

USER GUIDE

RKS

RAIL CLIMBING SYSTEM



IMPORTANT:

Any safety provisions as directed by the appropriate governing agencies must be observed when using our products.

The pictures in this document are snapshots of situations at different stages of assembly, and therefore are not complete images. For the purpose of safety, they should not be deemed as definitive.

All instructions regarding safety and operations contained in this document, and the data on stress and loads must be respected. ULMA's Technical Department must be consulted any time that field changes alter our equipment installation drawings.

The loads featured in this document, related to the basic parts of the product, are approximate.

Our equipment is designed to work with accessories and parts produced by our company only. Combining such equipment with other brands is not only dangerous without having made all corresponding verifications, it also voids any or all our warranties.

The company reserves the right to introduce any modifications deemed necessary for the technical development of the product.

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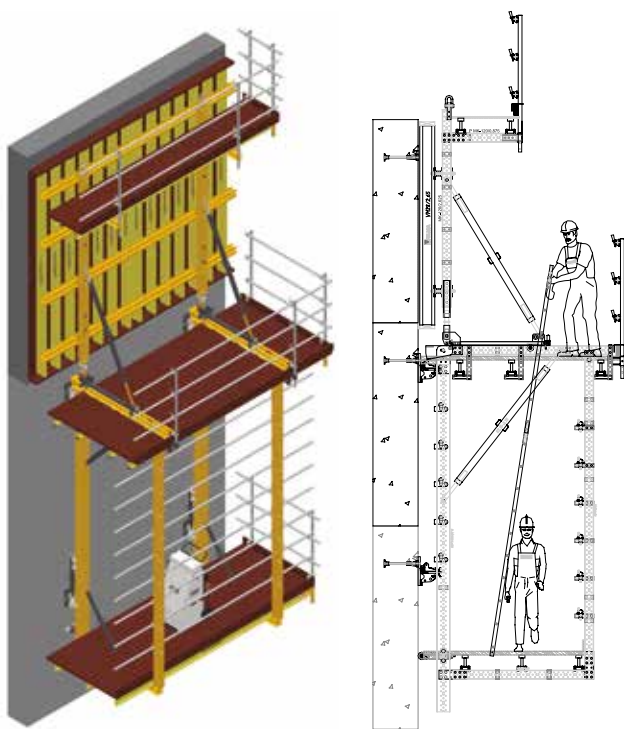
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1. PRODUCT DESCRIPTION

The term climbing system is applied to all formwork that uses repetitively, the concrete element executed previously with the same formwork as a support base. The main characteristic of this guided system is that it is a system where the main structure is based on an MK system and to which the same hydraulic solution of hydraulic windshield system can be added, HWS, in order to enable the elevation of the system without a crane.

Its elaborated design along with an adequate combination with various accessories, not only unique of the MK system but also shared with other ULMA products, provide a great versatility to the rail climbing system which characterizes all structures made with MK system.



The rail climbing system, RKS, is formed by brackets which support the formwork and by different platforms that allow the performance of the different tasks required during the working steps.

Depending of the dimension of the pouring height, the system can have up to 4 working platforms:

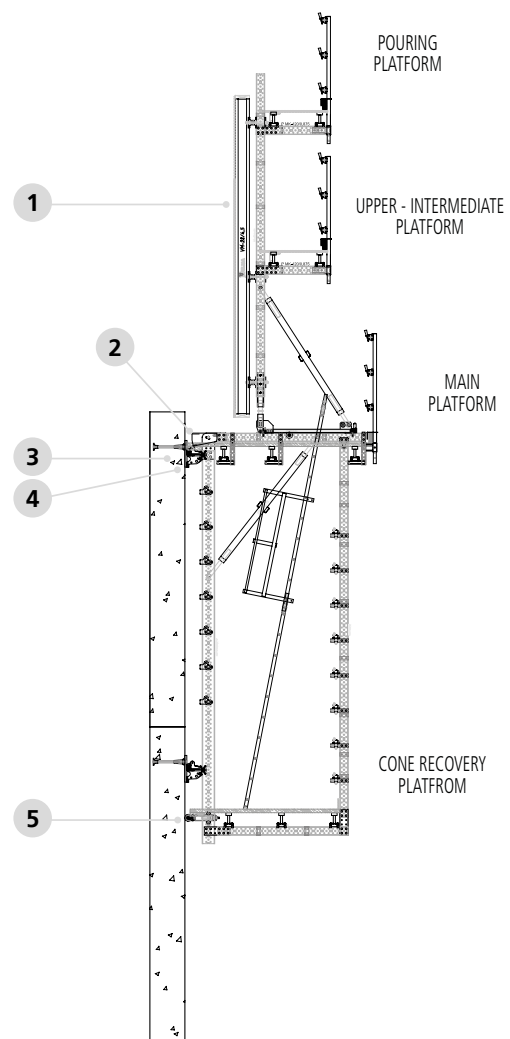
- **Pouring Platform:** It is used for concrete pouring and anchorage positioning.
- **Upper-Intermediate Platform:** It is used to place and remove the tie rods DW from the upper waler row of the formwork (it is used in the cases which the pouring height is so high that it is not possible to place and remove the tie rods DW from the main platform). Therefore, its installation is not always necessary.
- **Main Platform:** This is the largest working platform. It is used as passage to strip, to approach and to plumb the formwork panel. By using roll-back carriage MK-120 system, steel reinforcement works and panel cleaning can be carried out from this platform.

This platform is also used to access the climbing heads and to operate the hydraulic cylinders.

- **Cone recovery platform:** From this platform, the cones and anchor brackets which remain in the concrete from previous pouring stages are recovered. Usually in this platform also the hydraulic group (it is also possible to place it in the main platform depending on the need of the jobsite) is placed, being realized then the control of elevation from this platform.

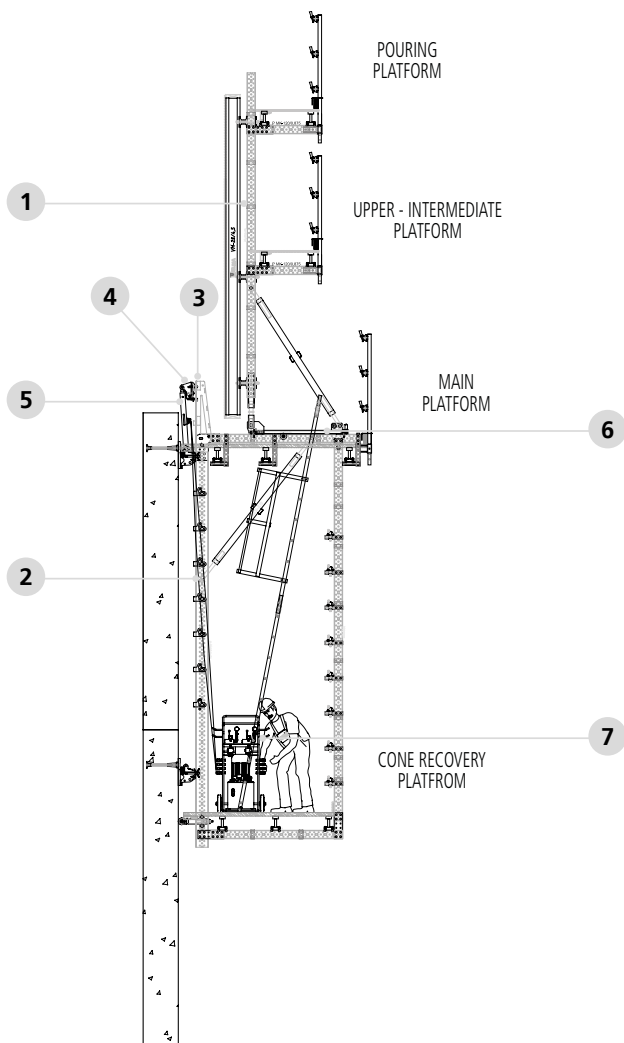
Masts are the main walers of the structure and they are joined with the different platforms mentioned above, forming the final structure. Each mast is made up of 2 MK-180 profiles spaced 52 mm in order to be connected to standard MK walers.

The masts as well as supporting all the load of the structure, have to guide and fix the structure through the LT HWS heads (the structure has to be guided at least in 1 level and be fixed in 1).



WORKING POSITION

- 1 Formwork
- 2 Additional profile RKS
- 3 Wall bracket LT HWS
- 4 Head LT HWS
- 5 Mast shoe RKS



HYDRAULIC CLIMBING POSITION

- 1 Vertical waler
- 2 Mast
- 3 Initial pushing mast RKS
- 4 Climbing head HWS
- 5 Cylinder HWS
- 6 Roll-back carriage MK-120
- 7 Hydraulic power unit HWS

The main features of ULMA's rail climbing system RKS, are:

- Great versatility, own of MK system, making the adaptation of the system to each jobsite easier.
- Crane elevation possible.
- No crane is required to handle the climbing system, using for that requirement the same hydraulic solution used in a hydraulic windshield system, HWS.
- All the assemblies can be lifted by one power unit HWS and two cylinders.
- System elevation possible even under adverse weather conditions. Elevation possible up to wind speeds of 55 km/h.
- Safe elevation and handling of the climbing system at great heights.

- Working load of the hydraulic cylinder: 5 t = 50 kN.
- Large and completely protected working platforms.
- The system can be adapted to different pouring height. The standard range established is to 2.7 m up to 4.5 m height.



2. SOLUTIONS

Subsequently, the most common solutions with the rail climbing system are described along with some examples of the typical solutions.

2.1 SECTION TYPES OF RKS STRUCTURE

Along the guide we will find a concept that will be repeated very often:

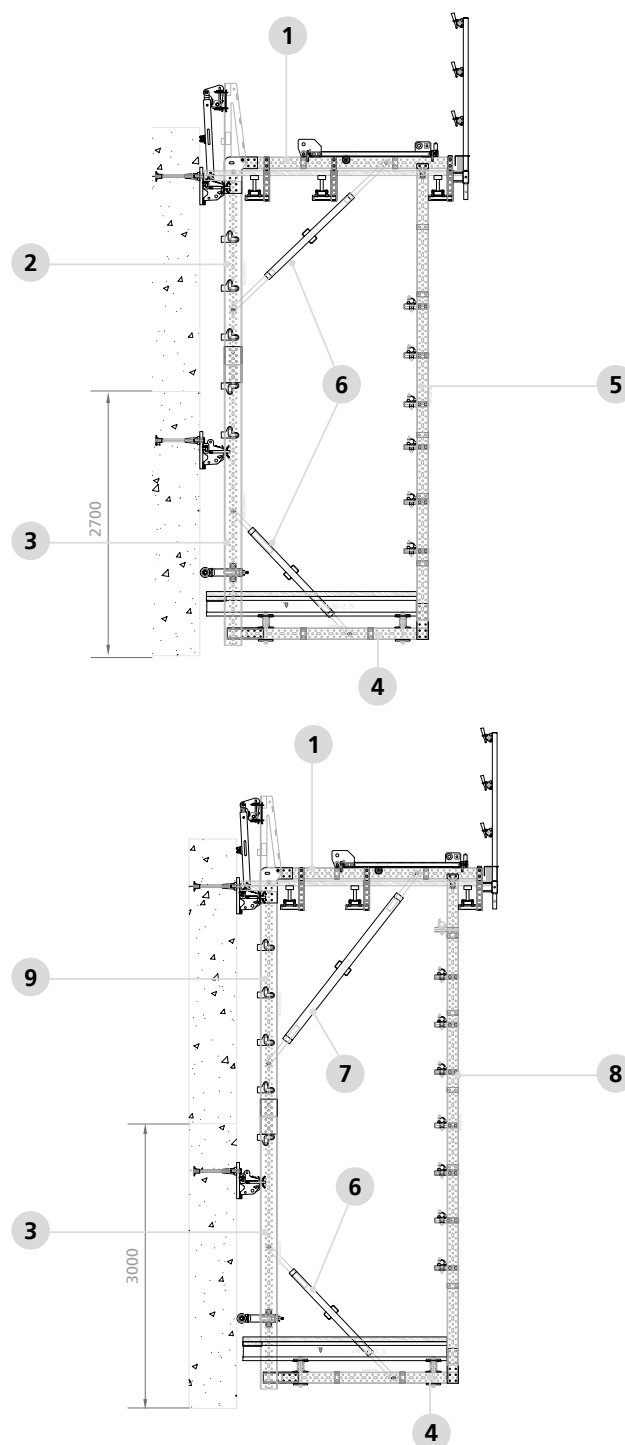
- ONE ANCHOR PER POURING HEIGHT – Means that only one anchor is set in each pouring height.
- DOUBLE ANCHOR PER POURING HEIGHT – Means that two anchors are set in each pouring height.

The compositions of the most common used section are described below for different pouring heights.

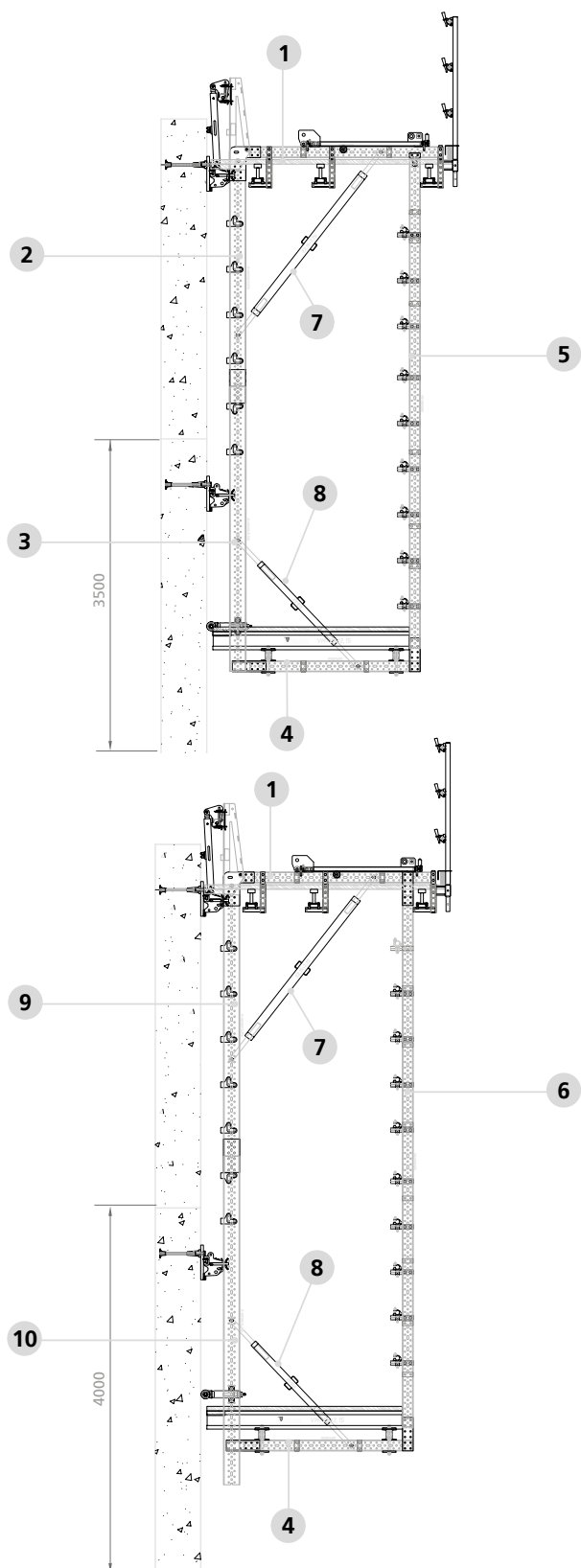
All sections shown below are defined in the start position of climbing by hydraulic system.

2.1.1 Divided mast one anchor per pouring height

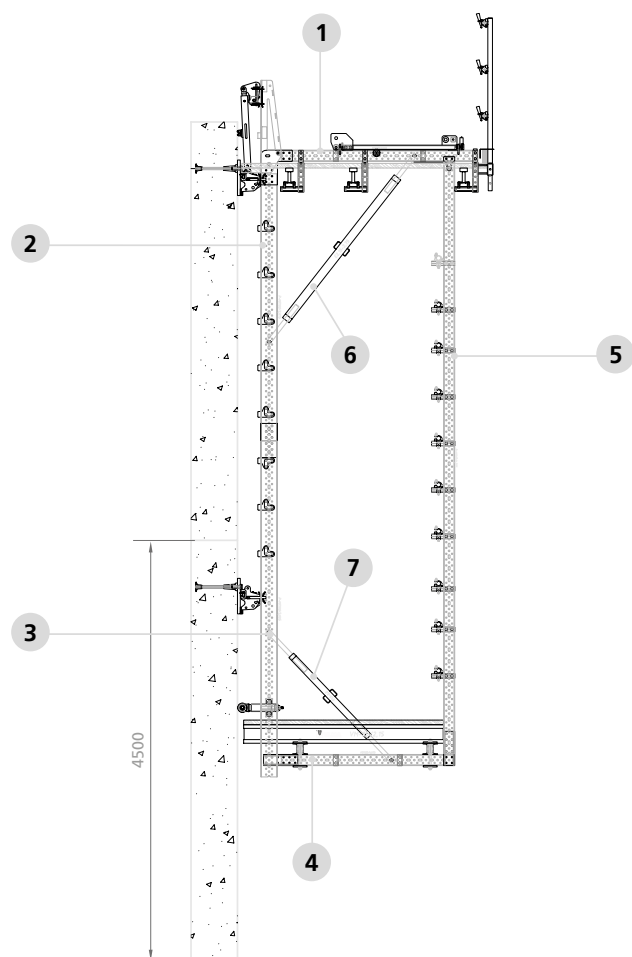
The mast is made up joining two short and two long MK-180 profiles to obtain the total length.



- | | |
|--------------------------------|--------------------------|
| 1 Waler MK-120 2.125 | 8 Waler MK-120 5.125 |
| 2 2 Profile MK-180 1.875 | 9 2 Profile MK-180 2.375 |
| 3 2 Profile MK-180 2.875 | |
| 4 Waler MK-120 1.875 | |
| 5 Waler MK-120 4.625 | |
| 6 Push – Pull Prop E 1.51-2.2 | |
| 7 Push – Pull Prop E 2.15-2.75 | |

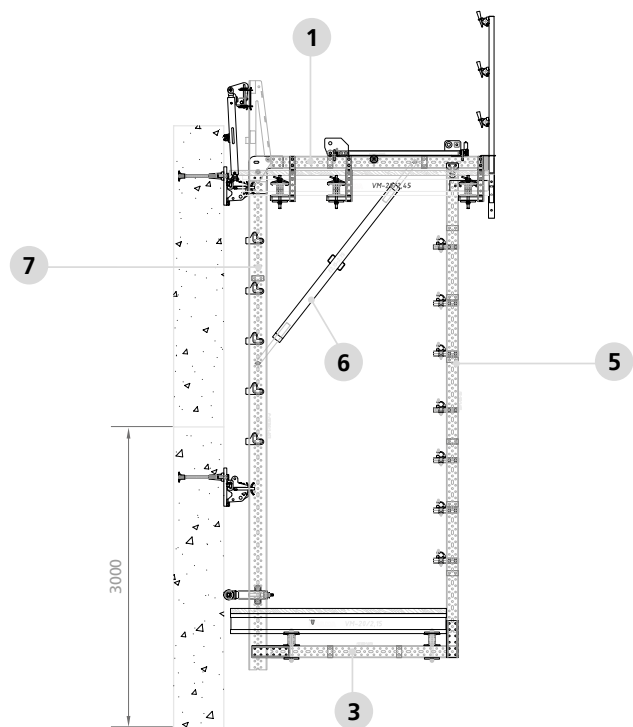
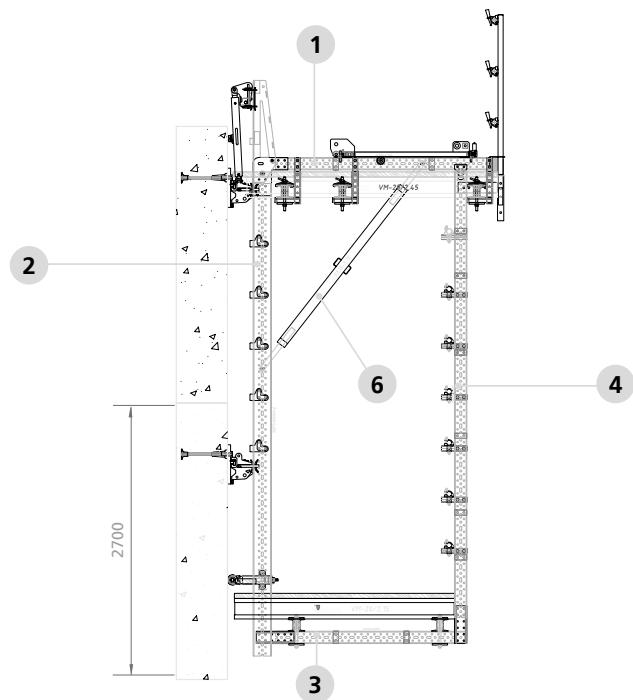


- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 2.375
- 3 2 Profile MK-180 3.125
- 4 Waler MK-120 1.875
- 5 Waler MK-120 5.375
- 6 Waler MK-120 5.875
- 7 Push – Pull Prop E 2.15-2.75
- 8 Push – Pull Prop E 1.51-2.2
- 9 2 Profile MK-180 2.875
- 10 2 Profile MK-180 3.625

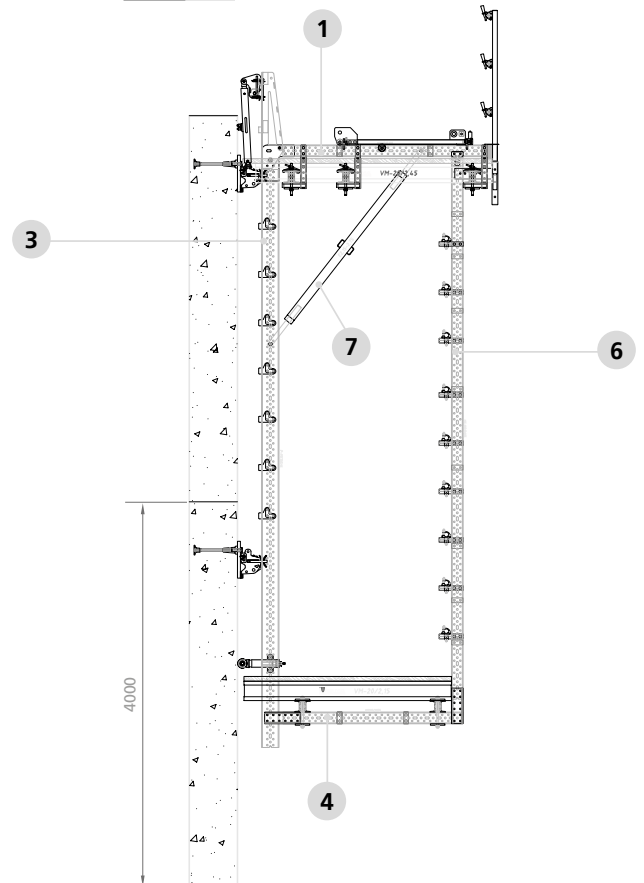
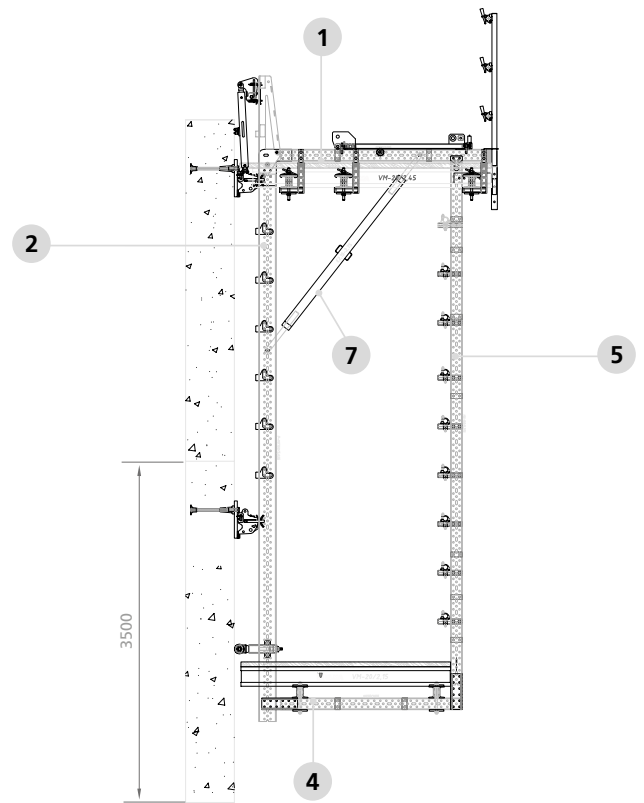


- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 2.875
- 3 2 Profile MK-180 3.625
- 4 Waler MK-120 1.875
- 5 Waler MK-120 6.375
- 6 Push – Pull Prop E 2.15-2.75
- 7 Push – Pull Prop E 1.51-2.2

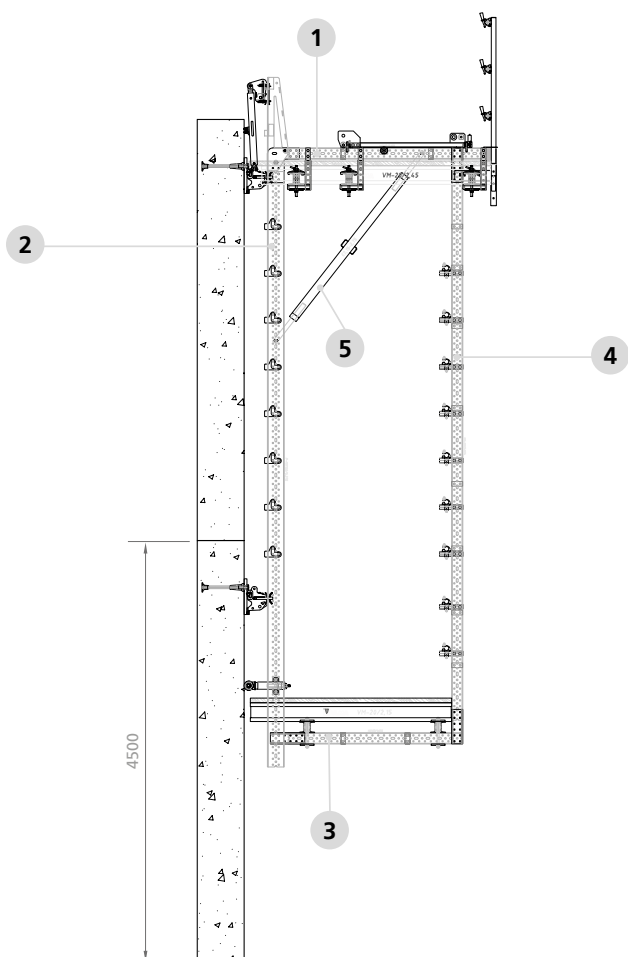
The mast is made up by two continuous MK-180 profiles.



- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 4.625
- 3 Waler MK-120 1.875
- 4 Waler MK-120 4.375
- 5 Waler MK-120 4.625
- 6 Push – Pull Prop E 2.15-2.75
- 7 2 Profile MK-180 4.875



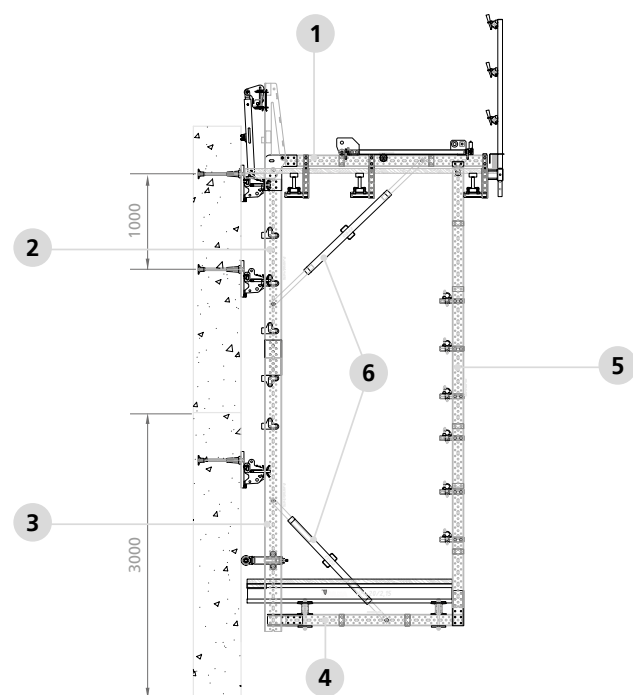
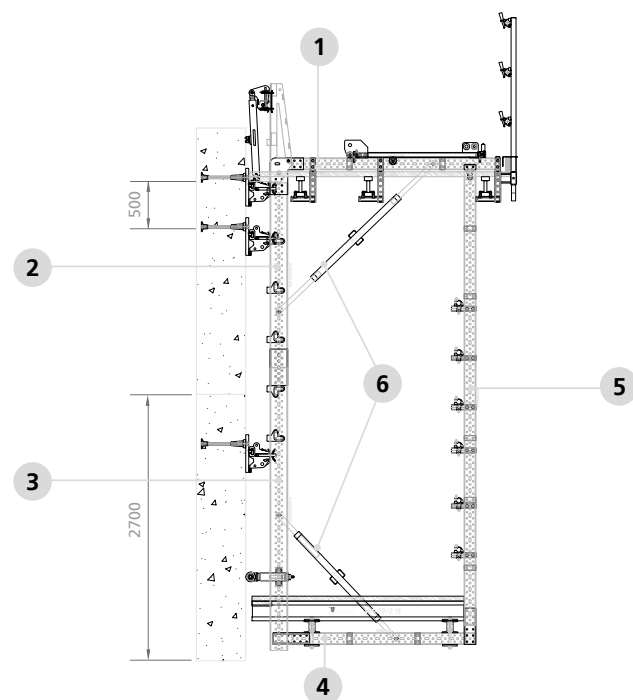
- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 5.625
- 3 2 Profile MK-180 6
- 4 Waler MK-120 1.875
- 5 Waler MK-120 5.375
- 6 Waler MK-120 5.625
- 7 Push – Pull Prop E 2.15-2.75



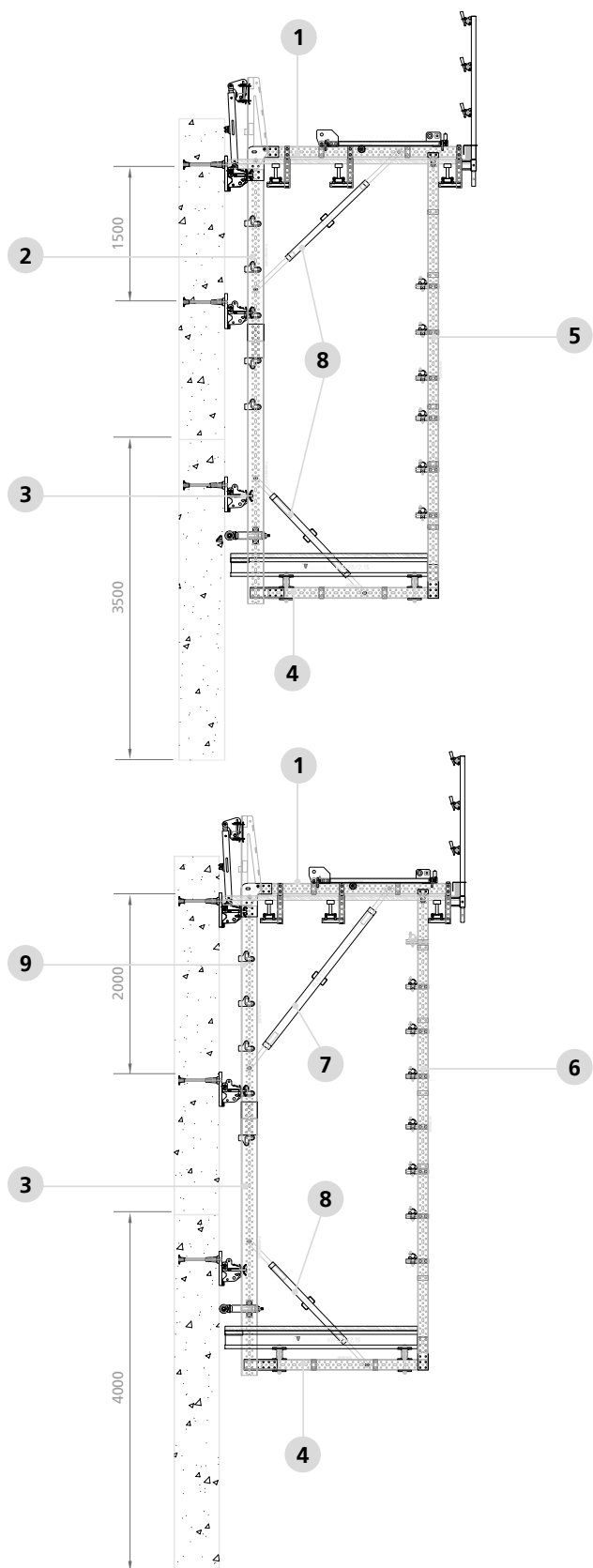
- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 6.375
- 3 Waler MK-120 1.875
- 4 Waler MK-120 5.875
- 5 Push – Pull Prop E 2.15-2.75

2.1.3 Divided mast two anchors per pouring height

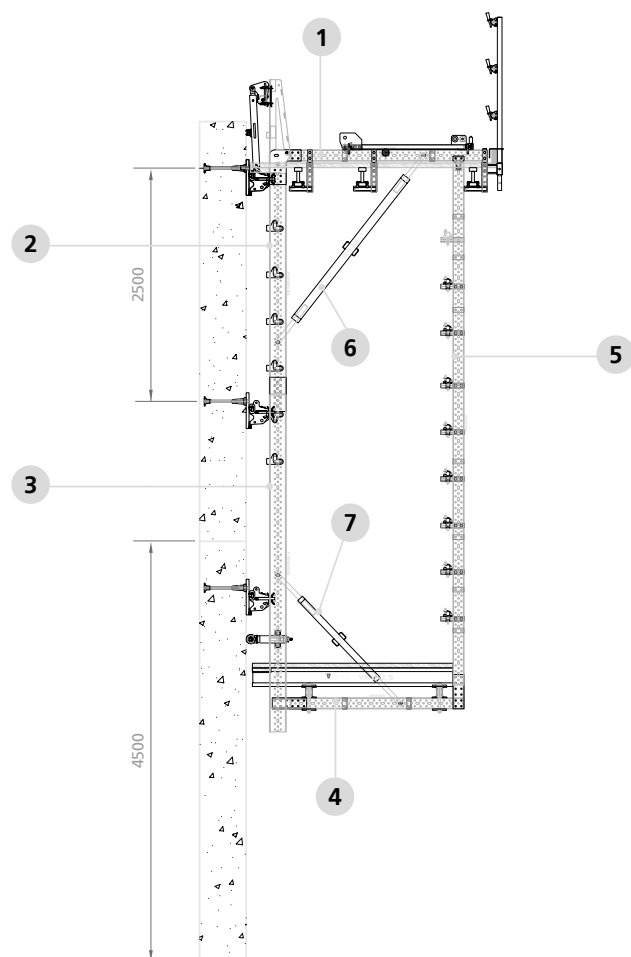
The mast is made up joining two short and two long MK-180 profiles. The structure is held in at least two anchors.



- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 1.875
- 3 2 Profile MK-180 2.875
- 4 Waler MK-120 1.875
- 5 Waler MK-120 4.625
- 6 Push – Pull Prop E 1.51-2.2



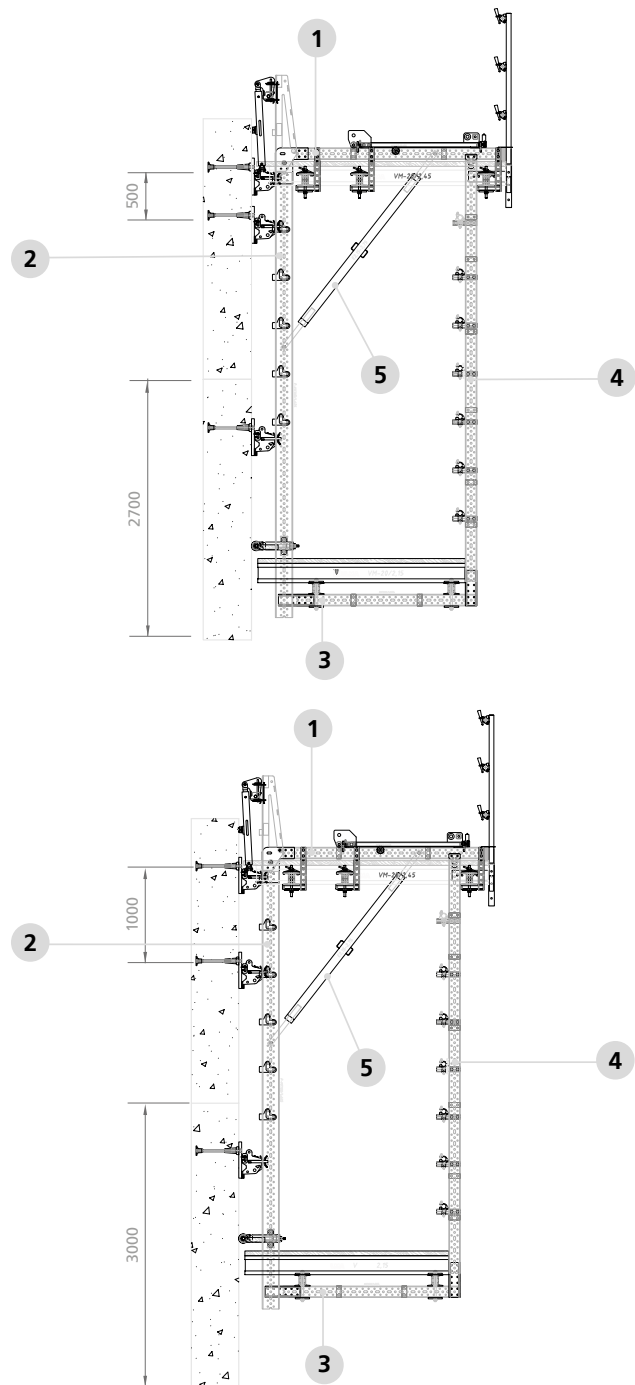
- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 1.875
- 3 2 Profile MK-180 2.875
- 4 Waler MK-120 1.875
- 5 Waler MK-120 4.625
- 6 Waler MK-120 5.125
- 7 Push – Pull Prop E 2.15-2.75
- 8 Push – Pull Prop E 1.51-2.2
- 9 2 Profile MK-180 2.375



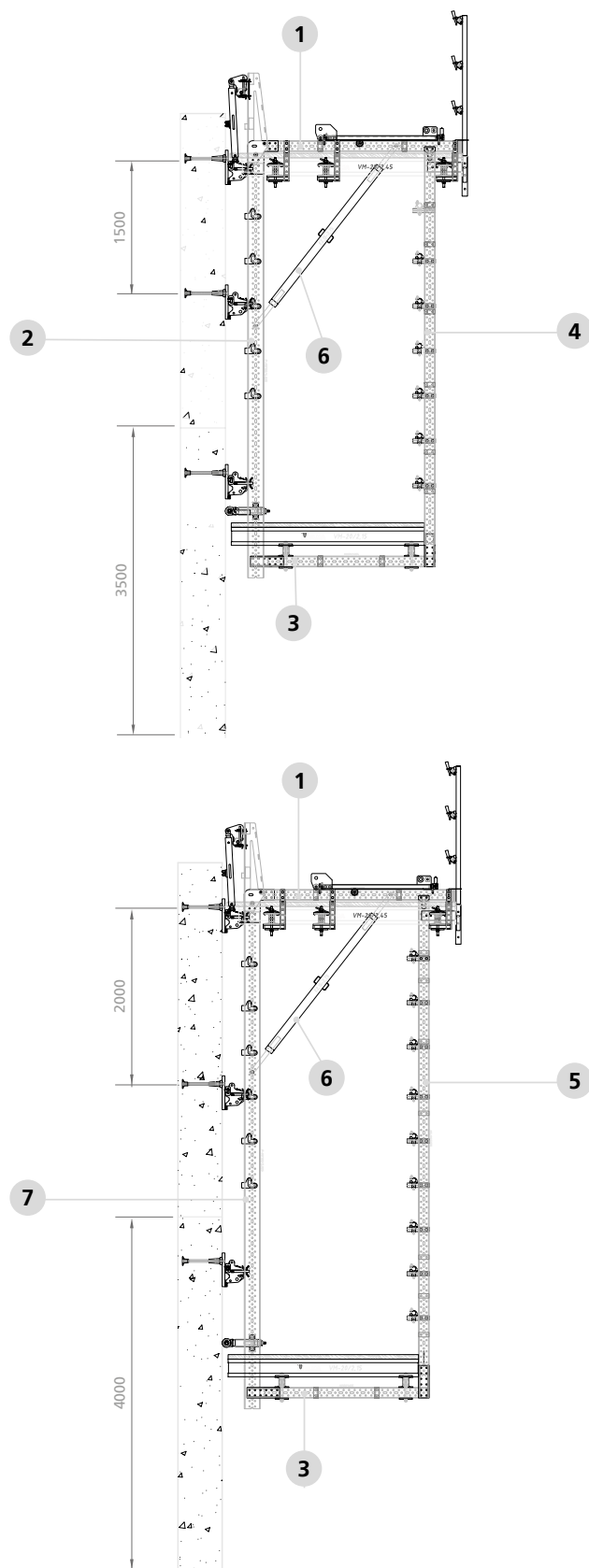
- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 2.375
- 3 2 Profile MK-180 3.675
- 4 Waler MK-120 1.875
- 5 Waler MK-120 5.625
- 6 Push – Pull Prop E 2.15-2.75
- 7 Push – Pull Prop E 1.51-2.2

2.1.4. Entire mast two anchors per pouring height

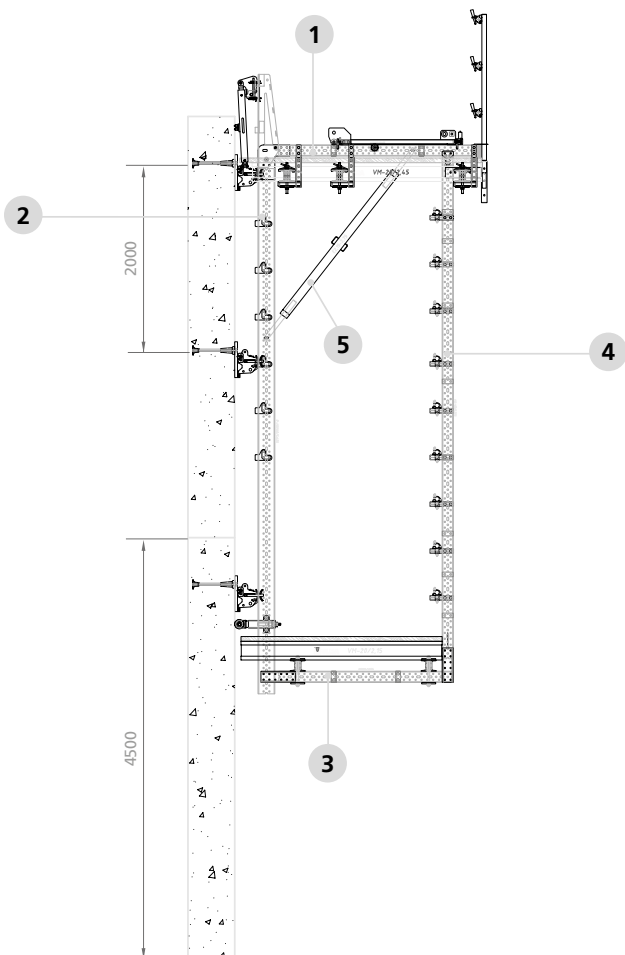
Main mast formed of a whole piece (2 profiles MK-180).



- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 4.625
- 3 Waler MK-120 1.875
- 4 Waler MK-120 4.375
- 5 Push – Pull Prop E 2.15-2.75



- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 4.625
- 3 Waler MK-120 1.875
- 4 Waler MK-120 4.375
- 5 Waler MK-120 5.375
- 6 Push – Pull Prop E 2.15-2.75
- 7 2 Profile MK-180 5.625



- 1 Waler MK-120 2.125
- 2 2 Profile MK-180 5.625
- 3 Waler MK-120 1.875
- 4 Waler MK-120 5.375
- 5 Push – Pull Prop E 2.15-2.75



To perform an intermediate measure pouring height, usually it must be taken the next typical pouring height section. Examples:

- to perform a wall of 3.25 m use the structure corresponding to 3.5 m height.
- to perform a wall of 4.35 m use the structure corresponding to 4.5 m height.

Anyway, it is recommended to realize a previous study of the corresponding section due to the great variability of the MK system.

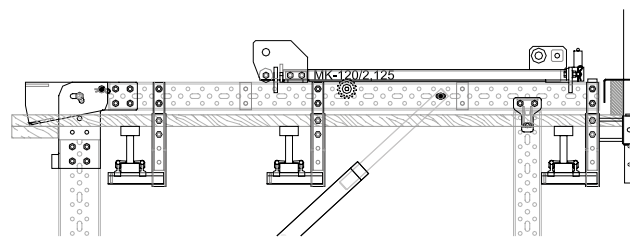
2.2 PLATFORMS ASSEMBLY

In all working platforms, the gap between the building and platforms is recommended to be less than 12 cm.

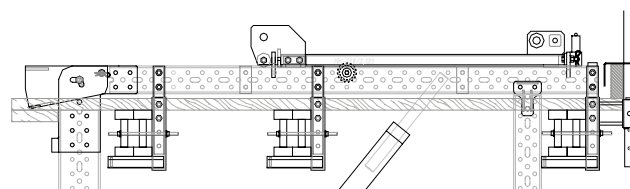
The assembly of the different platforms is detailed in chapter 3.4.

2.2.1 Main platform

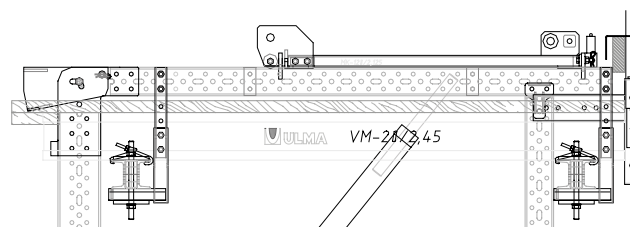
Below are the four different configurations possible:



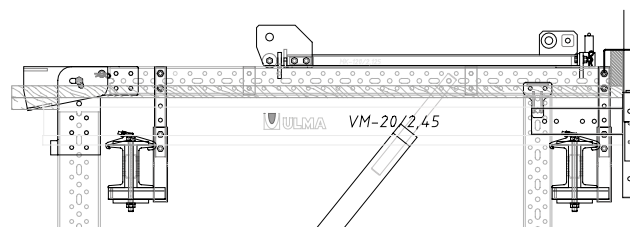
LONGITUDINAL TIMBER BEAM VM-20



DOUBLE LONGITUDINAL TIMBER BEAM VM-20



LONGITUDINAL WALER MK-120 AND PERPENDICULAR TIMBER BEAMS VM-20



DOUBLE MK-180 LONGITUDINAL PROFILES AND PERPENDICULAR TIMBER BEAMS VM-20

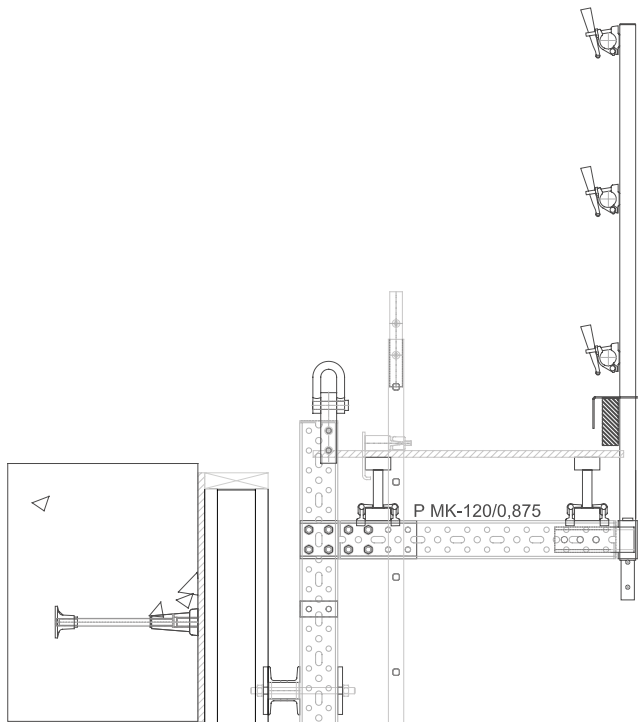
Normally, the option for the longitudinal VM-20 beam is chosen, since it is the most economical and lightweight.

When the dimensions of the platform or the working loads on the beams are not able to withstand this overload, the solution with longitudinal double beam VM-20 will be chosen.

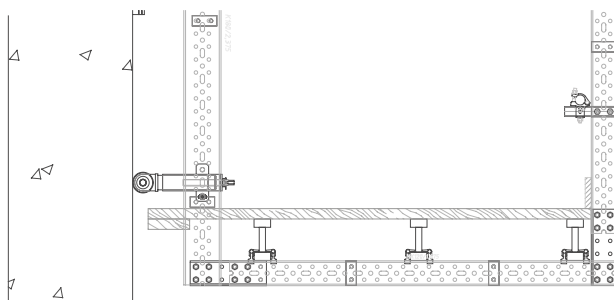
The longitudinal waler solution shall be adopted where higher stiffness is desired. For example, in the case when the roll-back carriage goes above the platform (for example in curved walls) or in the case of large overhangs.

2.2.2 Lower and upper platforms

The pouring, upper intermediate and cone recovery platforms are usually constituted by means of longitudinal VM-20 beams on the MK-120 walers of the main section, covered by a wooden plank.



POURING PLATFORM ON MK-120 VERTICAL WALER



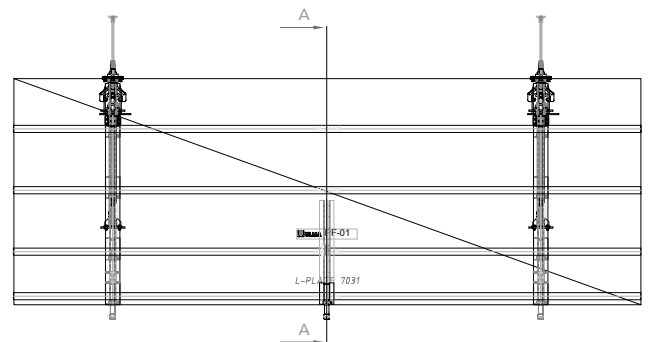
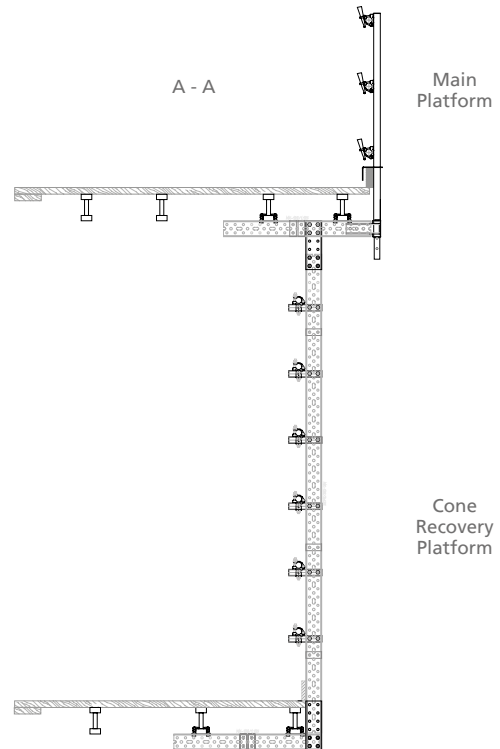
CONE RECOVERY PLATFORM

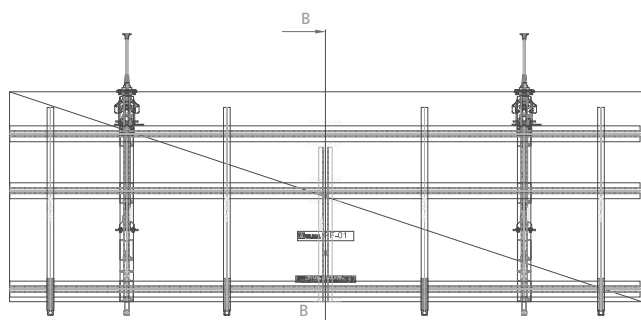
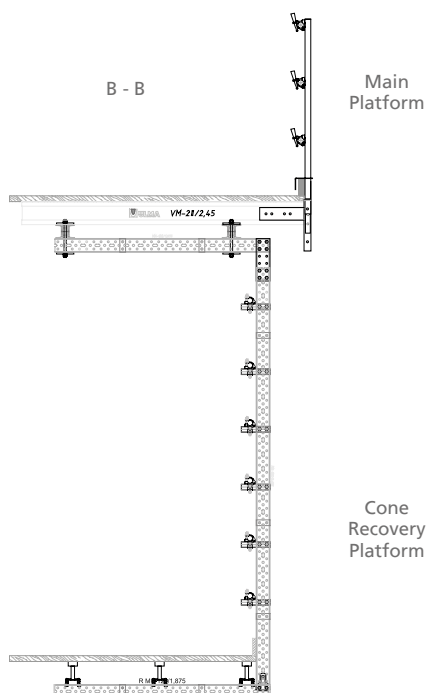
It is also possible to use longitudinal MK-120 + perpendicular VM-20 beams covered by three-layer plywood.

2.2.3 Additional handrails

When the distance between the main sections is considerably wide, it is required to place an additional intermediate handrail, according to EN 13374 "Temporary edge protection systems" standard.

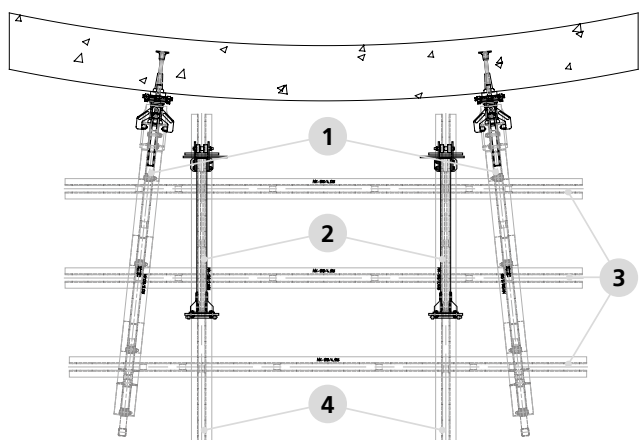
To place the additional handrails, MK-120 walers are placed below the platforms.





2.3 CURVED WALLS

In curved walls the roll-back carriage MK-120 must be placed on main platform above two false walers placed over the VM-20 timber beams of the main platform. In this way, the two carriages must run parallel to each other while the brackets are perpendicular to the wall.



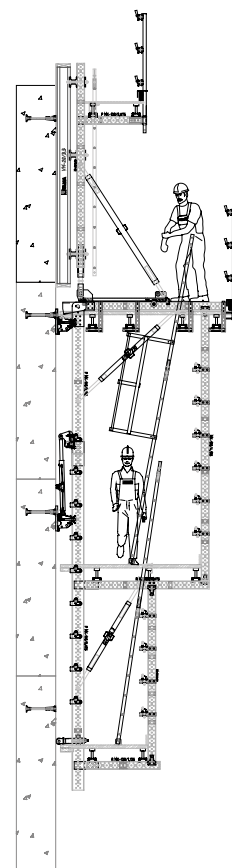
- 1 Main section
- 2 Roll-back carriage MK-120
- 3 Main platform walers
- 4 False walers

2.4 SECTION WITHOUT INITIAL PUSHING MAST RKS

This type of configuration is also based on a "one anchor per pouring height" of concreting but also adding a lower platform, which means that during the climbing process always the guided structure in two levels of anchors (heads).

The reason why it requires one more level of platform is that in this case the "Initial Pushing Mast RKS" is not used, but the whole pushing is made from the mast, so this is much longer. The positioning of the hydraulic cylinder and the climbing head for pushing occurs on the heads located on the control platform, resting on all strokes on the climbing blocks placed on the main mast.

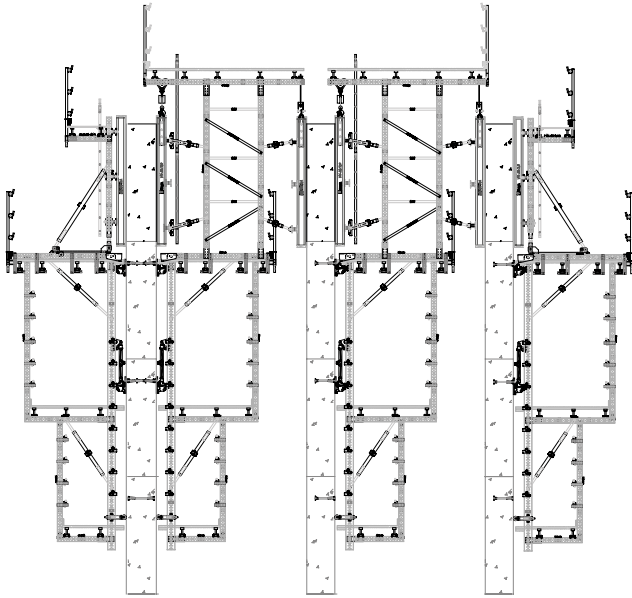
In this type of configuration, the "Additional Profile RKS", which acts as a guide for the roll-back carriage MK, also has the function of facilitating the threading on the anchor on hold during the climbing.



2.5 OTHER EXAMPLES

As the main structure of the rail climbing system is based on MK system, it has a great versatility enabling perform different types of solutions comparing to those previously described taken into account the features of the system (hydraulic system limitation, climbing elements limitations, fixing elements limitations and anchor bracket limitations).

Subsequently, some examples of different types of structures that can be perform with the system are shown:



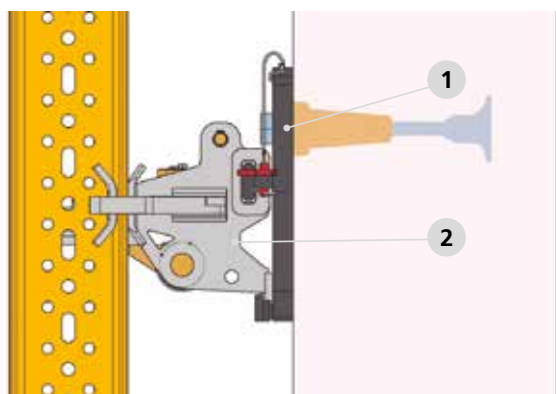
3. ASSEMBLY, USE AND DISASSEMBLY

3.1 ANCHOR SETTING



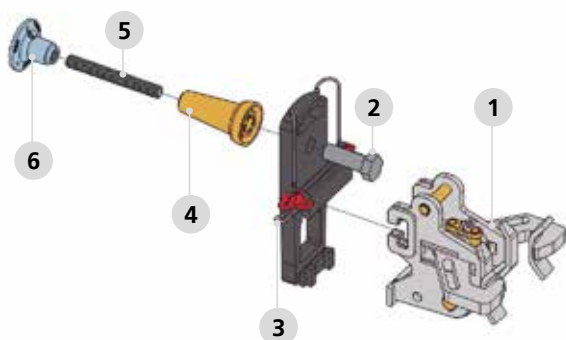
It is very important to make a correct positioning and placement of the anchors, since its main function in the system is to guide and support the complete structure. The different elements that compose it and its placement are described below.

The anchoring system is made up of 2 independent parts.



- 1 Wall Bracket LT HWS
- 2 Head LT HWS

In the next example the complete exploded of the wall bracket LT HWS is shown.



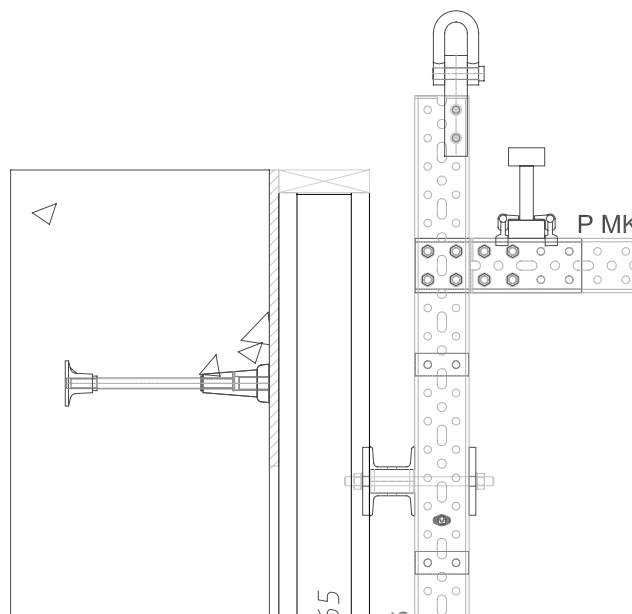
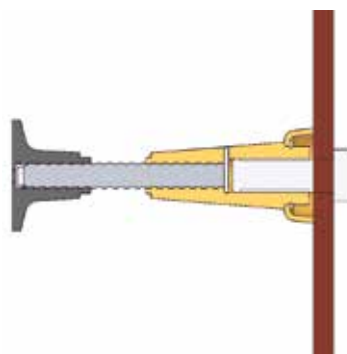
- 1 Head LT HWS
- 2 Bolt M30 x 90 DIN-931-8.8
- 3 Wall Bracket LT HWS
- 4 Cone DW20/M30
- 5 Tie Rod DW20
- 6 Fix Anchor DW20



As it is a system designed to execute walls, the LT HWS head is usually placed on the wall. There is still the possibility of placing the LT HWS head on slabs, window hollows, balconies, etc. Using other types of supports other than wall support (For more information consult the HWS user guide).

3.1.1 Positioning the cone to the wall

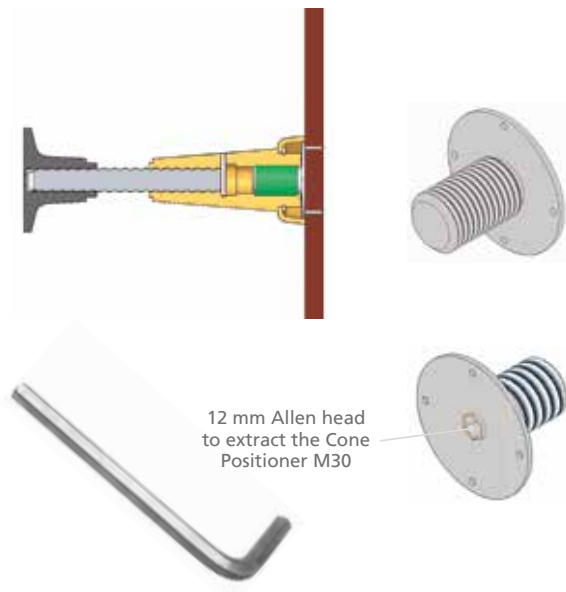
The positioning of the cone is done by fixing it to the formwork using the M30 x 90 bolt of the anchor. As it is fixed to the formwork always in the same place in successive pouring stages the cone will always be embedded in the same position in the wall.



