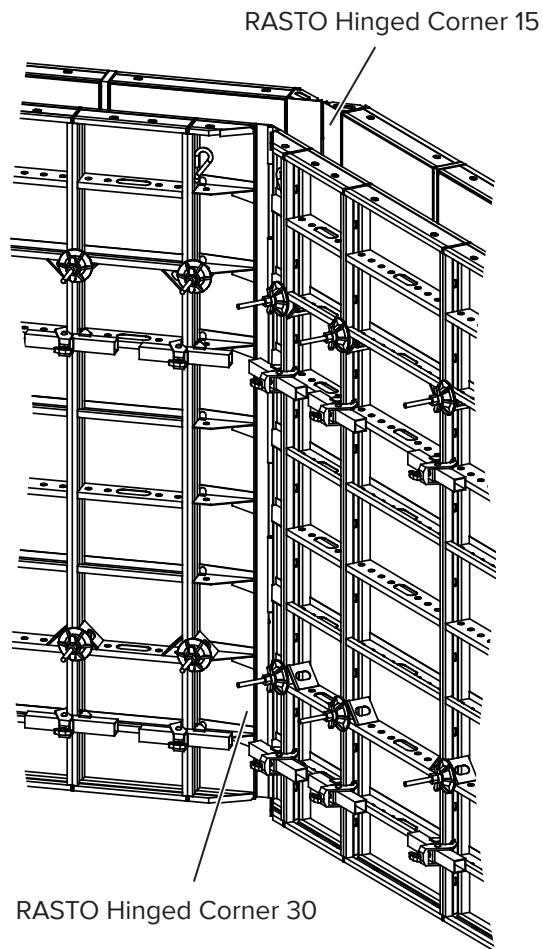
The two RASTO Hinged Corners 15 and 30 are intended to be used to form oblique-angled corners of structures created with RASTO system components. The following table shows a comparison of the Hinged Corners 15 and 30. Outer corners can also be created with RASTO Panels, spacers available on site and Multipurpose Walers (Refer to page 76).

	Hinged Corner 15	Hinged Corner 30
Leg length	150 mm	300 mm
Setting range as outer corner		
Setting range as inner corner		
Type of connector	Centring Tension Bolt and Centring Nut 100	Aligning Panel Clamp, Centring Tension Bolt and Centring Nut 100
Number of connectors when used as inner corner	2	2
Number of connectors when used as outer corner	Hinged Corner 15/150: 2; Hinged Corner 15/270: 3	At least at every second H-rib

Example of application: Hinged Corner 30 as inner corner, Hinged Corner 15 as outer corner

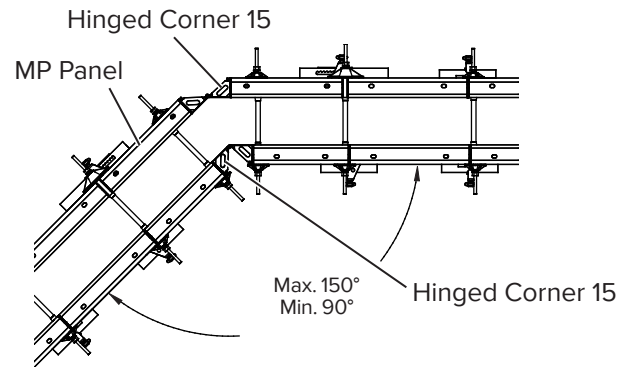
RASTO MP Panels in the outer formwork make tying of corners greater than 90° easier.



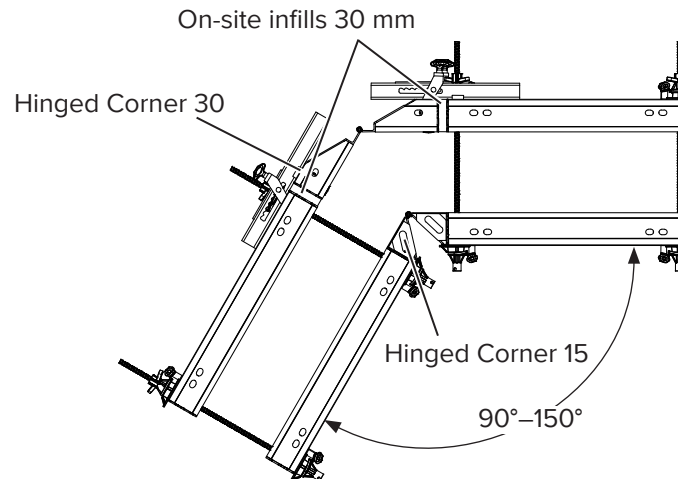


Example of application: Hinged Corner 15 as inner and outer corner

This combination is possible only in the obtuse angle ($> 90^\circ$) range.

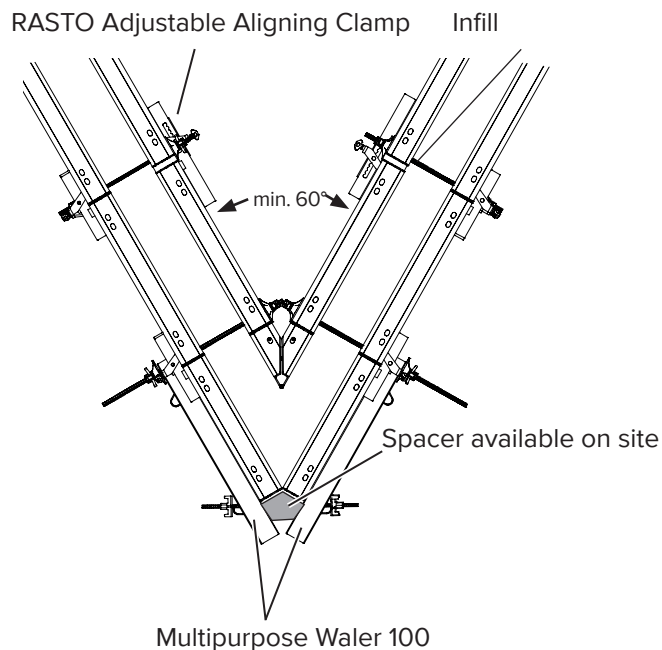


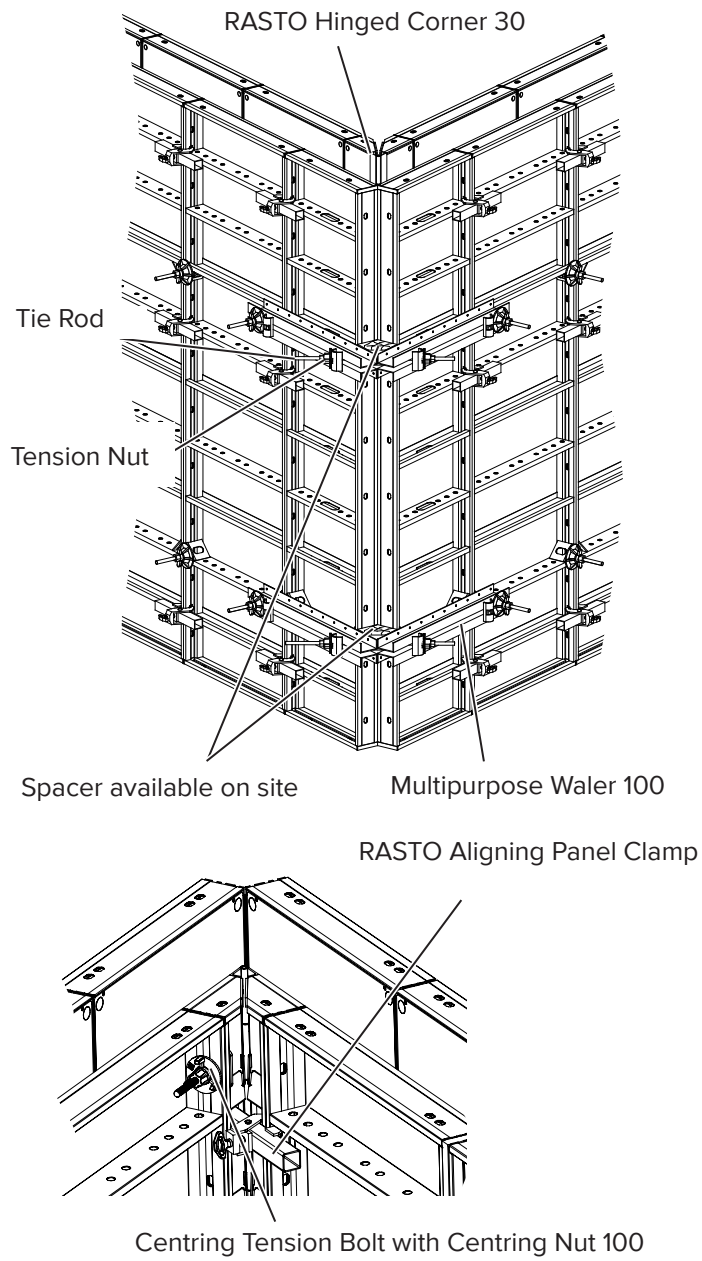
Example of application: Hinged Corner 30 as outer corner, Hinged Corner 15 as inner corner



Example of application: Hinged Corner 30 as inner corner, RASTO Panels as outer corner

Outer corners can also be formed with RASTO Panels, Multipurpose Walers 100, Tie Rods, Tension Nuts and on-site spacers. This works particularly well for sharp-angled corners.

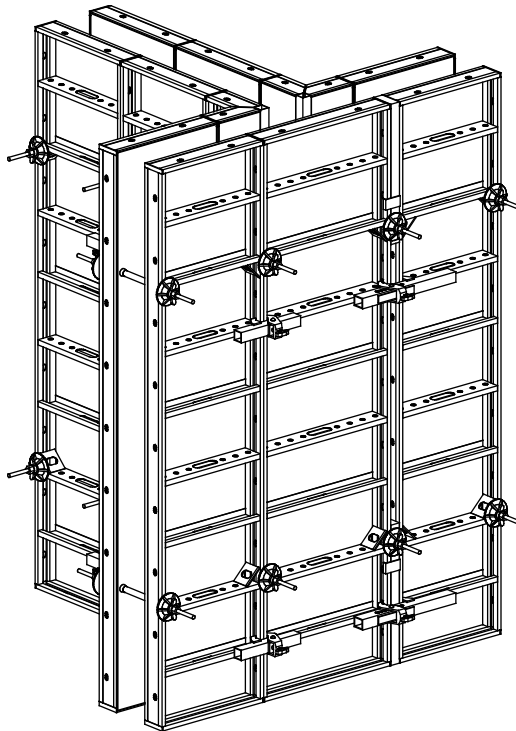




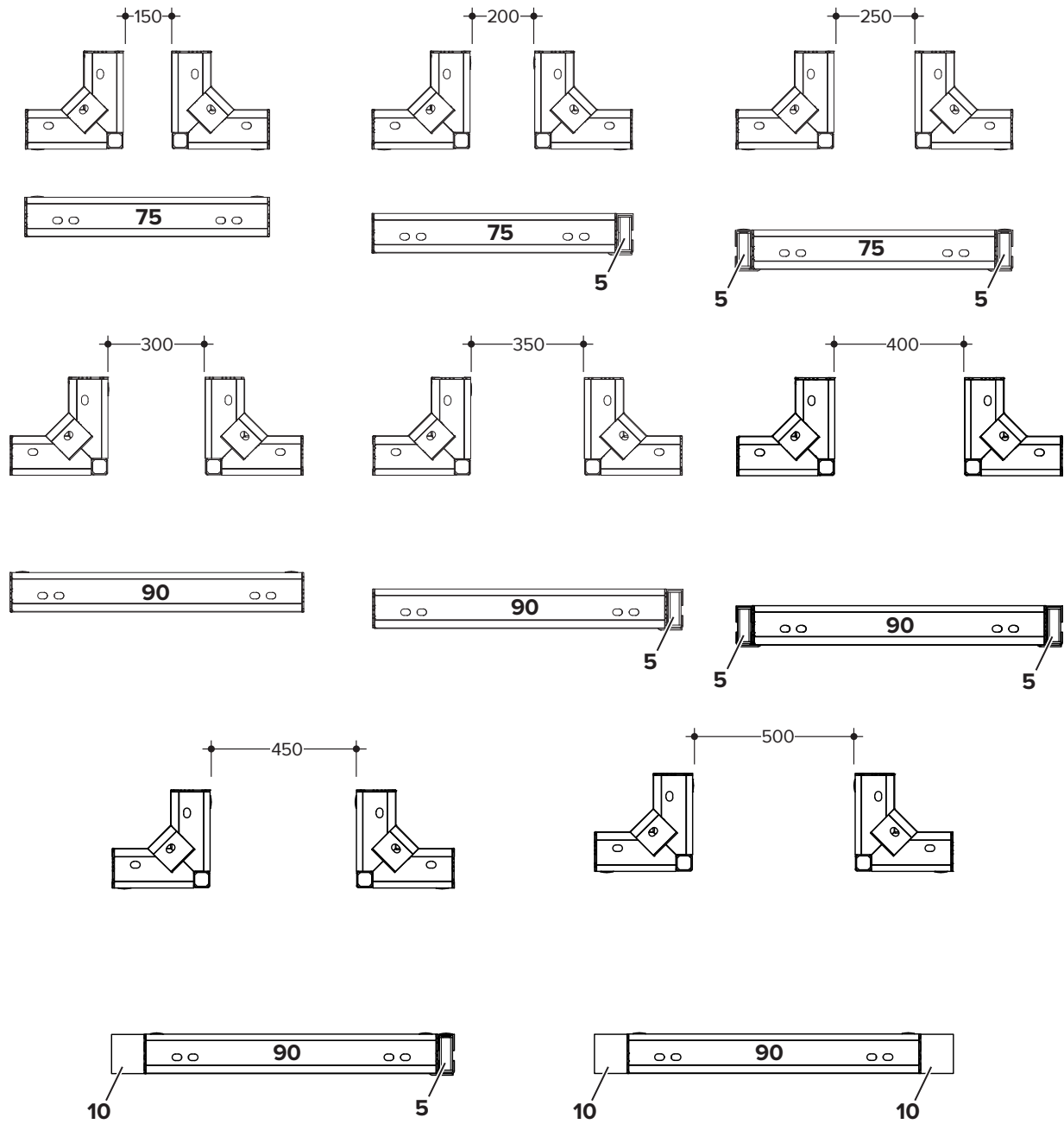
Step 1 Construct the corner needed for the application. Use the required number of connectors to join the components.

10.3 T-walls

RASTO system components can be used to form walls up to 40 cm thick at T-wall junctions. The various panel widths and the 5 cm wide infill are used to create the desired wall thickness. The following illustration shows a typical T-arrangement. Solutions for common wall thicknesses are shown after that.



T-walls with RASTO Panels and Corners for wall thicknesses of 15 to 40 cm, in increments of 5 cm



11 Stopends

Construct a stopend using a form lining available on-site, square timbers and the RASTO Bulkhead Clamp. The Bulkhead Clamp is used in place of the outermost row of ties. It is also possible to use the Waler 80, but then the outermost row of ties is needed.

11.1 Selecting number of connectors for stopends

As at the corners, there is excessive strain on the formwork adjacent to the ends. This is why more Alignment Panel Clamps are needed in these sections (section 1 in the illustration below) than in the normal sections along a straight wall.

NOTE

Risk of formwork collapsing!

When the RASTO Clip (code:602645) is used in sections of the formwork that are subjected to higher tensile loads, e.g. outer corners and stopends, the RASTO Clip may be overloaded when concrete is poured! This can cause the formwork to open and concrete to escape!

For the RASTO Clip, the length of section 1 is 2.30 m at corners and 1.15 m at stopends. Do not use the RASTO Clip in this section!

NOTE

Connectors are overloaded!

The panels at the ends (**A**, illustration below), just before the stopends, have to have at least the following widths.

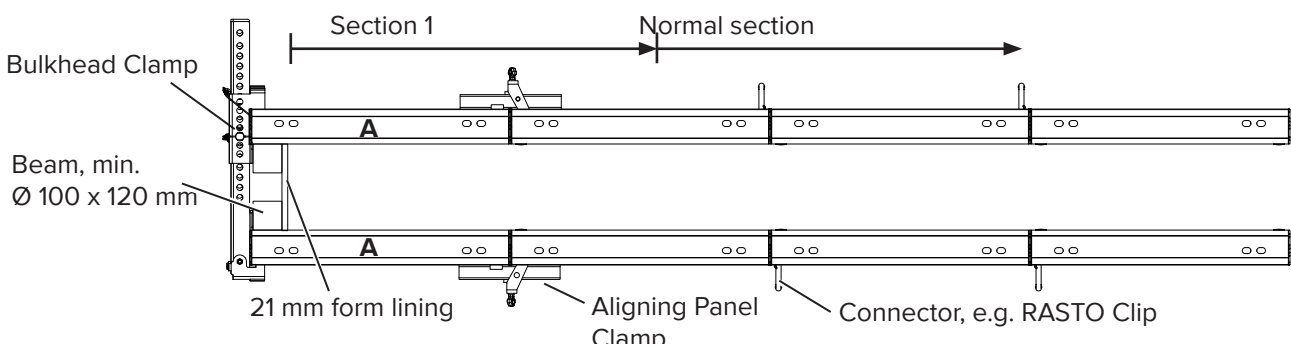
Wall thickness ≤ 45 cm, panel width (**A**) at least 75 cm!

Wall thickness ≤ 30 cm, panel width (**A**) at least 45 cm!

Otherwise the connectors will be overloaded!



Depending on the conditions on site, we recommend avoiding vertical joints in section 1 whenever possible, e.g. by using RASTO panels XXL adjacent to the panels in the stopend.



Panel height	Wall thickness ≤ 45 cm		Wall thickness ≤ 30 cm				Wall thickness 31–45 cm			
	Normal section		Stopend		Section 1 < 30 cm		Stopend		Section 1 < 55 cm	
	Req. no. of connectors		Req. no. of Bulkhead Clamps		Req. no. of Al. Panel Clamps		Req. no. of Bulkhead Clamps		Req. no. of Al. Panel Clamps	
≤ 150	2		2		2		2		2	
270	2		3		2		3		2	
150 150 ^{*)}	2	2 ^{*)}	2	2 ^{*)}	2	2 ^{*)}	2	2 ^{*)}	2	2 ^{*)}
270 120 ^{*)}	2	2 ^{*)}	3	2 ^{*)}	3	2 ^{*)}	3	2 ^{*)}	3	2 ^{*)}
270 150 ^{*)}	2	2 ^{*)}	3	2 ^{*)}	3	2 ^{*)}	3	2 ^{*)}	4	2 ^{*)}
270 270 ^{*)}	2	2 ^{*)}	3	3 ^{*)}	3	2 ^{*)}	3	3 ^{*)}	4	2 ^{*)}

^{*)} Stacked panels

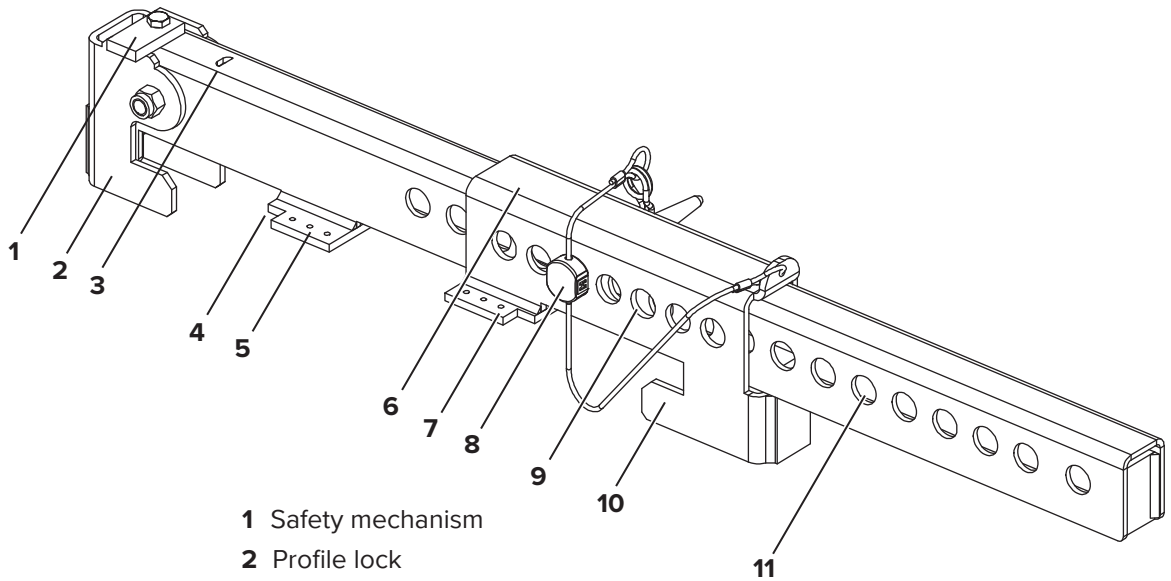
Single or stacked panels 120 and 150 can optionally be joined with the RASTO Clip. When Waters 80 are used, the number of Waters is the same as the number of Bulkhead Clamps. One tie must be placed in each tie hole. Thicker walls require more Bulkhead Clamps, and their structural stability has to be confirmed separately.

11.2 With the RASTO Bulkhead Clamp

A stopend can be constructed quickly and easily with the RASTO Bulkhead Clamp. No fasteners or components other than the Bulkhead Clamp are needed. The thickness of the wall to be poured can be set in increments of 0.5 cm, between 15 and 45 cm on the Bulkhead Clamp. Wall thicknesses of 50 cm and 60 cm are also possible for pure foundation formwork up to 1.5 m high. This ensures that the Bulkhead Clamp is always set correctly for the same wall thickness, even after multiple uses.

The Bulkhead Clamp is resistant to tension and pressure, allowing it to secure the formwork precisely at the set position, on the exterior as well as the interior. There is no need for additional measures to prevent the formwork from being compressed. The Bulkhead Clamp also replaces the row of ties normally required along the edge of the last panel.

11.2.1 RASTO Bulkhead Clamp



- 1 Safety mechanism
- 2 Profile lock
- 3 Mark on the top of the carriage
- 4 Notch
- 5 Inner limit stop / nail plate
- 6 Carriage
- 7 Inner limit stop / nail plate
- 8 Bolt
- 9 Holes in carriage; used to set the wall thickness
- 10 Carriage claw
- 11 Holes in Bulkhead Clamp; used to set the wall thickness



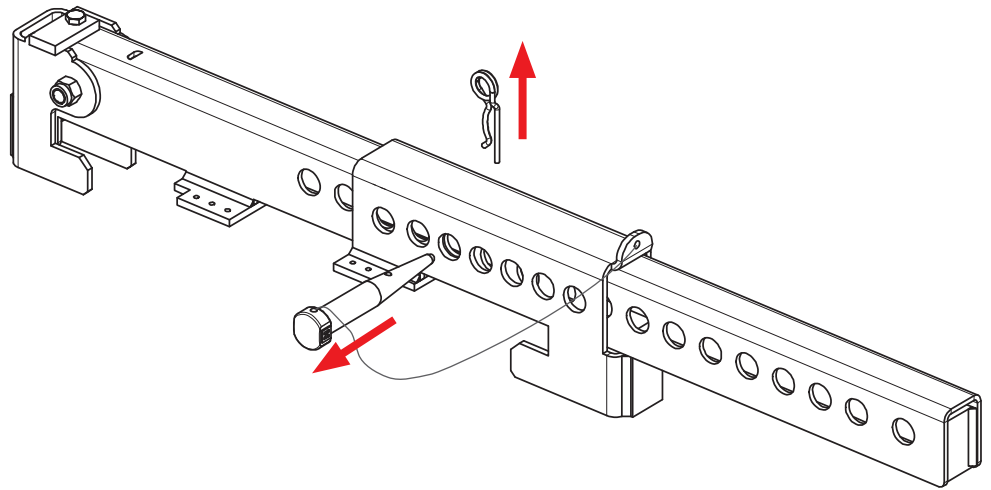
The Bulkhead Clamp can be used symmetrically. The profile lock can be attached to the advancing side as well as to the closing side.

11.2.2 Setting wall thickness

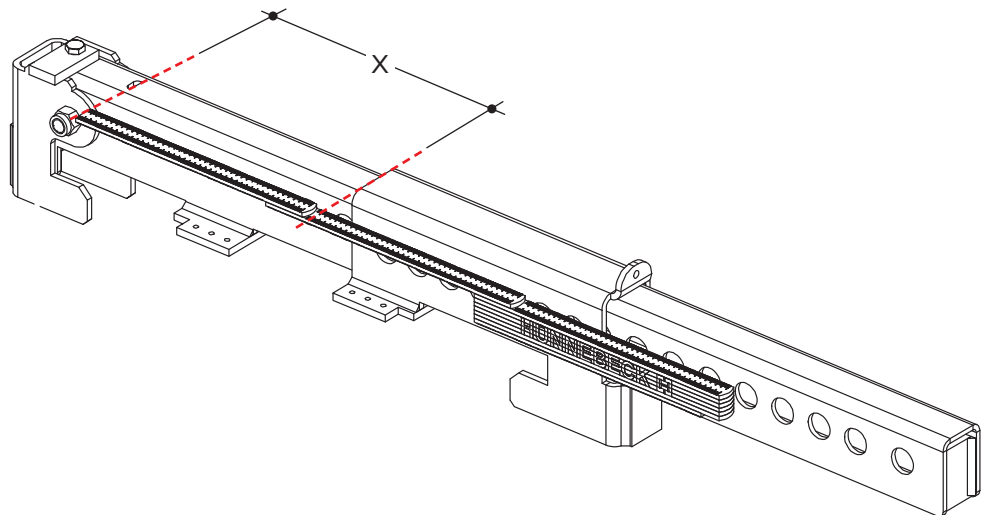
Use the carriage to set the thickness of the wall to be poured. Secure the carriage position with the captive bolt attached to the Bulkhead Clamp.

Measure the wall thickness on the Bulkhead Clamp. It is the distance to the mark on the top to the carriage. Set the dimension by sliding the carriage along the Bulkhead Clamp. For each value there is only one hole in the carriage that corresponds precisely to one of the holes in the Bulkhead Clamp.

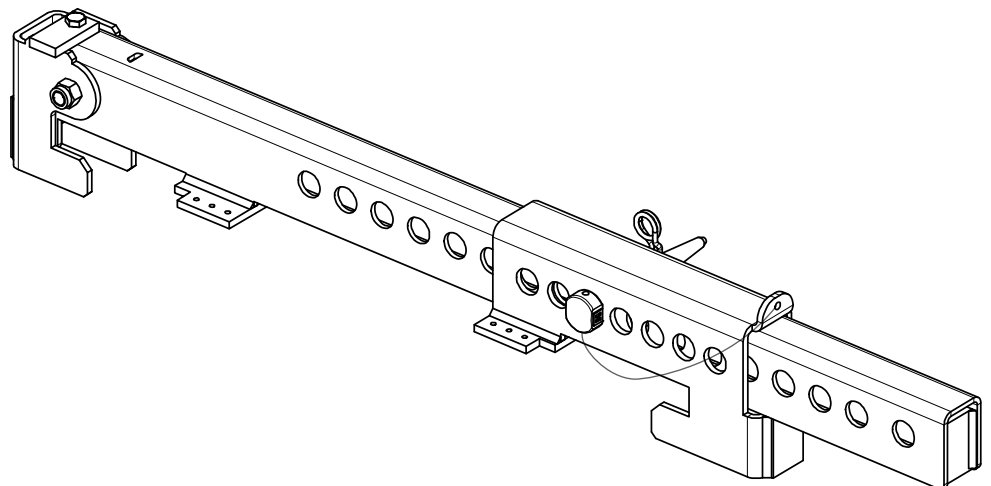
Step 1 Pull the spring cotter pin out of the pin on the carriage and extract the pin from the Bulkhead Clamp.



Step 2 Set the thickness of the wall to be poured on the Bulkhead Clamp. To do this, measure the distance between the mark on the top and the carriage (dimension X in the illustration below). This distance should be the same as the desired wall thickness.



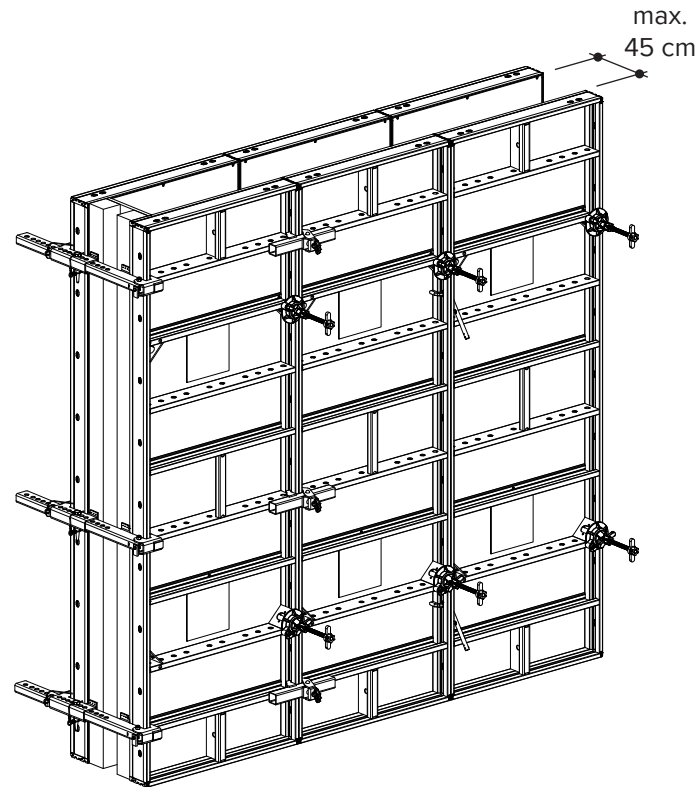
Step 3 Insert the pin in the proper hole in the carriage and secure it with the spring cotter pin.



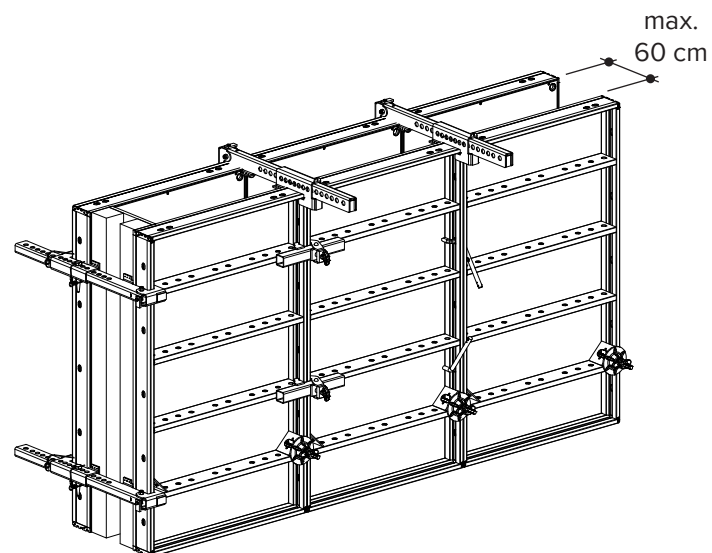
11.2.3 Positioning the Bulkhead Clamp on the stopend

Where to position the Bulkhead Clamp on the stopend is a factor of the panel height used and of whether the panels are oriented vertically or horizontally. The position is the same for panels that are on the ground and those that are stacked.

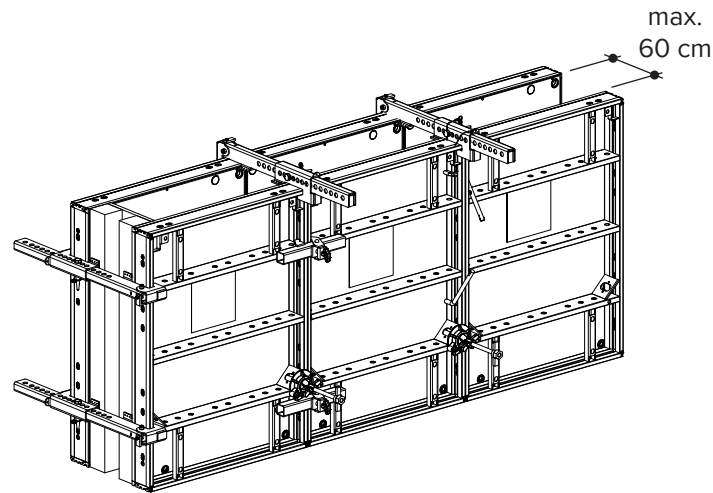
On vertically oriented Panels 270



On vertically oriented Panels 150



On vertically oriented Panels 120



On horizontally oriented panels

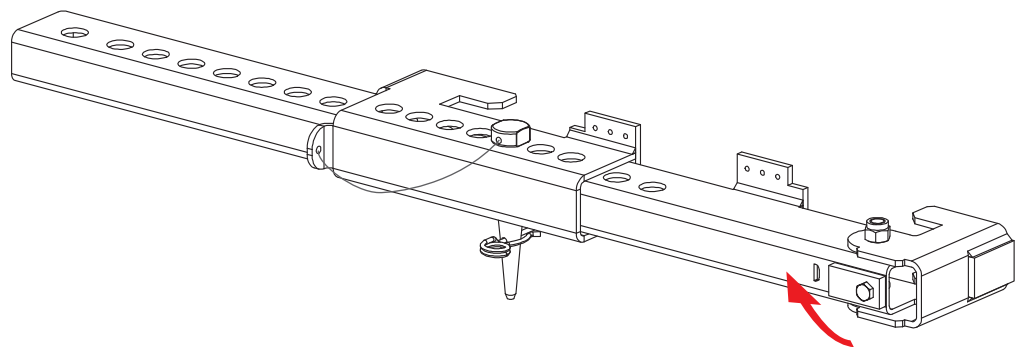
For horizontally oriented panels, the maximum width that may be permitted to burden a Bulkhead Clamp is 900 mm, e.g. 450 mm of panel above and below the Bulkhead Clamp. Whenever possible, attach the Bulkhead Clamp to a panel joint or a V-rib. Otherwise the Bulkhead Clamp has to be nailed into place on the stopend.