Before stripping the formwork, the anchor screw must be released.

In the case of modular formwork it can be the case of not being able to place the screw (to coincide with a rib) or do not want to pierce the wood. In this case the "Cone Positioner M30" is placed, fastening it with nails to the board. Next, the cone, tie rod DW and fix anchor are threaded between them with the "Cone Positioner M30".

CONE POSITIONER M30



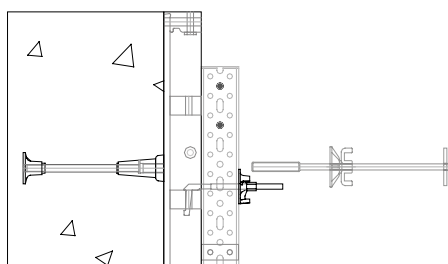
Once stripping the formwork by means of an Allen wrench of 12 mm, the cone positioner M30 is extracted for the cone.

Another option is the "Cone-Waler Connector M30". This is a rod formed by M30 and the rest DW20.

The cone-waler connectors are used to support the anchor elements over the ORMA formwork panels, by means of the hole made in the wood of the formwork.

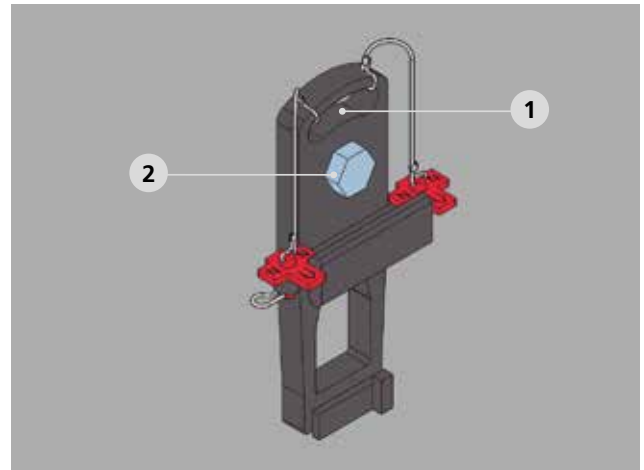


CONE WALER CONNECTOR M30



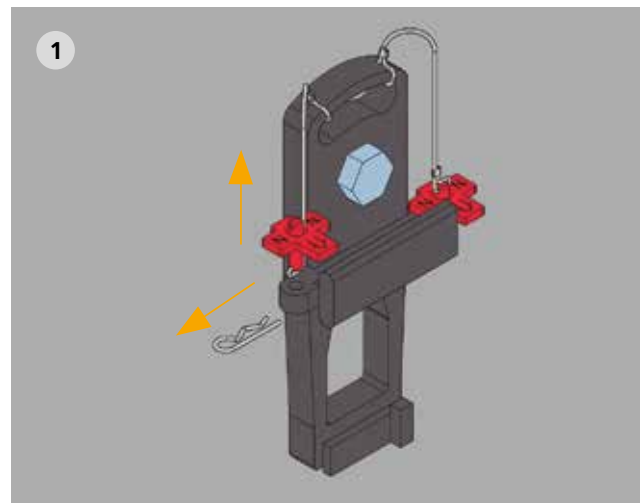
3.1.2 Assembly of wall bracket LT HWS

Bracket used in RKS to permit the fixing of the structure to the wall. It is fixed directly to the cone embedded in the concrete with a bolt M30 x 90. The bracket is directly in contact with the concrete.



- 1 Wall Bracket LT HWS
- 2 Bolt M30 x 90 DIN931-8.8

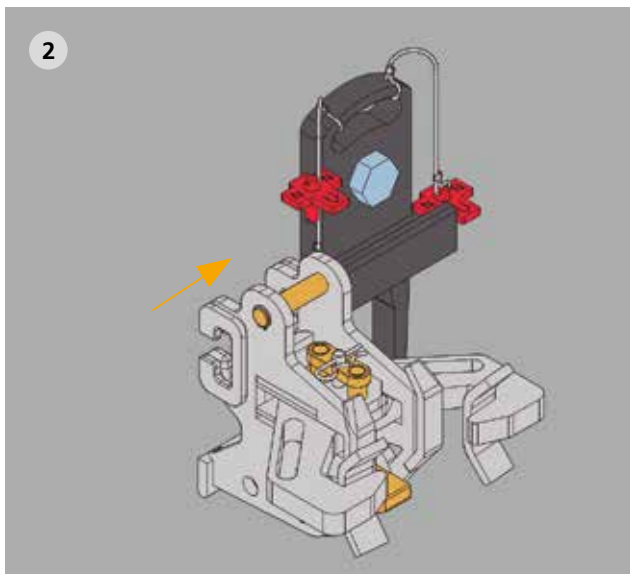
The head LT HWS is connected to the wall bracket LT HWS as follows:



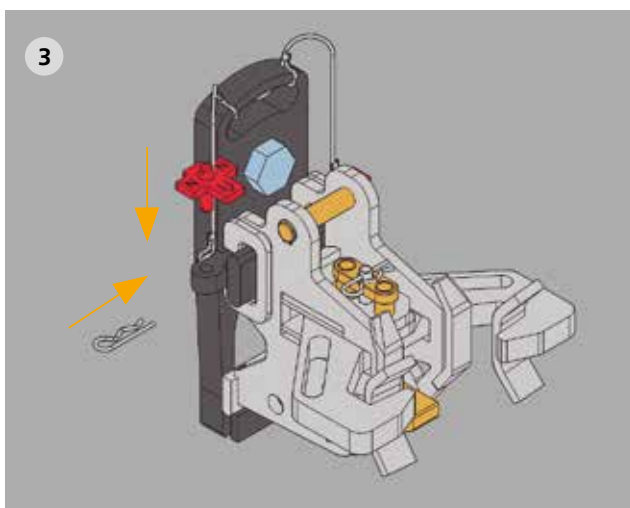
Remove the Cotter Pin R/3 and the Red Positioning Pin



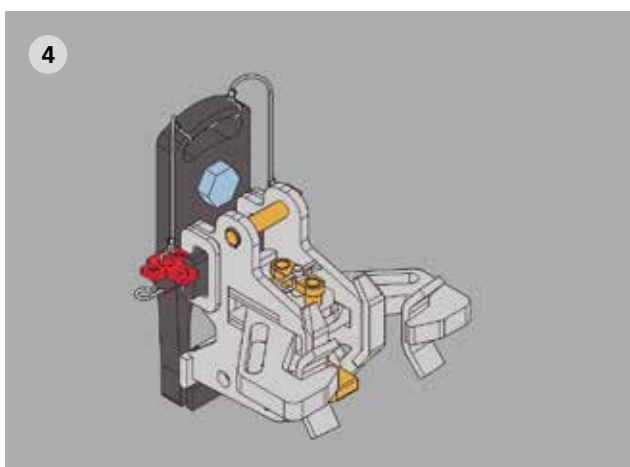
Remove ONLY 1 side positioning pin.



Insert the head laterally



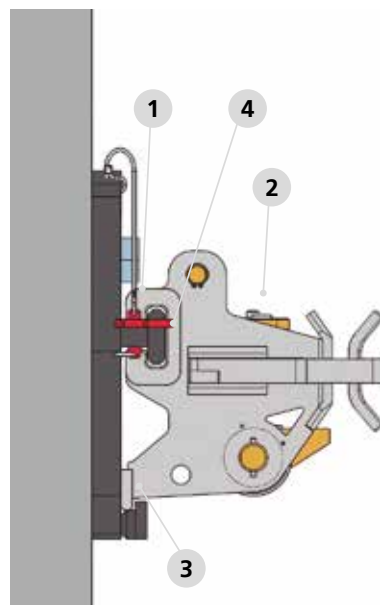
Pull the head along until it reaches the pin of the other side



Reposition the red positioning pin and the Cotter Pin R/3

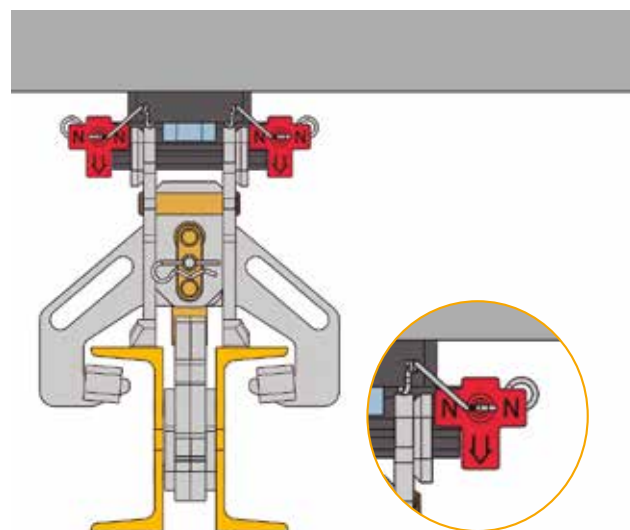


After fixing the "Head" into the "Wall bracket" check the following points:

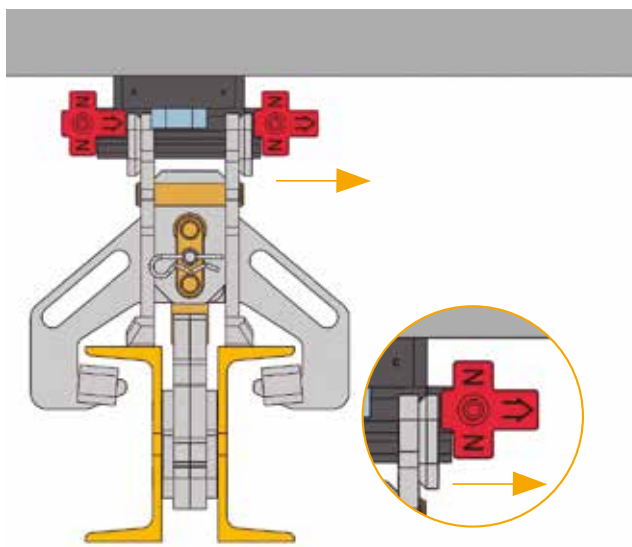


- 1 The 2 red positioning pins are correctly positioned and blocked with its respective cotter pins R/3.
- 2 The double pin of the Head LT HWS is correctly positioned and locked with the cotter pin R/3.
- 3 The Head LT HWS rest vertically on the lower part of the Wall Bracket LT HWS.
- 4 The Head LT HWS rest horizontally in the horizontal support. NEVER support vertically the head on the horizontal support.

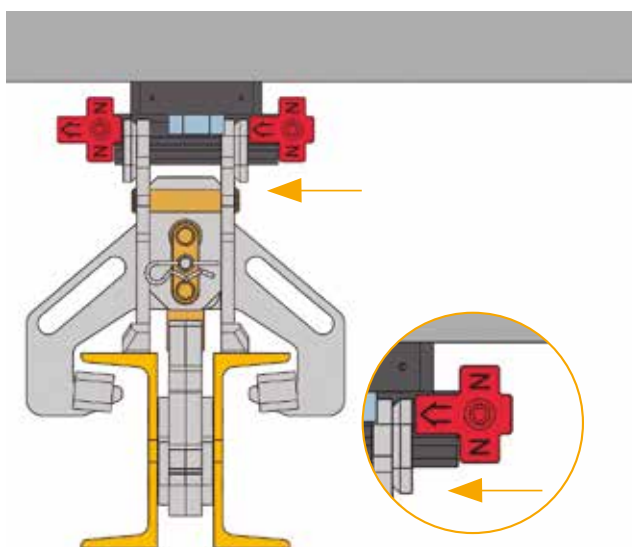
The red positioning pin of the wall bracket LT HWS allows the horizontal regulation of the head LT HWS for correcting the possible errors in the positioning of the cones embedded in the concrete. This regulation allows placing the head 10 mm to each side, having 3 different positions into the wall bracket:



NEUTRAL POSITION



POSITION 10 mm TO THE RIGHT



POSITION 10 mm TO THE LEFT

NEUTRAL POSITION: standard position of the head where the head should always be if the cone is in the correct position.

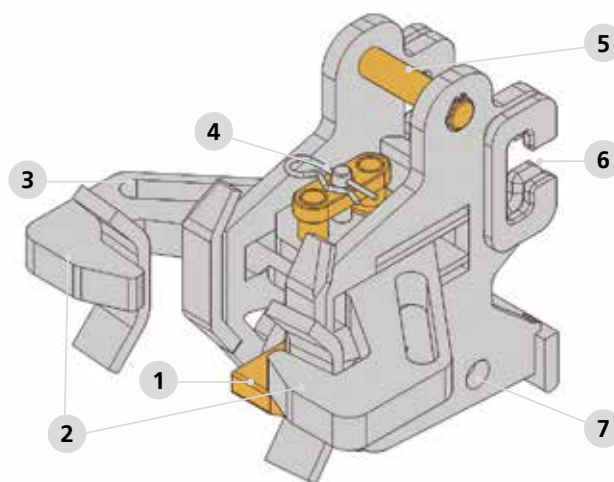
POSITION 10 mm TO THE RIGHT: position obtained fixing the two arrows of the red positioning pin of the wall bracket facing to the right. It is used to correct that the cone is located 10 mm to the left than the corresponding location.

POSITION 10 mm TO THE LEFT: position obtained fixing the two arrows of the red positioning pin of the wall bracket facing to the left. It is used to correct that the cone is located 10 mm to the right than the corresponding location.

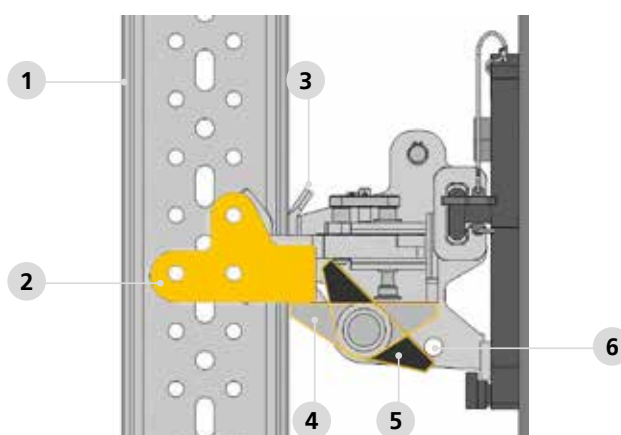
3.1.3 Head LT HWS

The "Head LT HWS" contains the support (pawl) and the guiding mechanisms (claws) for rail climbing system sets.

HEAD LT HWS



- 1 Pawl
- 2 Claws
- 3 Handle
- 4 Double Pin
- 5 Cylinder Connection Pin
- 6 Bracket Connection
- 7 Pawl Locking Hole



- 1 Mast
- 2 Block
- 3 The mast is guided by claws
- 4 Working position
- 5 Block passing position
- 6 Introduce a bar in Pawl locking in required

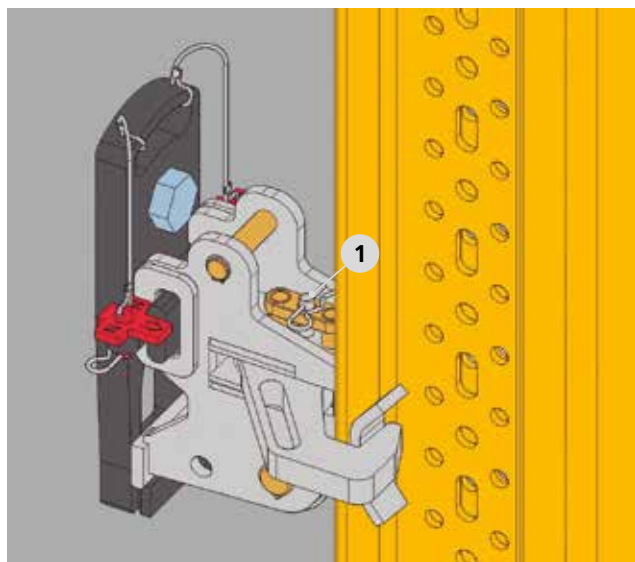
The “claws” are the guides of the masts along the building, hugging it by its wings and thus avoiding the horizontal displacement of the set (responsible for transmitting the horizontal efforts of the set) climbing. However, they allow their vertical sliding.

Once the mast is inside the “Head”, the “Pawl” is the element where the whole structure is supported by the “Self-Climbing Block LT HWS”.

The “Pawl” allows the passage of the “Self-Climbing Block LT HWS” in an upward direction, being blocked in the opposite direction. To allow the passage at the time of descent, the “Pawl” can be locked in “block passing position” by inserting a DW15 bar into the head hole.

3.1.4 Recovery of anchors

Another functionality of the “claws” is their possible opening and closing. It is composed of two rotating semiclaws, fixed to the body of the head, by means of a vertical double pin that connects both.



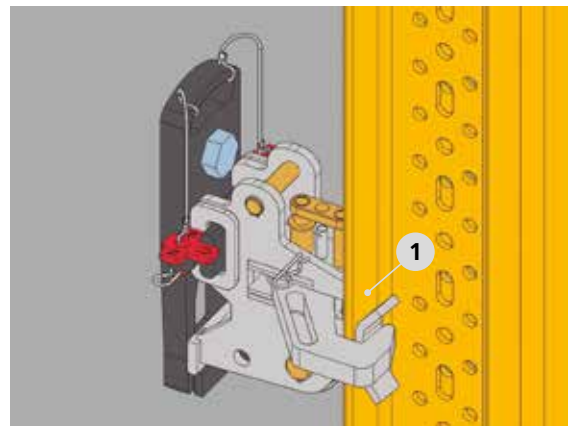
1 Claws Closed Double Pin Locked with the Cotter Pin R/3



Except for anchor recovery, claws must always keep closed with the double pin locked with cotter pin R/3. For anchor recovery claws will open as shown in the next pictures.

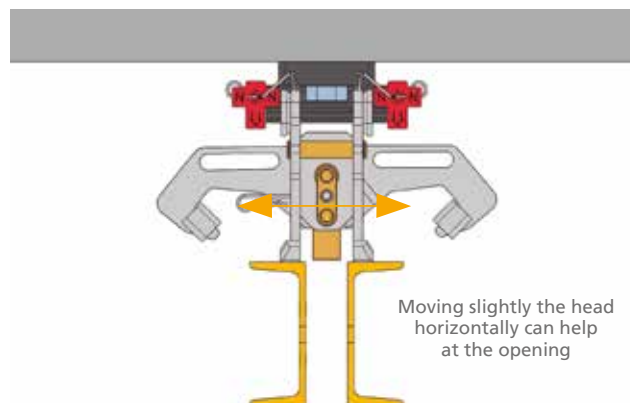
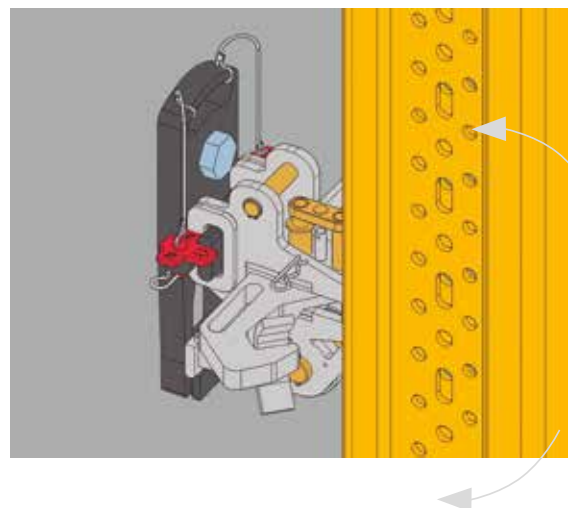
For the recovery of anchors the claws are opened as detailed in the following 3 images:

UNLOCK THE CLAWS



1 Remove the Cotter Pin R/3 and lift the Double Pin

OPEN THE CLAWS

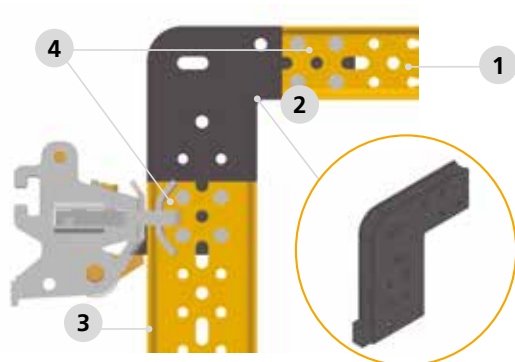


Claws are closed following the steps in the inverse order.

3.2 PREASSEMBLY OF RKS ELEMENTS

3.2.1 Main support RKS

The "Main Support RKS" joins the horizontal waler of the main platform with the vertical mast. The union is made by 4 + 4 bolts 16 x 90.