There must be at least one Bulkhead Clamp fastened to each panel, e.g. at the panel joint.

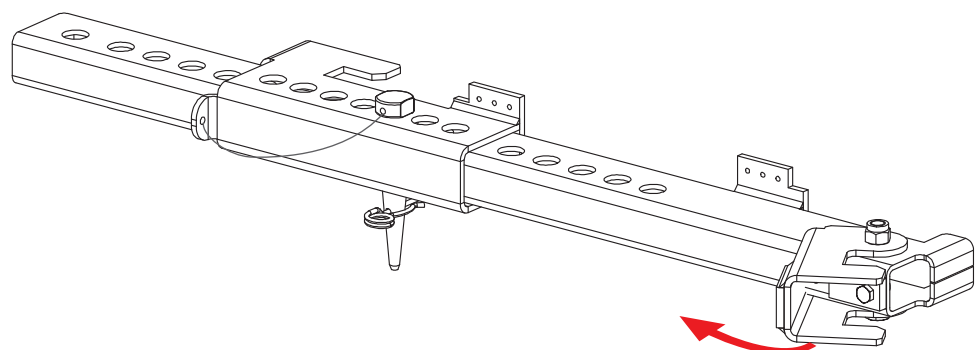
11.2.4 Attaching Bulkhead Clamp to panel

The Bulkhead Clamp has a profile lock that secures it to the edge profile of the panels. The profile lock itself is secured with a safety mechanism when the Bulkhead Clamp is lying on its side and fastened to the vertical edge profile of the panel.

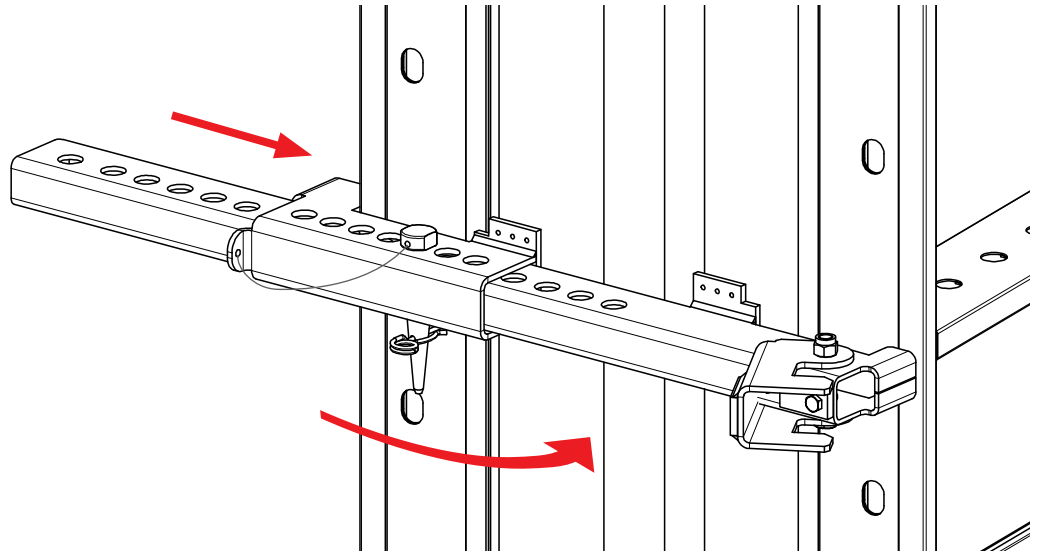
Step 1 Unlock the safety mechanism.



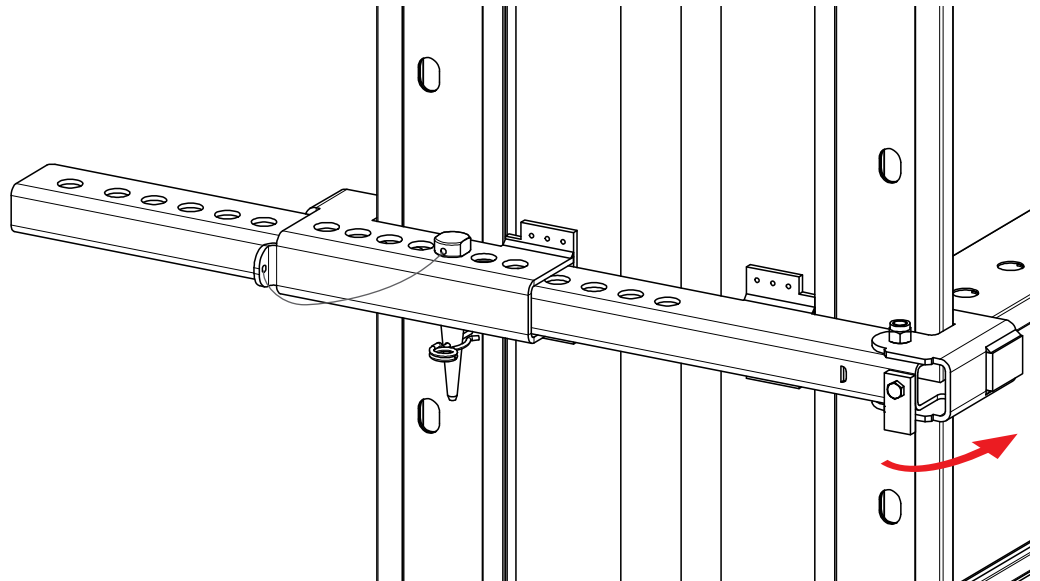
Step 2 Open the profile lock.



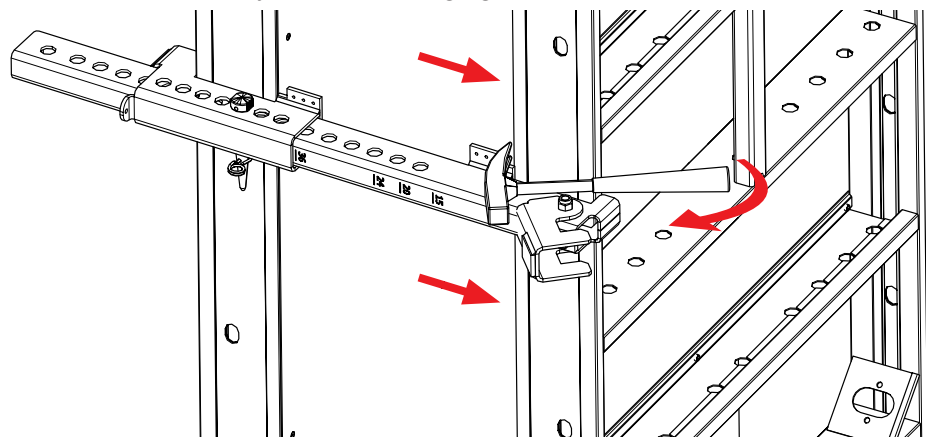
Step 3 Place the claw on the carriage in the edge profile of the panels and clamp it against both panels.



Step 4 Close the profile lock. The safety mechanism closes automatically and secures the profile lock. The Bulkhead Clamp is now in place and secured against being opened unintentionally.

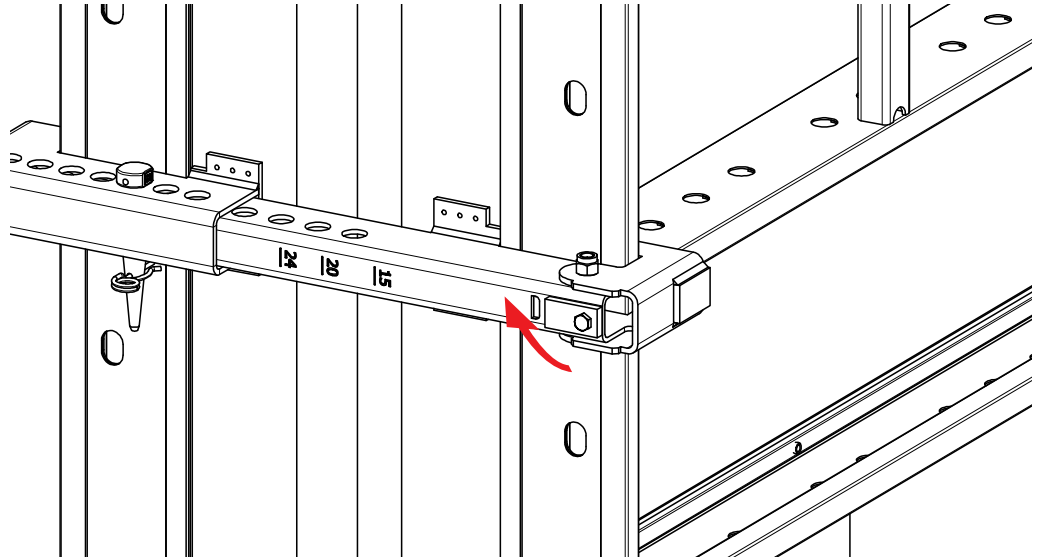


If the formwork is too close together, the tip of a roofing hammer can be fitted into the notch in the Bulkhead Clamp. Then carefully pry apart the formwork with the roofing hammer. Work carefully to avoid damaging the form sheet!

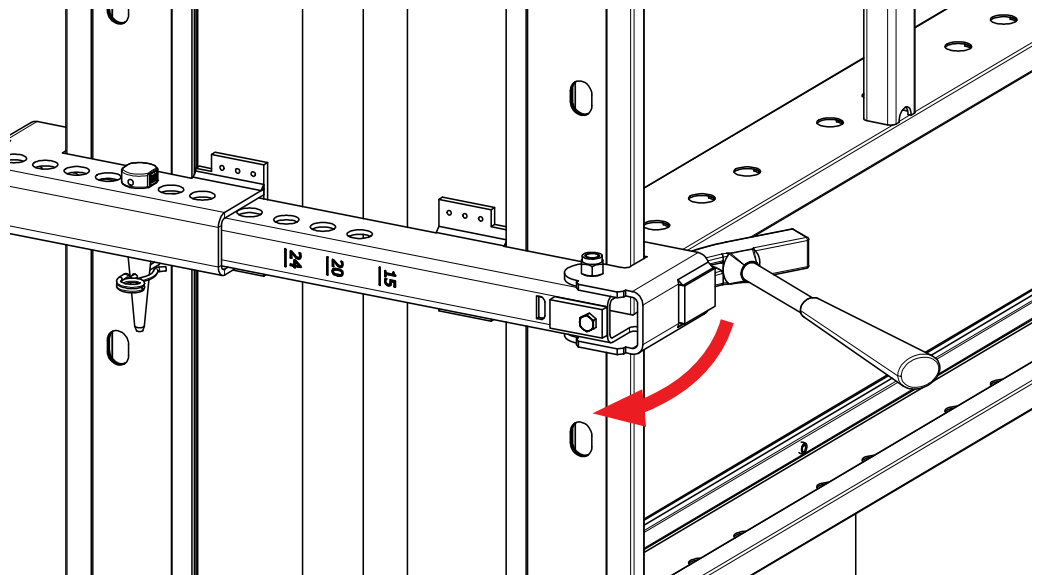


11.2.5 Detaching Bulkhead Clamp

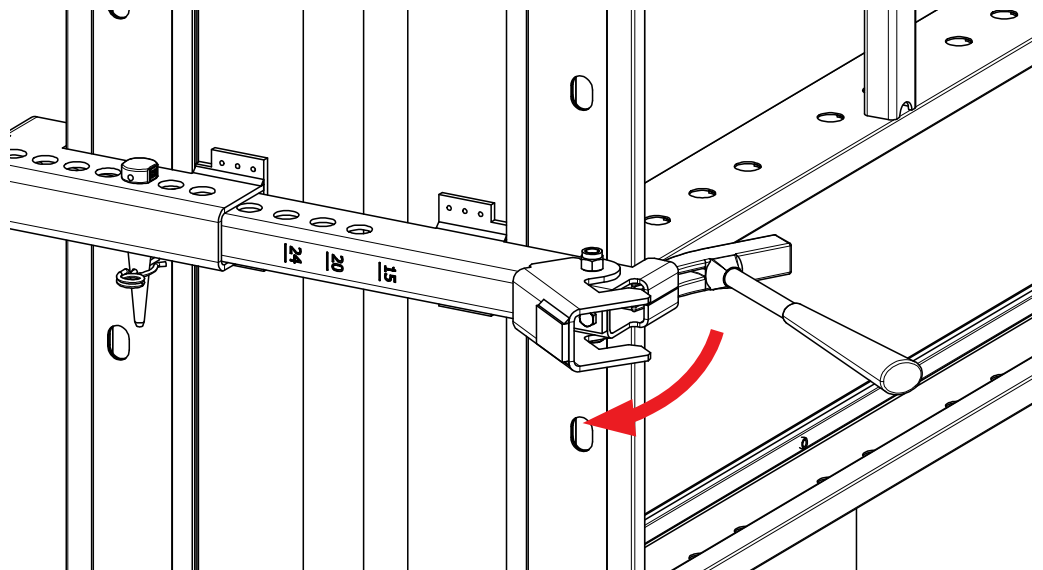
Step 1 Unlock the safety mechanism.



Step 2 Use the tip of a roofing hammer to open the profile lock.



Step 3 Use the tip of a roofing hammer to pry the Bulkhead Clamp off of the panel.



11.3 With the Waler 80

If it is not possible to use a Bulkhead Clamp, e.g. because there is not one available, the stopend can be created with Walers 80. Use Centring Tension Bolts and Centring Nuts 100 or Tension Nuts to secure the Walers to the edge profile of the panels.

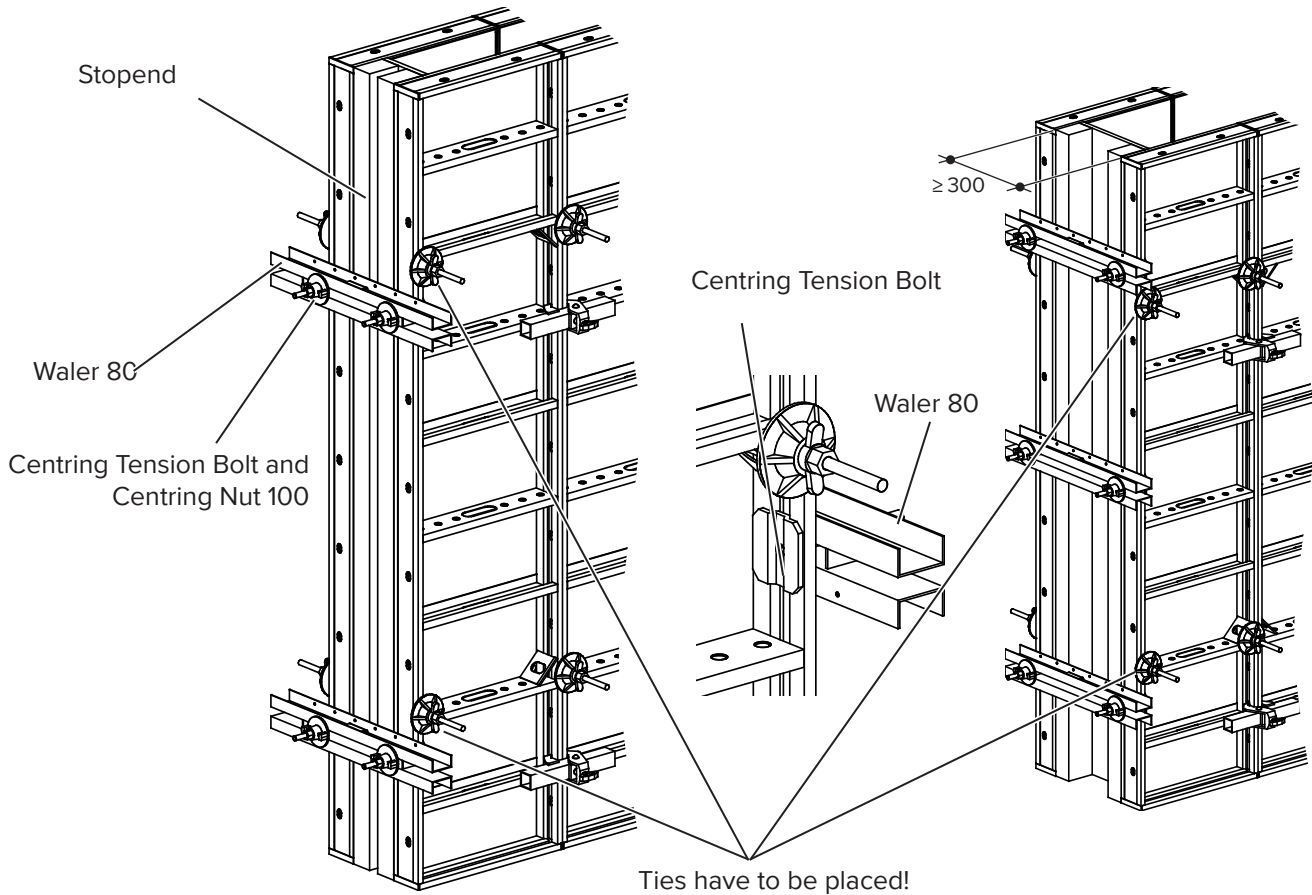
The following illustration shows how to assemble and position the Walers.



WARNING

Warning!

For wall thicknesses > 30 cm, use at least three Walers 80 for a wall height of 2.70 m!



12 Adapting length with infills

The formwork can be adapted to most formwork lengths by using RASTO Panels of different widths and the Corner Adjustment 5 (infill).

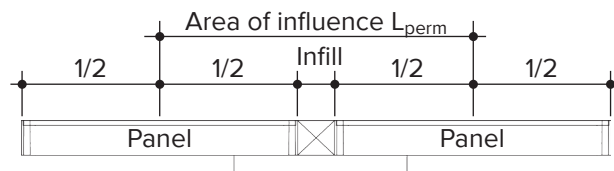
If the length has to be adjusted on site, you can construct infills using suitable square timbers and, when applicable, strips of form lining. The infill always has to be 120 mm deep, and it has to be flush with the form lining and the back of the panel.

Infills up to 300 mm wide can be created this way.

Whenever there is an infill between panels, the panels have to be joined using an Adjustable Aligning Clamp (up to 150 mm infill) or a Waler 80 or Multipurpose Waler (up to 300 mm infill).

There are different ways to tie the structure near the infill, depending on the width of the infill. If you wish to tie the structure through the infill constructed on site, you can only use conventional ties. One-sided tying with the RASTO G2 MR tie system is not possible.

Using infills increases the area of influence L of the formwork on the tie rod. This subjects the tie rod to a greater load.



The area of influence to which the tie rods are subjected may not exceed 95 cm when non-stacked panels with steady hydrostatic concrete pressure are used. The area of influence may not exceed 90 cm when stacked panels with steady pressure of 55 kN/m² (only RASTO XXL) are used.

When the area of influence is greater, the infill always has to be secured with 2no. ties per tie position (double tie)



WARNING

Risk of formwork collapsing!

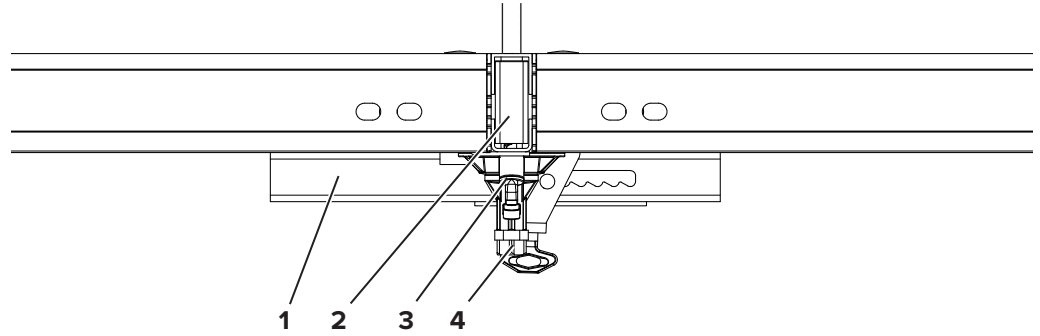
Comply with the maximum area of influence of the formwork permitted on the tie rods!
Use double ties when needed!



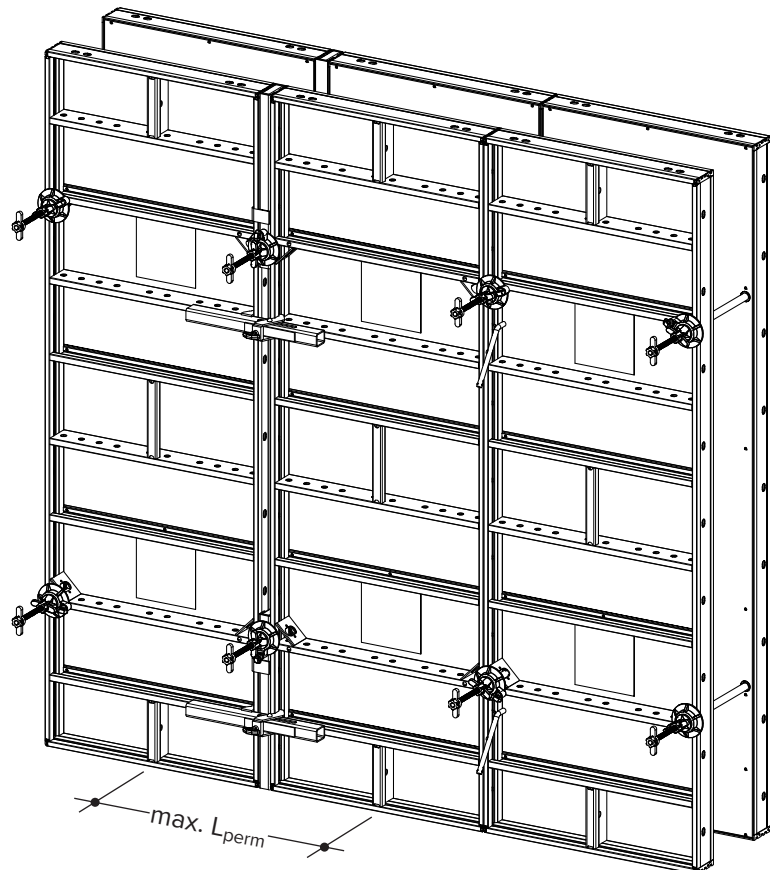
Double ties can only be used on infills that are at least 100 cm wide. The tie nuts will collide with one another if the infills are narrower.

12.1 Using Corner Adjustment 5 (50 mm wide)

An infill of 50 mm can be created quickly and easily with the Corner Adjustment 5 (infill). The Corner Infill has its own tie holes, allowing you to tie the 2no. adjacent panels with 1no. tie per tie position, as usual. The one-sided RASTO G2 MR tie system can also be used with the TAKKO G2 Corner Infill 5 and the RASTO G2 Corner Infill 5/270.



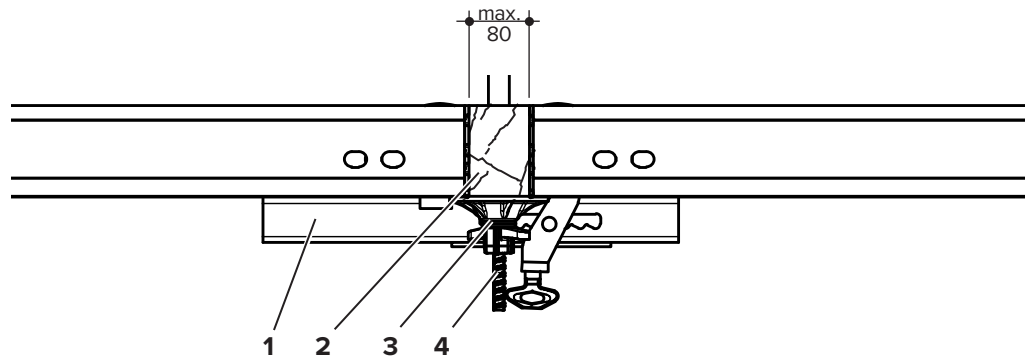
- 1 RASTO Adjustable Aligning Clamp
- 2 Corner Adjustment (Infill) 5
- 3 Operating Nut or Tie Nut
- 4 Tie Rod



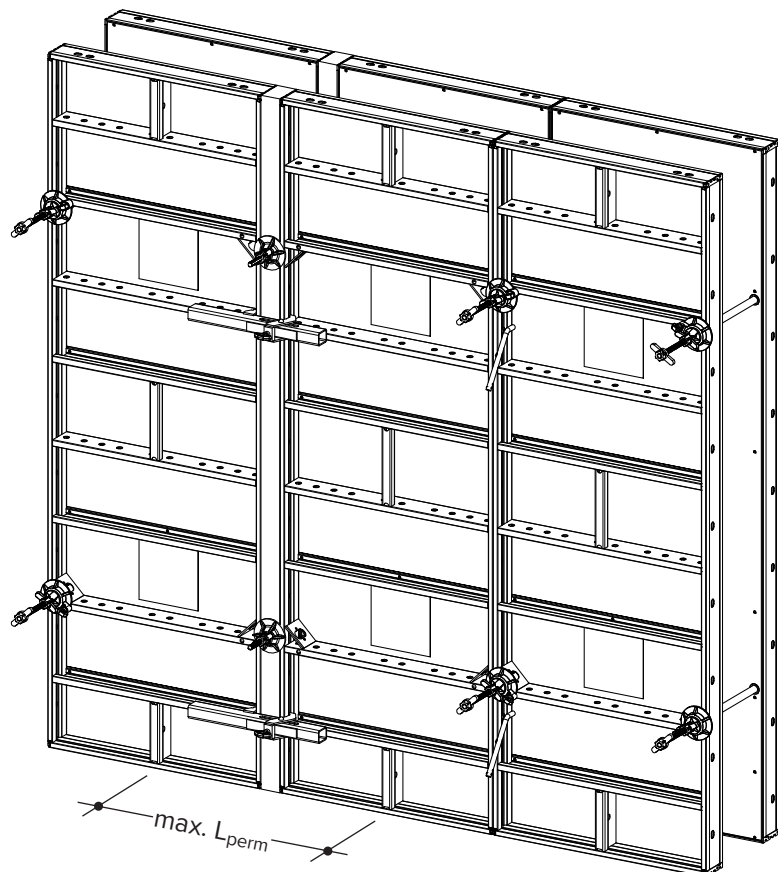
- Step 1** Assemble the panels and Corner Infills 5.
- Step 2** Join the panels using the required number of RASTO Adjustable Aligning Clamps.
- Step 3** Secure the ties through the tie holes in the Infill.

12.2 Adapting length with infills up to 80 mm wide on site

Infills up to 80 mm wide can be tied by passing the Tie Nut through the infill. In this case the appropriate holes have to be drilled in the infill for the ties.



- 1 RASTO Adjustable Aligning Clamp
- 2 Square timber, 120 mm thick
- 3 MANTO Tie Nut
- 4 Tie Rod



- Step 1** Drill tie holes in the required places along the square timber.
- Step 2** Put the panels and square timber in place.
- Step 3** Join the panels using the required number of RASTO Adjustable Aligning Clamps.
- Step 4** Secure the ties through the infill.

12.3 Adapting length with infills up to 150 mm wide on site

Infills up to 150 mm wide can be tied in two different ways:

- Through the infill (area of influence $L \leq L_{perm}$)
- Through the tie holes in the panels (area of influence $L > L_{perm}$)

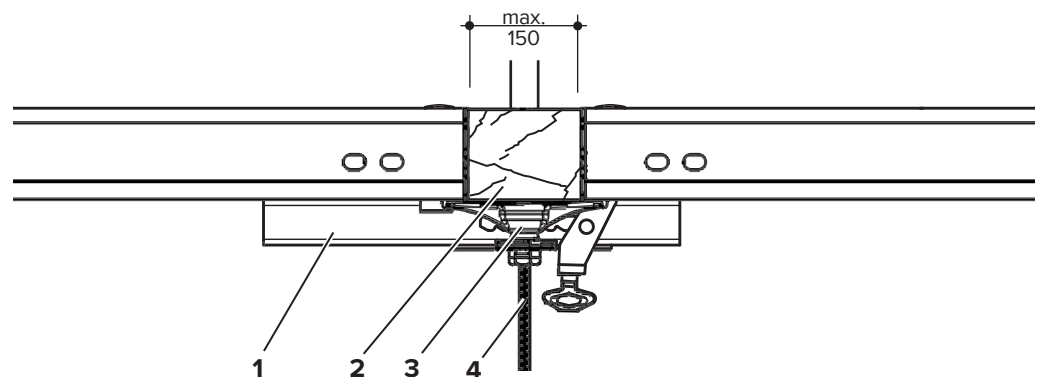
How you choose to tie the structure also depends e.g. on the position of the tie holes in the opposite side of the formwork.

12.3.1 Tying through the infill (area of influence $L \leq L_{perm}$)

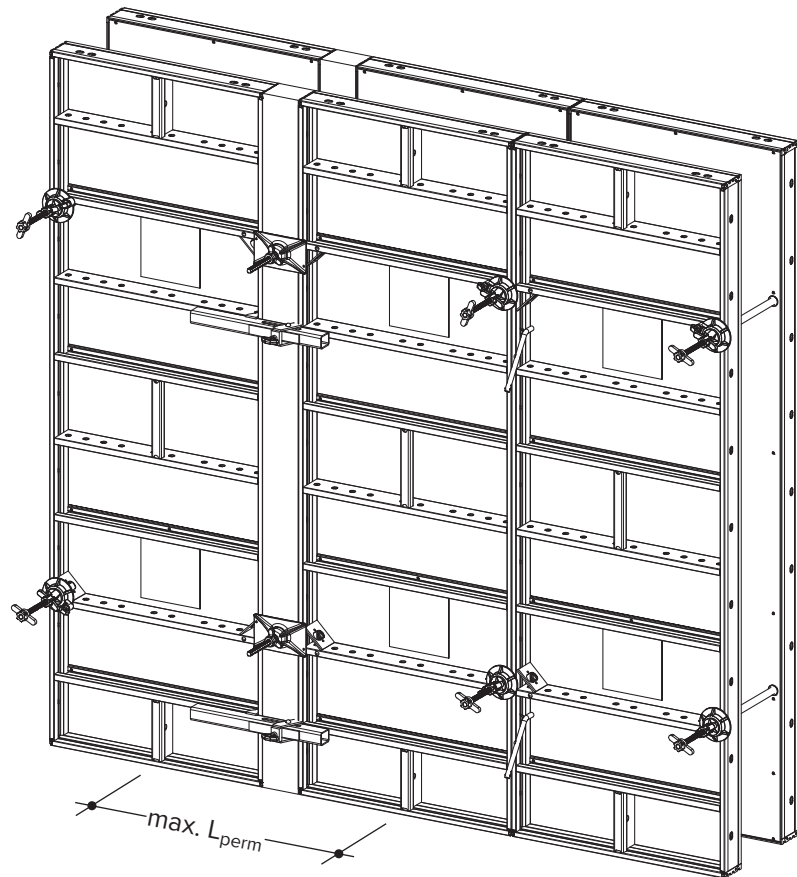
If the area of influence L is not exceeded, tying through the infill can be done with formwork that is not extended. The Tie Nut 230 is needed. This is the only Tie Nut that is wide enough to span the infill and the adjacent panels.



This tying method is permitted only when the formwork is not extended! It is essential to tie through the tie holes in the panels when the formwork is extended (Refer to section 12.3.2).



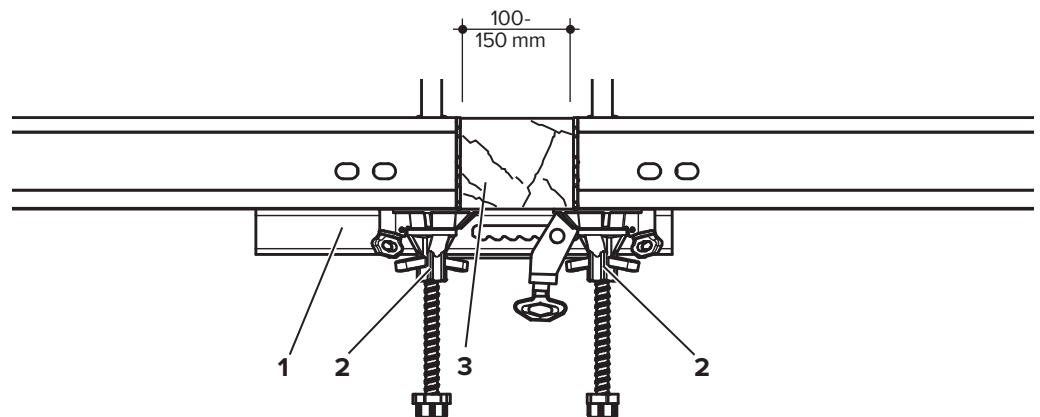
- 1 RASTO Adjustable Aligning Clamp
- 2 Square timber, 120 mm deep
- 3 MANTO Tie Nut 230
- 4 Tie Rod



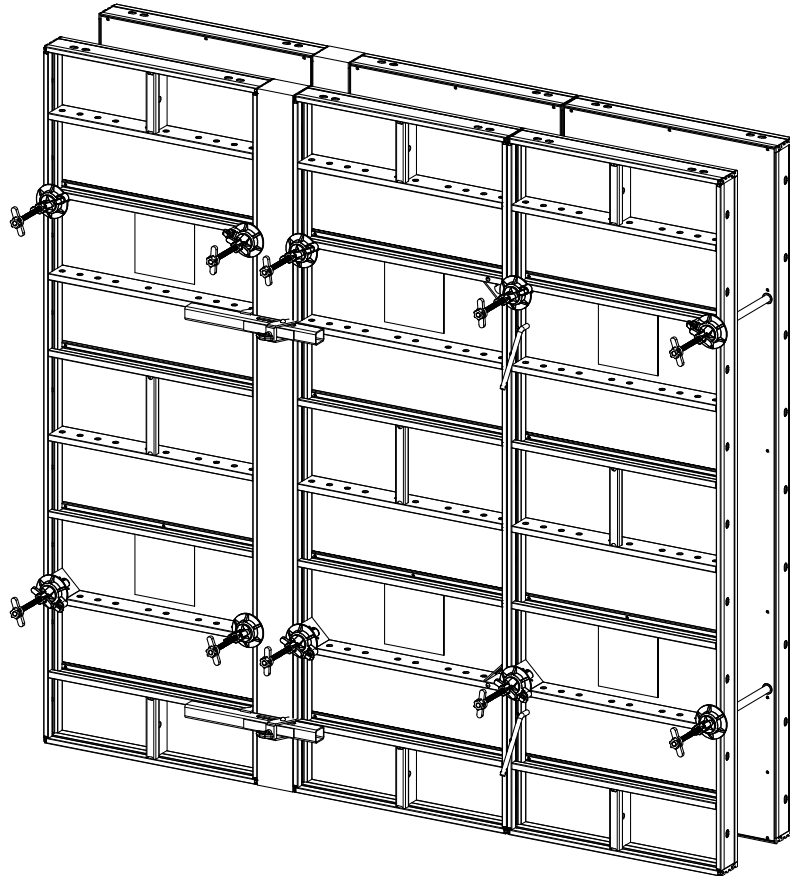
- Step 1** Drill tie holes in the required places along the square timber.
- Step 2** Put the panels and square timber in place.
- Step 3** Join the panels using the required number of RASTO Adjustable Aligning Clamps.
- Step 4** Secure the ties through the infill.

12.3.2 Tying through the tie holes in the panels (area of influence $L > L_{perm}$)

If the permitted area of influence L_{perm} is exceeded, double ties have to be used. You will need 2no. MANTO Tie Nuts and Tie Rods for each tie position. The one-sided RASTO G2 MR tie system can also be used with RASTO G2 Panels (Refer to the illustration).



- 1** RASTO Adjustable Aligning Clamp
- 2** RASTO one-sided tie system
- 3** Square timber, 120 mm deep



- Step 1** Put the panels and square timber in place.
- Step 2** Join the panels using the required number of RASTO Adjustable Aligning Clamps.
- Step 3** Secure the ties through the tie holes in the panels.

12.4 Adapting length with infills 150–300 mm wide on site

Infills up to 300 mm do not need to be solid. As an alternative, you can use two square timbers and a strip of form lining. The square timbers have to rest against the adjacent panels.

Use the Multipurpose Waler to create the infill. The Waler joins the adjacent panels such that the joint is resistant to tension. It aligns them and serves as the tie position for the tie that passes through the infill.

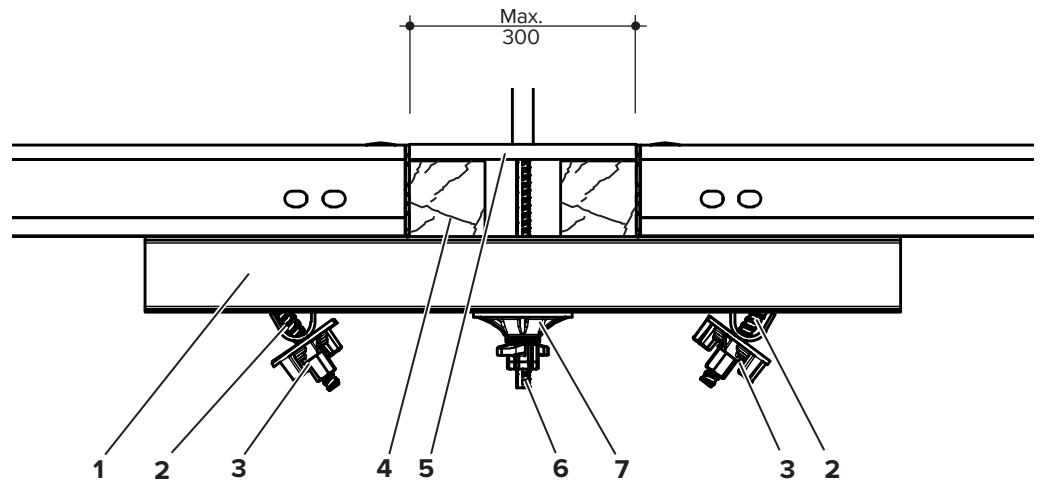
Fasten the Multipurpose Waler to the adjacent panels using two Waler Spanners and two Tension Nuts. Always attach the Waler Spanners such that they run diagonally from the Waler towards the centre of the panel. This is the only way that the Waler Spanner can join the panels in a way that makes them resistant to tension.

Infills 150–300 mm wide can be tied in two different ways:

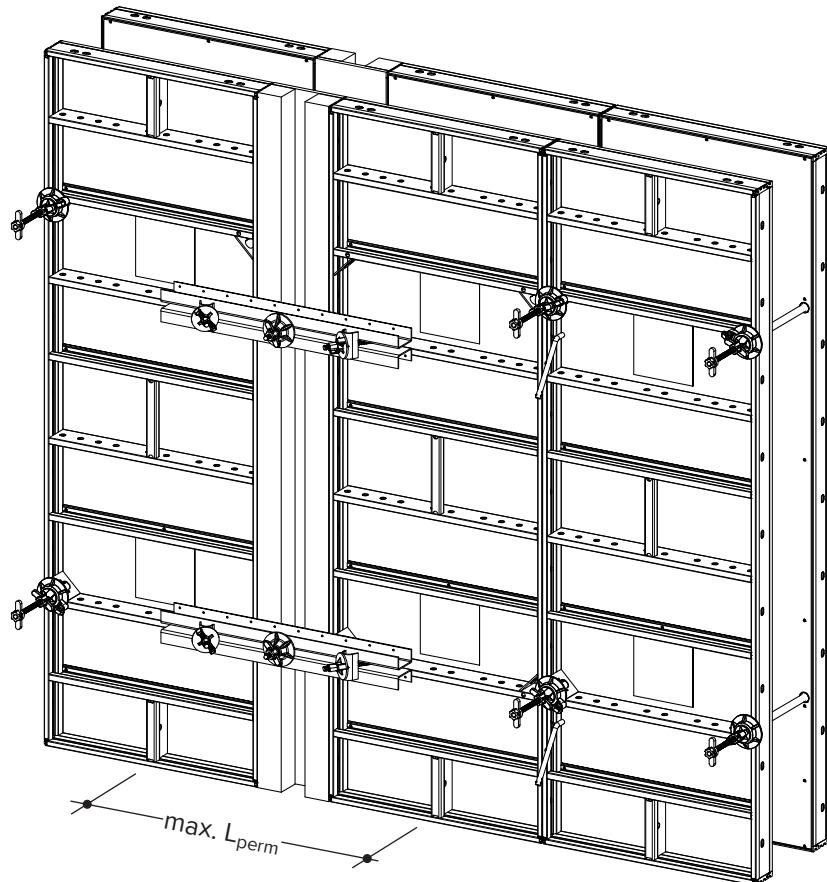
- Through the infill (area of influence $L \leq L_{perm}$)
- Through the tie holes in the panels (area of influence $L > L_{perm}$)

How you choose to tie the structure also depends e.g. on the position of the tie holes in the opposite side of the formwork.

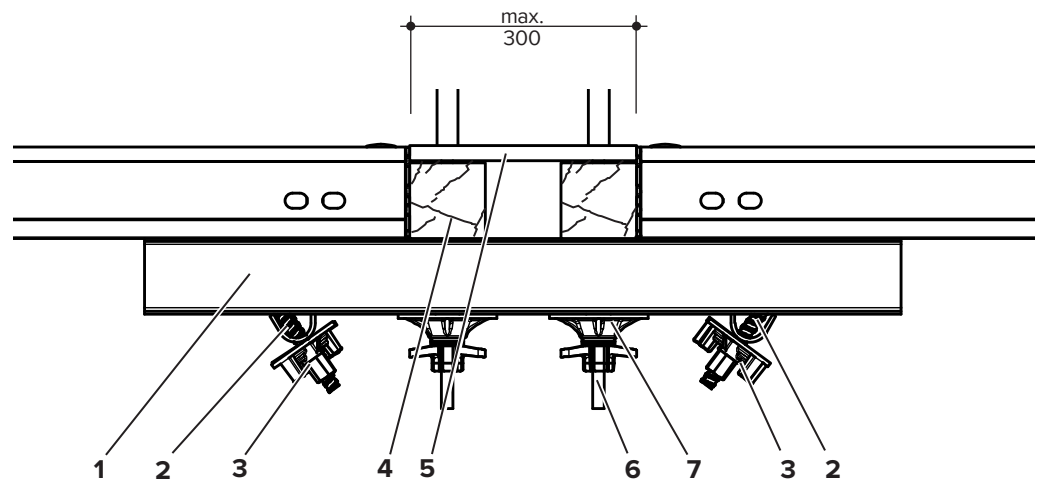
12.4.1 Tying through the centre of the infill (area of influence $L \leq L_{perm}$)



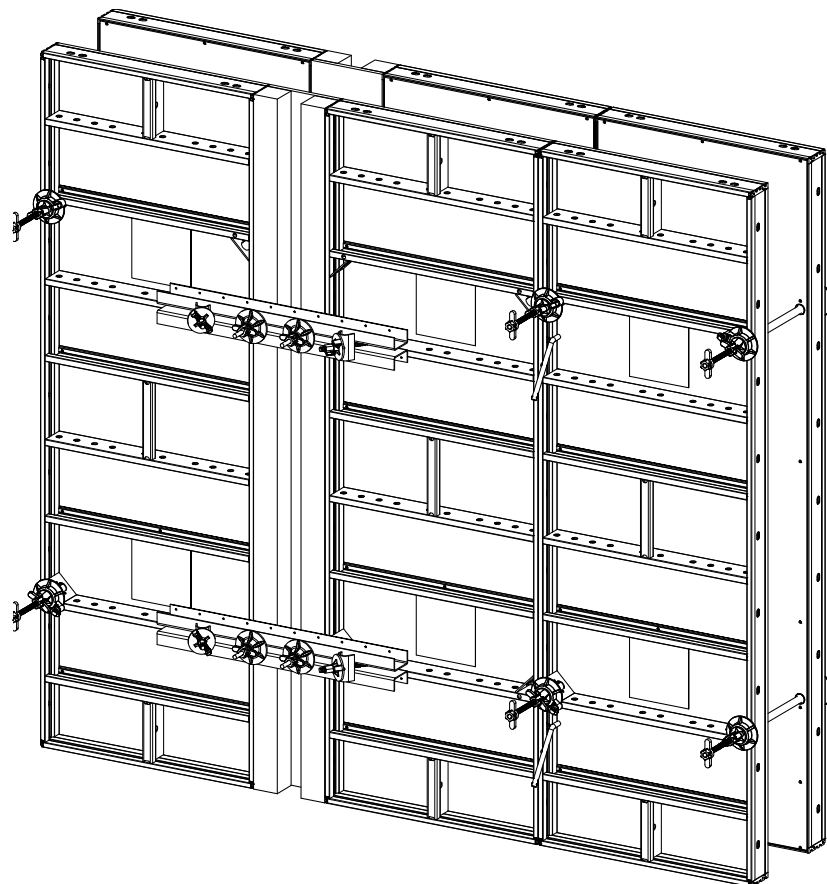
- 1 Multipurpose Waler
- 2 Waler Spanner
- 3 Tension Nut
- 4 Square timber, e.g. 100 x 100 mm
- 5 Form lining
- 6 Tie Rod
- 7 MANTO Tie Nut



12.4.2 Tying through the square timbers (area of influence $L > L_{perm}$)

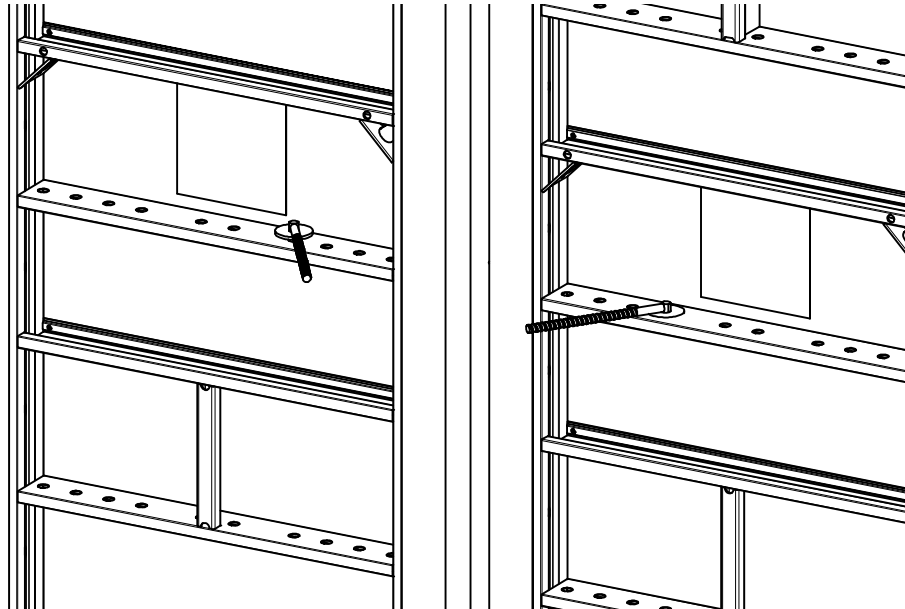


- 1 Multipurpose Waler
- 2 Waler Spanner
- 3 Tension Nut
- 4 Square timber, e.g. 100 x 100 mm
- 5 Form lining
- 6 Tie Rod
- 7 MANTO Tie Nut

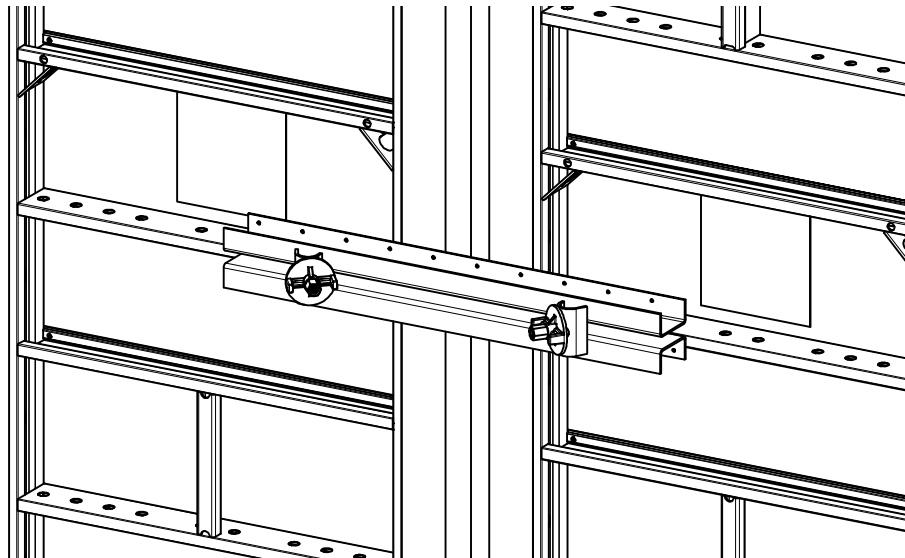


12.4.3 Constructing an infill

- Step 1** Use two square timbers and form lining to construct an infill.
- Step 2** Drill tie holes in the form lining in the required places.
- Step 3** Put the panels and infill in place.
- Step 4** For each Multipurpose Waler, mount 2no Waler Spanners in the proper position along the H-rib of the adjacent panel.

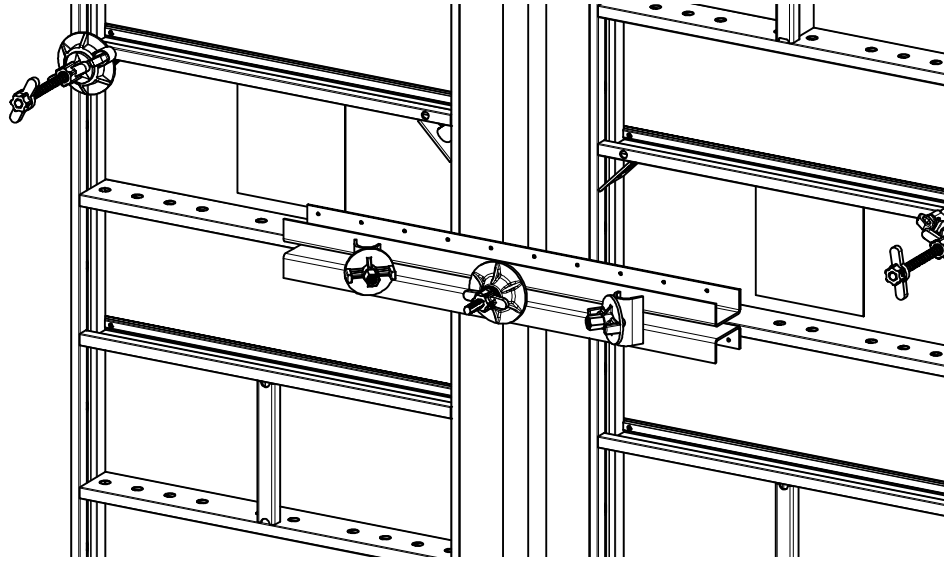


- Step 5** Slide the Multipurpose Waler onto the Waler Spanners and secure with Tension Nuts.



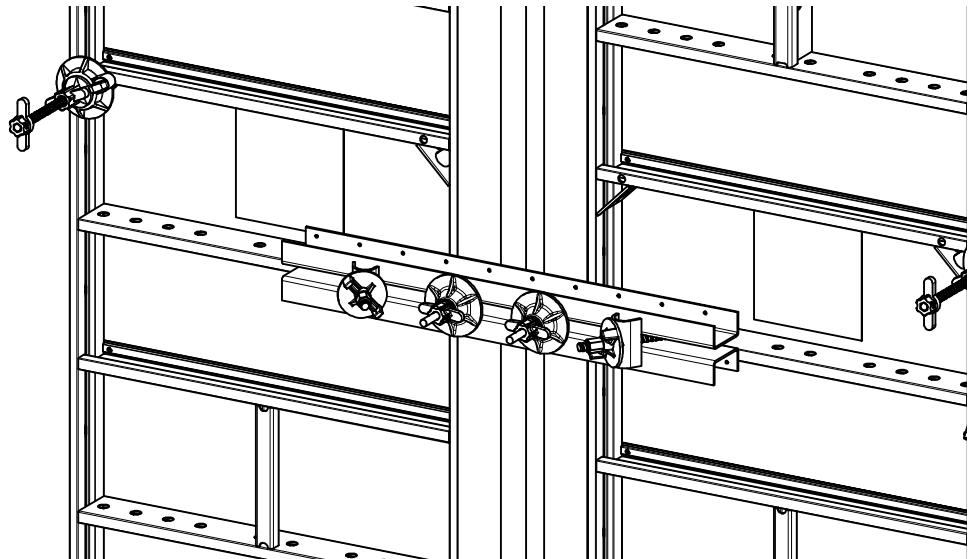
Adapting length with infills

Step 6 Secure a single tie through the infill.



or

Step 7 Secure a double tie through the square timber of the infill.



13 Bracing

Struts are used to prevent the formwork elements from toppling over and to align the formwork elements at the same time. There are several ways to use the struts in conjunction with RASTO/TAKKO formwork elements.

WARNING

Formwork can overturn!

Formwork that is not braced can topple over! This can cause personal injury or death! Always brace upright formwork with struts! Tie the struts to the ground!

WARNING

Wind can cause formwork to topple over!

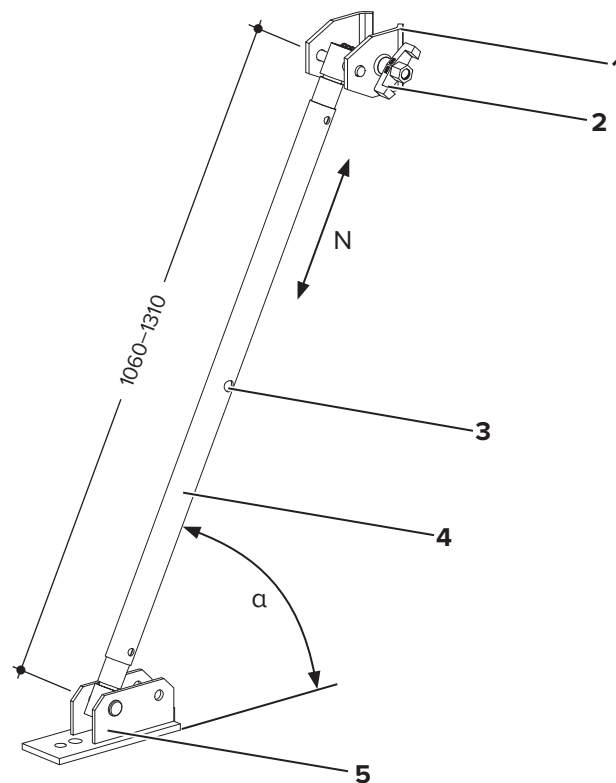
Wind can cause formwork to topple over, even if it is braced! Struts alone cannot adequately protect formwork from uplift forces! Always secure formwork to protect it from uplift forces, e.g. with ties in the ground or ballast!

13.1 Bracing TAKKO Panels with TAKKO Adjusting Struts

Use the TAKKO Adjusting Strut to brace and align single-storey TAKKO Panels. The TAKKO Adjusting Strut can be connected to the V-ribs of the TAKKO Panels or to a vertical joint.

To properly align the Panels, the TAKKO Adjusting Strut can be extended or retracted with the aid of the spindle. The Adjusting Strut can be between 1060 and 1310 mm long, depending on the length of the spindle.

13.1.1 TAKKO Adjusting Strut



- 1 Claw
- 2 Tension Nut
- 3 Hole, Ø21, to turn the spindle
- 4 Spindle to extend the Adjusting Strut
- 5 Strut Base, with holes Ø18 and Ø21 to secure it to the ground

13.1.2 Permissible loads for TAKKO Adjusting Strut

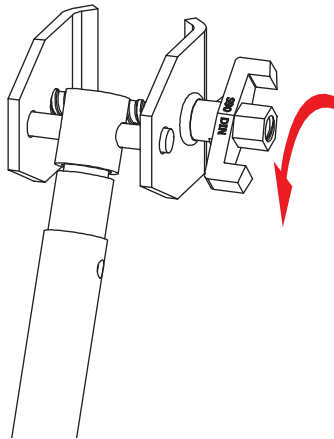
The following table indicates the permissible load for the TAKKO Adjusting Strut, as a factor of the angle of the Adjusting Strut to the ground (Refer to illustration above).

α [°]	$N_{perm.}$ [kN]
45	5.7
50	6.3
55	7.1
60	8.1

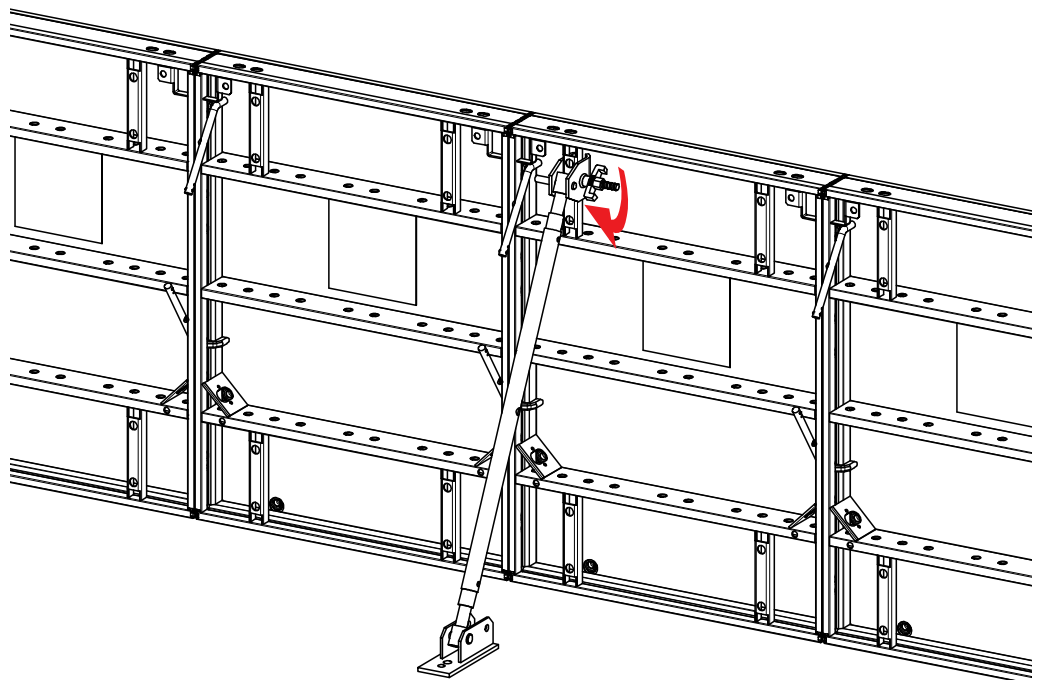
13.1.3 Attaching TAKKO Adjusting Strut to Panel

Use the claws and the Tension Nut to fasten the TAKKO Adjusting Strut to the V-rib or the vertical joint. Secure the base point of the formwork to prevent it from slipping, e.g. with a stop fillet.

- Step 1** Set the Adjusting Strut to the approximate length needed. Turn the middle piece of the Adjusting Strut in the desired direction to adjust.
- Step 2** Release the Tension Nut and open the claw.



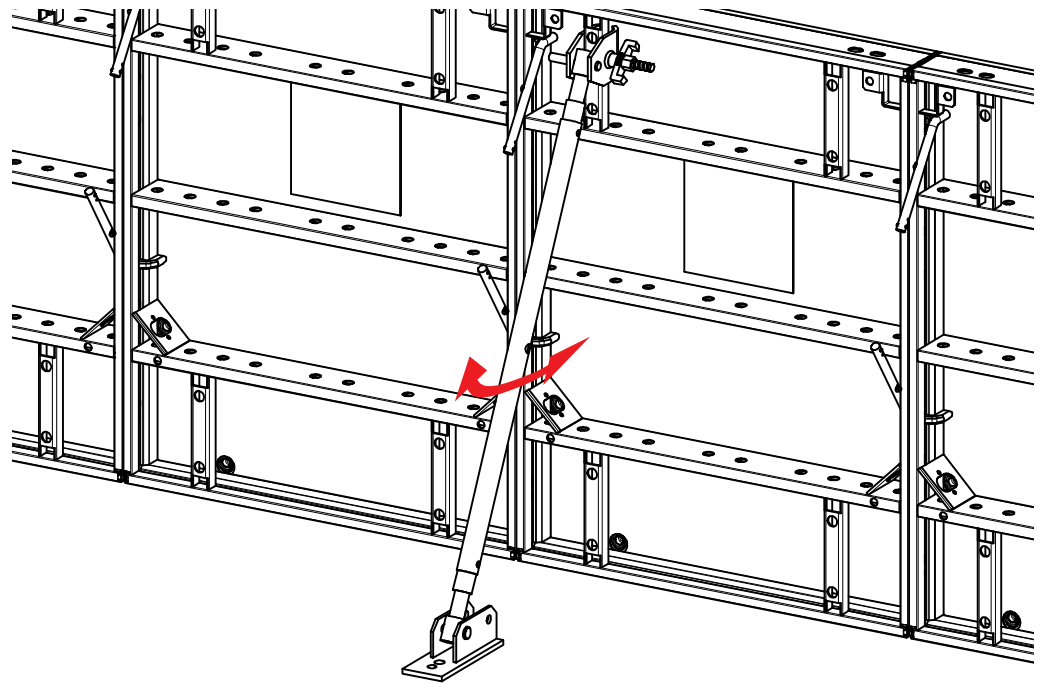
- Step 3** Slide the claw over the V-rib or the vertical joint and tighten the Tension Nut hand-tight.



Step 4 Then use a suitable tool to tighten it.

Step 5 Tie the Strut Base to the ground.

Step 6 Turn the spindle and align the formwork.



13.2 Bracing TAKKO Panels with RASTO Adjusting Struts

Stacked TAKKO Panels can be braced and aligned with RASTO Adjusting Struts. The RASTO Adjusting Strut can be attached to the V-ribs or to a vertical joint. All connecting pieces are included and are captive parts.

To properly align the Panels, the RASTO Adjusting Strut can be extended or retracted with the aid of the spindle. The length of the Adjusting Strut can be adjusted between 1605 mm and 1845 mm.

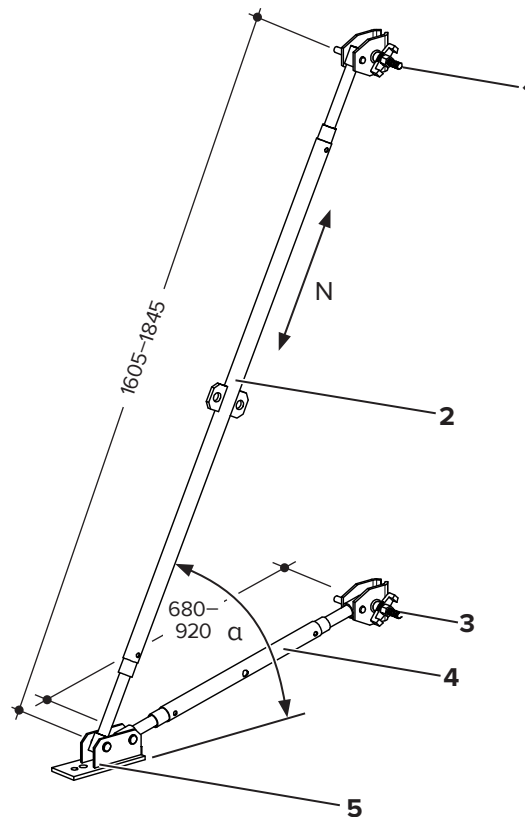
The strut heads on RASTO Adjusting Struts function similarly to those on TAKKO Adjusting Struts.

NOTE

Risk of formwork collapsing!

If the RASTO Adjusting Struts are spaced too far apart, the formwork can collapse when subjected to strong wind! Always calculate the spacing required for your wind zone! Comply with the positions specified in the assembly instructions when assembling the formwork.