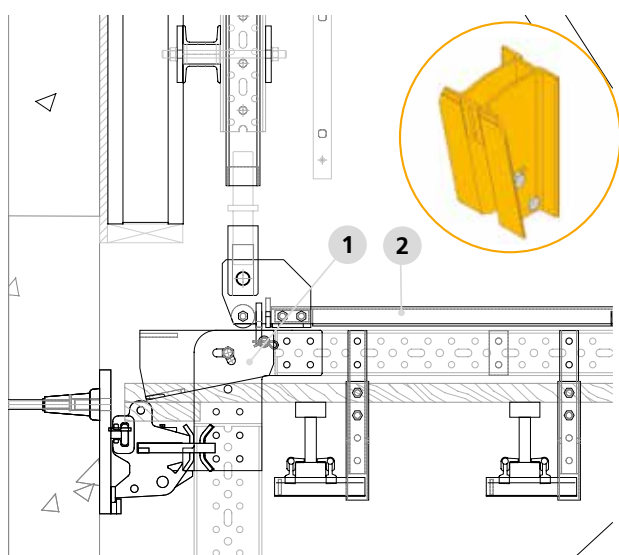


- 1 Waler MK-120
- 2 Main support RKS
- 3 Mast
- 4 8 Bolts M16 x 90 DIN-931-8.8
8 Nuts M16 DIN-985-8

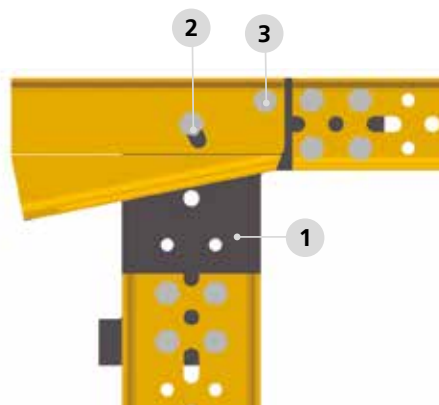
Once the RKS structure is assembled, it will rest on the LT anchor using the block it incorporates.

3.2.2 Additional profile RKS

The additional profile serves as a guide to the roll-back carriage MK-120. It is fastened to the "Main Support RKS" by one pin D20 x 90 and one bolt M20 x 100 DIN-931-8. Both included in the item.

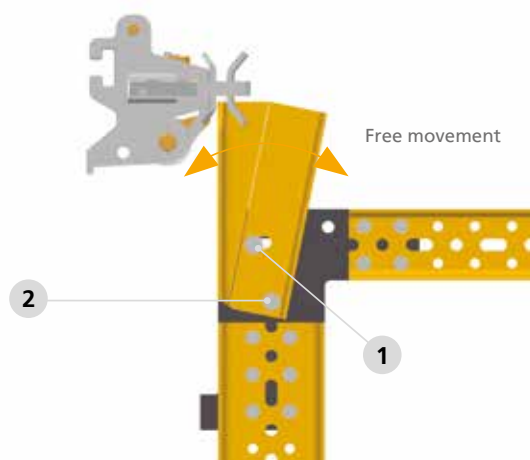


- 1 Additional Profile RKS
- 2 Roll-Back Carriage MK-120



- 1 Main Support RKS
- 2 Bolt M20 x 100 DIN-931-8.8
Nut M20 DIN-934-8
- 3 Pin D20 x 90
Cotter Pin R/4

During the climbing phase in case of solution "WITHOUT INITIAL PUSHING MAST RKS" (see chapter 2.4), and if the lifting process is by crane, the insert must be placed vertically to facilitate threading on the holding anchor. Once it is vertical, it is fixed with a bolt that comes with the piece. The bolted joint of the rabbet must have a looseness to allow free movement.



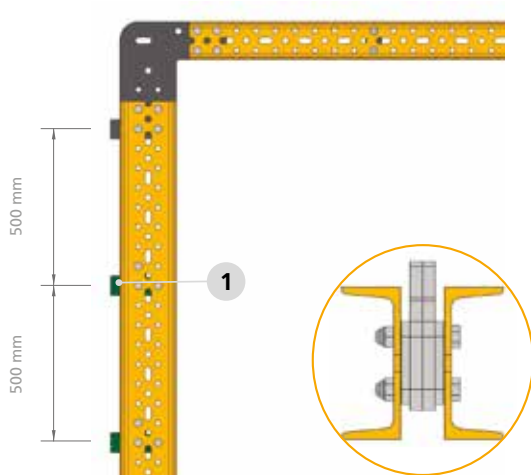
- 1 Looseness between bolt and nut to move along the rabbet
- 2 Pin D20 x 90

3.2.3 Self-climbing block LT HWS

They are placed on the mast to support the vertical loads of the RKS system during the hydraulic climbing process. The distance between blocks will always be 500 mm starting from the "Main Support RKS". It is a symmetrical piece that can be mounted both ways, but always respecting the 500 mm between faces of support.

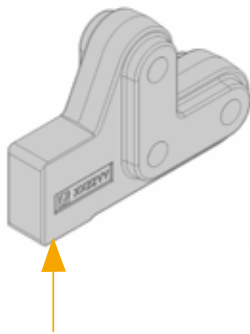
They are assembled between MK-180 profiles with 3 bolts M16 x 90 DIN-931-8.8 and Nuts M16 DIN-985-8.

The number of blocks placed on the mast will vary depending on the pouring height and used structure.



- 1** 3 Bolts M16 x 90 DIN-931-8.8
3 Nuts M16 DIN-985-8

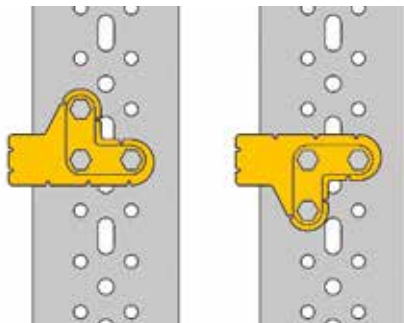
SELF-CLIMBING BLOCK LT HWS (1991375)



WORKING LOAD ELS:

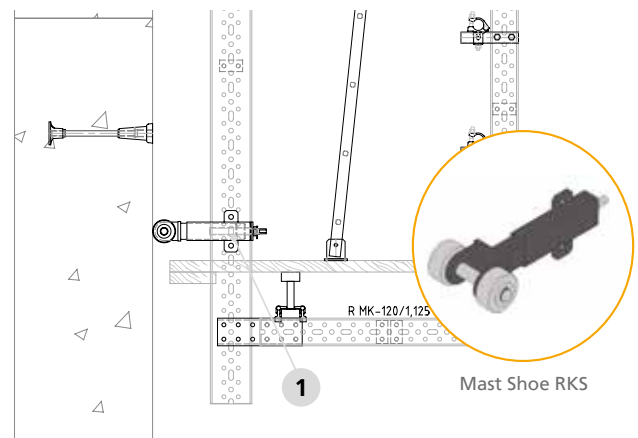
- Working & Out of Service: 66 kN
- Climbing: 50 kN

SYMMETRICAL



3.2.4 Mast shoe RKS

It is placed just under the bottom anchorage. Its function is to facilitate the extraction of the head LT HWS. It is fixed to the mast by 2 pin E20 x 70 and activated by a hexagonal wrench size 19.

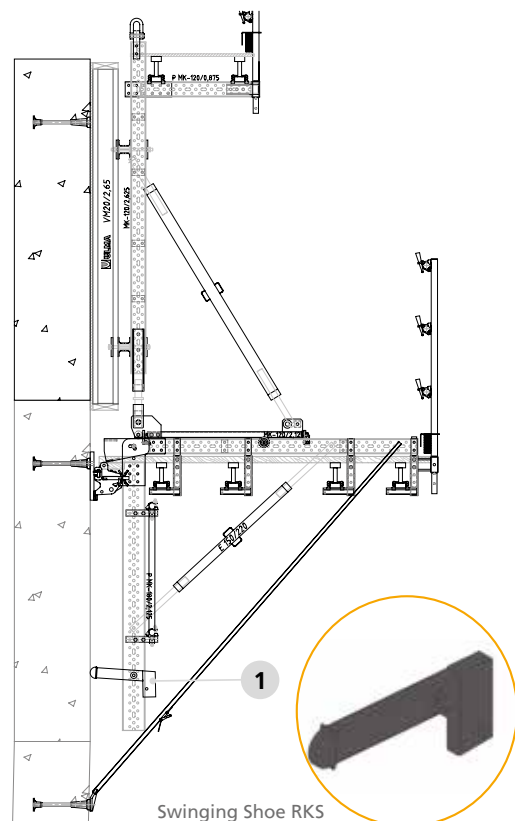


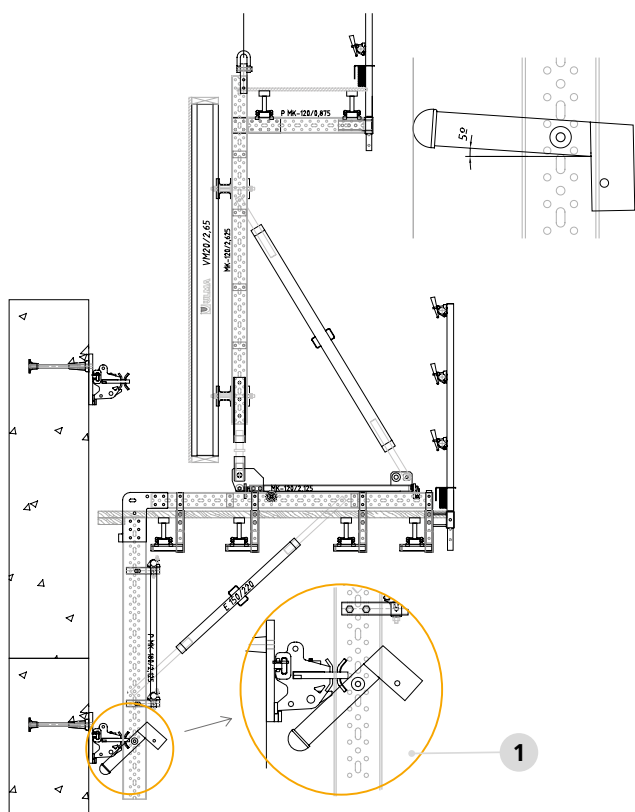
- 1** 2 Pin E20 x 70
2 Cotter Pin R/5

3.2.5 Swinging shoe RKS

In case of using the RKS from the beginning of the execution of the wall, the upper part of the divided mast is used as a climbing bracket. During these pouring heights the swing shoe RKS placed in the lower part of the mast works like a support in the wall.

It is fastened to the mast by one pin E20 x 70, which allows it to swing about its axis during the lifting step avoiding the operation to open the claws.

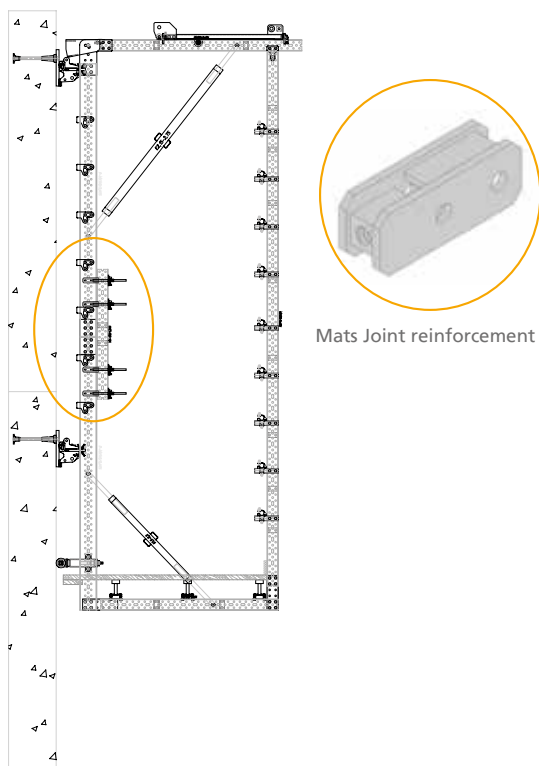




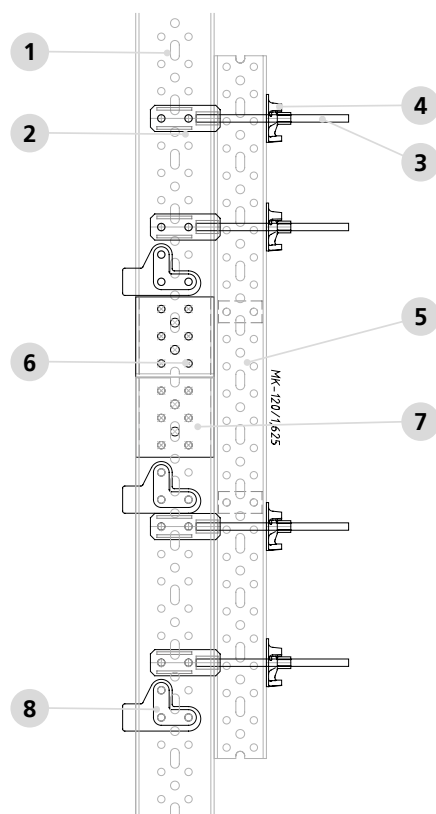
- 1 1 Pin E20 x 70
1 Cotter Pin R/5

3.2.6 MK waler front connector

In the case of a "stiffened divided mast", the connection is made as follows:



Mats Joint reinforcement



- 1 Mast Part 1
2 4 x MK Waler Frontal Connector
3 4 x Short Pin 0,35
4 4 x Plate Nut15
5 Mast Reinforcement Waler MK-120
6 Orthogonal Joint MK-180
7 12 x Bolt M16 x 90 DIN-931-8.8 + 12 x Nut M16 DIN985-8
8 Mast Part 2

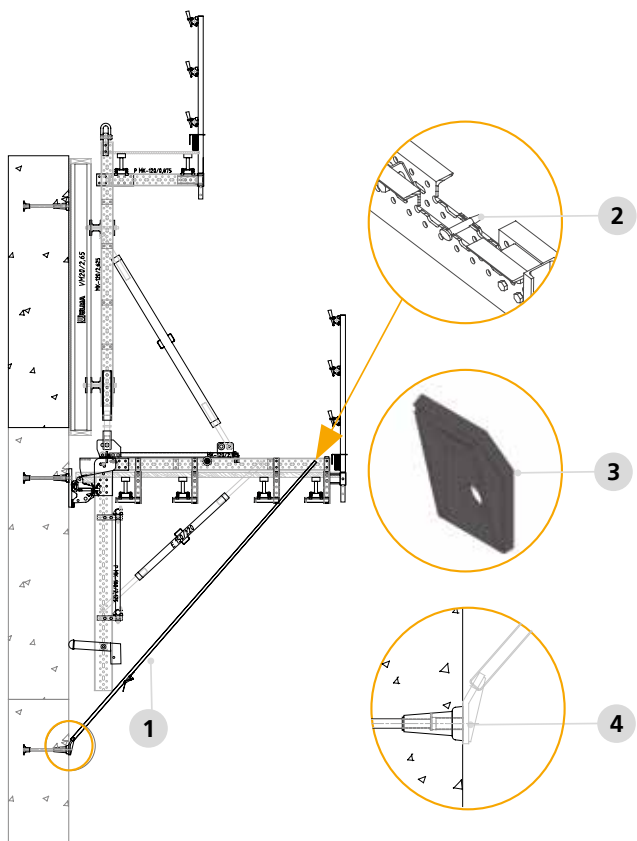
The "MK-120 Waler" that confers rigidity to the joint of the mast, joins the 1st part of the mast at two points as far apart as possible. In the same way, it also joins the second part of the mast.



It is only stiffened in cases where there is necessary increase the resistance of the structure or when the deformation of the structure in threading position is higher than the deformation that the initial pushing mast RKS can absorb.

3.2.7 Wind sling

It prevents the overturning of the upper part of the divided mast under windy conditions. The structure is fixed to the wall with a sling. This sling is tied to the pin of the horizontal waler and to the anchor cones of the previous pouring stage.



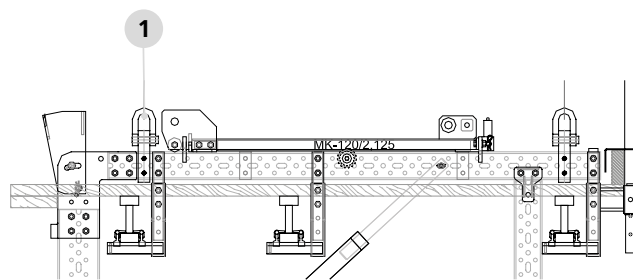
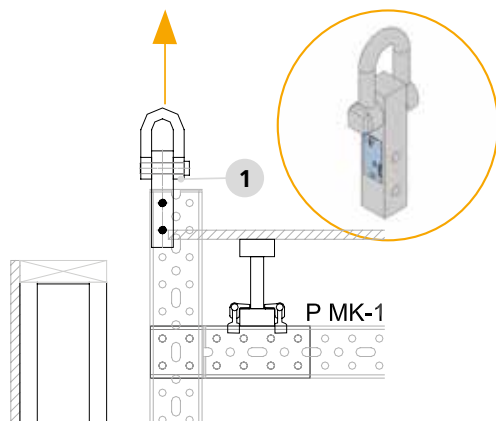
- 1 Wind Sling
- 2 Pin E20 x 70 (0252070)
Cotter Pin R/5 (0250000)
- 3 Wind Sling Fixer
- 4 Bolt M30 x 90 DIN-931 8.8

3.2.8 Lifting hook

To raise the RKS structure (or any part of it) is done by adding "lifting hooks" at the definite lifting points for each case.

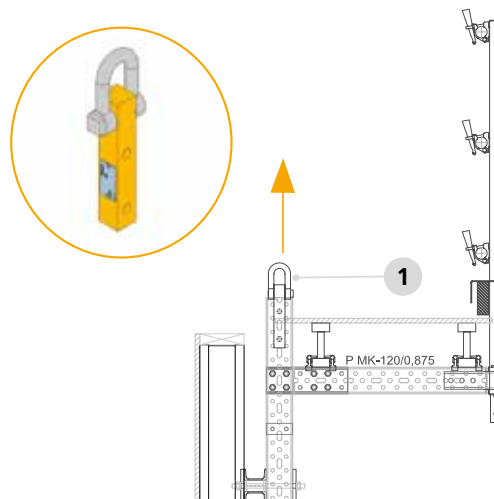
The lifting hook assembly is carried out as follows:

- **Lifting Hook RKS:** used in case of lifting on "Waler MK-120". It is attached to the vertical or horizontal waler with 2 "Pins 16 x 100" and 2 "Cotter Pins R/3".



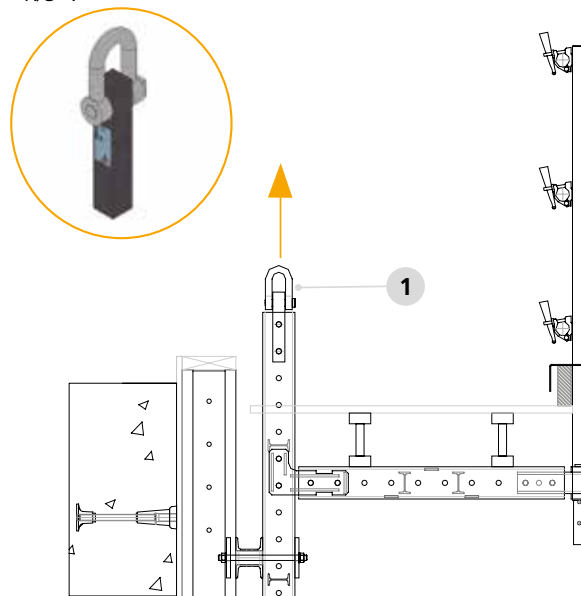
- 1 2 Pins 16 x 100
2 Cotter Pins

- **Lifting Hook MK:** used in case of lifting on vertical "MK-120 Walers". It is joined to the top part of the vertical waler (MK-120) fastened with 2 pins "E20 x 70" and 2 "Cotter Pins R/5".



- 1 2 Pins E20 x 70
2 Cotter Pins R/5

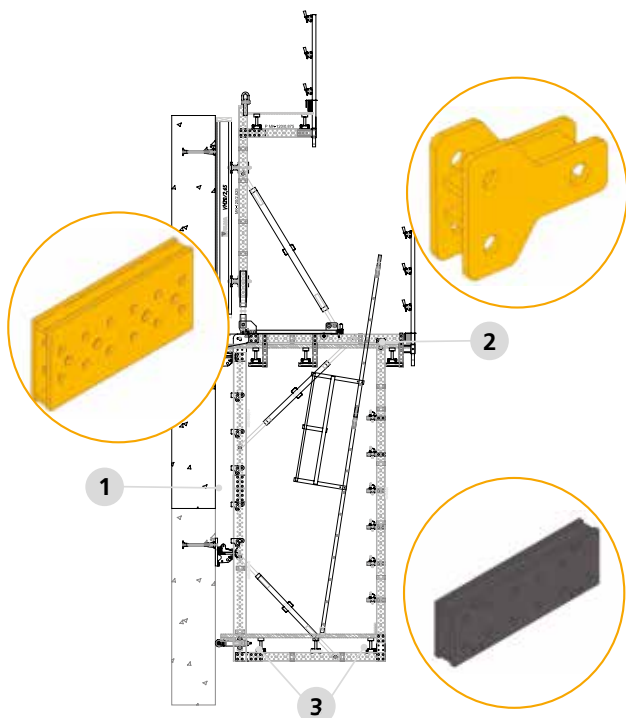
- **Waler Lifting Hook:** used in case of lifting on "DU-120 Walers". It is joined to the top part of the vertical waler using (DU-120) with 2 pins "E20 x 70" and 2 "Cotter Pins R/5".