13.2.1 RASTO Adjusting Strut



- 1 Adjustment Head, with claws and Tension Nut
- 2 Adjusting Strut, with spindle
- 3 Lower strut head, with claw and Tension Nut (Refer to TAKKO Adjusting Strut)
- 4 Lower strut, with spindle and hole $\varnothing 21$ to turn the spindle
- 5 Strut Base, with holes $\varnothing 18$ and $\varnothing 21$ to secure it to the ground

13.2.2 Permissible loads for RASTO Adjusting Strut

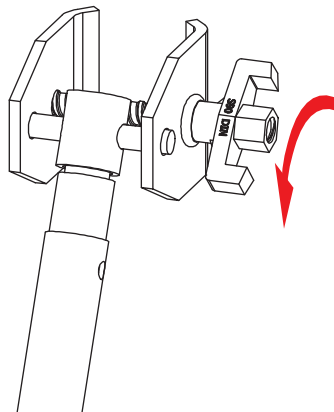
The following table indicates the permissible load for the RASTO Adjusting Strut, as a factor of the angle of the Adjusting Strut to the ground (Refer to illustration above).

α [°]	$N_{perm.}$ [kN]
45	5.7
50	6.3
55	7.1
60	8.1

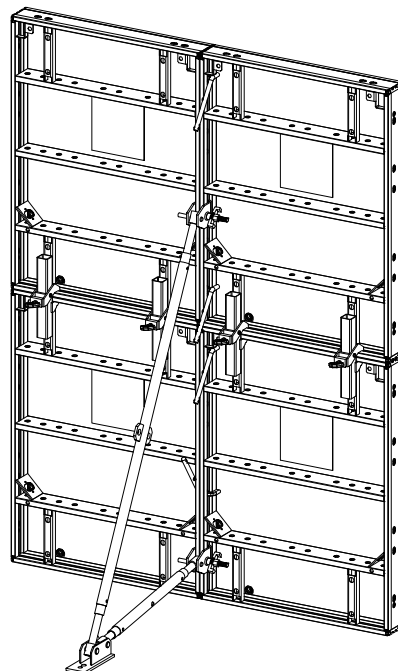
13.2.3 Attaching RASTO Adjusting Strut to Panel

Use the claw and the Tension Nut to fasten the RASTO Adjusting Strut to the V-rib or the vertical joint.

- Step 1** Set the Adjusting Strut and the lower strut to the approximate length needed. Turn the respective spindle in the proper direction to adjust.
- Step 2** Release the Tension Nuts on the lower strut and the Adjusting Strut, then open the claw.



- Step 3** Slide the claw over the V-rib or the vertical joint and tighten the Tension Nut hand-tight.
- Step 4** Then use a suitable tool to tighten it.
- Step 5** Tie the Strut Base to the ground.
- Step 6** Turn the middle pieces of the Adjusting Strut and the lower strut to adjust the formwork.



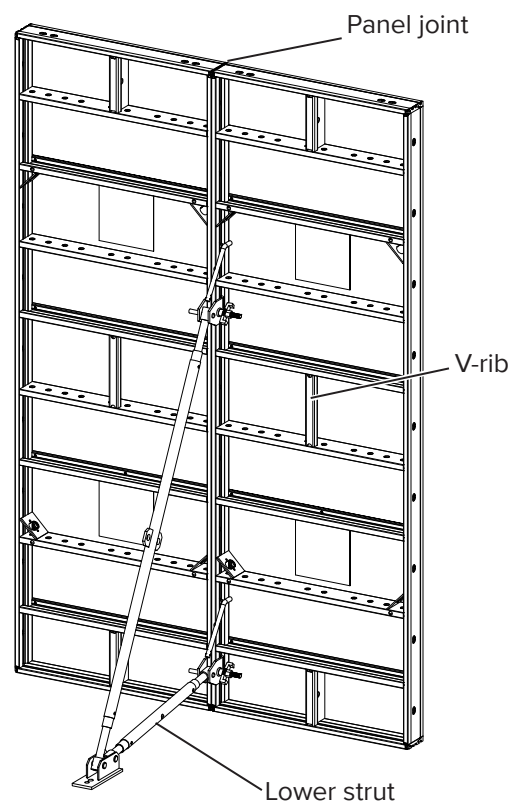
13.3 Bracing RASTO Panels with RASTO Adjusting Struts

Align and secure single-storey RASTO formwork (up to 3.00 m high) with RASTO Adjusting Struts. The Adjusting Struts can be fastened to RASTO G2 Panels at the panel joint and at V-ribs. The Adjusting Struts can be attached to the panel joint when using conventional RASTO Panels. All connecting pieces are included and are captive parts. Detailed information on how to use RASTO Adjusting Struts as well the permissible loads can be found in the Section *Bracing TAKKO Panels with RASTO Adjusting Struts* on page 102.

NOTE

Risk of formwork collapsing!

If the RASTO Adjusting Struts are spaced too far apart, the formwork can collapse when subjected to strong wind! Always calculate the spacing required for your wind zone! Comply with the positions specified in the assembly instructions when assembling the formwork.

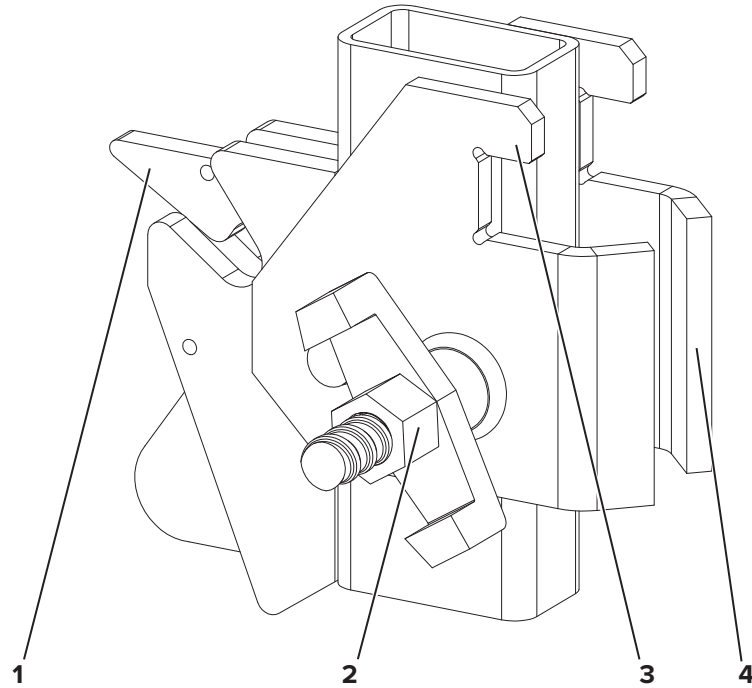


13.4 With Alignment Struts

Alignment Struts generally have to be used to brace stacked formwork > 3 m high. All Alignment Struts can be telescoped. The Alignment Struts also have a fine-adjustment feature that facilitates alignment of the formwork. Use the Quick-Action Strut Connector to attach the Alignment Struts to RASTO or TAKKO Panels.

13.4.1 Quick-Action Strut Connector

No additional adapters are needed when the Quick-Action Strut Connector is used to attach Alignment Struts to any RASTO or TAKKO Panels. Attach the Quick-Action Strut Connector to the panel when it is lying flat. When you are properly protected, you can attach the Quick-Action Strut Connector to an upright panel as well. Connect the Alignment Strut to the upright formwork from the ground.



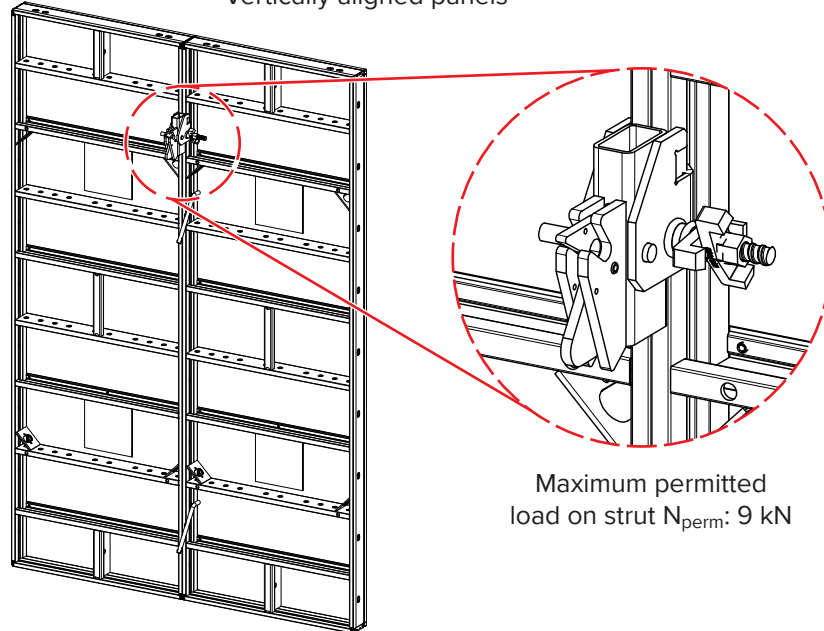
- 1 Drop latch with red mark
- 2 Nut
- 3 Claw
- 4 Clamp

Attaching Quick-Action Strut Connector to panel

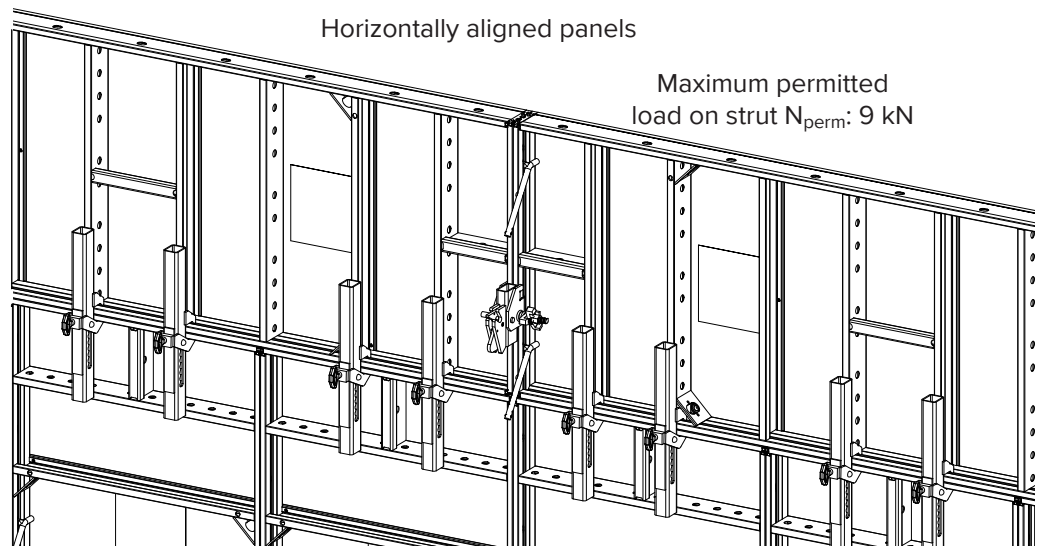
The Quick-Action Strut Connector can be fastened to these places on the RASTO/TAKKO formwork:

- At a vertical joint of any RASTO/TAKKO Panels In these cases the Quick-Action Strut Connector is clamped to the edge profiles of the two panels.

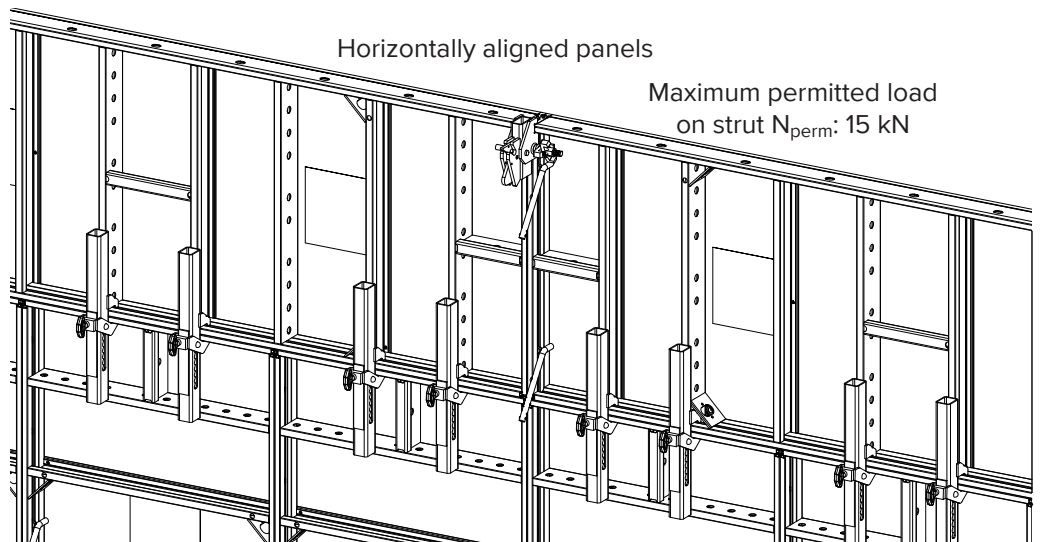
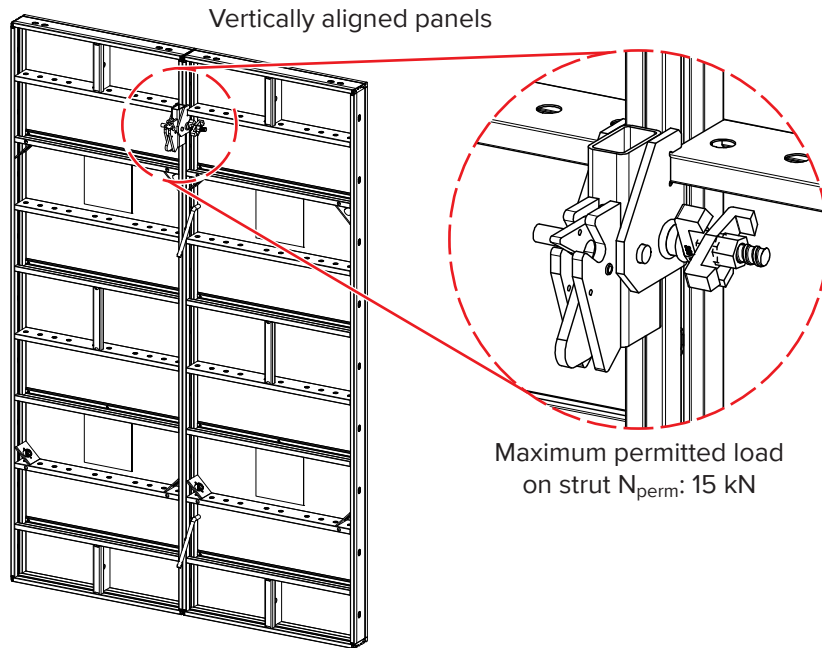
Vertically aligned panels



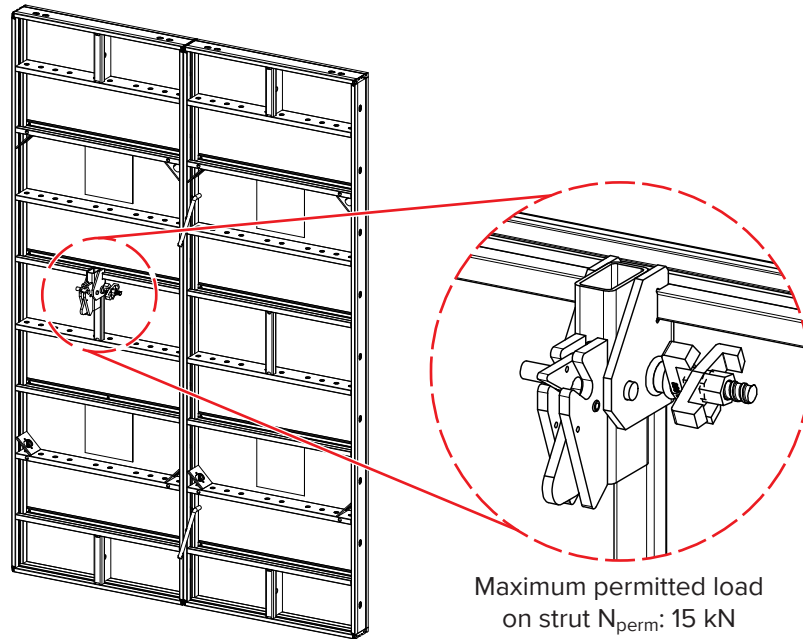
Horizontally aligned panels



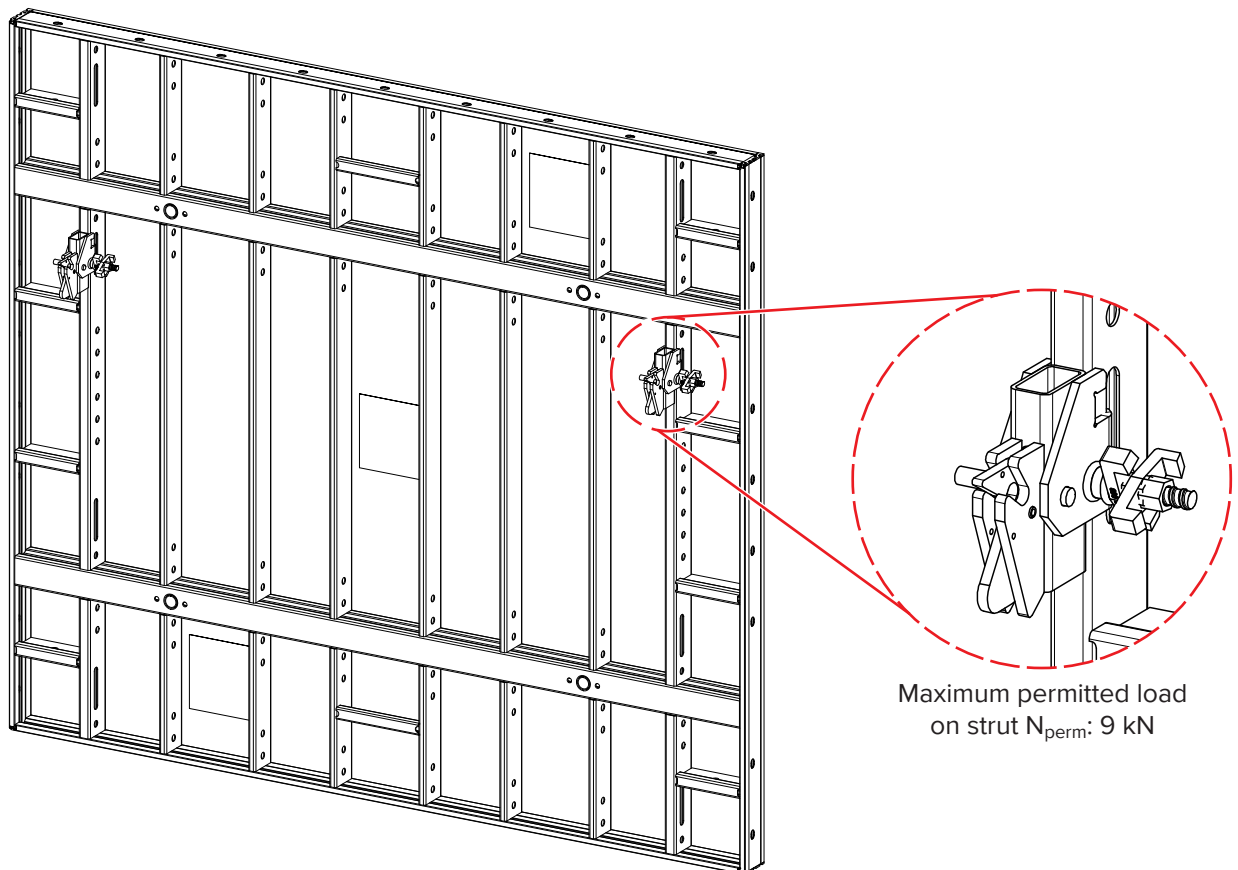
- At a vertical joint of any RASTO/TAKKO Panels where an H-rib meets the edge profile. In addition to the clamping of the Quick-Action Strut Connector, the claw reaches over a horizontal profile of the panel.



- On vertical RASTO G2 Panels, where the top of a V-rib meets an H-rib.



- By the slots in the H-ribs on horizontal RASTO XXL Panels. The clamp of the Quick-Action Strut Connector reaches into the slot.



13.4.2 Attaching Quick-Action Strut Connector to panel

Proceed as follows to fasten the Quick-Action Strut Connector to the panel. Refer to page 105 for information on the components of the Quick-Action Strut Connector.

- Step 1** Release the nut on the Quick-Action Strut Connector.
- Step 2** Slide the clamp over the panel profile in a suitable place.
- Step 3** First tighten the nut by hand, then use a roofing hammer to tighten securely.

Connecting Alignment Strut to Quick-Action Strut Connector

Connect the Alignment Strut to to the Quick-Action Strut Connector from the ground.

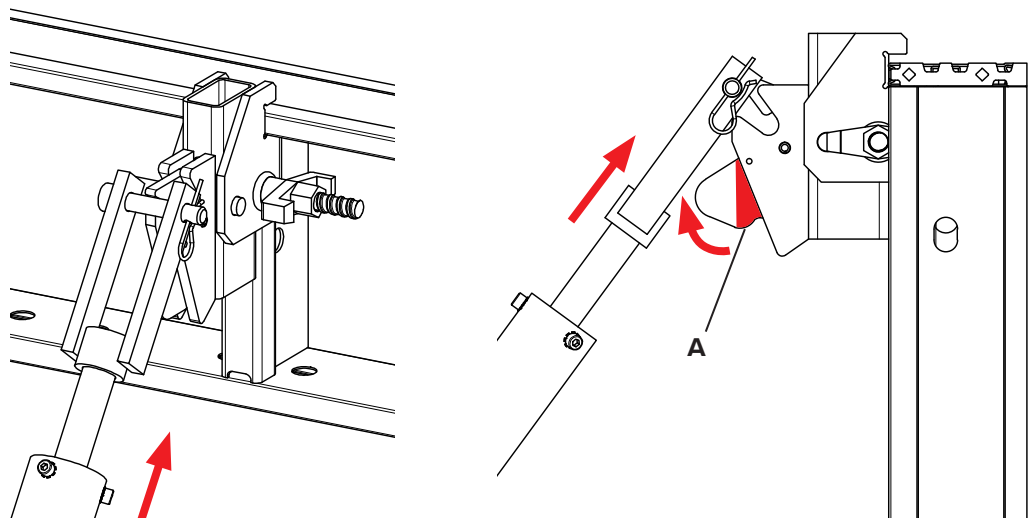


WARNING

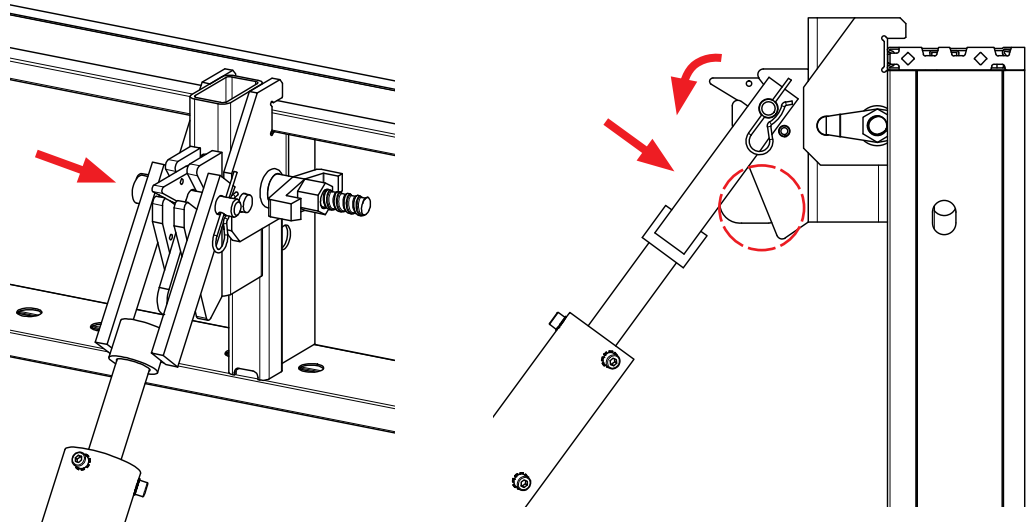
Alignment Strut can drop!

If the Alignment Strut is not locked to the Quick-Action Strut Connector properly, the Alignment Strut can fall off. This can cause personal injury or death! Jerk the Alignment Strut after attaching it to be sure that it is correctly locked into place.

- Step 1** Set the Alignment Strut to the approximate length needed.
- Step 2** Press up the drop latch on the Quick-Action Strut Connector with the retaining bolt on the Alignment Strut. The red mark **(A)** on the drop latch becomes visible.



Step 3 Push the Alignment Strut down diagonally against the Quick-Action Strut Connector. The Alignment Strut clicks into place and the drop latch closes. The red mark on the drop latch is no longer visible.



Step 4 Jerk the Alignment Strut to be sure that it is locked properly into the Quick-Action Strut Connector.

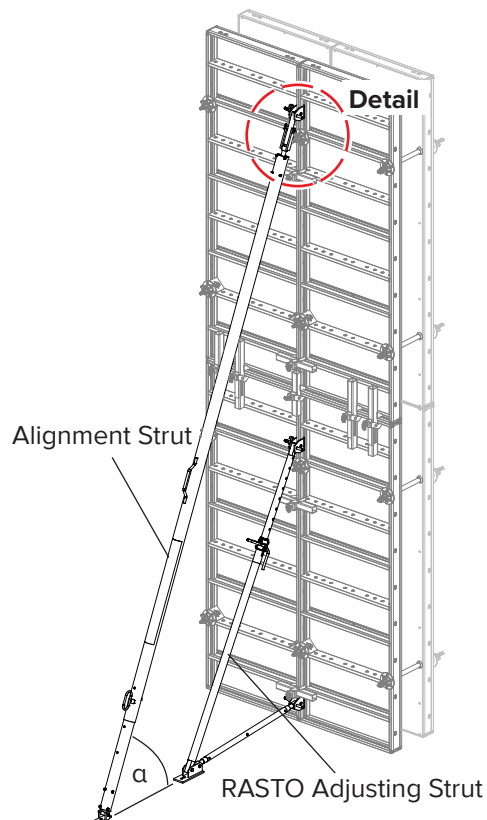
Step 5 Secure the Alignment Strut to the ground.

Step 6 Turn the middle piece the Alignment Strut to adjust the length.

13.4.3 Connecting Alignment Strut with Adapter for Alignment Struts and Adjustment Head to a vertical panel joint or V-rib

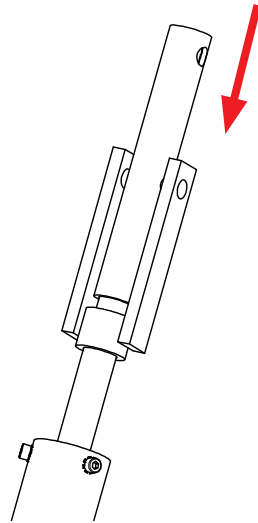
Hünnebeck recommends using the Quick-Action Strut Connector to attach Alignment Struts to RASTO/TAKKO formwork.

If there is no Quick-Action Strut Connector available, Alignment Struts can also be attached to the formwork with the Adapter for Alignment Struts and the Adjustment Head.

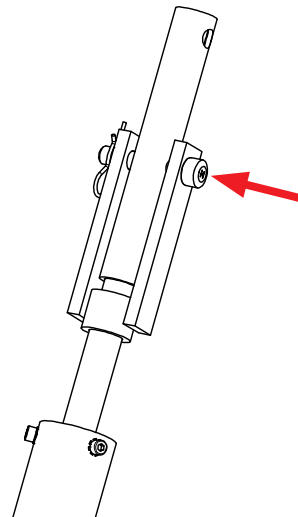


α [°]	Alignment Strut N_{perm} [kN]
45	5.7
50	6.3
55	7.1
60	8.1

Step 1 Slide the Adapter for Alignment Struts into the Alignment Strut.

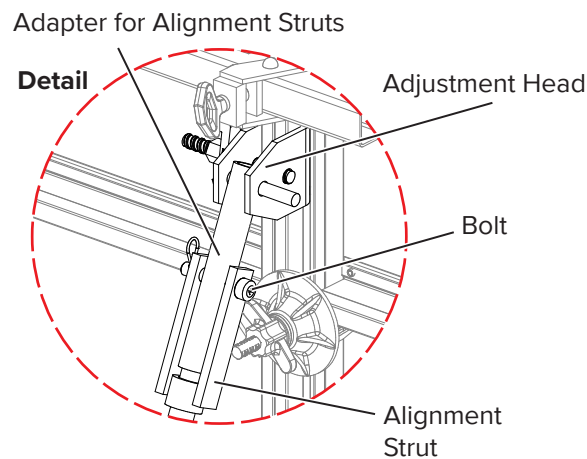


Step 2 Secure the Adapter for Alignment Struts with the pin.



Step 3 Attach the Adjustment Head to the Adapter for Alignment Strut.

Step 4 Connect the Adjustment Head to the panel joint or V-rib.



13.5 With steel props

Stacked formwork higher than 3.00 m can also be braced with conventional steel props in conjunction with the RASTO Strut Connector and the Strut Base.



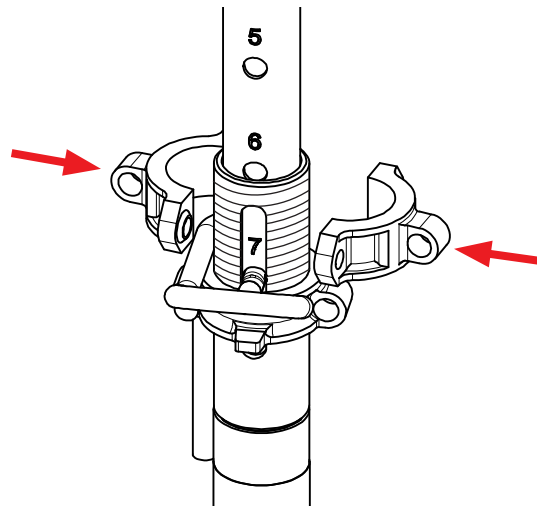
WARNING

Formwork can overturn!

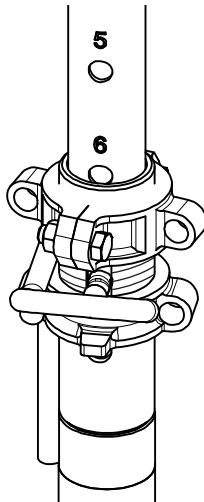
Without additional Counter Nuts, EUROPLUS Steel Props are not resistant to tension! If EUROPLUS Steel Props are used without additional Counter Nuts, the formwork can topple over towards the opposite side. Always attach an additional Counter Nut to each EUROPLUS Prop.

13.5.1 Attaching Counter Nuts to EUROPLUS Props

Step 1 Place both halves of the Counter Nut on the thread of the EUROPLUS Prop.

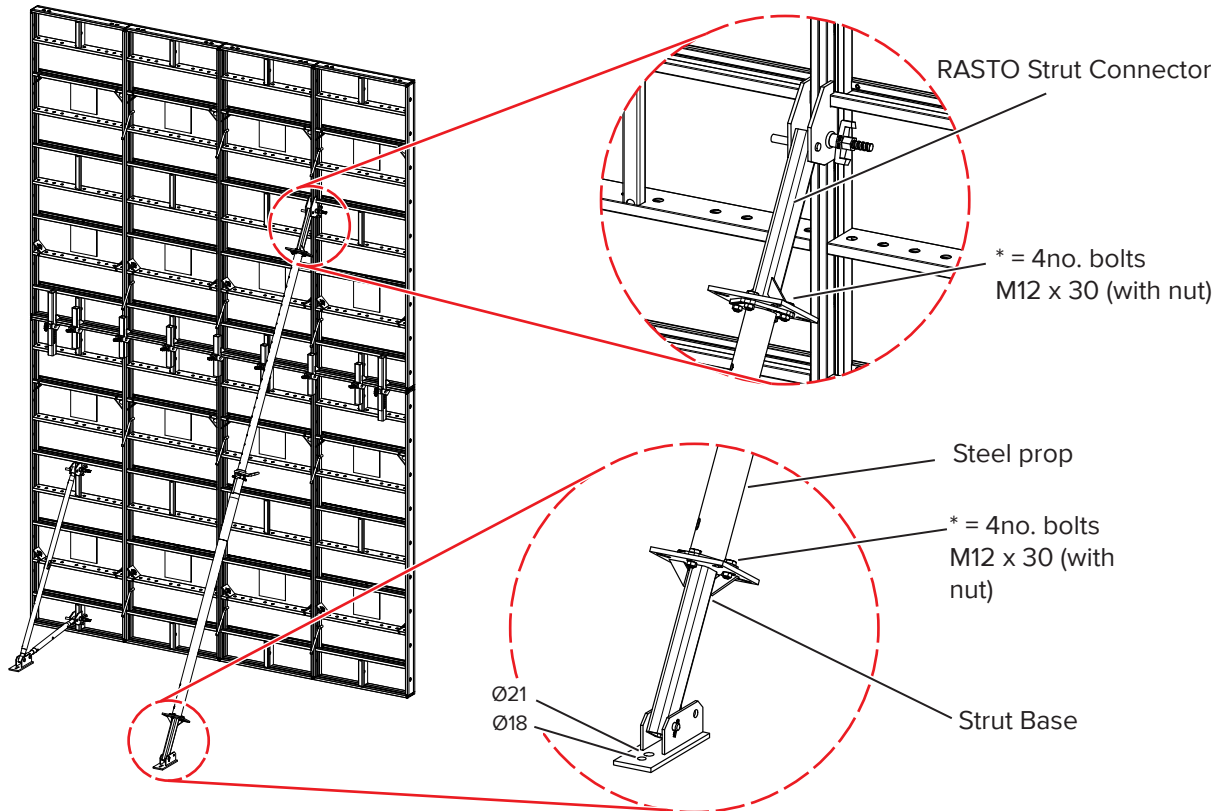


Step 2 Join the two halves of the Counter Nut using 2no. screws M12 x 40 and nuts.

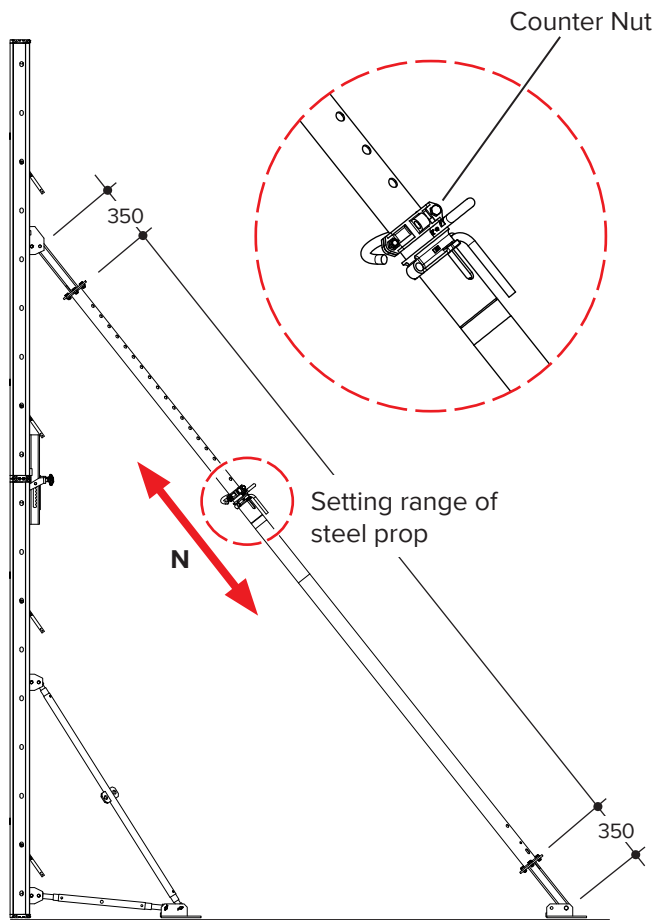


13.5.2 Bracing formwork

Attach the Strut Connector to the upper end of the steel prop with 4no M12 x 30 screws and nuts. The Strut Connector has holes in the connection plate for this purpose. The Strut Connector can be attached to all HÜNNEBECK steel props. BKS alignment struts can also be used in certain cases. Attach the Strut Base to the lower end of the steel prop in the same way. The following illustration shows the Strut attached to the panel. The Strut Base Plate has two holes for tying the Strut to the ground.



The type of steel prop to be used is a factor of the formwork height and the subsequent extension length. Props that can be extended from 1.05 m to 5.5 m are available from Hünnebeck.



- Counter Nut A/DB 260/300** (no. 107107)
for EUROPLUS® 260, 300 DB/DIN,
EUROPLUS®*new* 20-250, 20-300
EUROPLUS®*new* 30-150.
- Counter Nut AS/DB 350/410** (no. 107118)
for EUROPLUS® 350 DB/DIN,
EUROPLUS®*new* 20-350, 20-400
EUROPLUS®*new* 30-250, 30-300, 30-350.
- Counter Nut EC 400/DC 550** (no. 587675)
for EUROPLUS® 400 EC, 550 DC,
EUROPLUS® 20-550, 30-400.

Counter Nuts

The maximum permissible tensile force of the steel prop is 15 kN and is restricted by the Counter Nut.

Select the proper Counter Nut from the list above, depending on the steel prop used, and order it separately.

14 Constructing working platforms

14.1 With Universal Formwork Platform

With the Universal Formwork Platform, you can completely assemble a formwork platform with 360° side protection on panels lying flat and then raise the panels upright. The system ladders can then be used to safely ascend to the completely protected area.

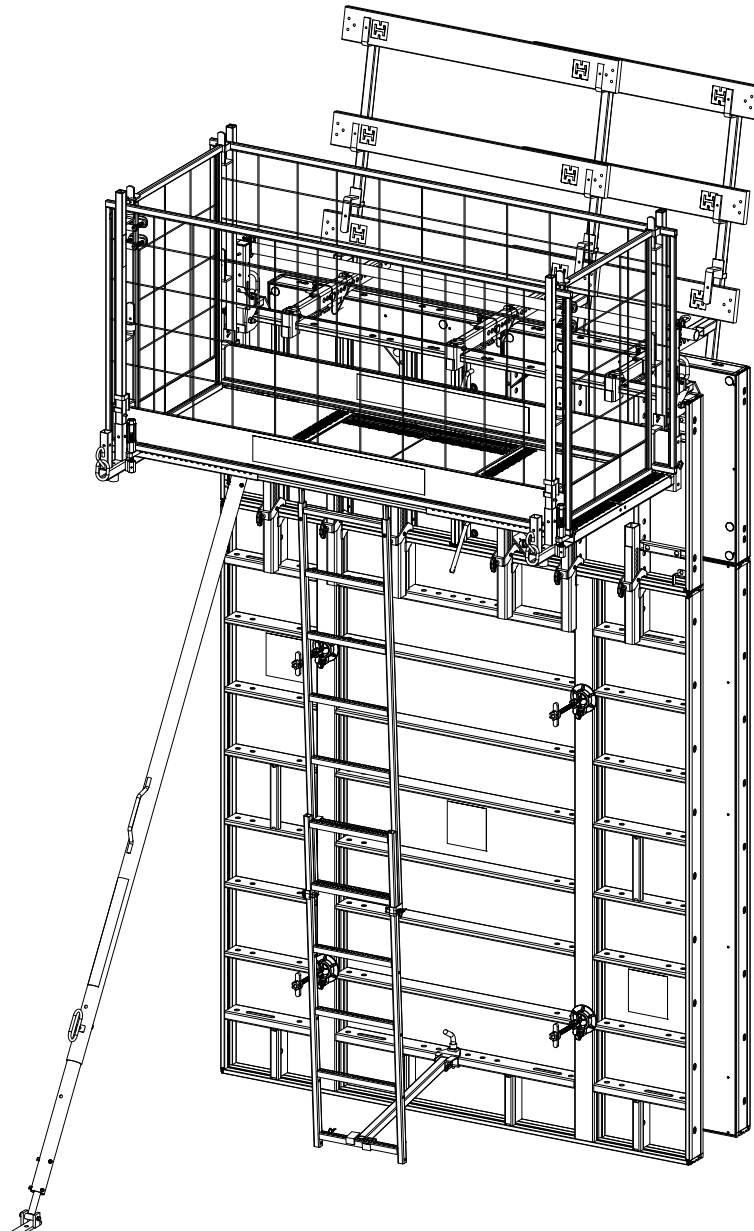
Another option is to use a crane to hang the completely assembled Formwork Platform on the formwork.

The formwork platform can be secured to either the upper edge of the panels or to the profiles within the panels.

The permissible load on the Formwork Platform complies with load class 2 (150 kg/m²) pursuant to DIN EN 12 811-1 and DIN 4420-1.



Use of the Formwork Platform is described in detail in the separate user guide for the Universal Formwork Platform.

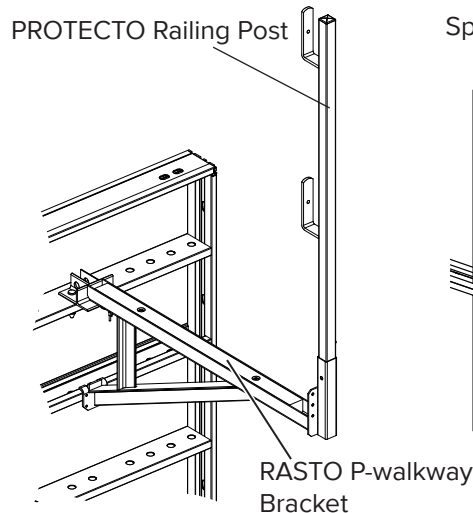


14.2 With RASTO Walkway Brackets

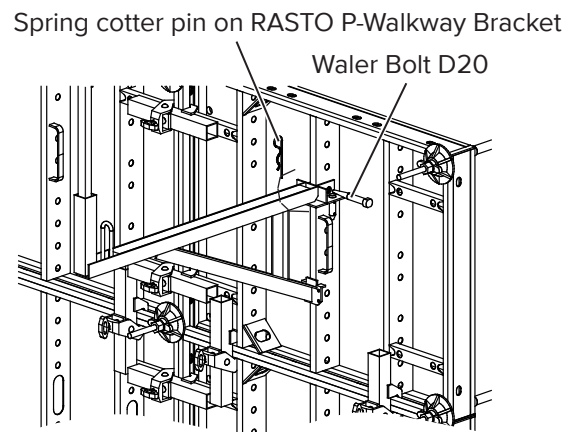
A pouring platform 900 mm wide can be created using RASTO Walkway Brackets. The permissible load on the pouring platform complies with load class 2 (150 kg/m²) pursuant to DIN EN 12 811-1 and DIN 4420-1. The Walkway Brackets can be mounted on horizontal or on vertical formwork. You will need a Waler Bolt D 20 when mounting on horizontal formwork (code:420000).

Ensure that you are in a properly protected position, e.g. on a scissor lift, when performing assembly work.

Mounted on vertically aligned formwork



Mounted on horizontally aligned formwork



WARNING

Risk of falling when Walkway Brackets are spaced too far apart!

If Walkway Brackets are spaced too far apart, the handrail boards can break when subjected to strain!

This can lead to persons falling off the platform and suffering injuries or death!

When PROTECTO Protective Mesh Panels are used, the horizontal space between two RASTO Walkway Brackets may not exceed 2.40 m! If handrail boards are used, they may be spaced no more than 2.00 m apart!



WARNING

Risk of falling due to unsuitable materials!

If unsuitable planks or handrail boards are used, they can break when subjected to strain!

This can lead to persons falling off the platform and suffering injuries or death!

Use only planks and handrail boards C24 that comply with DIN EN 338 and DIN EN 14081-1!

Planks have to be at least 50 mm thick and 200 mm wide.

Handrail boards have to be at least 30 mm thick and 150 mm wide.



WARNING

Risk of falling due to lack of Lifting Retainers!

If planks are not secured, they can lift off of the Walkway Brackets when in use or when subjected to wind.

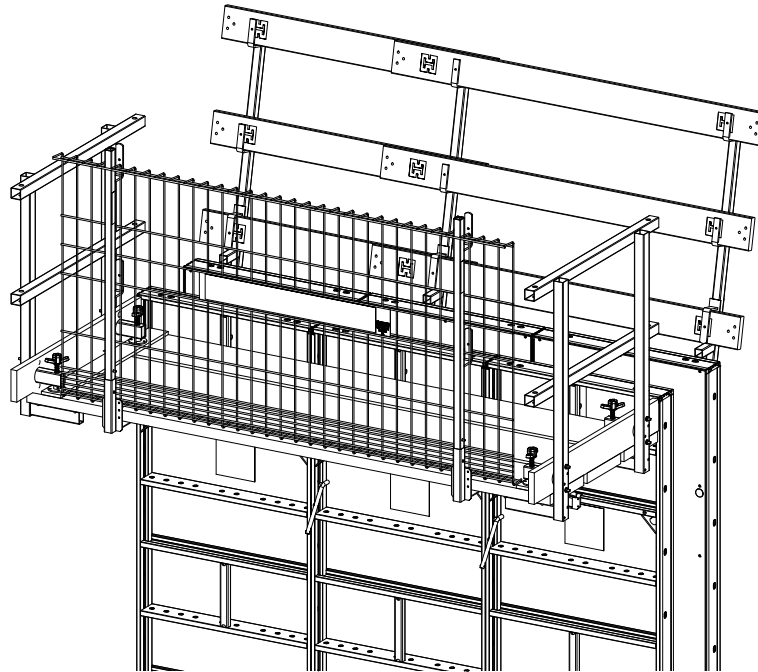
This can lead to persons falling off the platform and suffering injuries or death!

Always secure the planks to prevent them from lifting off; e.g. nail them to the Walkway Bracket!

Hang the RASTO Walkway Bracket in the holes in the rib profiles of the RASTO/TAKKO Panels. Use the captive spring cotter pin to secure the Walkway Bracket and prevent unintentional liftoff.

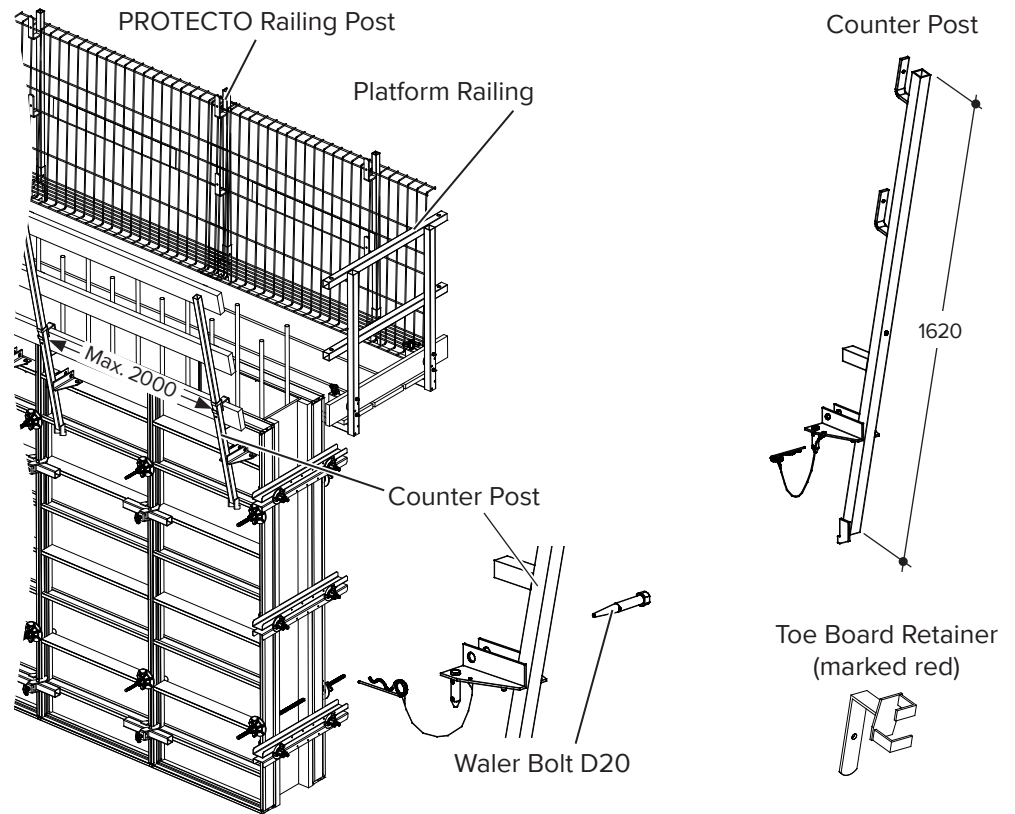
Use PROTECTO Railing Posts and a mesh panel to construct 1 m high side protection. Insert the PROTECTO Railing Posts in the receptacles on the Walkway Brackets. Then hang the Protective Mesh Panel on the hooks along the PROTECTO Railing Posts (Also refer to the separate user guide for the PROTECTO system).

Handrail boards can be placed in the Railing Posts as an alternative to the PROTECTO Protective Mesh Panels. Use Platform Railings to secure the ends of the platform (Refer to page 118).



14.2.1 Counter Post

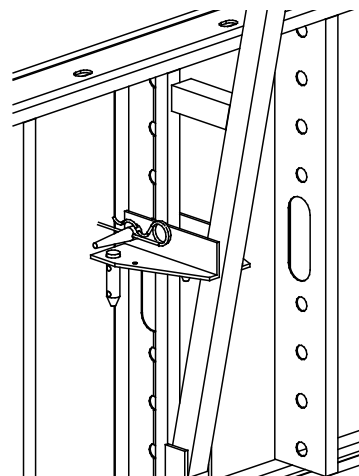
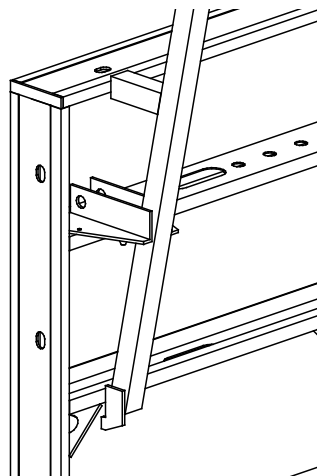
Operating personnel are protected by the railing on only one side when working on the pouring platform. The Counter Post on the opposite side of the formwork and the guardrail created with the Counter Post ensure that there is protection on both sides. As with the RASTO Walkway Bracket, the Counter Post is secured to the top rib of the panel lying flat. Use the captive spring cotter pin to secure the Counter Post. The diagonal position of the Counter Post provides the space needed above the formwork to be able to pour the concrete. The Counter Post can be fastened to panels lying flat when an additional Waler Bolt D 20 is used.



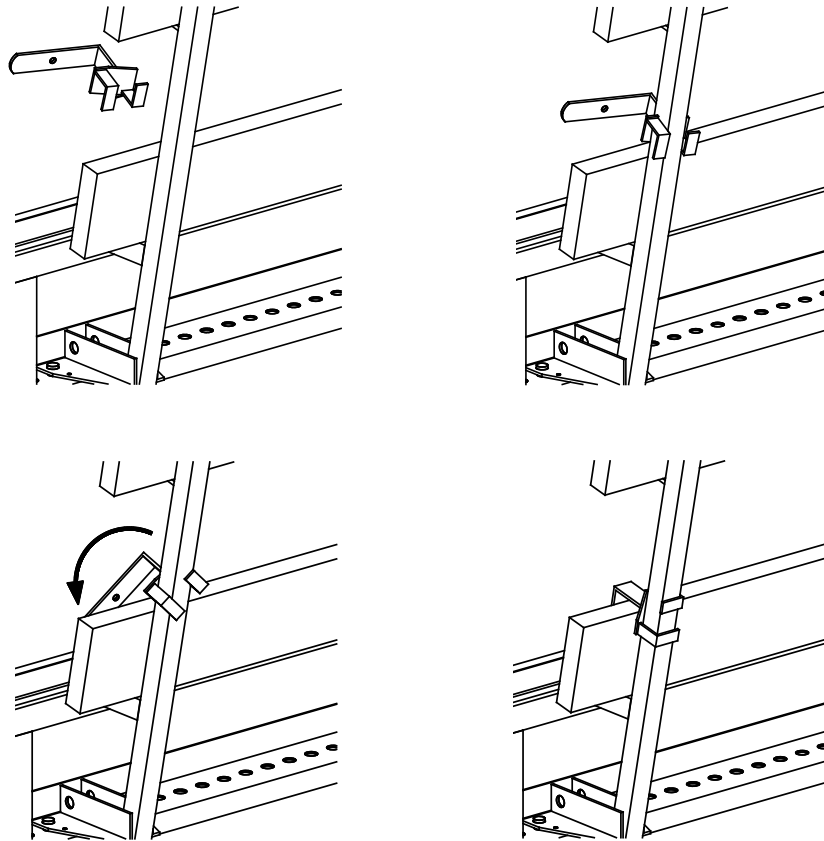
Mounting Counter Posts to upright RASTO/TAKKO Panels or Panels lying flat

Vertical RASTO Panel

Horizontal RASTO Panel



Attaching Toe Board Retainer to Counter Post



15 Erecting formwork

The RASTO G2 Transport Hook is normally used to lift formwork lying on the ground to an upright position. If a Universal Formwork Platform is mounted on the uppermost panel, the RASTO Lifting Device has to be used to erect and move the formwork. The respective user guides describe how to use the RASTO G2 Transport Hook and the RASTO Lifting Device.

When element assemblies are erected, the joints between the elements are subjected to excessive strain. When erecting the formwork, always verify that the formwork elements are joined using the correct number and type of connectors.



If you are using the one-sided RASTO G2 MR tie system (Refer to Section *One-sided tying* on page 120), attach the Counter Nuts to the opposite side of the formwork before erecting the formwork.

Step 1 Erect the formwork as described in the user guide for the lifting accessory used.

16 Tying

Once the formwork is upright, you can place the ties. The ties absorb the concrete pressure to which the formwork is subjected while concrete is being poured and during the time it takes for the concrete to set. Refer to the erection diagrams or the assembly instructions.

When using RASTO G2 panels, there are two ways to tie the formwork: with the one-sided RASTO G2 MR tie system or with conventional tie rods and the corresponding tie nuts.

When using conventional RASTO Panels, the only way to tie the formwork is to use conventional tie rods and MANTO Tie Nuts.

16.1 One-sided tying

When the one-sided RASTO G2 MR tie system is used to tie RASTO G2 panels, the ties can be operated from only one side of the formwork. The benefits of this system are:

- Tying does not take as much time.
- Fewer persons are needed.
- Access to the ties is needed only on one side of the formwork.
- The ties create a connection between the advancing side and the opposite side that is resistant to tension and pressure. Additional spreaders are not needed.

One-sided tying is particularly helpful when it is difficult to access one side of the formwork, e.g. in shafts. Walls up to 45 cm thick can be constructed with the one-sided tie system.

Typical steps for constructing formwork with one-sided tying:

1. Erect the advancing side of the formwork.
2. Add reinforcement.
3. Attach the Counter Nuts for the one-sided tie system in the corresponding tie holes on the opposite side while it is still lying flat.
4. Erect the opposite side of the formwork.
5. Connect the Tie Rod with Cladding Tube, the Sealing Cones and the Operating Nuts from the advancing side of the formwork.



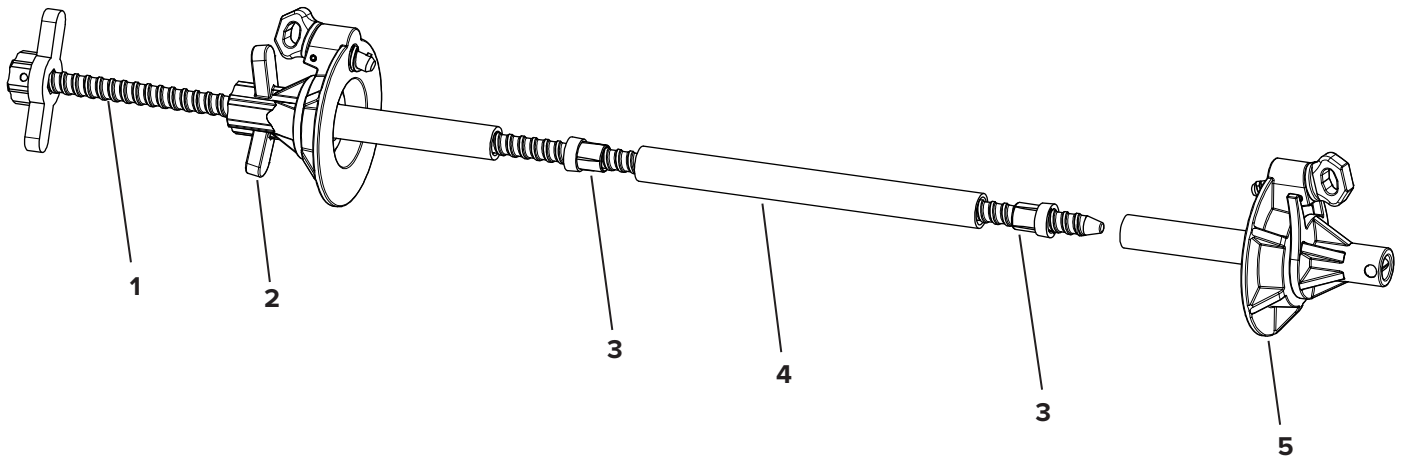
WARNING

Risk of falling!

If you attempt to attach the formwork to the crane from a position in which you are not properly protected, you can fall off of the formwork! This can cause personal injury or death! Always stand in a safe place when attaching the formwork to the crane! Use e.g. one of the Hünnebeck platform systems that is suitable for the respective formwork!

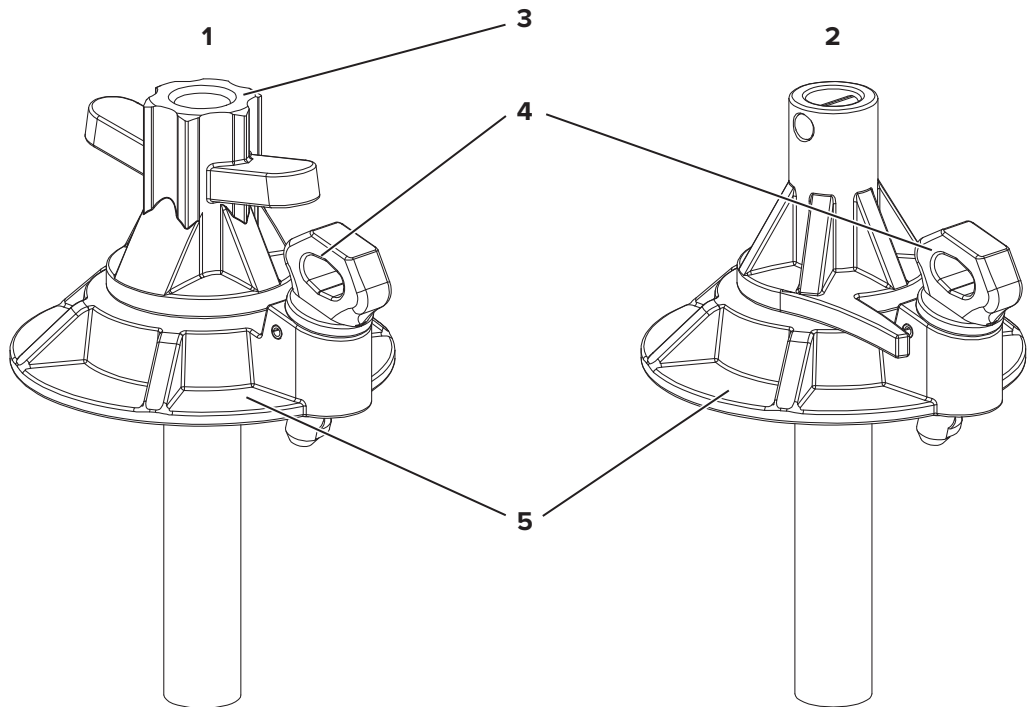
16.1.1 Components of the one-sided tie system

Overview

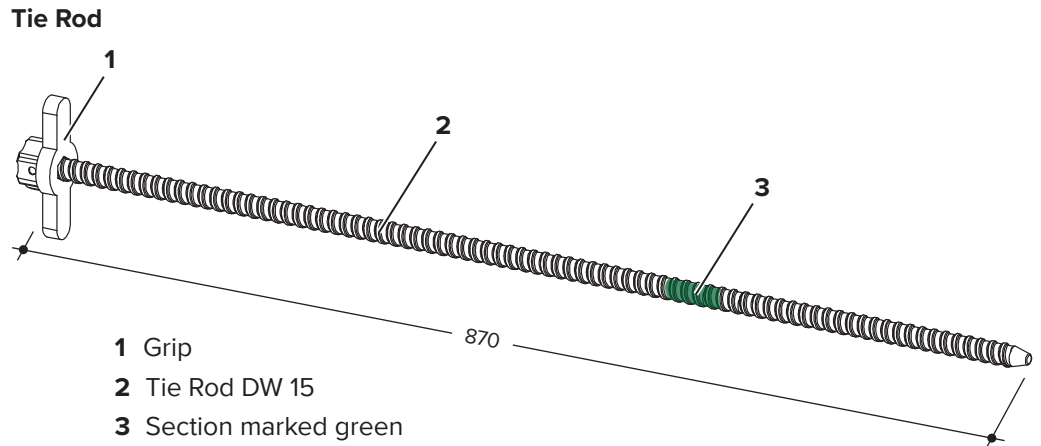


- 1 Tie Rod with grip
- 2 Operating Nut
- 3 Sealing Cone
- 4 Cladding Tube 26/22
- 5 Counter Nut

RASTO Operating Nut and Counter Nut (galvanized yellow)



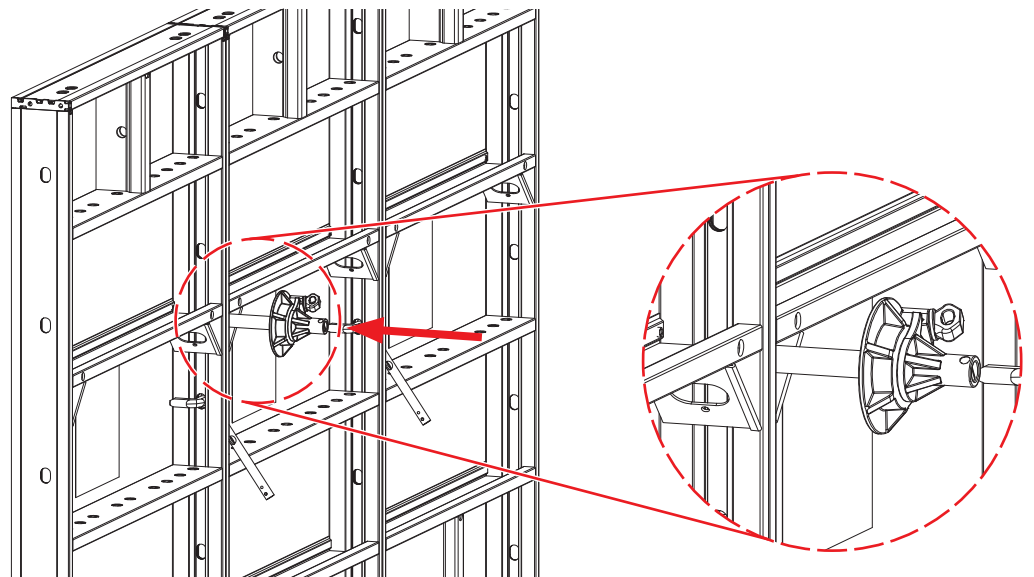
- 1 Operating Nut
- 2 Counter Nut
- 3 Twist grip
- 4 Fixing screw
- 5 Tie plate



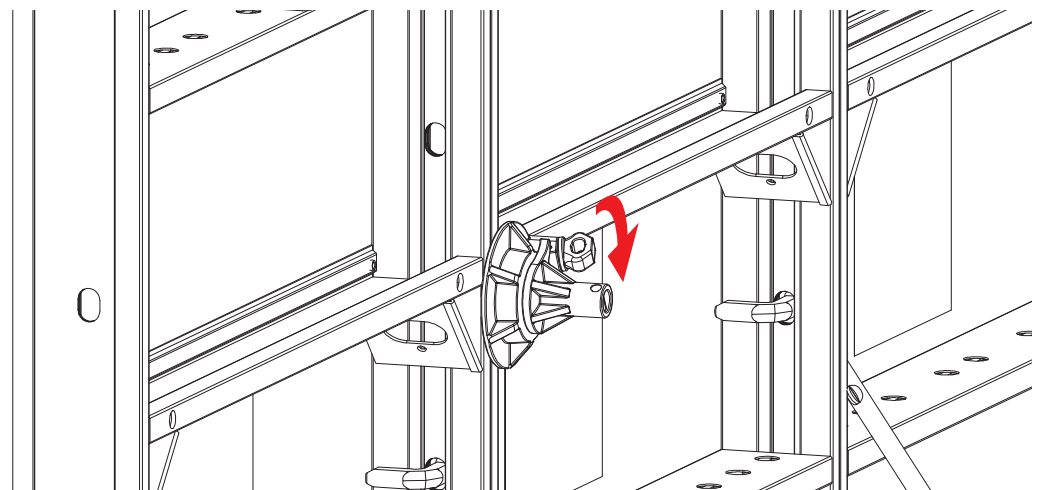
16.1.2 Attaching Counter Nut to opposite side of formwork

There is a hole in the H-rib next to each tie hole on RASTO G2 Panels for attaching the Counter Nut. The locking screw of the Counter Nut is inserted into this hole. This is how the Counter Nut is fastened to the panel.