- 1 2 Pins E20 x 70
2 Cotter Pins R/5

3.3 ASSEMBLY OF JOINING ELEMENTS

The main connecting elements of the profiles and braces MK that serve for the formation of the final structure RKS are described below.

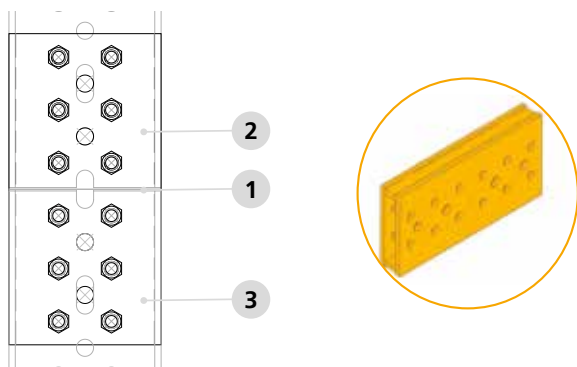


- 1 Orthogonal Joint MK-180
- 2 Axial Node M D20 MK
- 3 Orthogonal Joint MK

3.3.1 Orthogonal joint MK-180

The orthogonal joint MK-180 is used to join the profiles MK-180 to make up the divided mast.

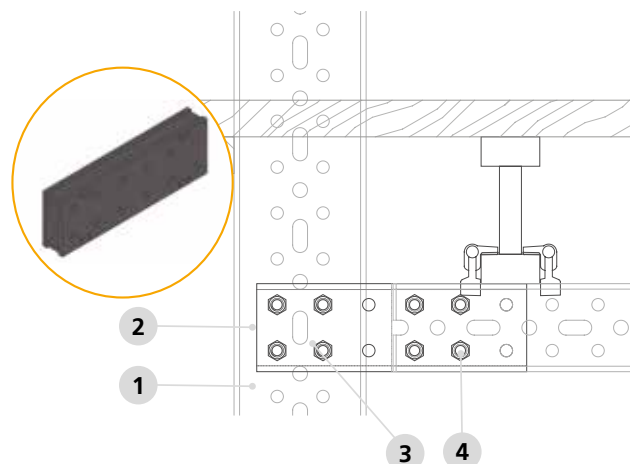
The joint is fastened with 12 bolts M16 x 90 and 12 nuts M16 (to each part of the mast).



- 1 6 Bolts M16 x 90 DIN-931-8.8 and Nuts M16 DIN-985-8
- 2 Orthogonal Joint MK -180
- 3 6 Bolts M16 x 90 DIN-931-8.8 and Nuts M16 DIN-985-8

3.3.2 Orthogonal joint MK

The orthogonal joint MK is used to join the walers MK-120 the different platforms to the mast.



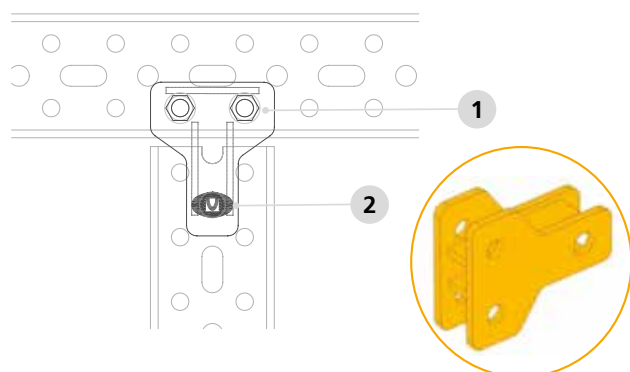
- 1 Mast
- 2 Orthogonal Joint MK
- 3 4 Bolts M16 x 90 DIN-931-8.8
4 Nuts M16 DIN-985-8
- 4 4 Bolts M16 x 90 DIN-931-8.8
4 Nuts M16 DIN-985-8

The joint is performed by bolts M16 x 90 DIN-931-8.8 and nuts M16 DIN-985 (4 units in each waler).

The orthogonal joint MK, can be used also to join longitudinally two walers MK-120.

3.3.3 Axial node M D20 MK

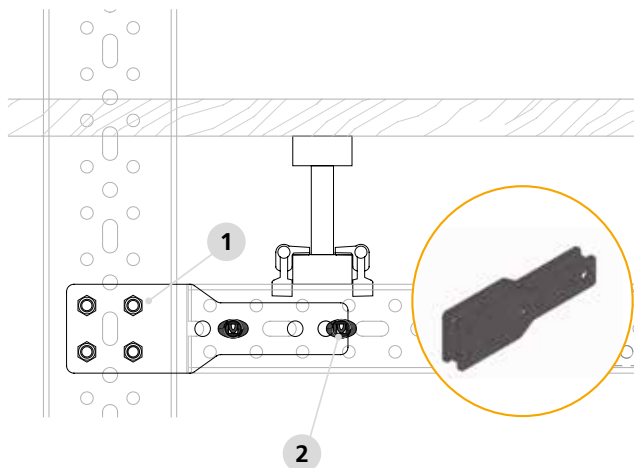
The axial node M D20 is used to join the additional handrail walers.



- 1 2 Bolts M16 x 90 DIN-931-8.8
2 Nuts M16 DIN-985-8
- 2 1 Pin E20 x 70
1 Cotter Pin R/5

3.3.4 Axial node M 2-D20 MK

The axial node M 2-D20 MK is an optional element to join the waler MK-120 perpendicularly.



- 1** 4 Bolts M16 x 90 DIN-931-8.8
4 Nuts M16 DIN-985-8
- 2** 2 Pins E20 x 70
2 Cotter Pins R/5

3.4 ASSEMBLY OF PLATFORM ELEMENTS

3.4.1 Main platform

Next we will see the assembly of the 4 possible configurations of the main platform.

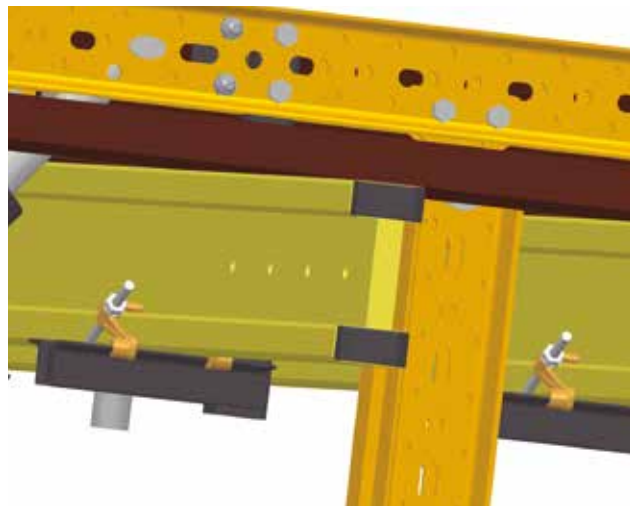
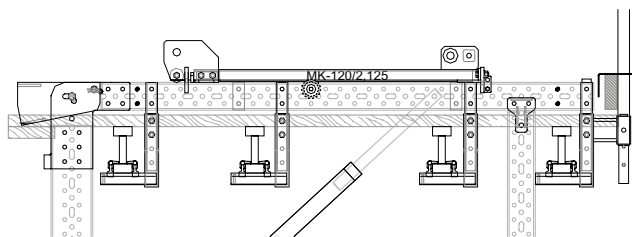
All of them remain at the same level regardless of the adopted solution (except with longitudinal MK-180 that there is a 60 mm jump). This is achieved by varying for each case the mounting of the supports (retracted or extended).



The number of VM-20 beams, MK-120 walers or MK-180 profiles will depend on the project and the loads that the platforms must support.

- **Longitudinal timber BEAM VM-20:**

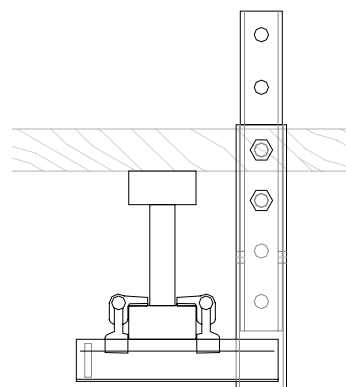
In this option the supports are mounted in their retracted position. The timber beam VM-20 is supported by platform support BMK and platform rear support BMK and fixed to it by waler VM-20 clamp 2T.



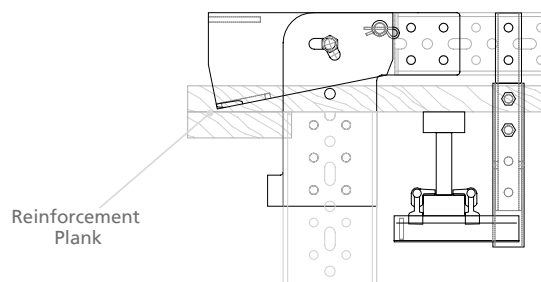
Cover the platforms with C24 class resistance planks (20 x 5 cm or 15 x 5 cm) according with EN 338.

Each plank must be fastened to the timber beam VM-20 with 2 screws 6 x 90 DIN7505-A in each timber beam VM-20.

Fasten a plank (20 x 5 cm or 15 x 5 cm) at the bottom of platforms corners in order to distribute better the loads. The plank must be fastened with other planks by screws 6 x 90 DIN7505-A, one screw in each plank of the platform.

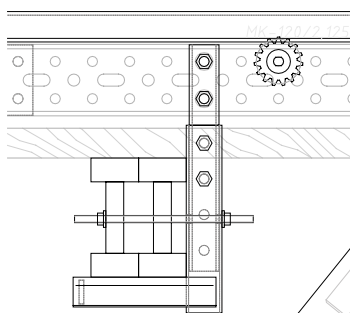
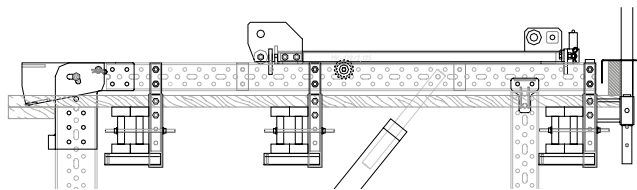


LONGITUDINAL TIMBER BEAM VM-20



- **Double longitudinal timber BEAM VM-20:**

In this option the supports are mounted in their retracted position. The fastened to the support is made with a threaded rod M12 x 300, two washers A12 DIN-125 ST and two nuts M12 DIN-934-8 or by means of 4 screws 6 x 60 DIN7505-A.



FASTENED BY THREADED ROD M12 X 300

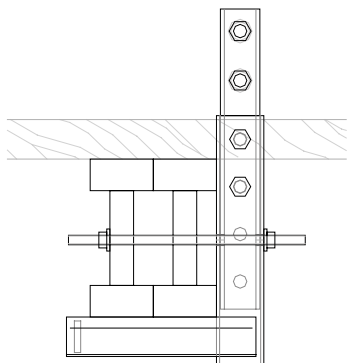


FASTENED BY SCREWS 6 X 60 DIN-7505-A

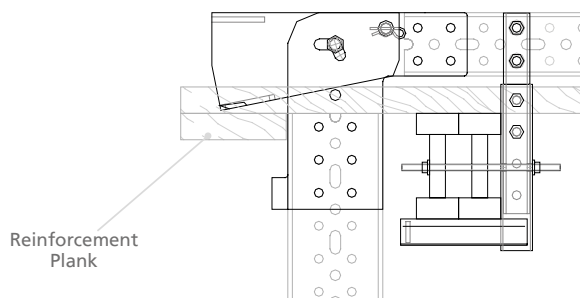
Cover the platforms with C24 class resistance planks (20 x 5 cm or 15 x 5 cm), according with EN 338.

Each plank must be fastened to the timber beam VM-20 at least with 1 screw 6 x 90 DIN-7505-A, in each timber beam VM-20.

Fasten a plank (20 x 5 cm or 15 x 5 cm) at the bottom of platforms corners in order to distribute better the loads. The plank must be fastened with other planks by screws 6 x 90 DIN-7505-A, one screw in each plank of the platform.



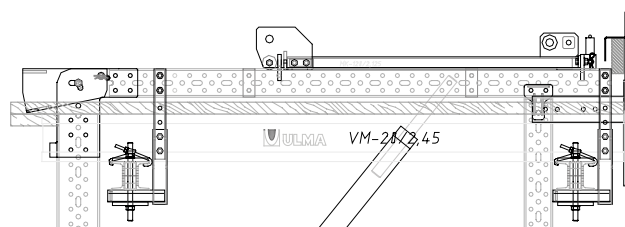
DOUBLE LONGITUDINAL TIMBER BEAM VM-20



• Longitudinal waler MK-120 and perpendicular timber beams VM-20:

In this option the supports are mounted in their extended position.

The walers are attached to the supports using "Clamp M20 x 330 (2P-150 x 150)". The perpendicular VM-20 beams are mounted on the walers and attached to it by the "Waler RVM20 Clamp 2T".

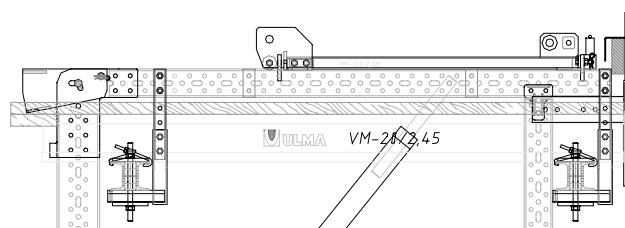


The platforms are covered with 27 mm three layer plywood, fastened with screws 6 x 60 DIN-7505-A.

• Double profile MK-180 longitudinal profiles and perpendicular timber beams VM-20

In this option the supports are mounted in their extended position.

The preassembly of the walers conformed by "Profiles MK-180" is realized. These walers are attached to the supports using "Clamp M20 x 330 (2P-150 x 150)". The perpendicular VM-20 beams are mounted on the walers and attached to it by the "Waler RVM20 Clamp 2T".

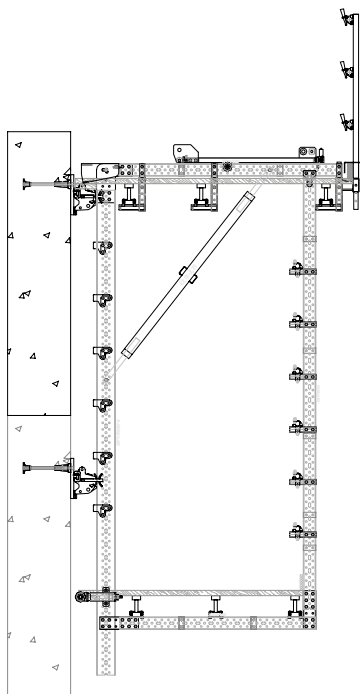




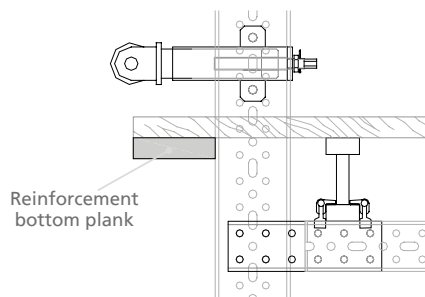
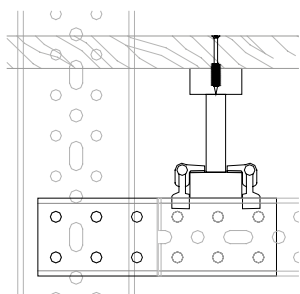
The platforms are covered with 27 mm three layer plywood, fastened with screws 6 x 60 DIN-7505-A.

3.4.2 Cone recovery platform

The longitudinal timber beams VM-20 are supported by the horizontal walers of the main platform and fastened by the Waler VM-20 clamp 2T.



CONE RECOVERY PLATFORM



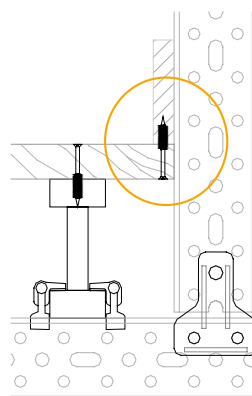
To cover the platforms C24 class resistance planks (20 x 5 cm or 15 x 5 cm) must be used, according with EN 338. Each plank must be fastened to the timber beam VM-20 with 2 Screw 6 x 90 DIN-7505-A in each timber beam VM-20.

It is advisable fastened a plank (20 x 5 cm or 15 x 5 cm) at the bottom of platforms corners in order to distribute better the loads. The plank must be fastened with other planks by screws 6 x 90 DIN-7505-A, one screw in each plank of the platform.

3.4.3 Toe board

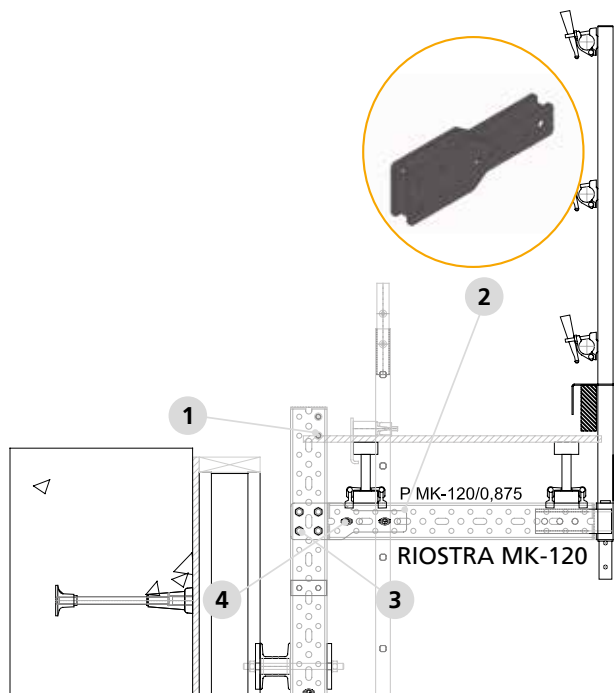
A toe board must be placed in all the platforms in order to avoid the fall of the elements from them.

The toe board is a wood plank which at least has 15 x 3 cm dimensions and C24 class resistance according with EN 338 which is fastened to the platform by means of by screws 6 x 90 DIN-7505-A.

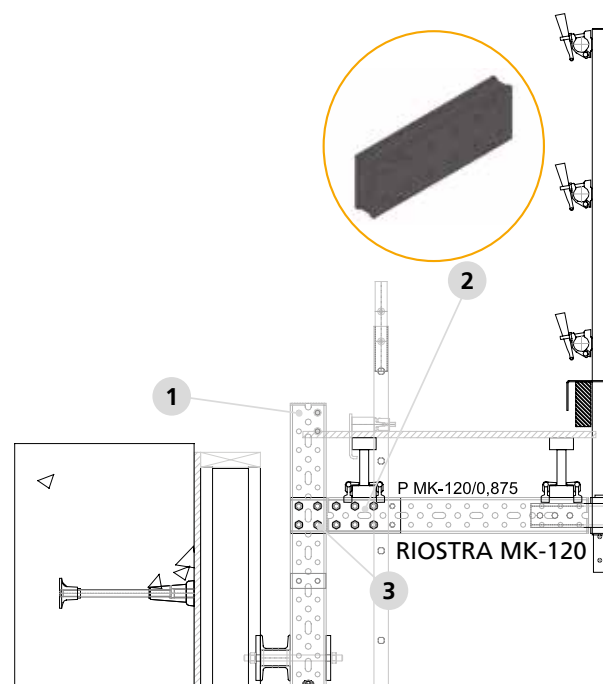


3.4.4 Pouring and upper intermediate platform

The assembly of the platform depends on the type of vertical waler used. In the case of the Waler MK-120 the "Axial Node M2-D20 MK" joins the platforms to the vertical waler with 4 "M16 x 90 Bolts" and 2 "E20 x 70 Pins". In the case of waler DU-120, the "Universal Head" is used, which joins the platforms to the vertical waler with 4 "Bolts E20 x 70". Another option with MK-120 is the "Orthogonal Joint MK" which is attached to the vertical waler using 12 "Bolt M16 x 90".