Step 1 Push the Tie Rod on the Counter Nut into the tie hole in the panel until the Counter Nut touches the panel. The A-plug is forced out of the panel.



Step 2 Screw the fixing screw on the Counter Nut into the hole in the panel and tighten it.

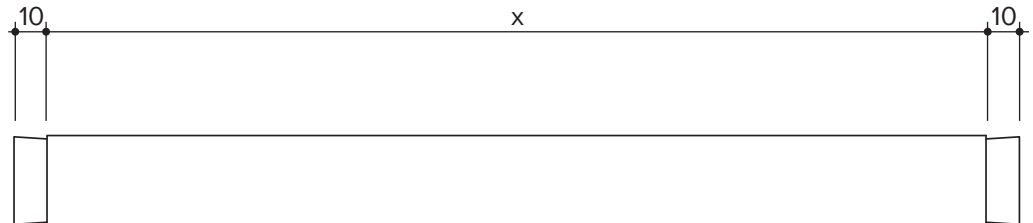


Step 3 Insert A-plugs into all tie holes not being used.

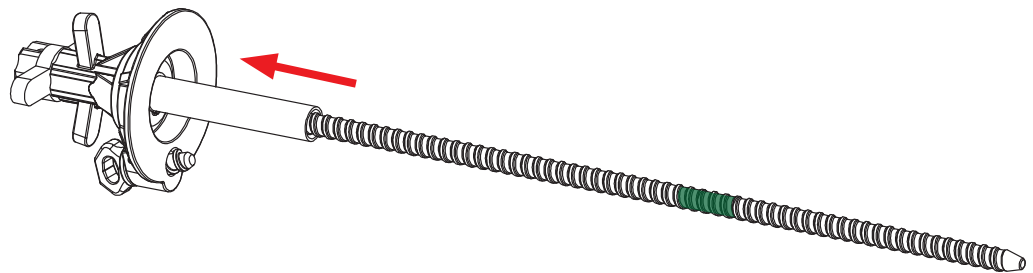
16.1.3 Preparing Tie Rod and Operating Nut

The Tie Rod, Operating Nut, Cladding Tube and Sealing Cones form an assembly that is operated from the advancing side of the formwork. The Cladding Tube has to be cut to the right length before it can be used.

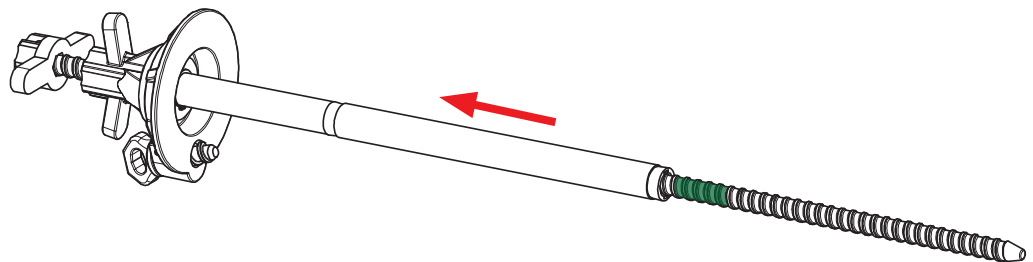
The length of the Cladding Tube should be the thickness of the wall to be poured minus 20 mm. Use only Cladding Tubes with an outer diameter of 26 mm and an inner diameter of 22 mm!



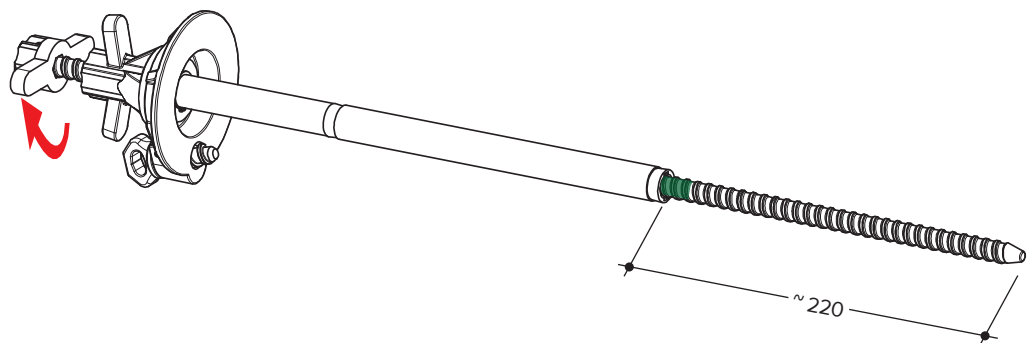
- Step 1** Cut the Cladding Tube to the required length.
- Step 2** Insert a Sealing Cone all the way into both ends of the cladding tube.
- Step 3** Screw the Operating Nut onto the Tie Rod.



- Step 4** Slide the Cladding Tube with Sealing Cones over the Tie Rod.

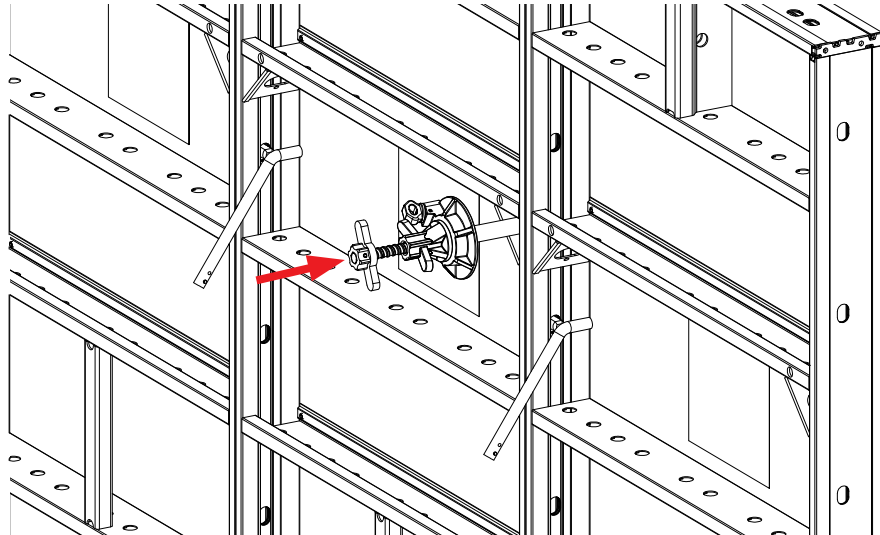


- Step 5** Unscrew the Tie Rod far enough that the end of the Cladding Tube is in the section of the Tie Rod marked green (approx. 220 mm, measured from the tip of the Tie Rod).

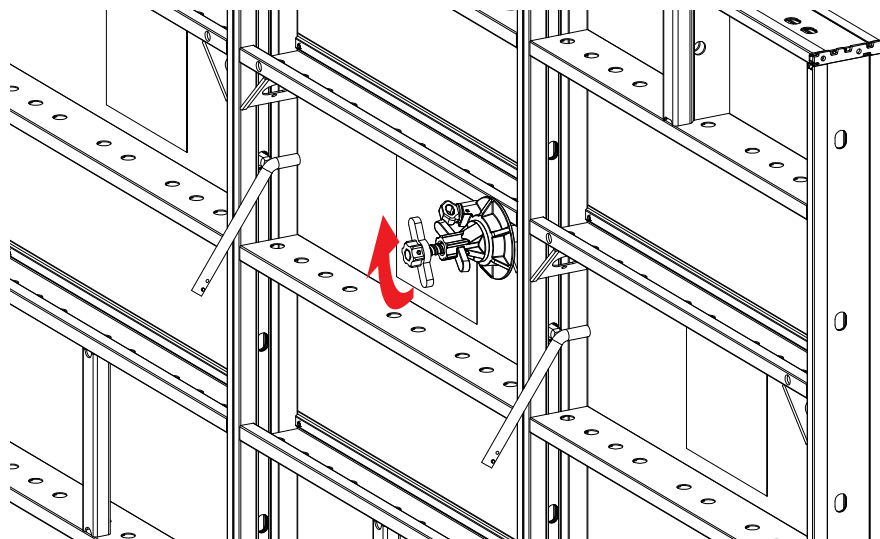


16.1.4 Attaching Tie Rod and Operating Nut to advancing side of formwork

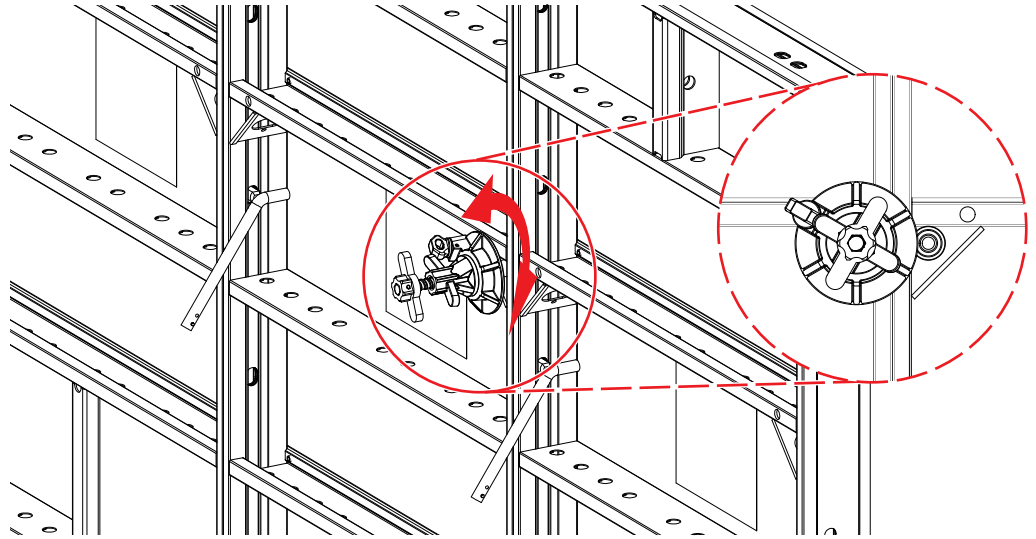
- Step 1** Extract the A-plugs from the tie holes to be used.
- Step 2** Use A-plugs or MANTO Plugs (MP Panels) to seal unused tie holes.
- Step 3** Erect the opposite side of the formwork.
- Step 4** Slide the Tie Rod with Operating Nut, Cladding Tube and Sealing Cones all the way through the tie hole in the advancing side of the formwork.



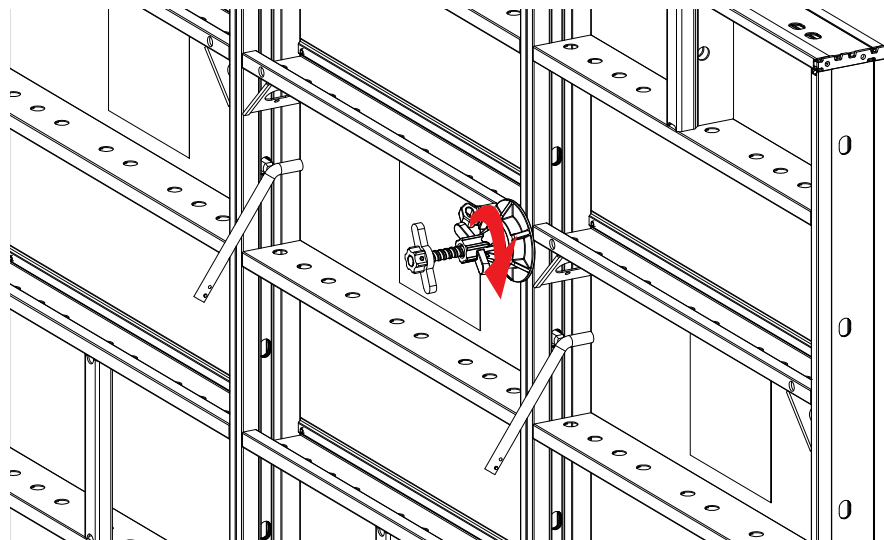
- Step 5** Screw the Tie Rod all the way into the Counter Nut.



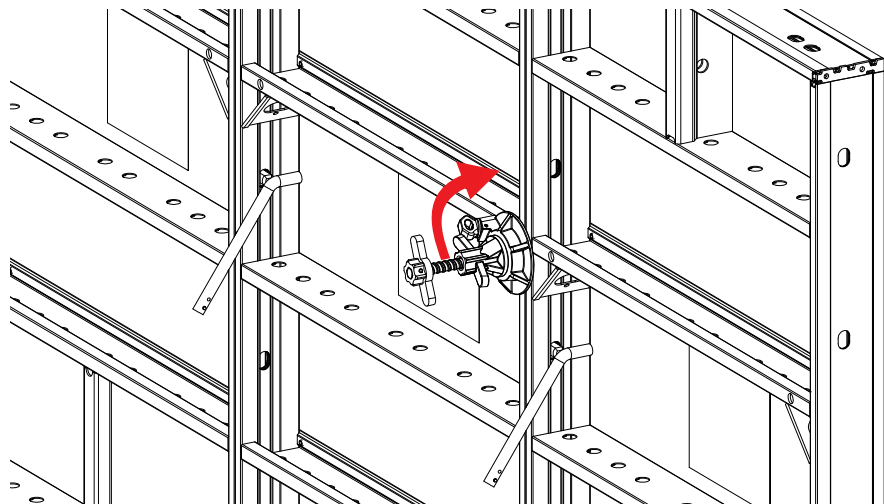
Step 6 Turn the tie plate on the Operating Nut such that the fixing screw is above the hole in the H-rib.



Step 7 Use the twist grip to screw the Operating Nut all the way into the formwork.



Step 8 Screw the fixing screw on the Operating Nut into the hole and tighten it.



Step 9 Secure the other one-sided ties in the same way.

16.1.5 Removing ties before striking

Before striking and moving the formwork, the Tie Rods have to be removed.



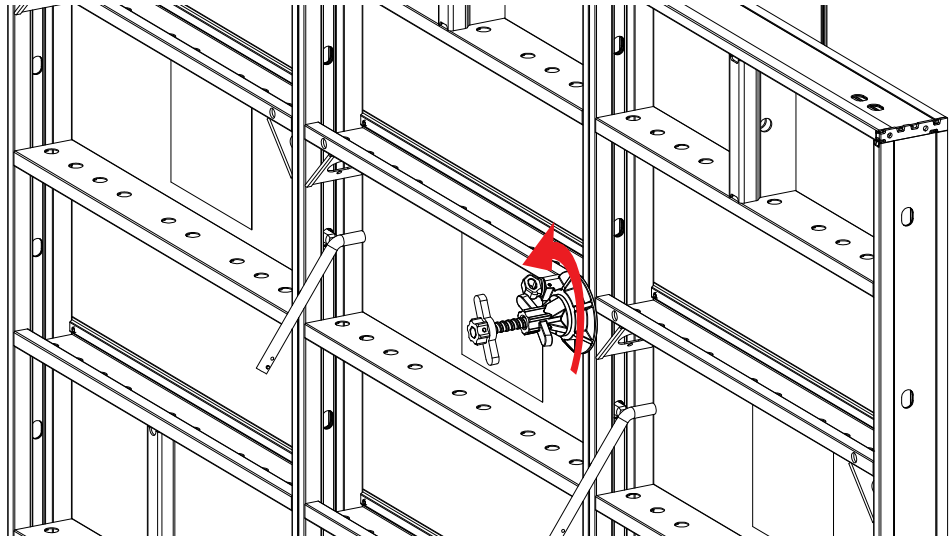
WARNING

Formwork can collapse!

If you release all of the ties from a panel assembly, the assembly will topple over! This can cause personal injury or death! Leave at least one tie in place until the formwork is attached to the crane or secured to prevent it from toppling over! This also applies to single panels not connected to other panels!

Step 1 Release the fixing screw on the Operating Nut and then extract it from the panel profile.

Step 2 Release the twist grip on the Operating Nut.



Step 3 Grasp the grip to unscrew the Tie Rod and extract it from the Counter Nut (approx. 60 mm).

Step 4 Pull the Tie Rod and Operating Nut out of the formwork. The Tie Sleeve remains in the concrete. The Sealing Cones can be removed after striking (Refer to page 133).

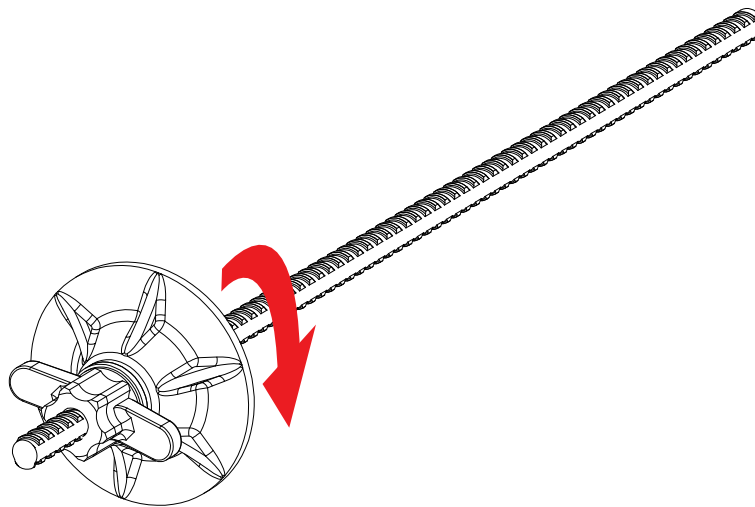
16.2 Tying with conventional tie rods

RASTO/TAKKO Panels can also be tied with conventional tie rods and MANTO Tie Nuts. To be able to do this, both sides of the formwork have to be accessible. Particularly ties up higher on the formwork have to be accessible on both sides from a safe place to stand.

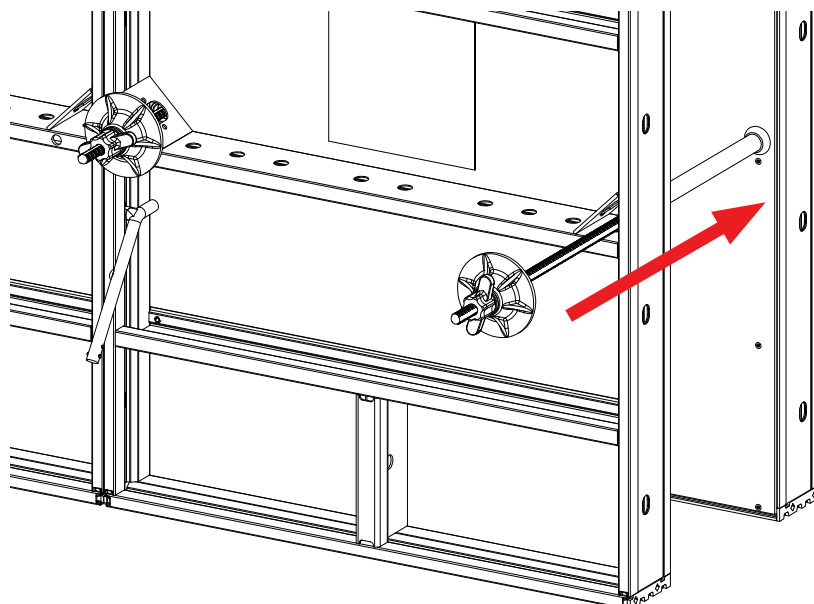
To tie at a joint without an infill, use the MANTO Tie Nut. When an infill is ≤ 80 mm, the Tie Nut 230 has to be used (Refer to page 89). The procedure is the same for both Tie Nuts.

16.2.1 Attaching ties

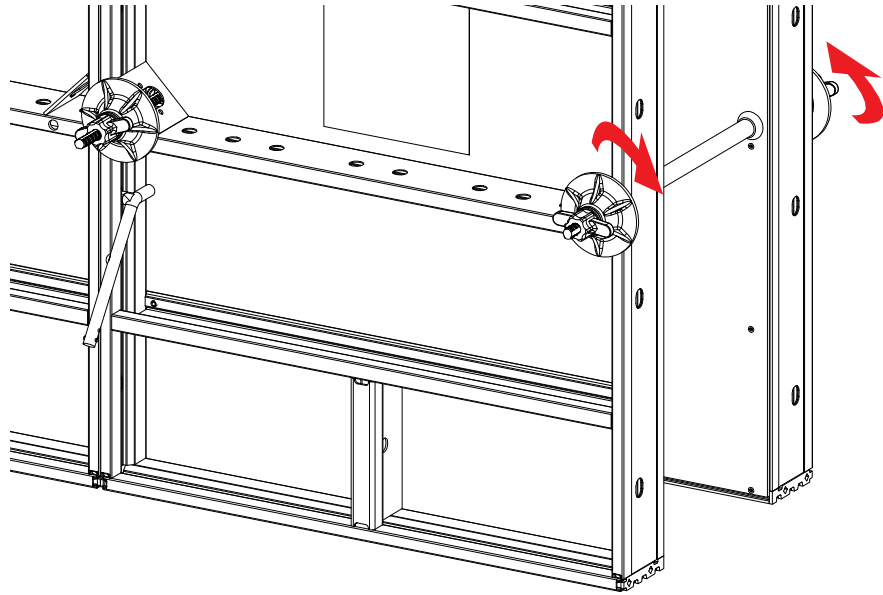
- Step 1** Extract the A-plugs from the tie holes to be used.
- Step 2** Use A-plugs or MANTO Plugs (MP Panels) to seal unused tie holes.
- Step 3** Screw the MANTO Tie Nut onto the one side of the tie rod.



- Step 4** Slide the tie rod through the tie holes in the advancing side or opposite side of the formwork. As the tie rod is being slid through, slide the Cladding Tube and Sealing Cones onto it.



- Step 5** Screw the MANTO Tie Nut onto the other side of the tie rod and tighten it. Counter the Tie Nuts from the other side.



- Step 6** Secure the other ties in the same way.

16.2.2 Removing ties before striking

Before striking and moving the formwork, the Tie Rods have to be removed.



WARNING

Formwork can collapse!

If you release all of the ties from a panel assembly, the assembly will topple over! This can cause personal injury or death! Leave at least one tie in place until the formwork is attached to the crane or secured to prevent it from toppling over! This also applies to single panels not connected to other panels!

- Step 1** Release the MANTO Tie Nut from one side of the formwork and completely detach it from the tie rod.
- Step 2** Pull the MANTO Tie Nut with tie rod all the way out of the formwork from the other side.

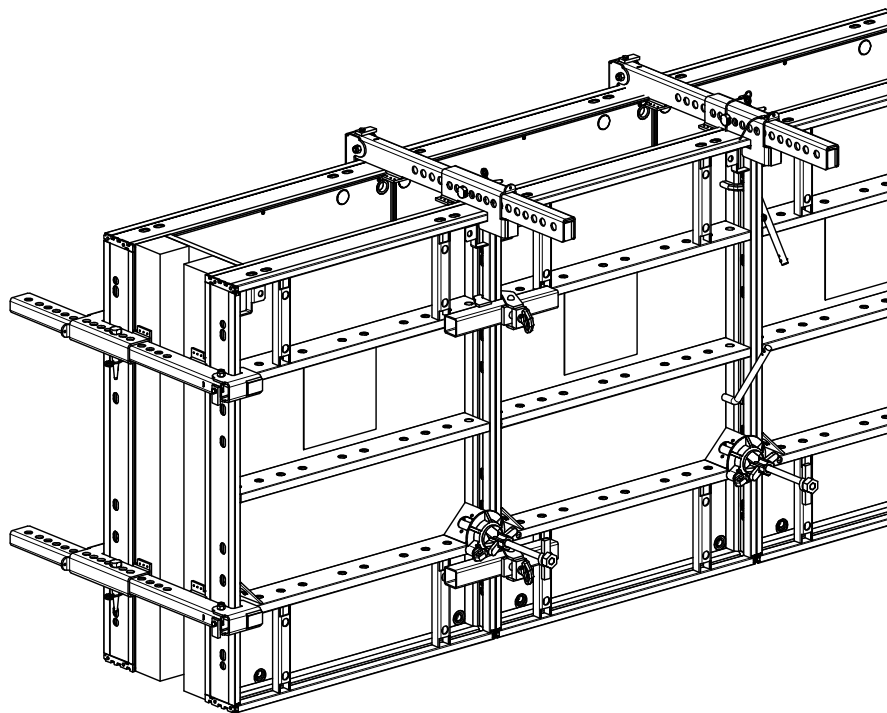
16.3 Tying with dry ties

16.3.1 Tying with the RASTO Bulkhead Clamp

The RASTO Bulkhead Clamp can be used as a dry tie on the upper edge profile of the formwork.

The Bulkhead Clamp joins the panels opposite one another such that they are resistant to tension and pressure, and it replaces the uppermost tie position on many RASTO/TAKKO Panels. The only panels for which the Bulkhead Clamp cannot replace the uppermost tie position are vertically oriented Panels 300 and 270, and horizontally and vertically oriented XXL Panels.

How to use the RASTO Bulkhead Clamp is described in the Section *With the RASTO Bulkhead Clamp* on page 81, which explains how to use the Bulkhead Clamp for stopends. The Bulkhead Clamp is used in the same way as a dry tie, the only difference being that the Bulkhead Clamp rests on top of the formwork when used as a dry tie.



16.3.2 Tying with the Edge Tie Fastener MR

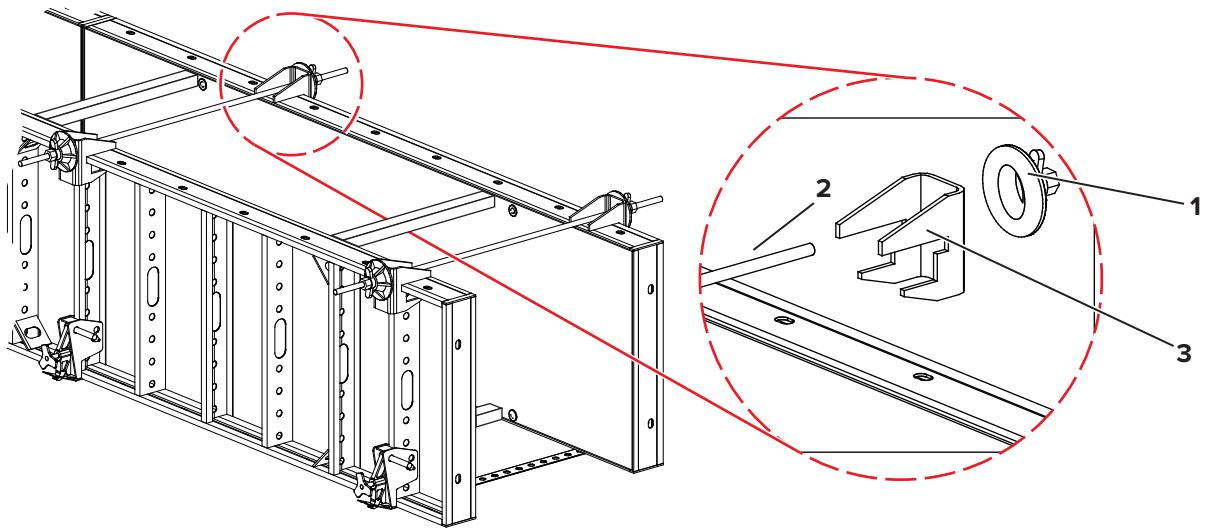
The Edge Tie Fastener MR can also be used as a dry tie. The Edge Tie Fastener MR secures the Tie Rod to the edge profile of the panel.

The maximum load capacity of the Edge Tie Fastener MR is 10.0 kN. So when the formwork is 900 mm high, the resulting tie spacing is 1.75 m.

To ensure that the formwork connection with the Edge Tie Fastener MR is resistant to tension and pressure, always place spacers between the Panels.



Use a Cladding Tube to protect the Tie Rod from becoming soiled when the concrete is poured.



- 1 MANTO Tie Nut
- 2 Tie Rod
- 3 Edge Tie Fastener MR

16.4 Tying near the ground

When tying horizontally aligned panels near the ground, e.g. for foundation formwork, you often cannot use tie nuts. For example, the tie nut could protrude beyond the edge of the panel and touch the ground, or embankments may prevent the use of tie rods.

In such cases tie the formwork with the FU Tightener or with the Plate 8/8 and the Hexagon Nut 15/50 (Refer to page 132).

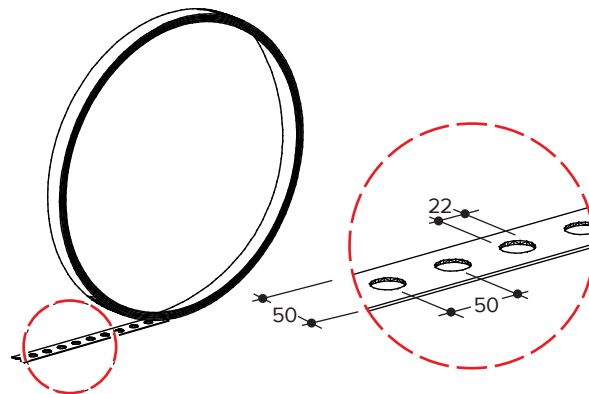
16.4.1 Tying with the FU Tightener

The FU Tightener can be used to tie formwork neat the ground, in places where tying with a Tie Nut is no longer possible. Place pairs of FU Tighteners across from one another and connect them with the Punched Steel Tape. Use the tightening device on the FU Tightener to tense the Punched Steel Tape.

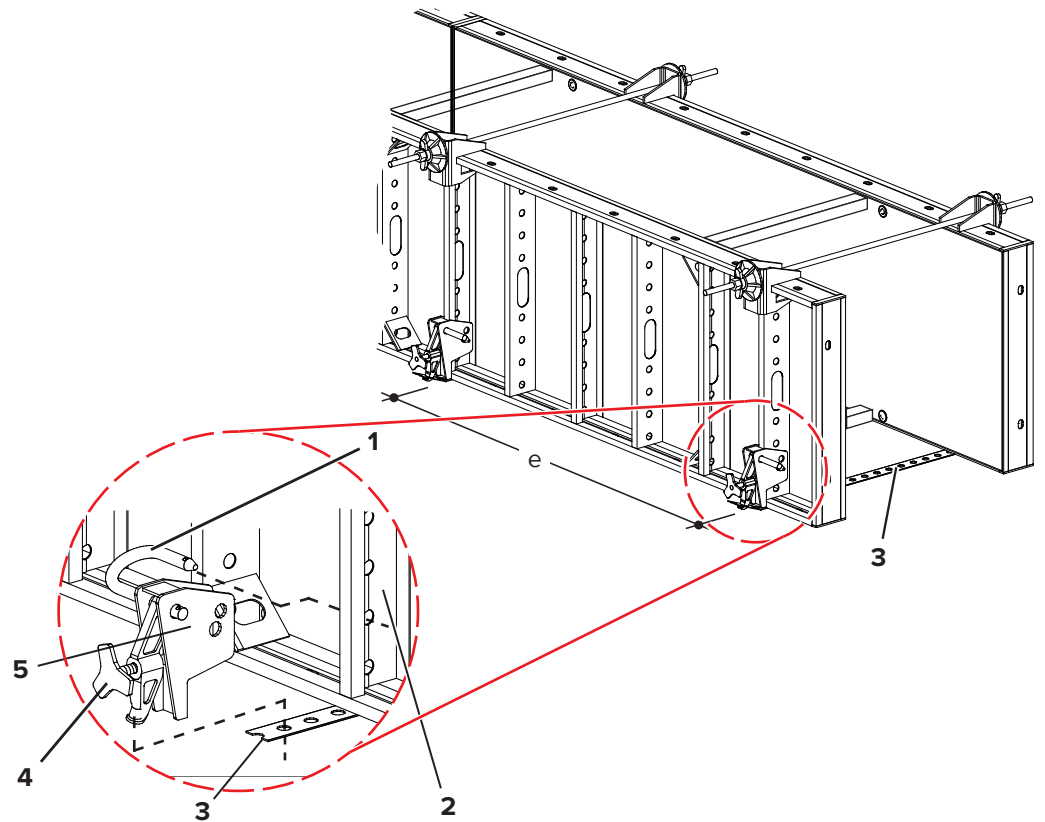
The maximum permissible load when tying with the Punched Steel Tape and the FU Tightener is 12.0 kN.

Permitted distance (e) [mm] of FU Tightener at formwork height (h) [mm]			
h	0.90	1.05	1.20
e	1.75	1.30	1.00

Punched Steel Tape 25.0 m, width: 50 mm, thickness: 2 mm



Place the FU Tightener on the edge profile of the panel and secure it to the rib with the safety clip. Hook the Punched Steel Tape, cut to the required length, into the FU Tightener. Turn the setscrew to tense the Punched Steel Tape.