- 1 Vertical Waler MK-120
- 2 Axial Node M 2-D20 MK
- 3 4 Bolts M16 x 90 DIN-931-8.8
4 Nuts M16 DIN-985-8
- 4 2 Pin E20 x 70
2 Cotter Pin R/5

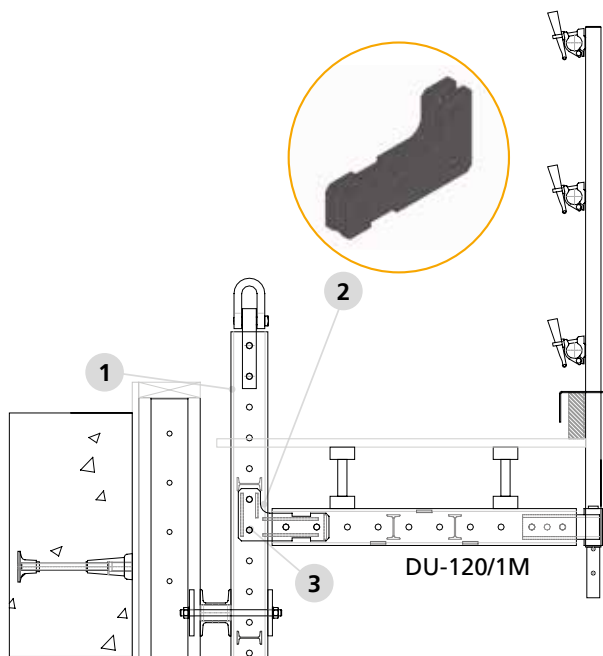


- 1 Vertical Waler MK-120
- 2 Orthogonal Joint MK
- 3 8 Bolts M16 x 90 DIN-931-8.8
8 Nuts M16 DIN-985-8

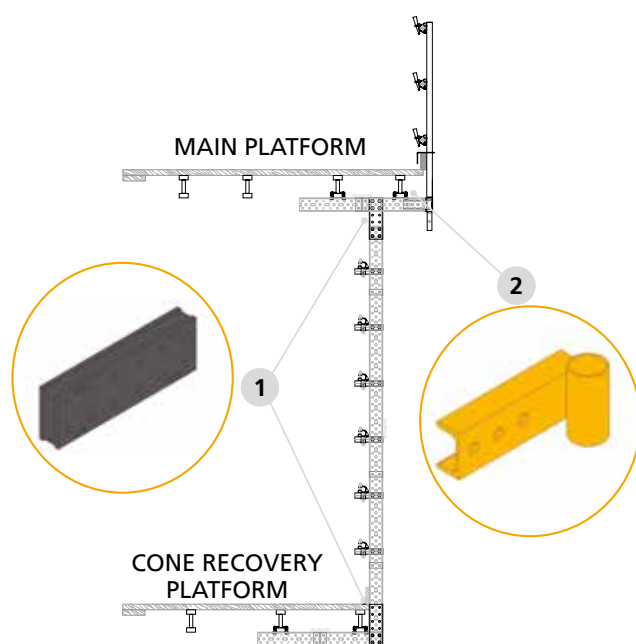
The longitudinal VM-20 beams are mounted on the walers and attached to it by the "Union RVM20 2T".

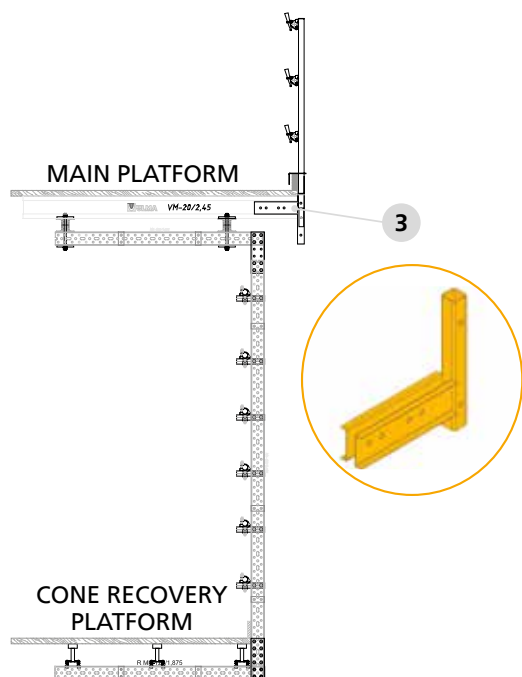
Cover with 27 mm three layer plywood, fixing it on the waler VM-20 clamp with "6 x 60 DIN-7505-A" screw.

3.4.5 Additional handrails



- 1 Vertical Waler DU-120
- 2 Universal Head
- 3 4 Pins E20 x 70
2 Cotter Pins R/5





- 1 Orthogonal Joint MK
- 2 Handrail Socket D50
- 3 VM Handrail Support

Assembly of false walers:

- Platform with longitudinal VM-20 timber beams: fixed through "Waler-RVM20 Clamp 2T".
- Platform with waler MK-120 longitudinal: fixed using "Clamp M20 x 330 (2P-150 x 150)".

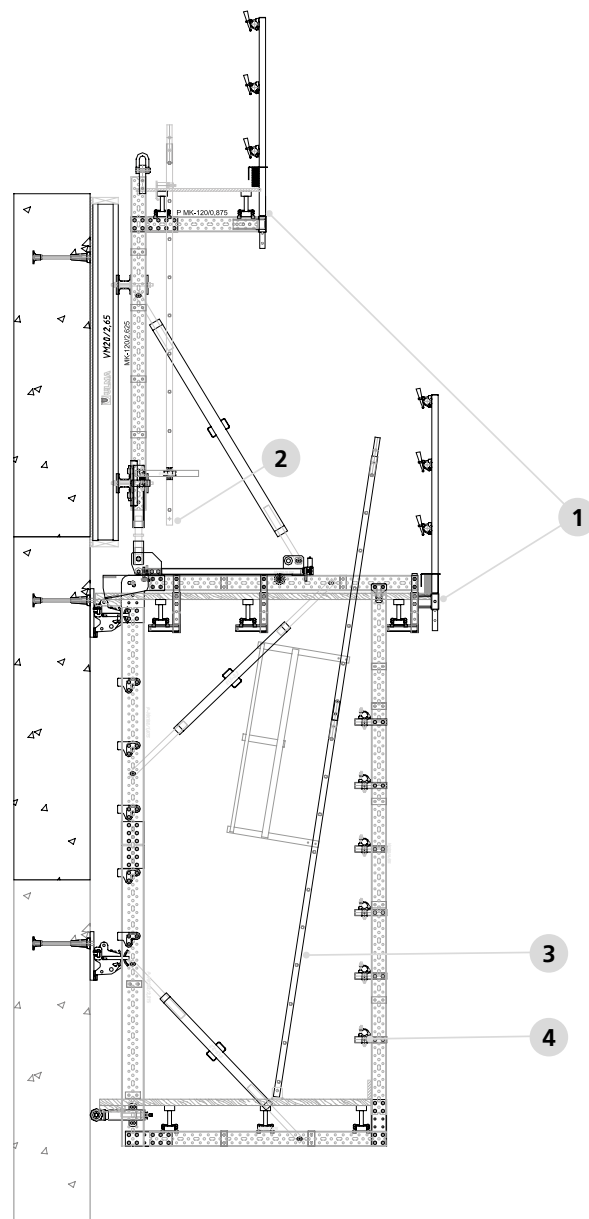
Additional "Handrail Post 1.5" Mounting:

- Platform with VM-20 longitudinal timber beams: it is placed on the "Handrail Socket D50" located at the end of the waler. The socket is fixed with 2 "Pins E20 x 70" and 2 "Cotter Pins R / 5".
- Platform with waler MK-120 longitudinal: it is placed on the "VM Handrail Support" attached to the "VM-20 Timber Beams" using 2 "Panel Bolt" and 2 "Hexagonal Nuts".

The additional waler is fixed between the 2 false walers (between main platform and cone recovery platform) using "Orthogonal Joint MK". Each joint is made of 8 "Bolts M16 x 90 DIN-931-8.8" and "Nuts M16 DIN-985-8".

3.5 LADDER AND HANDRAIL ASSEMBLY

The various ladder and handrail assemblies are detailed below.



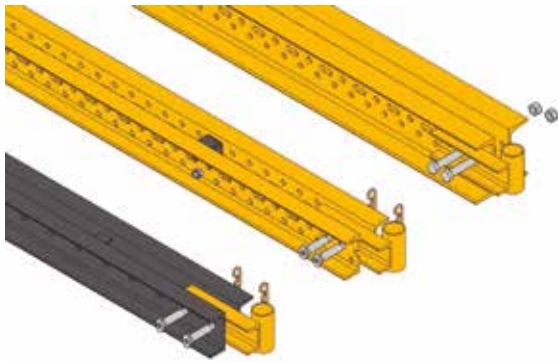
- 1 Platform Handrail
- 2 Formwork Ladder
- 3 Lower ladder
- 4 External Closure Handrail

3.5.1 Assembly of handrail in platform

First, the supports for the "Handrail Post 1'5" must be fixed on the corresponding walers or timber beams VM-20.

The fixation is done as follows:

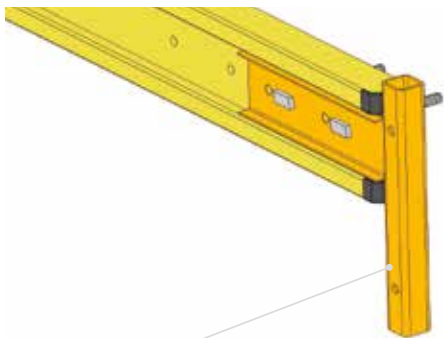
FIXING ON WALERS



HANDRAIL SOCKET D50

- Socket on the inside
2 Pins E20 x 70 and Cotter Pins R/5
- Socket on the outside
2 Bolts M20 x 100 DIN-931-8.8 and Nuts M20 DIN-985-8

FIXING ON VM-20 TIMBER BEAMS



VM Handrail Support



Support Panel Bolt + Hexagonal Nut 15

On these supports the corresponding "Handrail Post 1'5" is inserted and the mobile toe board is adjusted.

In the case of "Handrail Post 1.5" the handrail formed by "Ø 48 tubes" is fixed by means of the wedges that incorporate the handrail post. In case of "Handrail Post 1.5 wood" the handrail is formed by planks.



3.5.2 Assembly of handrail in external closure

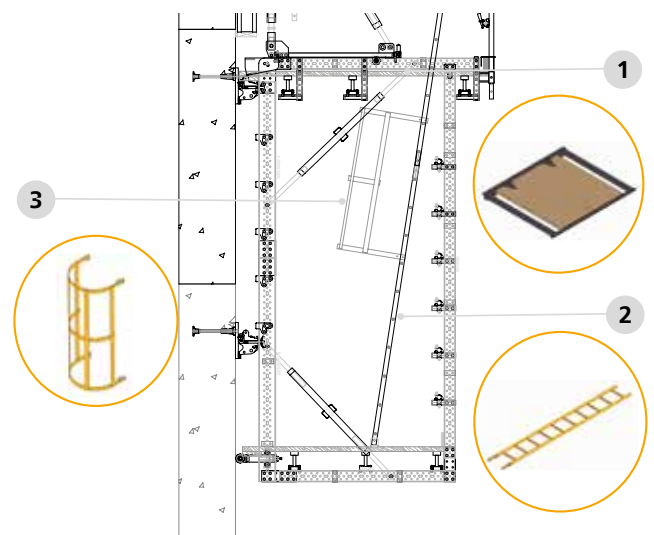
The external closure handrails formed by "Ø 48 Tubes" are fixed to the "Handrail Heads MK" located in the closures with "Right Angle Couplers 48/48":



- 1 Tube Ø 48
- 2 Handrail Head MK
- 3 Right Angle Coupler 48/48
- 4 2 Bolts M16 x 90 DIN-931-8.8
2 Nuts M16 DIN-985-8.8

3.5.3 Assembly of the access ladders

To save the height between different platforms, "Ladder C2.1" or "Ladder C3" are used, which can be used separately or connected to each other, according to the pouring height.

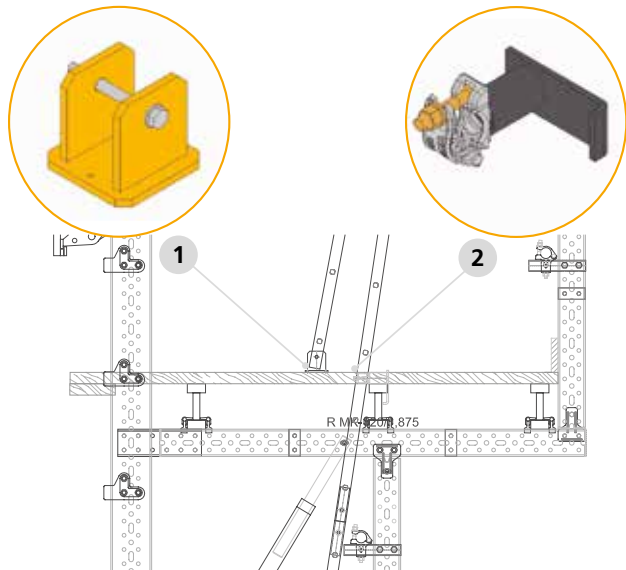


- 1 Ladder Hatch
- 2 Ladder C2.1
Ladder C3
- 3 Ladder Protection

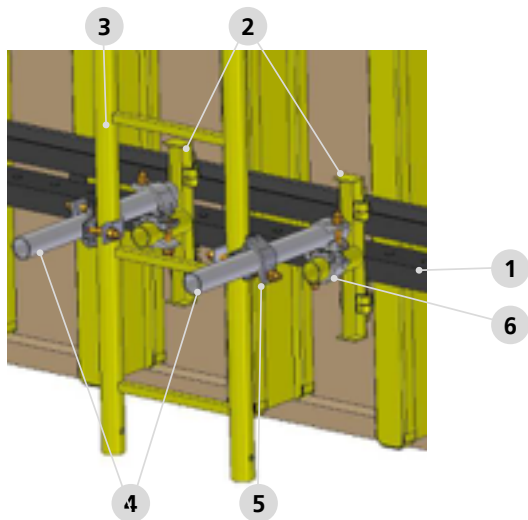
When the height is above 2.5 m, ladder protection must be placed.

The ladder hatch is nailed to the board of the working platforms to allow access between them. In case of realizing the trapdoors on site they use 2 "Hatch Hinges" and a "Hatch Handle".

The ladder at the bottom is attached to the platform using the "Ladder Fixer". In its upper part it is fixed by means of the "Ladder Hanger":



- 1 Ladder Fixer
- 2 Ladder Hanger



- 1 Waler DU
- 2 Simple Bracing
- 3 Ladder C2.1 or C3
- 4 Tube 48 x 0.5
- 5 Right Angle Coupler 48/48
- 6 Simple Bracing

The simple bracing is attached to the lower horizontal waler of the formwork. Couplers and tubes Ø 48 x 0.5 are used to join the ladder with the simple bracing.

3.6 ASSEMBLY OF THE STRUCTURE AND SETTING TO THE WALL

This section describes the steps to follow when assembling a rail climbing system.

The assemblies are as follows:

- RKS assembly with divided mast (one or two anchors per pouring height).
- RKS assembly with entire mast (one or two anchors per pouring height).
- * Due to the versatility of the system, assembly details will be specified on "assembly drawings" in each case.

3.6.1 RKS assembly with divided mast

The divided mast is used for the cases, which the execution of the wall is going to make from the first pouring height due to is not possible assembled the entire mast in the first pouring heights.

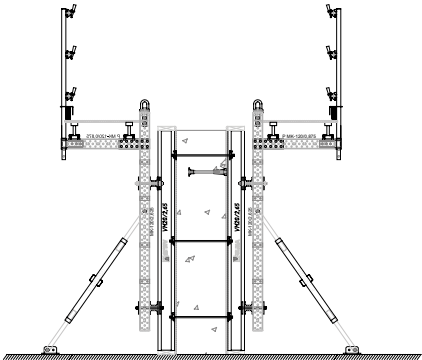
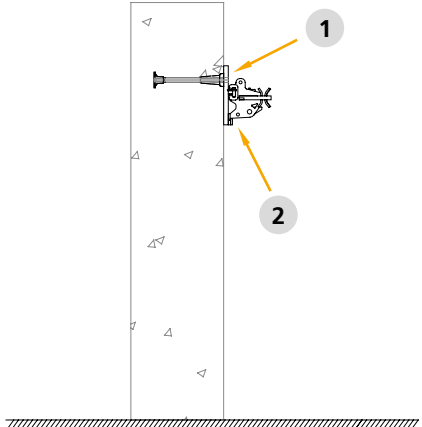

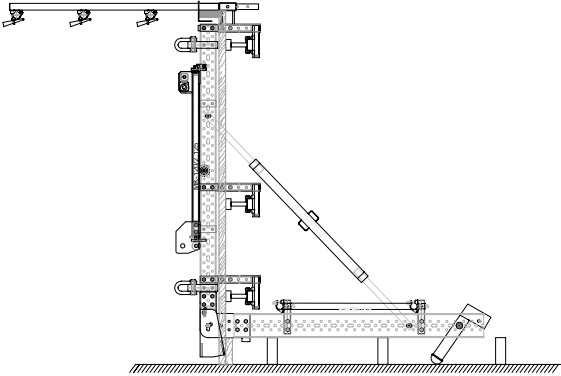

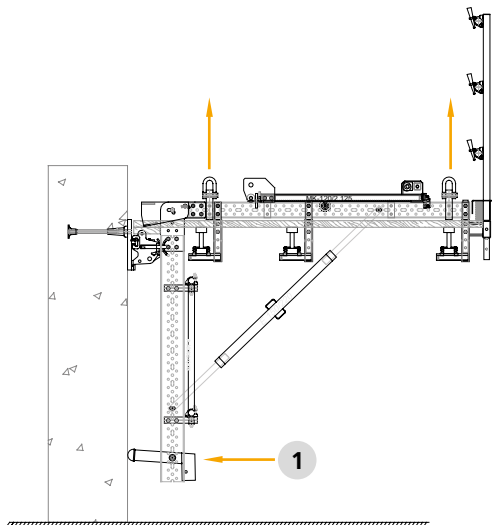
To do this, the assembly is performed in phases by placing on the first pouring the 1st part of the mast to which the 2nd part of the mast is added for the execution of the posterior pouring steps.

The divided mast is formed by combination of the following profiles length depending of the pouring height that is going to be realized:

COMBINATION PROFILES MK-180

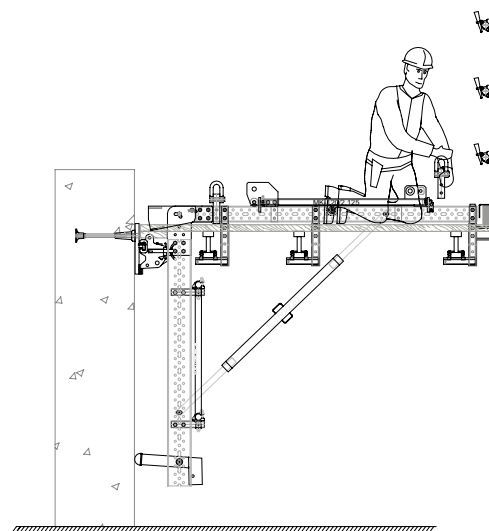
POURING HEIGHT (m)	ONE ANCHOR		TWO ANCHORS	
	1 ST PART	2 ND PART	1 ST PART	2 ND PART
2.70 m	1.875 m	2.375 m	1.875 m	2.375 m
3 m	2.375 m	2.375 m	1.875 m	2.375 m
3.50 m	2.375 m	2.875 m	1.875 m	2.375 m
4 m	2.875 m	2.875 m	2.375 m	2.375 m
4.50 m	2.875 m	3.125 m	2.375 m	2.875 m

The assembly process is described below.

STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
1	Assemble the corresponding formwork positioning the anchors. Pour the concrete.		
2	Strip and remove the formwork. Place the wall bracket LT HWS (1) into the cone and assemble the LT HWS head (2) on it with the claws opened.		
3	Assemble the different elements of the first part of the structure according to the "assembly drawings".  Place the section palely in the required distance and brace the structure with Ø 48 x 3 tubes. Perform the main platform and place the lifting hooks RKS.		
4	Lift the first part of the structure by means of the crane, place the structure over the LT HWS heads. Close the claws of the LT HWS heads.  Verify that the blocks of the mains support RKS are resting onto the pawls. Verify that the swinging shoe RKS (1) is correctly positioned.		

STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
------	-------------	---	--

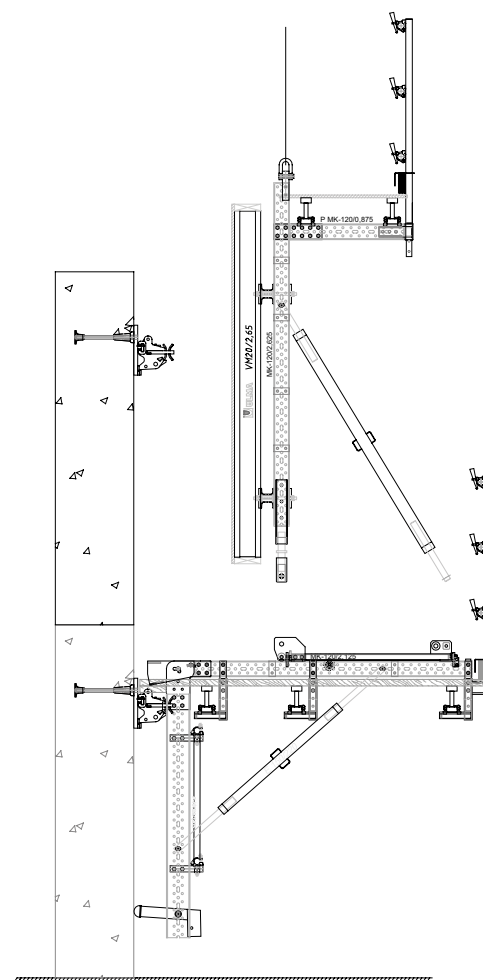
- 5 Remove the lifting hook RKS to the main platform.