- 1 Safety clip
- 2 Rib
- 3 Punched Steel Tape
- 4 Setscrew
- 5 FU Tightener

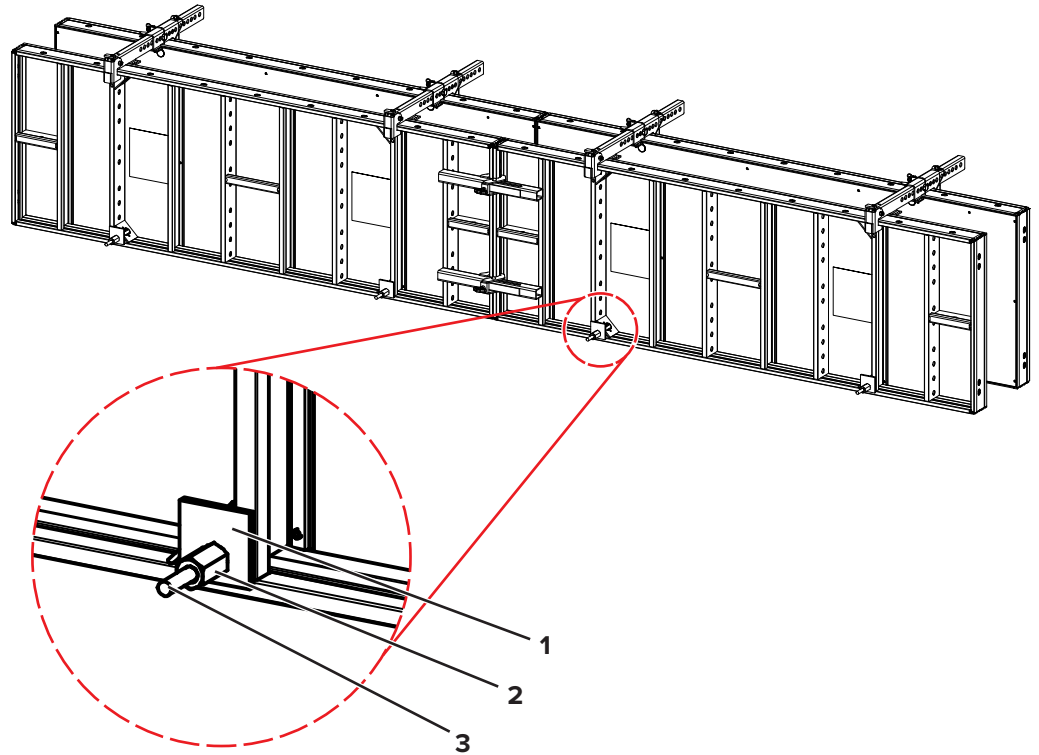


Determine the length of the Punched Steel Tape:

Concrete dimension + 2 × 12 cm (thickness of formwork) + 2 × 15 cm (to attach to the FU Tightener)

16.4.2 Tying with tie rod and Plate 8/8

A conventional tie rod can be used to tie the formwork near the ground when it is used in conjunction with the Plate 8/8 and the Hexagon Nut 15/50. The Plate 8/8 serves as the base for the Hexagon Nut. Screw the Hexagon Nut onto the tie rod. The hole in the Plate 8/8 is not in the centre. Position the Plate such that the hole is close to the ground.



- 1 Plate 8/8
- 2 Hexagon Nut 15/50
- 3 Tie Rod DW 15

17 Striking

Once the concrete is sufficiently hardened, you can begin striking.

WARNING

Formwork can collapse!

If you release all of the ties from a panel assembly, the assembly will topple over! This can cause personal injury or death! Leave at least one tie in place until the formwork is attached to the crane or secured to prevent it from toppling over! This also applies to single panels not connected to other panels!

WARNING

Risk of falling!

If you attempt to attach the formwork to the crane from a position in which you are not properly protected, you can fall off of the formwork! This can cause personal injury or death! Always stand in a safe place when attaching the formwork to the crane! Use e.g. one of the Hünnebeck platform systems that is suitable for the respective formwork!

17.1 Removing ties

The way in which the ties are removed depends on the tie system used. It is described in the Section *Tying* on page 120 for the respective tie system.

Always stand in a safe place when removing ties mounted up high! Use e.g. the Universal Formwork Platform.

- Step 1** Remove the ties while standing in a safe place. Leave one tie per panel assembly in place, or secure the panel assembly in some other way to prevent it from toppling over.
- Step 2** Do not remove the last tie until the formwork is secured to prevent it from toppling over or it is attached to a crane and the sling is tensed.

17.2 Disassembling formwork elements

Before individual formwork elements or panel assemblies can be moved, the respective units have to be detached from the adjacent formwork elements.

Always stand in a safe place when removing connectors mounted up high! Use e.g. the Universal Formwork Platform.

- Step 1** Release the connectors to the adjacent formwork elements and remove them. Store connectors such that they are protected from dirt and pollution.

17.3 Removing formwork elements

Once these steps have all been performed, you can remove the formwork elements and move them to wherever they will be used or stored next (Refer to Section *Transporting formwork elements* on page 39).

17.4 Removing Sealing Cones

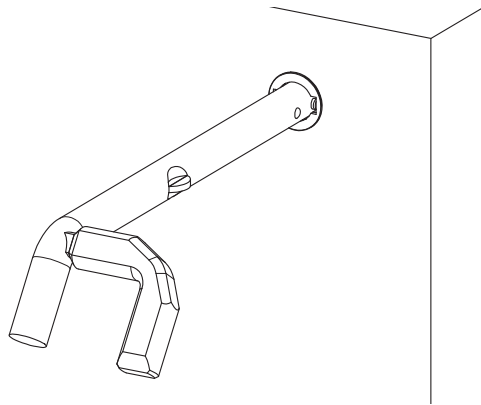
Once the concrete is exposed, you can extract the Sealing Cones from the one-sided RASTO G2 MR tie system. The best way to do this is with the RASTO Clip. The RASTO Edge Tie Fastener or another tool can also be used instead.

NOTE

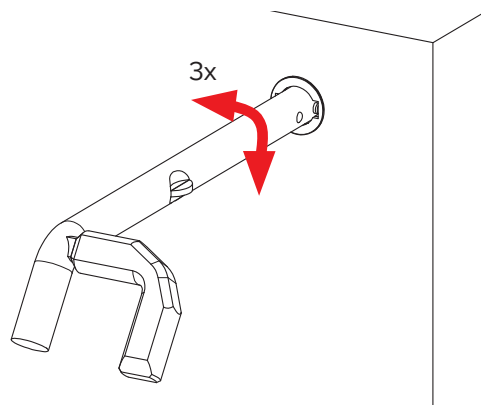
Sealing Cones can be reused!

Undamaged Sealing Cones can be reused up to five times. Do not damage the Sealing Cones when extracting them!

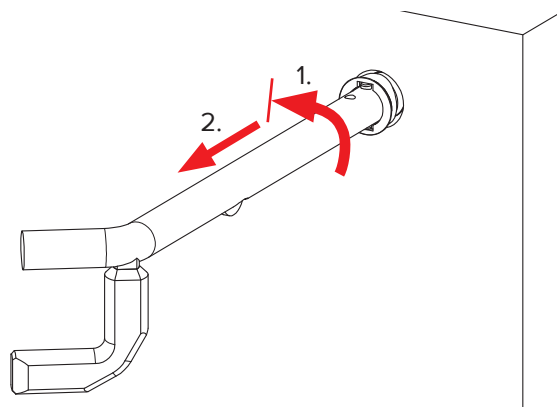
- Step 1** Insert the RASTO Clip grip into the Sealing Cone such that the pin on the RASTO Clip fits into the recesses on the Sealing Cone.



- Step 2** Turn the RASTO Clip back and forth a few times to release the sealing cone from the concrete.



- Step 3** Turn the RASTO Clip all the way to the left, then pull it out of the concrete along with the cone.



18 Special applications

18.1 Column formwork

18.1.1 Column formwork with TAKKO Panels

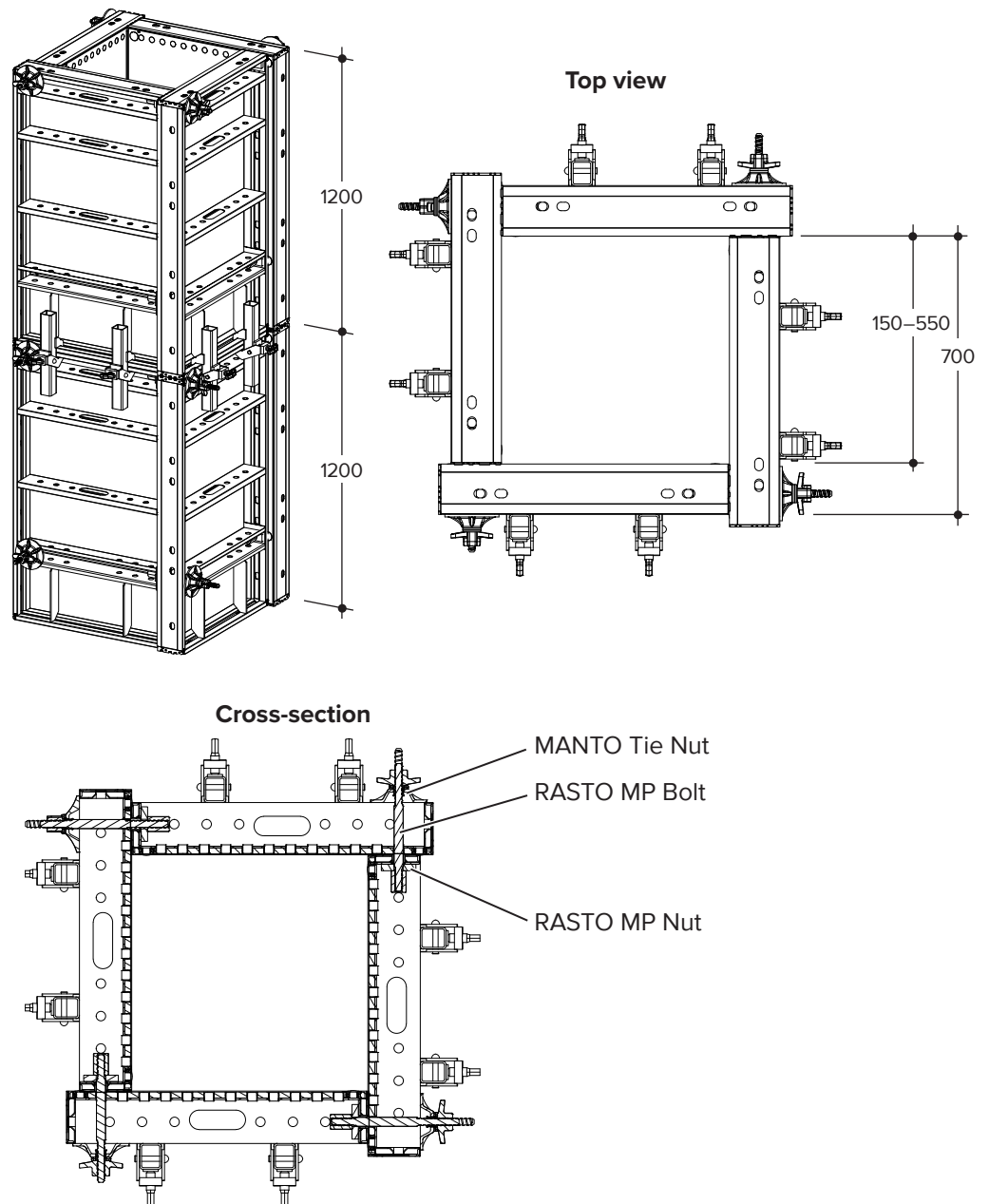
Column formwork with TAKKO Panels can be constructed either with 4no. TAKKO MP Panels or with 4no. TAKKO Panels.

With TAKKO MP Panels

The TAKKO MP Panels have a continuous tie hole grid. The tie holes are spaced 50 mm apart. This allows rectangular and square column cross-sections in increments of 50 mm to be constructed. The sides of the columns can be 150 mm to 550 mm long.

Use RASTO MP Bolts, RASTO MP Nuts and MANTO Tie Nuts to join the MP Panels.

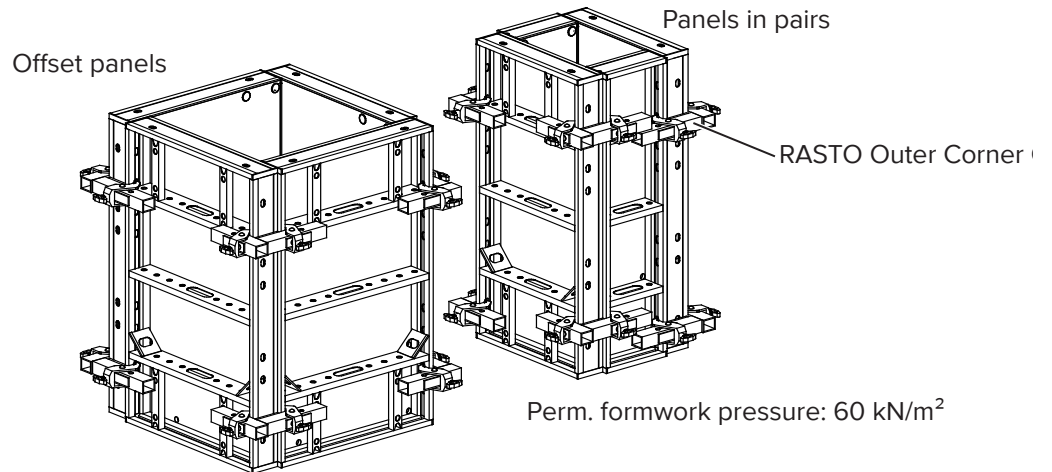
The following illustrations show examples of how to arrange TAKKO MP Panels to create column formwork. The maximum concrete pressure allowed when using TAKKO Panels is 60 kN/m².



With TAKKO Panels

You can quickly construct formwork for rectangular or square columns and block foundations using TAKKO Panels and the Outer Corner Clamp N. The Panels can be offset or arranged in pairs to be able to create the desired column dimensions using the available panel widths. The sides of the columns can be 200 mm to 850 mm long (Refer to page 140).

The following illustrations show examples of different column cross-sections.



18.1.2 Column formwork with RASTO Panels

Column formwork with RASTO Panels can be constructed either with 4no. RASTO MP Panels or with 4no. RASTO Panels.

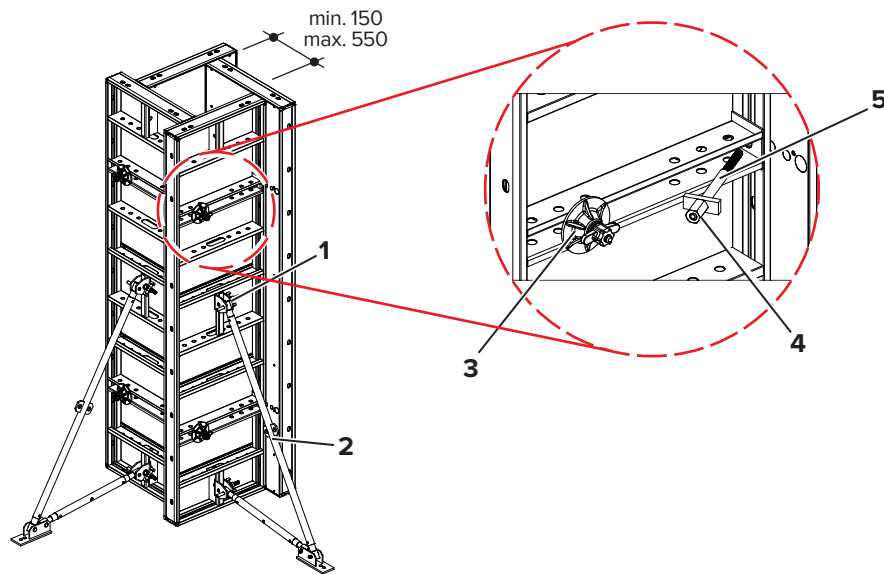
With RASTO MP Panels

The RASTO MP Panels have a continuous tie hole grid. The tie holes are spaced 50 mm apart. This allows rectangular and square column cross-sections in increments of 50 mm to be constructed. The sides of the columns can be 150 mm to 550 mm long.

Use RASTO MP Bolts, RASTO MP Nuts and MANTO Tie Nuts to join the MP Panels.

Attach RASTO Adjusting Struts to the Panels to secure them against horizontal wind forces. The Struts always have to be attached to adjacent sides of the column formwork. The Struts have to be tied to the ground.

The following illustrations show examples of how to arrange RASTO MP Panels to create column formwork. Comply with the permitted concrete pressure (Refer to page 152)!

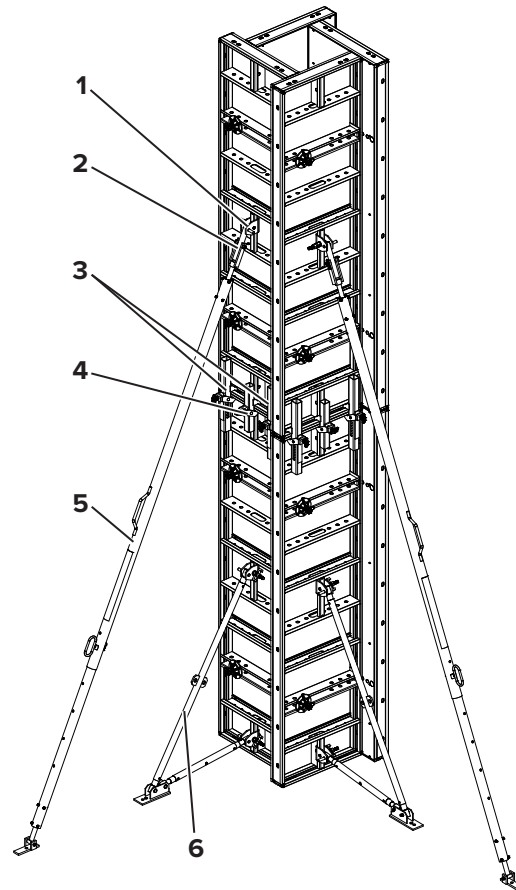


- 1 Adjustment Head
- 2 RASTO Adjusting Strut
- 3 MANTO Tie Nut
- 4 MP Nut
- 5 MP Bolt

If you construct column formwork with stackeded RASTO Panels, a shorter Panel always has to be placed at the bottom. Attach Alignment Struts to the stacked Panels to secure them against horizontal wind forces. Attach RASTO Adjusting Struts to the lower panels. The Struts always have to be attached to adjacent sides of the column formwork. The Struts have to be tied to the ground.

Connect the stacked Panels to one another using RASTO Aligning Panel Clamps and RASTO Adjustable Aligning Clamps as shown in the following illustration.

Comply with the permitted concrete pressure (Refer to page 152)!



- 1 Adjustment Head
- 2 Adapter for Alignment Struts
- 3 RASTO Adjustable Aligning Clamp
- 4 RASTO Aligning Panel Clamp
- 5 Alignment Strut
- 6 RASTO Adjusting Strut

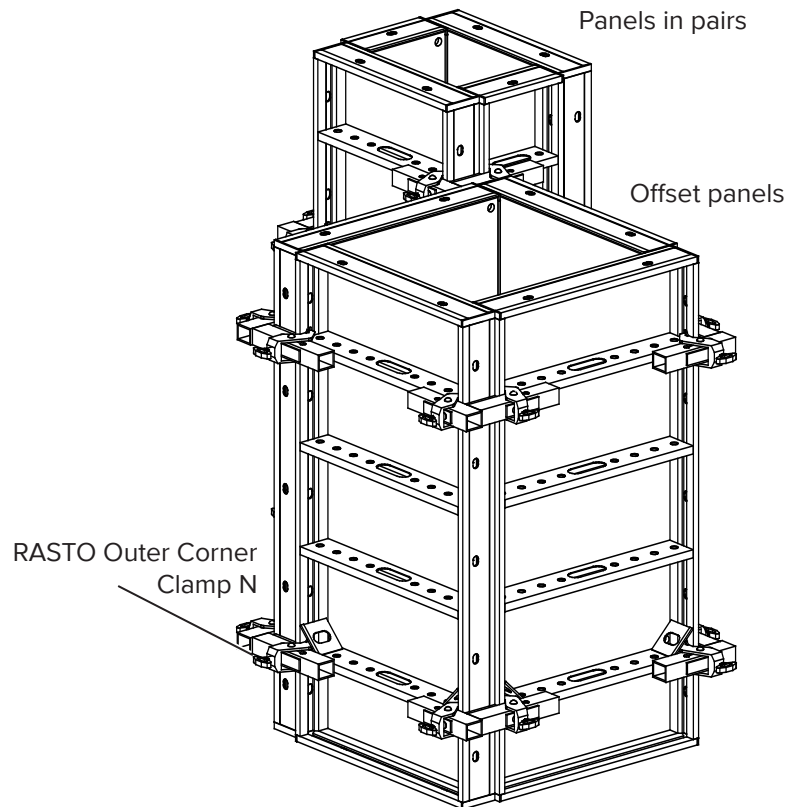
Column formwork (RASTO)

You can quickly construct formwork for rectangular or square columns and block foundations using RASTO Panels and the Outer Corner Clamp N.

Square columns with cross-sections in increments of 50 mm can be formed using one or more infills.

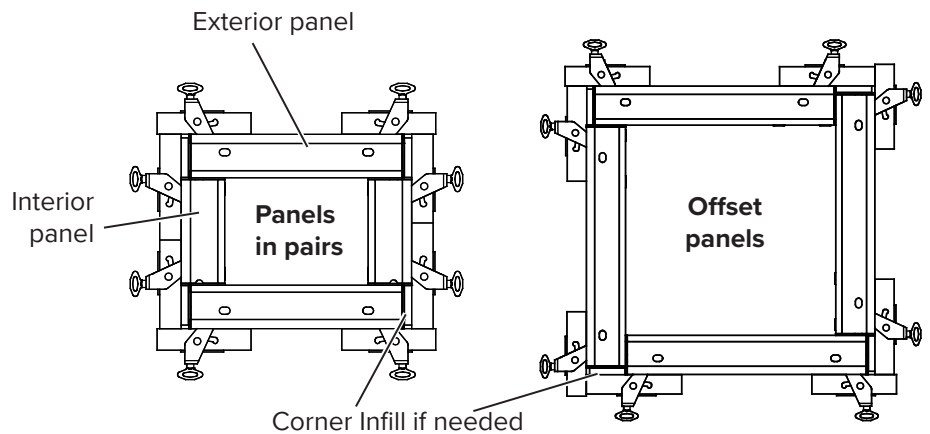
Comply with the permitted concrete pressure (Refer to page 152)!

The number of Corner Clamps needed for the connections depends on the height of the formwork and width of the RASTO Panels used (Refer to page 140).



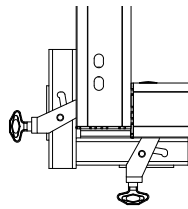
Panel arrangements

The Panels can be arranged in pairs or offset.

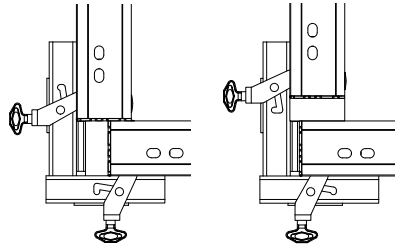


Corner Adjustment arrangements

Without Corner Adjustment



With 1no. Corner Adjustment



Number of Corner Clamps required per corner

Formwork height	Panel width	
	≤ 600 mm	≥ 600 mm
1.20 m	2	2
2.70 m	4	5
3.00 m*	5	6

* maximum formwork height



Wherever possible, the Corner Clamps should be attached to the H-ribs of the panels. If the Corner Clamps collide because the cross-section of the column is small, single Corner Clamps can be placed directly above or below an H-rib.

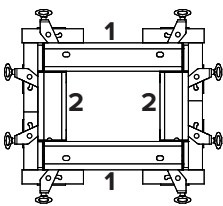
The following tables are intended to help select the possible panel widths to construct the desired side length of the column.



Only one Corner Adjustment can be used per corner. So not all of the side lengths contained in the table can be combined with one another.

Selecting panels for arrangement in pairs

When panels are to be arranged in pairs, you have to specify the width of the interior panel as well as the width of the exterior panel.

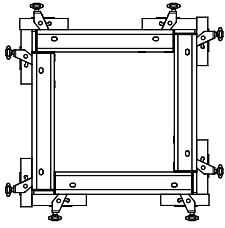


		Exterior panel (1)																	
Length of column sides [cm]		15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Panel width [cm]		30	30	45	45	45	60	60	60	75	75	75	90	90	90	/	/	/	/
Corner Adjustments per side		1	2	0	1	2	0	1	2	0	1	2	0	1	2	/	/	/	/

		Interior panel (2)																	
Length of column sides [cm]		15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Panel width [cm]		/	/	/	30	30	30	45	45	45	60	60	60	75	75	75	90	90	90
Corner Adjustments per side		/	/	/	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2

Selecting panels for offset arrangement

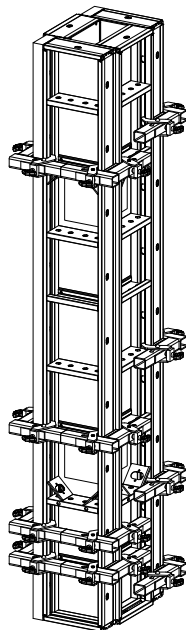
The following information has to be applied to all 4no. panels of the column formwork. The panels facing one another are always the same size.



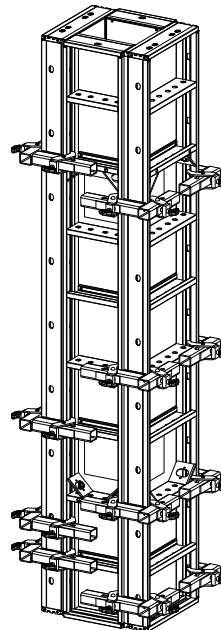
Length of column sides [cm]	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
Panel width [cm]	30	30	30	45	45	45	60	60	60	75	75	75	90	90	90
Corner Adjustments per side	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2

Examples of panels in pairs

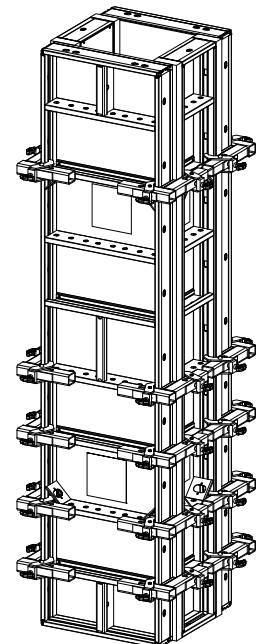
In pairs,
15 × 30 cm



In pairs,
25 × 30 cm

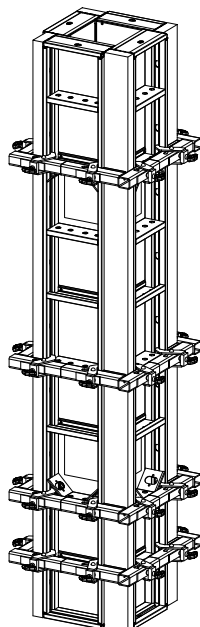


In pairs,
40 × 40 cm

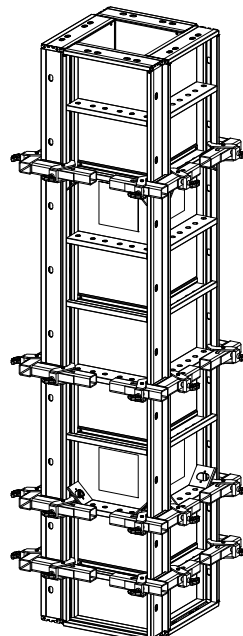


Examples of offset panels

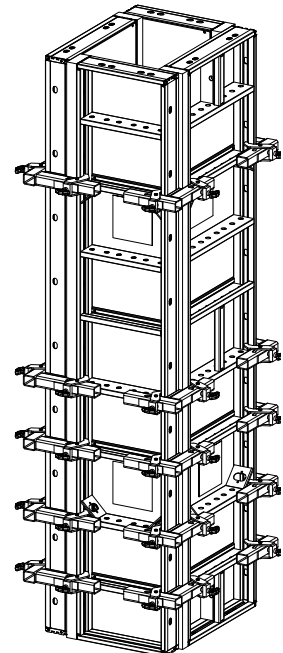
Offset,
25 × 25 cm



Offset,
35 × 35 cm



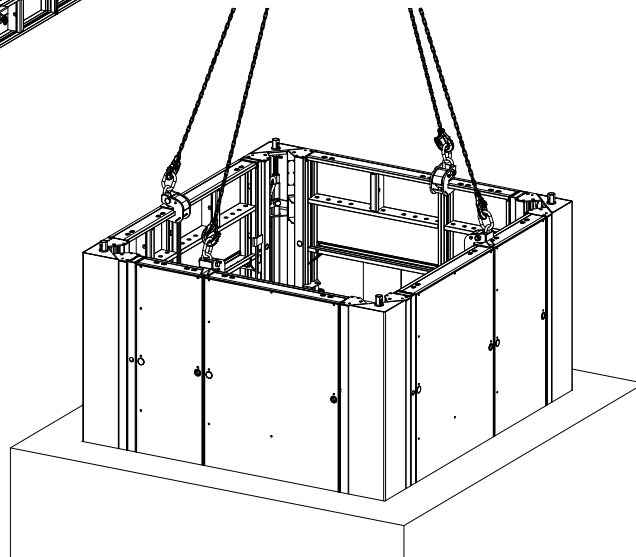
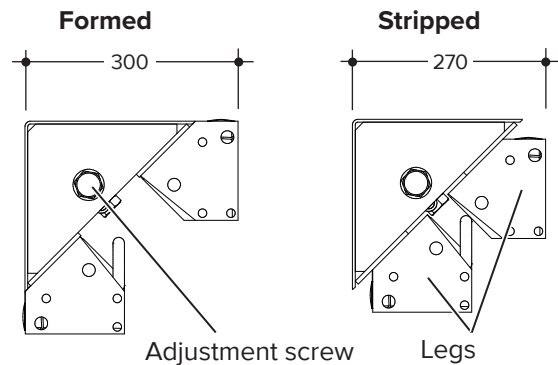
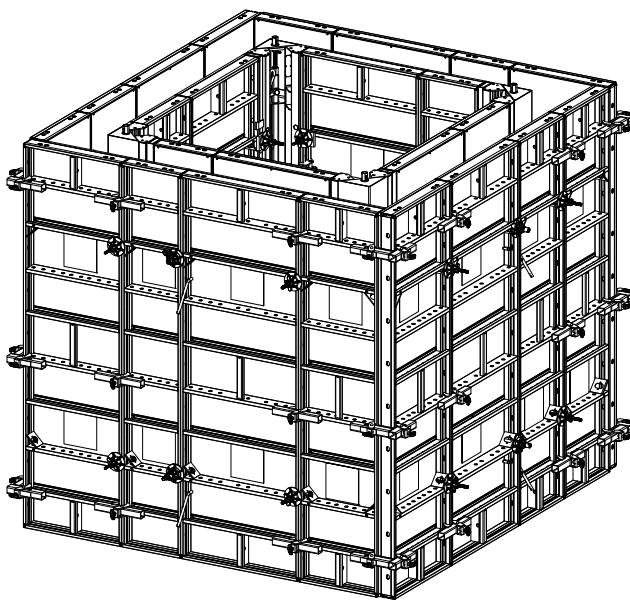
Offset,
40 × 50 cm



18.2 Shaft formwork

Use the MANTO Shaft Corner to construct shafts. The Shaft Corner has a mechanism that allows you to release the entire shaft formwork when striking it from the concrete. The mechanism is operated from above, so it is always accessible, even in tight shafts.

To release the Shaft Corner from the concrete, turn the setscrew on top of the Shaft Corner with the aid of the MANTO Ratchet. This causes the legs of the Shaft Corner to draw together diagonally. This provides striking clearance of 3 cm per leg. The legs on MANTO Shaft Corners are 300 mm long and can be stacked. Place infills up to 150 mm at the centre of the wall whenever possible. Once the shaft formwork has been completely removed from the concrete, the shaft formwork can be moved with a crane. Always use a four-strand suspension and 4no. RASTO Transport Hooks.



WARNING

Warning!

Always attach the Transport Hooks to the centre of the sides that make up the shaft formwork. Always determine the weight of the shaft formwork and do not overload the Transport Hook.

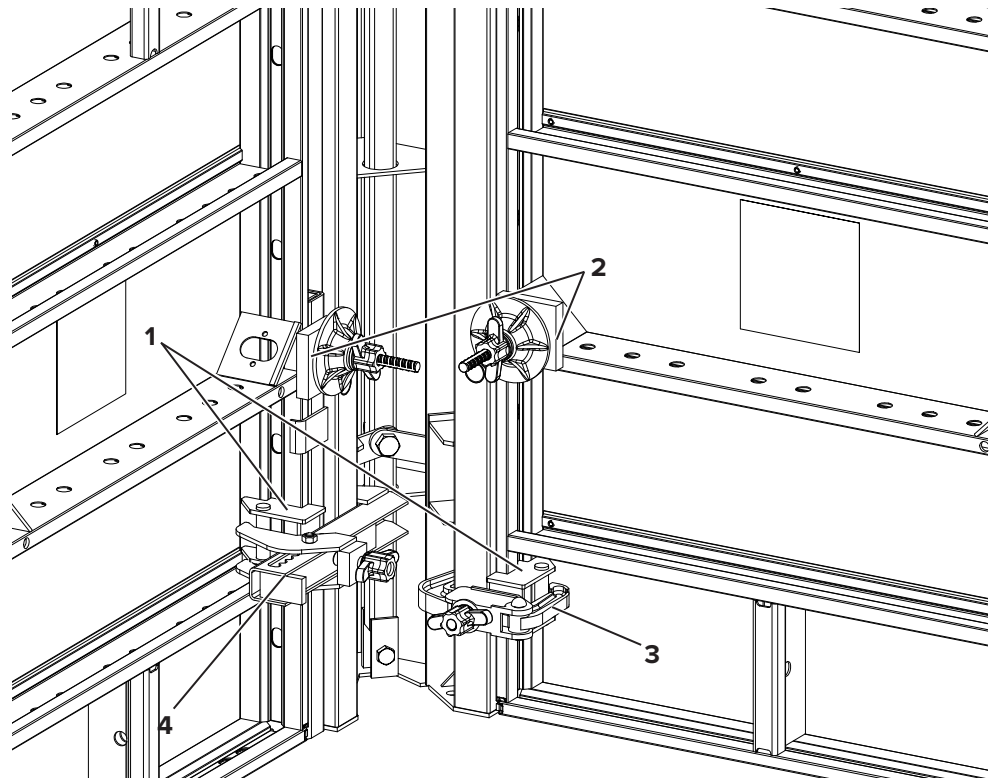
Stiffen the shaft formwork with braces to prevent it from drawing together when lifted.

18.2.1 Connecting MANTO Shaft Corner to RASTO/TAKKO Panels

Connect MANTO Shaft Corners to RASTO/TAKKO Panels with the aid of Panel Clamps and RASTO Shaft Corner Connectors.

You will also need the Spacer Tie Plate 20 for tying. The Spacer Tie Plate compensates for the difference between the 120 mm RASTO Panels and the 140 mm MANTO Panels. You can tie the structure either through the RASTO/TAKKO Panel or through the tie holes in the MANTO Shaft Corner.

The following illustration shows the assembled components.



- 1 RASTO Shaft Corner Connector
- 2 Spacer Tie Plate 20
- 3 Panel Clamp
- 4 Element Connector (for infills)

18.2.2 Using infills

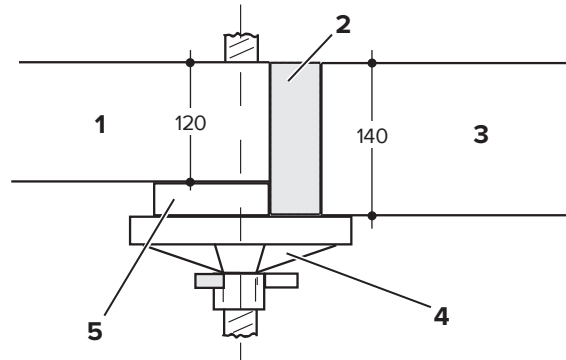
Use Element Connectors from the RONDA system and RASTO Shaft Corner Connectors to create infills between RASTO/TAKKO Panels and MANTO Shaft Corners up to 80 mm in size.

The specifications stated in the section *Section Adapting length with infills* on page 89 also apply to tying in infills. The only difference is that the Spacer Tie Plate 20 has to be used here. The Spacer Tie Plate compensates for the difference between the 120 mm RASTO Panels and the 140 mm MANTO Panels.

The illustration above shows the assembled components.

Using a 140 mm infill

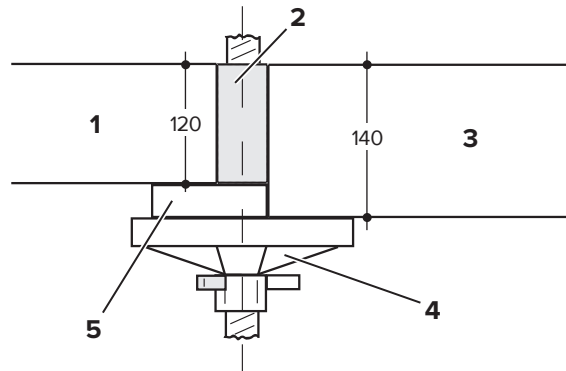
If you use a 140 mm infill, you can tie the formwork through the tie holes on the panels.



- 1 RASTO Panel
- 2 infill, 140 mm deep
- 3 MANTO Shaft Corner
- 4 Tie Nut 230
- 5 Spacer Tie Plate 20

Using a 120 mm Infill

If you use a 120 mm infill, you have to tie the formwork through the infill.



- 1 RASTO Panel
- 2 Infill, 120 mm deep
- 3 MANTO Shaft Corner
- 4 Tie Nut
- 5 Spacer Tie Plate 20

18.2.3 Stacking Shaft Corners

When Shaft Corners are stacked, the mechanisms in the corners have to be joined. This allows you to operate both Shaft Corners from above with the MANTO Ratchet at the same time.

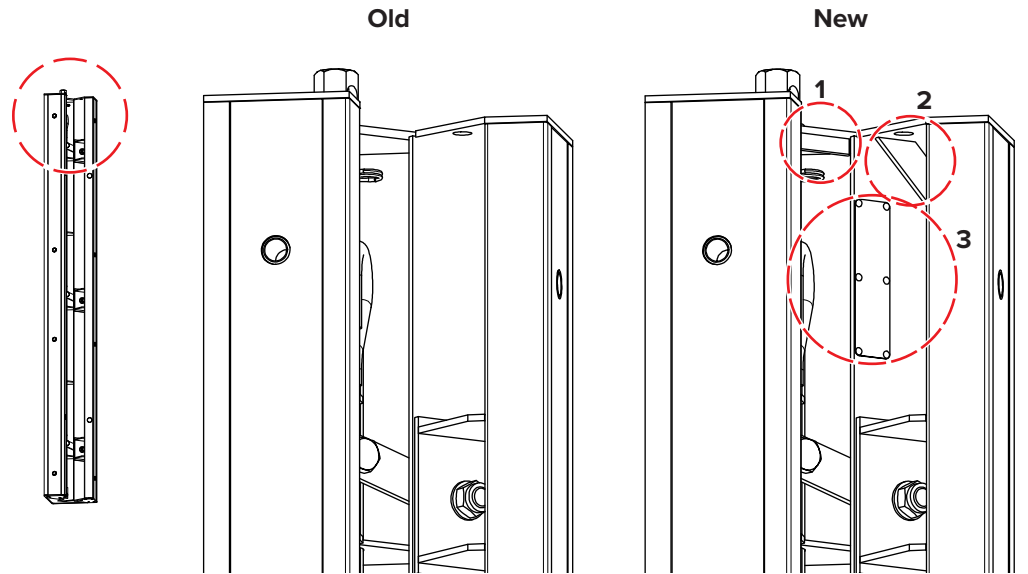
NOTE

Note!

Before stacking, ensure that the legs of the Shaft Corners are in the outermost position (original position). Do this by turning the hexagon nut (w.a.f 36) on the Shaft Corner counter-clockwise as far as it will go.

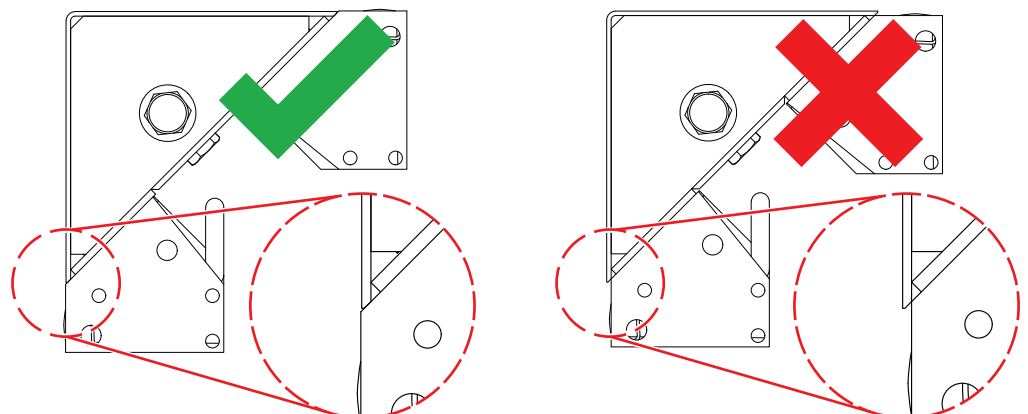
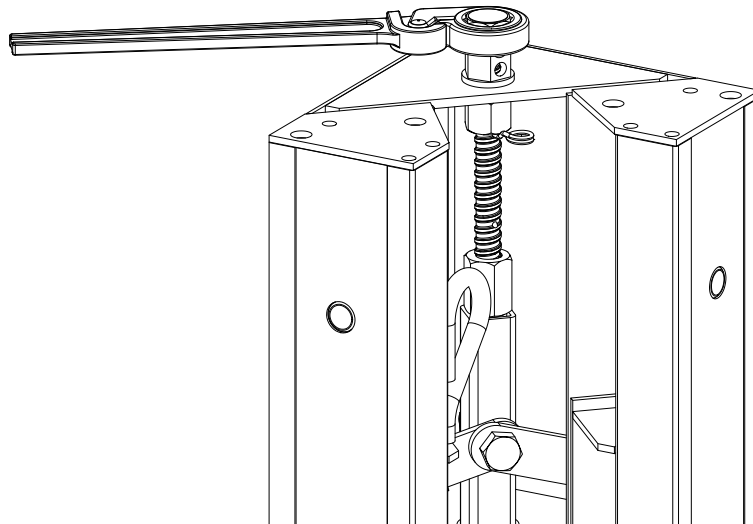


There are currently two versions of the Shaft Corner, an old and a new one. The Shaft Corners are easily differentiated. The new MANTO Shaft Corner has reinforcements (1 and 2) at the top as well as a label (3) that describes the stacking process. Stacking is done differently with the old and new Shaft Corner!

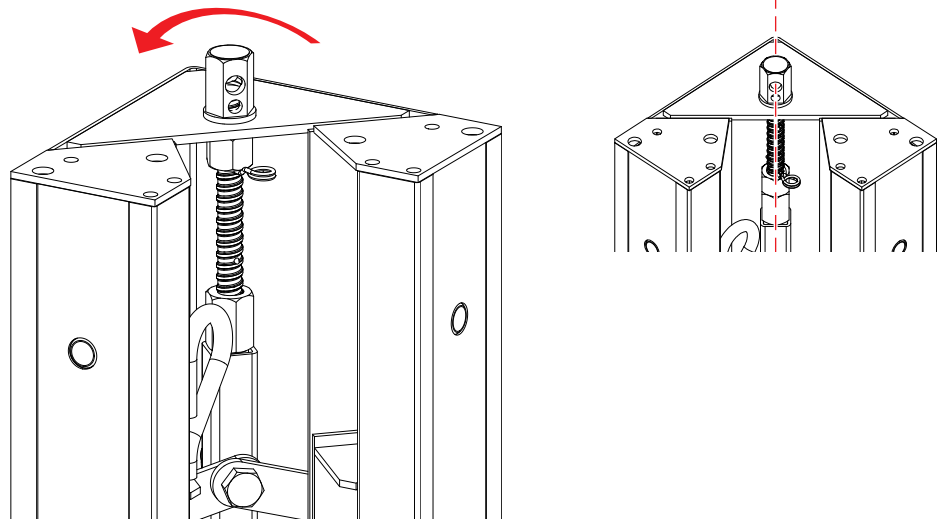


Stacking old Shaft Corners

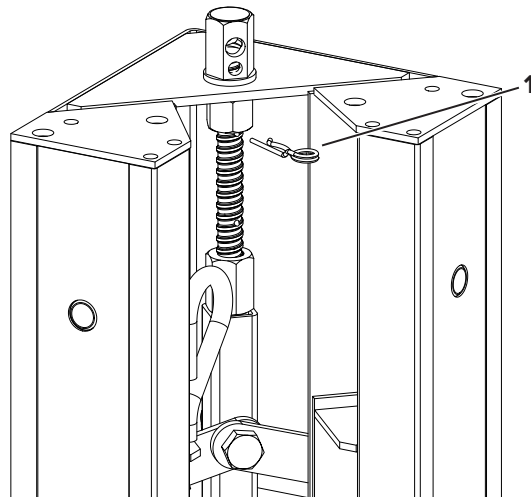
Step 1 Return both Shaft Corners to their original (formed) position. Do this by turning the hexagon nut (w.a.f 36) on the Shaft Corner counter-clockwise as far as it will go. The legs of the Shaft Corner should be flush on the outside.



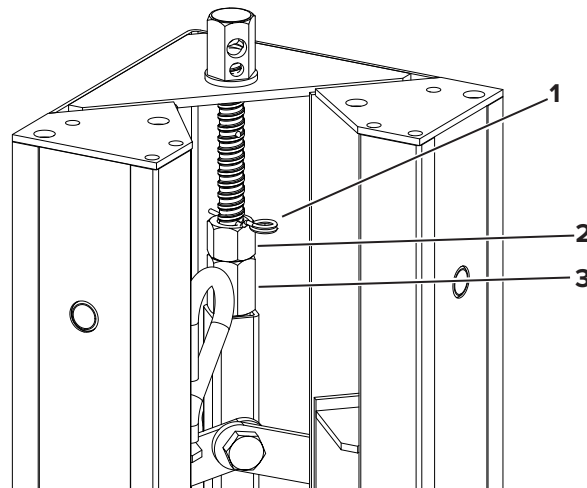
Step 2 Release the hexagon nut enough that the holes in the hexagon nut face the tip of the Shaft Corner.



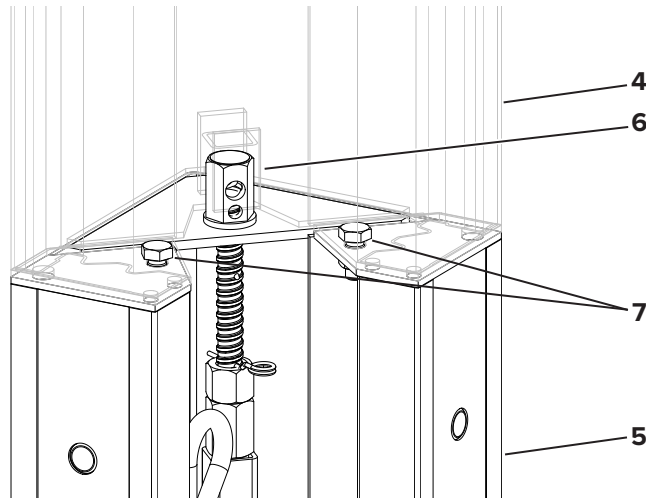
Step 3 Pull out the Spring Cotter Pin (1) from the lower Shaft Corner.



Step 4 Screw the upper Counter Nut (2) downward until it reaches the lower Counter Nut (3). Insert the spring cotter pin (1) in the hole directly above the upper Counter Nut.

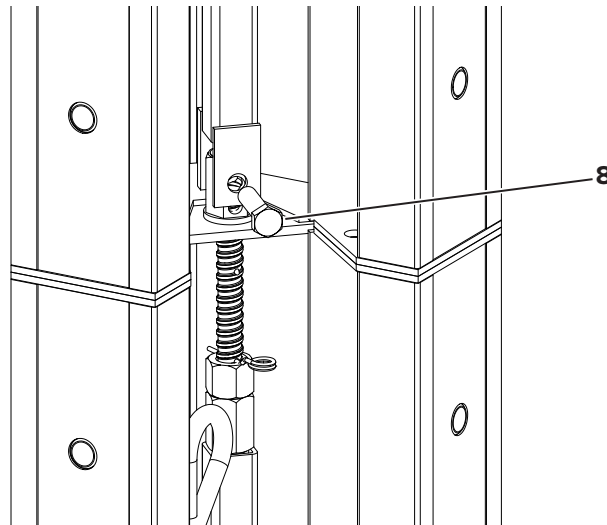


Step 5 Place the upper MANTO Shaft Corner (4) on the lower MANTO Shaft Corner (5). Verify that the grasper (6) fits over the Hexagon Nut and locks into the lower Shaft Corner. Use 2no. Bolts M16 × 35 (code:603623) and nuts (7) to join the legs of the Shaft Corners. Tighten the nuts hand-tight.



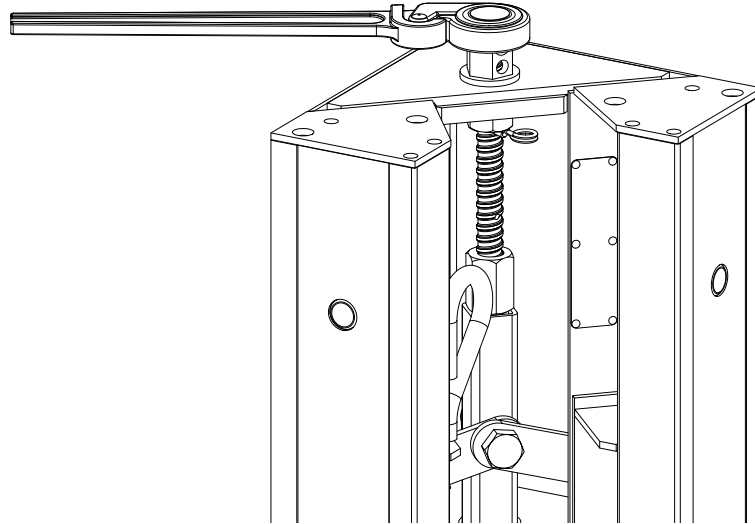
Ensure that the Shaft Corners lie on top of each other without any gaps and flush to each other.

Step 6 Insert the bolt M16 × 60 (8) in the bore in the head of the hexagon nut and tighten it. Also tighten the 2no. bolts M16 × 35 in the legs.

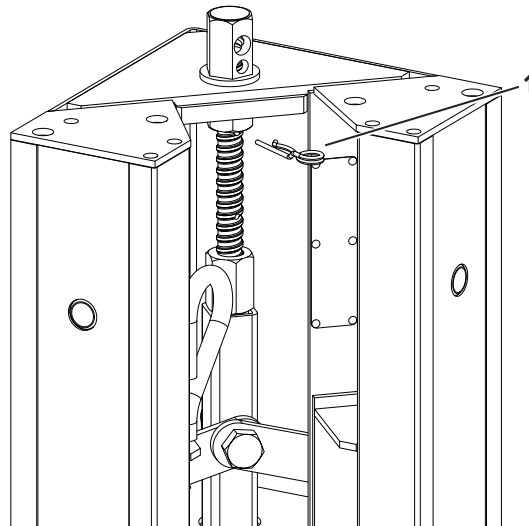


Stacking new Shaft Corners

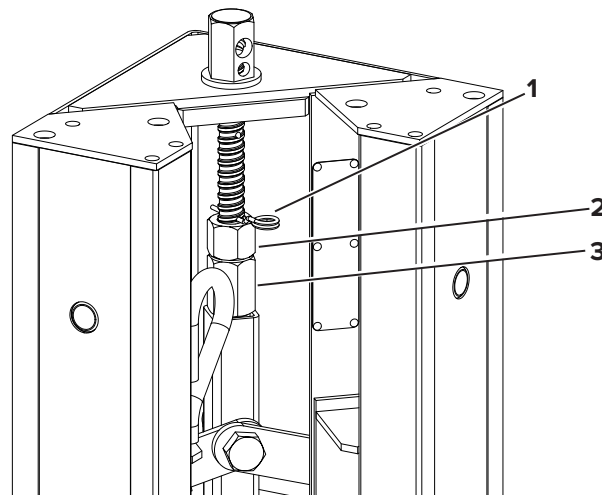
- Step 1** Return both Shaft Corners to their original (formed) position. Do this by turning the hexagon nut (w.a.f 36) on the Shaft Corner counter-clockwise as far as it will go. The legs of the Shaft Corner should be flush on the outside.



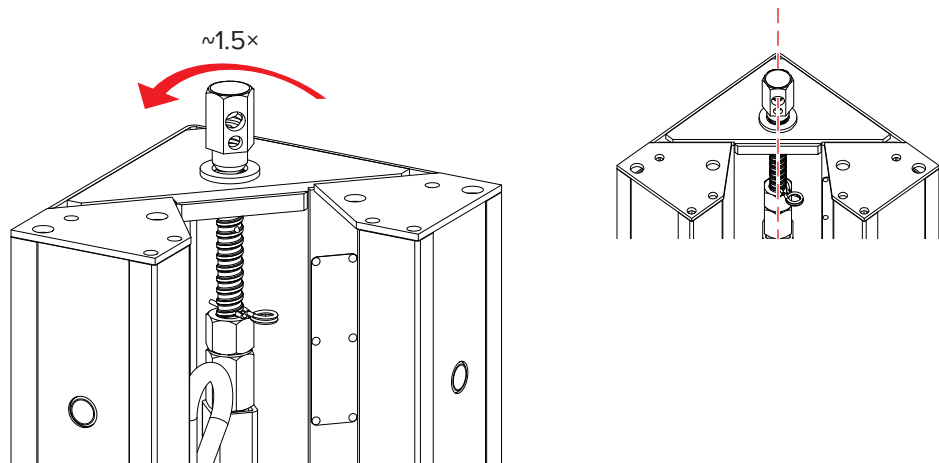
- Step 2** Pull out the Spring Cotter Pin (1) from the lower Shaft Corner.



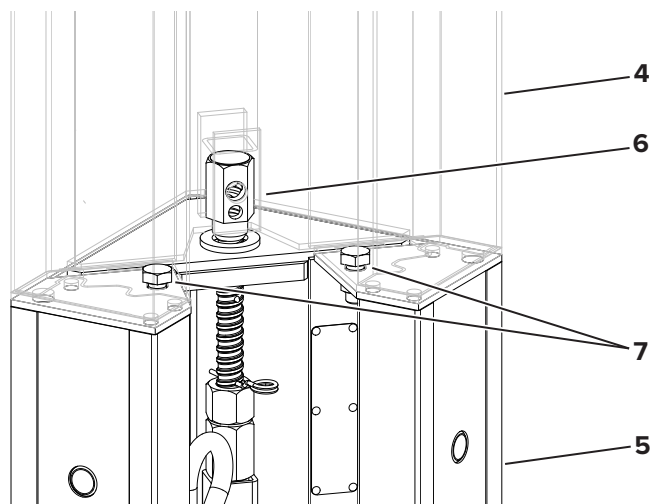
- Step 3** Screw the upper Counter Nut (2) downward until it reaches the lower Counter Nut (3). Insert the spring pin (1) in the hole directly above the upper Counter Nut.



Step 4 Turn the hexagon nut about 1.5 revolutions counterclockwise. The holes in the hexagon nut should face the tip of the Shaft Corner.

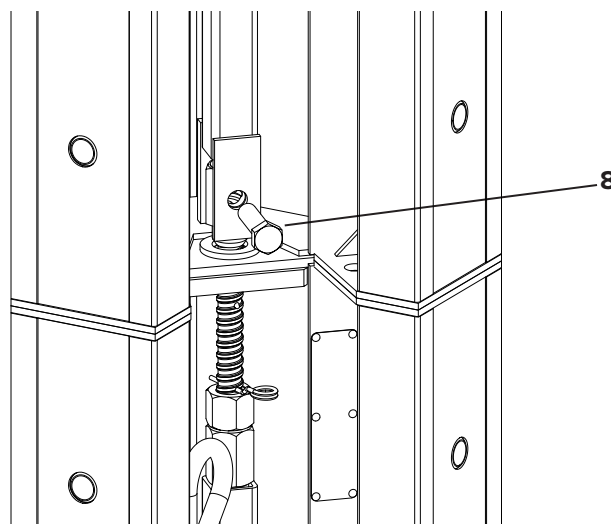


Step 5 Place the upper MANTO Shaft Corner (4) on the lower MANTO Shaft Corner (5). Verify that the grasper (6) fits over the Hexagon Nut and locks into the lower Shaft Corner. Use 2no. bolts M16 × 35 (code:603623) and nuts to join the Shaft Corners (7). Tighten the bolts hand-tight.



Ensure that the Shaft Corners lie on top of each other without any gaps and flush to each other.

Step 6 Insert the bolt M16 × 60 (8) in the bore in the head of the hexagon nut and tighten it. Also tighten the 2no. bolts M16 × 35 in the legs.

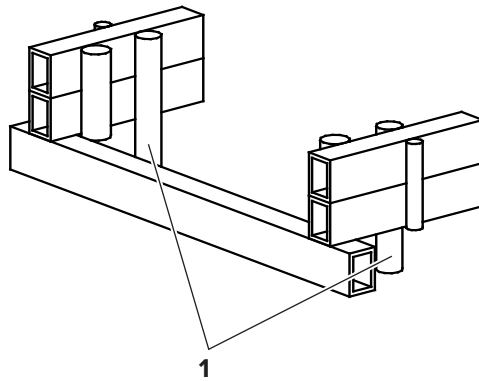


18.3 Combining RASTO Panels with MANTO Panels

When the RASTO/MANTO Adapter is used, different RASTO Panels and MANTO Panels can be connected to one another at the vertical joints. The Adapter compensates for the different profile depths of the MANTO and RASTO Panels, allowing them to be connected to one another. The MANTO Aligning Panel Clamp (code:467898) has to be used as the connector in this case. The MANTO user guide contains information on how to use the MANTO Aligning Panel Clamp.

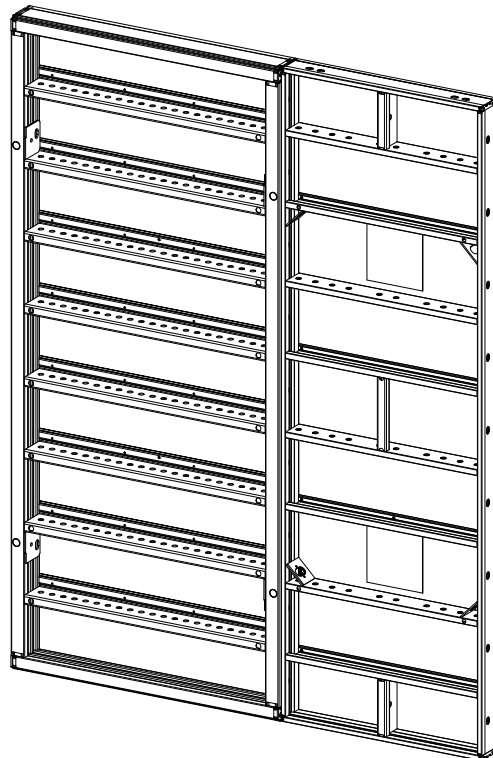
The RASTO/MANTO Adapter is designed to be used with the following RASTO Panels:

- RASTO G2/RASTO/RASTO E 90 cm wide
- RASTO G2/RASTO/RASTO E 75 cm wide
- RASTO/RASTO E 60 cm wide
- RASTO/RASTO E 45 cm wide

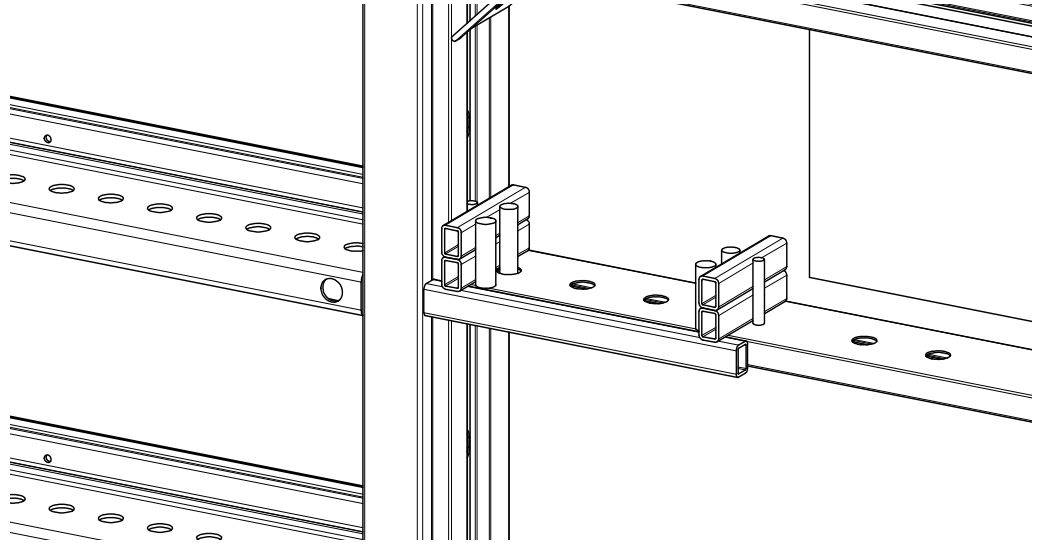


1 Bolts; usually mounted in the H-rib of the RASTO Panel

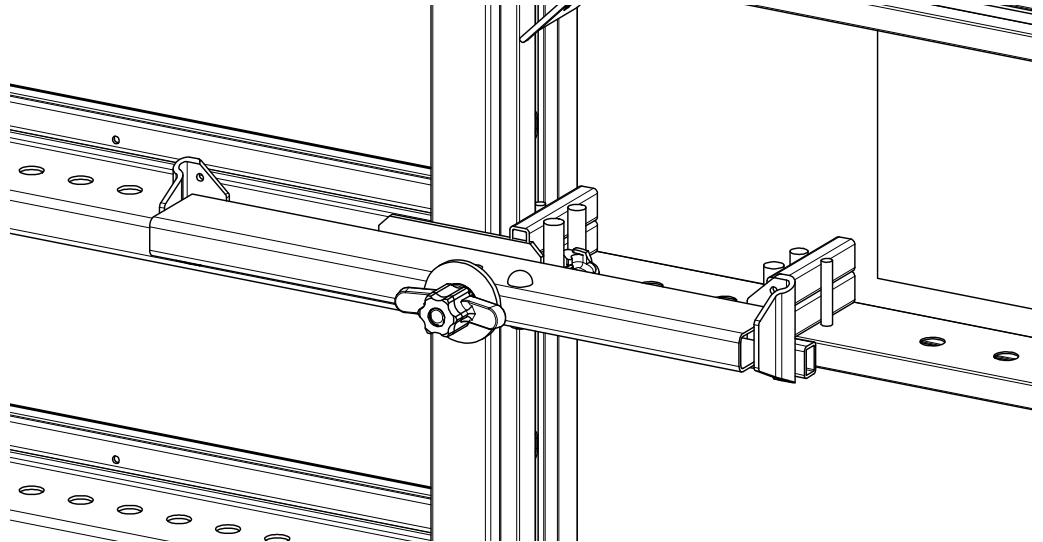
Step 1 Place the MANTO Panel and the RASTO Panel next to each other such that they are flush on the form lining side.



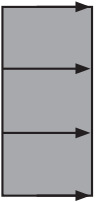
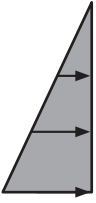
Step 2 Attach the RASTO/MANTO Adapter to the H-rib of the RASTO Panel.



Step 3 Connect the RASTO and MANTO Panels with the MANTO Aligning Panel Clamp.



19 Permitted concrete pressure

Concrete pressure distribution		Panel height [m]	Permitted concrete pressure [kN/m ²]	
			Maximum flatness tolerance pursuant to DIN 18202, table 3 and tie load capacity	
			Line	
			5, 6	7
Constant (stacked panels)		2.70	60.00	50.00
		1.50	55.00	37.00
		1.20	60.00	58.00
		XXL (2.40 × 2.70)	55.00	55.00
Hydrostatic (non-stacked panels)		All	Full hydrostatic pressure (*) Panels that are 2.70 m high have to be restricted to 60.00 kN/m ² .	
Full hydrostatic pressure – Height of single panel × concrete density (e.g. 1.20 m × 25 kN/m ³ = 30.00 kN/m ²)				

20 Chronology

Changes since edition 2020-06		
Change	Page	Date
Note added on the use of RASTO Clip in section 1 of corners and stopends.	63,80	2021-07
Permitted concrete pressure for stacked RASTO panels 270 line 7 updated	152	2021-07

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