- 6 Lift the formwork with the crane by means of the lifting hook RKS positioned in the vertical waler. Assemble the formwork to the stripping roll-back carriage MK-120 system and fastened with the corresponding pins.

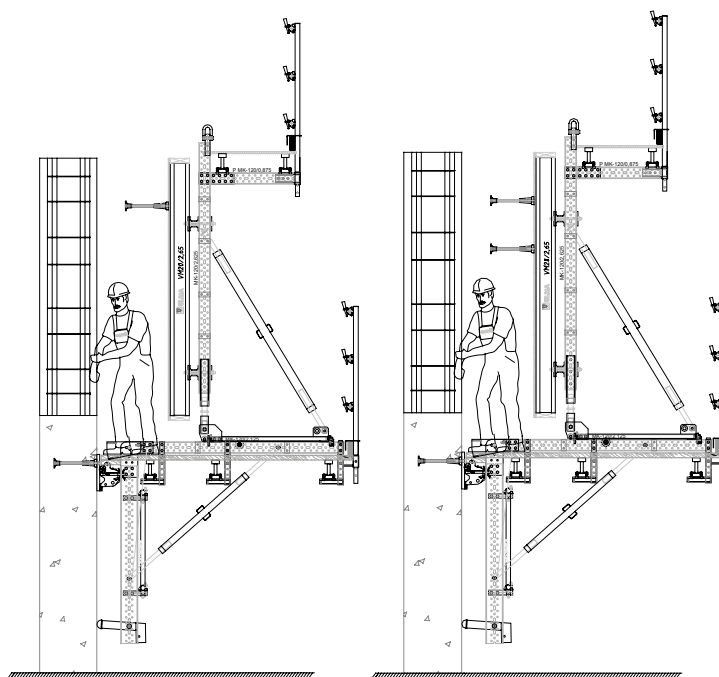


Verify that the stripping roll-back system is retracted and blocked by means of wedge locker and braking pin.

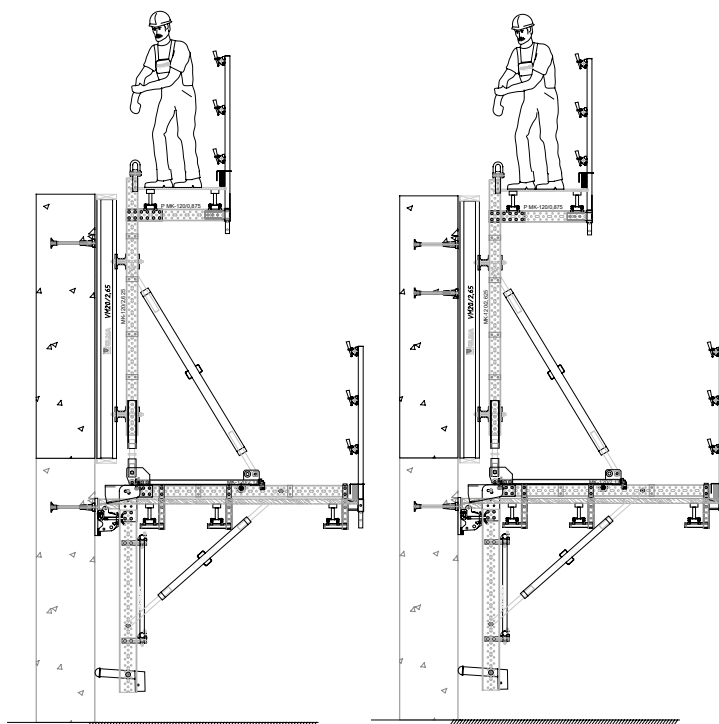


STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
------	-------------	---	--




- 7 Strip and retract the formwork to clean it applying release agent, steel reinforcement and place the anchors in the formwork.


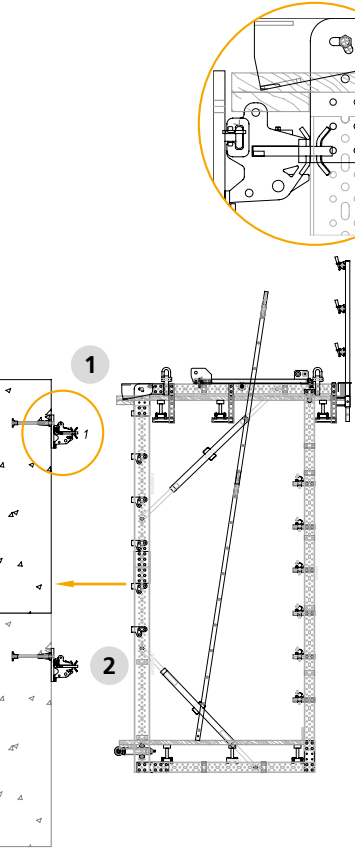
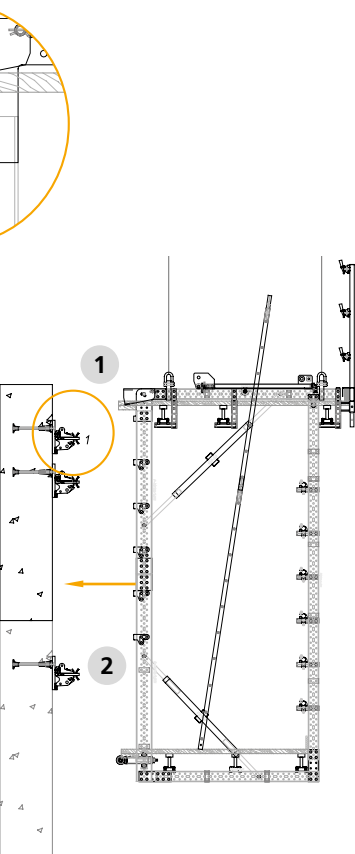
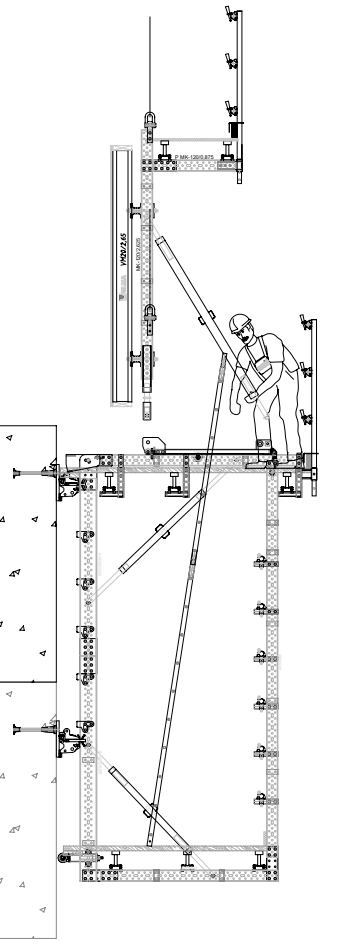
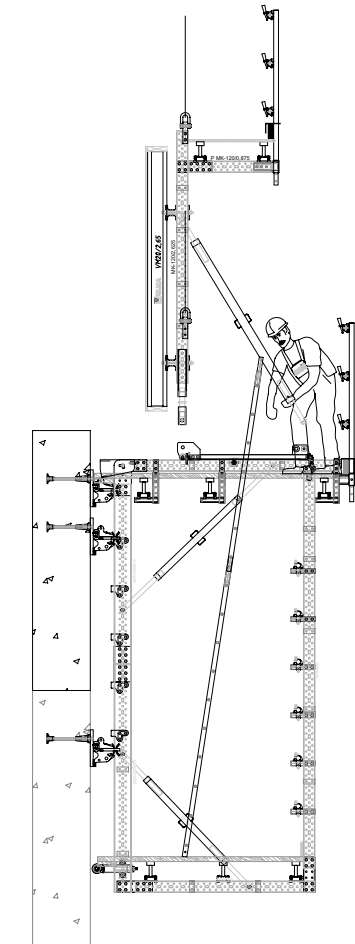


- 8 Approach the formwork to the wall, plumb with the help of the push-pull prop, level the formwork with the waler screw TR53 X 6 and lock the roll-back carriage system. Stay the formwork and pour the concrete.



STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
9	Strip and retract the formwork and lock the roll-back carriage system. Place the wall-brackets LT HWS and the heads LT HWS into the anchors of the wall executed before.		
10	Fix the crane slings in the lifting hook of the vertical waler, drop the formwork to the roll-back carriage system removing the pins and lift the structure to leave in a storage area.		

STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
11	Place the lifting hook RKS in the main platform and lift the structure withdrawing it from the wall.		
12	Assemble the cone recovery platform at ground level.  Verify that the selfclimbing block LT HWS are correctly positioned, oriented and the distance between them is the required one.		
13	Join the main platform with the rest of the structure assembled before by attaching the two parts of the mast (1). Finally place the rear waler MK-120 (2).  Verify that the self climbing block LT HWS are correctly positioned, oriented and the distance between them is the required one.		
14	 Joint the two parts ensuring the straightening of the mast. Acting to the lower push pull prop it is possible to achieve it.		

STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
15	<p>Lift the preassembled structure by crane. Approximate the block of the main support RKS to the head LT HWS's pawl.</p> <div data-bbox="258 383 365 479">  </div> <p>Verify that the blocks of the main support RKS are resting onto the pawls and close the head LT HWS's claws (1). Close the bottom head LT HWS's claws (2).</p>		
16	<p>Lift the formwork with the crane by means of the lifting hook positioned in the vertical waler.</p> <p>Assemble the formwork to the stripping roll-back carriage MK-120 system and fastened with the corresponding pins.</p>		

3.6.2 RKS assembly with entire mast

The entire mast is used when the height of the wall realized before by other systems is enough to place the entire structure RKS, eliminating the necessity to put any joint element.

The MK-180 profiles for creating the mast for certain type heights are shown below:

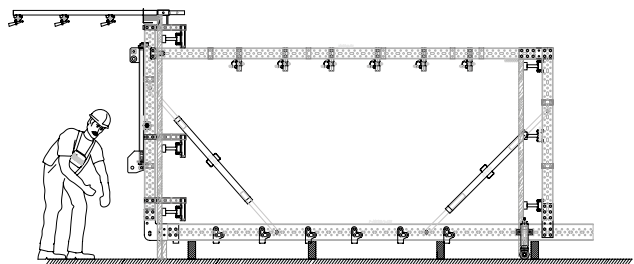
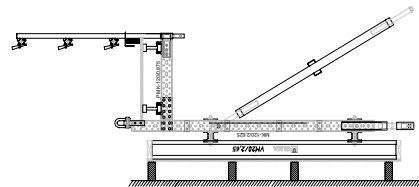
PROFILES MK-180		
POURING HEIGHT (m)	ONE ANCHOR	TWO ANCHORS
2.70 m	4.625 m	3.625 m
3 m	4.625 m	3.625 m
3.50 m	5.625 m	4.625 m
4 m	5.625 m	4.625 m
4.50 m	6.625 m	5.625 m

STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
------	-------------	--------------------------------------	---------------------------------------

- 1 Assemble the formwork at ground level.
Assemble the structure at ground level.



Verify that the self climbing block LT HWS are correctly positioned, oriented and the distance between them is the required one.

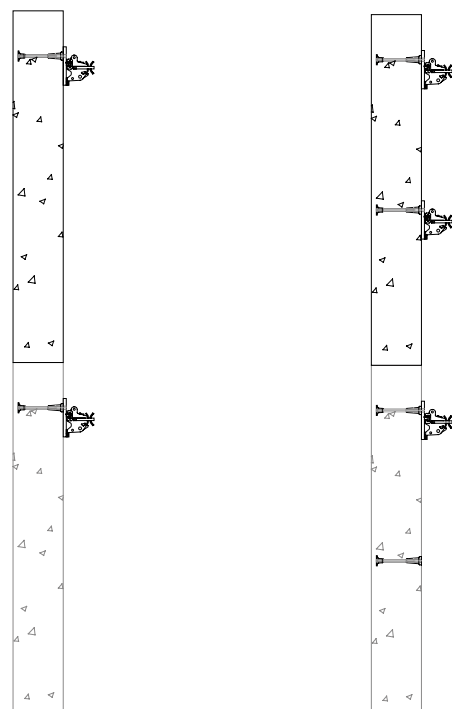


- 2



Placement of the anchors on the wall in the needed position shall be foreseen for assemble the structure in the wall.

Open the claws of the head LT HWS.



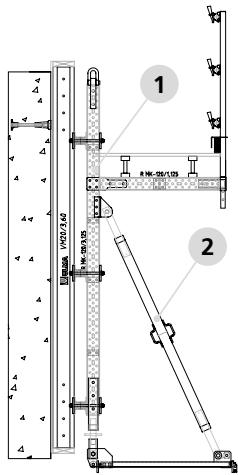
STEP	DESCRIPTION	SCHEME ONE ANCHOR PER POURING HEIGHT	SCHEME TWO ANCHORS PER POURING HEIGHT
3	<p>Lift the preassembled structure by crane. Approximate the block of the main support RKS to the head LT HWS's pawl.</p> <div data-bbox="252 371 360 468"> </div> <p>Verify that the blocks of the mains support RKS HWS are resting onto the pawls and close the head LT HWS's claws (1). Close the bottom head LT HWS's claws (2).</p>		
4	<p>Lift the formwork with the crane by means of the lifting hook positioned in the vertical waler.</p> <p>Assemble the formwork to the stripping roll-back carriage MK-120 system and fastened with the corresponding pins.</p>		

3.7 FORMWORK PANELS CONNECTION

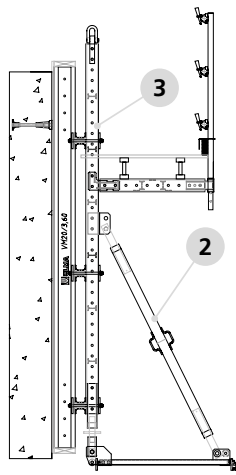
There are different types of panels that can be used with the RKS.

3.7.1 Vertical waler assembly

The vertical walers are the elements that support the formworks on which the pouring platform and the upper intermediate platform are mounted. It is normally made up by "Walers MK-120", although the "DU-120" can also be used.



ENKOFORM VMK
WITH MK-120
VERTICAL WALER



ENKOFORM VMK
WITH DU-120
VERTICAL WALER



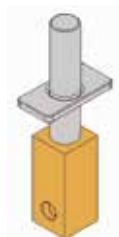
It is also possible ORMA+horizontal DU-100 walers

- 1 Vertical Waler MK-120
- 2 Push pull prop
- 3 Vertical waler DU-120

Coming up next there is a brief explanation of the main elements forming the vertical waler and its assembly.

• Waler-screw assembly

The "Waler-Screw Assembly", located at the bottom of the vertical waler, is used to fine-tune the formwork and to correctly perform the overlaps against the wall. By means of the corresponding screw bracket (depends on the type of vertical waler) the vertical waler is connected to the roll-back carriage.



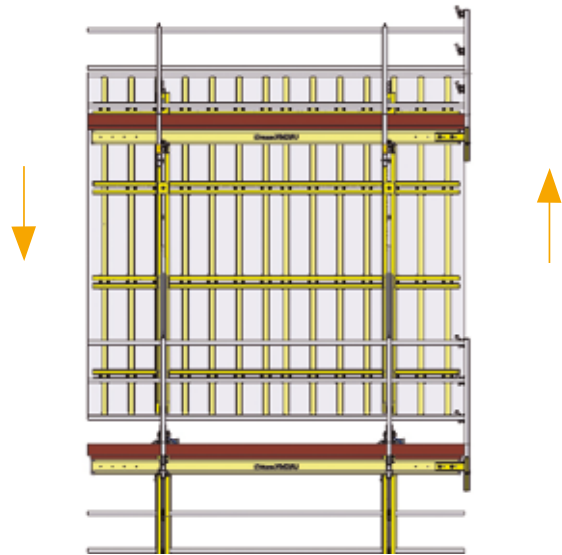
WALER SCREW
TR53 X 6



WALER MK-120
SCREW BRACKET

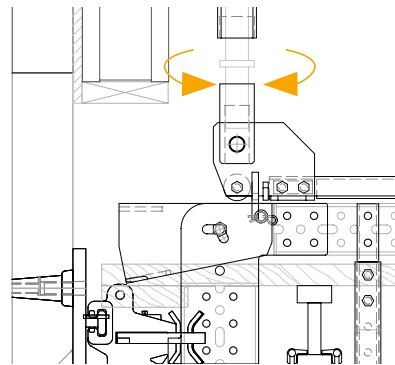


WALER SCREW
BRACKET TR53 X 6



Turning the spindle achieves this vertical adjustment (± 100 mm) of the vertical waler (in one direction or the other). To facilitate manual manipulation of the waler screw, the "Handle Screw TR53" is used.

In case of MK vertical waler, the joint between these elements is made as shown in the next picture:



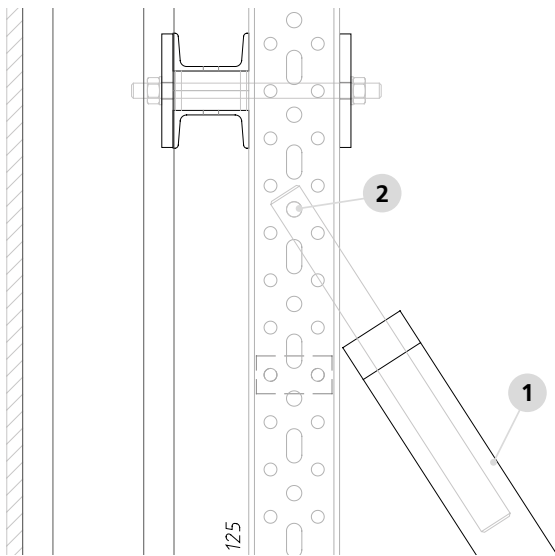
in case of Vertical Waler DU-120 use:

- * 3 Bushings D40 D20 L47
- * 3 Bolts M18 x 120 DIN-931-8.8
- * 3 Nuts M18 DIN-934-8
- * 6 Washers A18 DIN-125

- 1 Waler-Screw TR53 x 6
- 2 1 Pin D32 x 150
- 3 1 Cotter Pin R/5
- 4 Handle Screw TR53
- 5 Waler MK-120 Screw Bracket
- 6 3 Pin w/head D20 x 100
- 7 3 Cotter Pin R/5

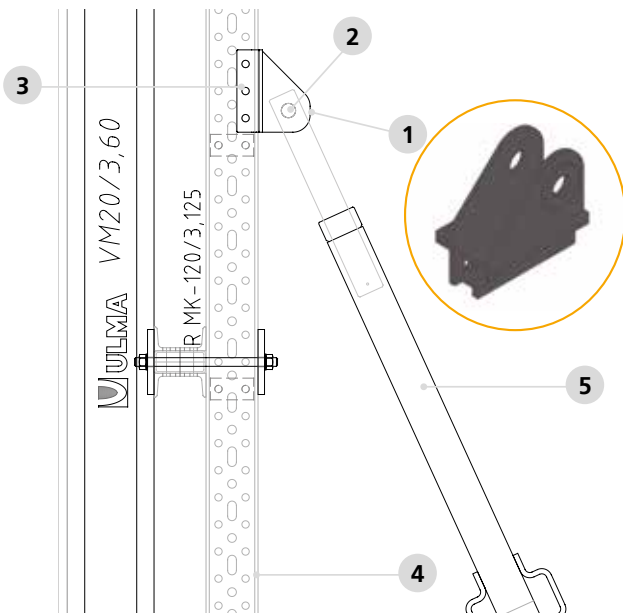
• Push-pull prop to vertical waler joint

The vertical waler is stabilized by means of a "Push Pull Prop E" placed between the vertical waler and the roll-back carriage. If the loads do not exceed the use loads of the push pull prop E the joint is made directly by means of one pin E20 x 70.

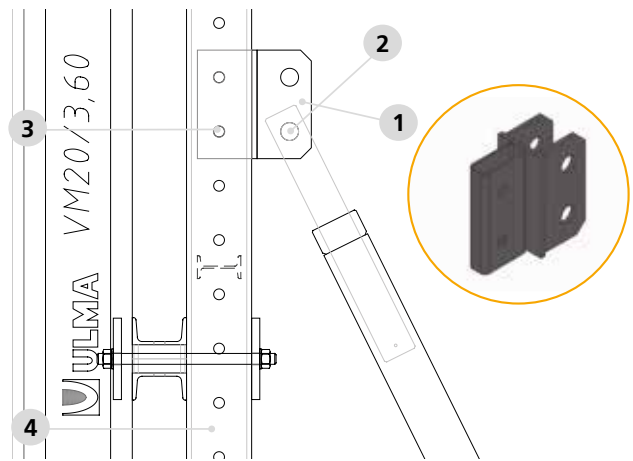


- 1 Push-pull prop E
- 2 Pin E20 x 70
Cotter R/5

The "TR 63 x 6 Tensors" are used in case of higher loads. They are joined to the vertical waler MK-120 using the "Push Pull Prop Head MK-120". In the case of DU-120 vertical waler it is realized by means of the "Push Pull Waler Head" with the vertical waler DU-120.



- 1 Push-Pull Prop Head MK-120
- 2 Pin D32 x 150 + Cotter Pin R/5
- 3 3 Bolts M16 x 90 DIN-931-8.8
- 4 Vertical waler MK-120
- 5 Push-pull TR 63 x 6

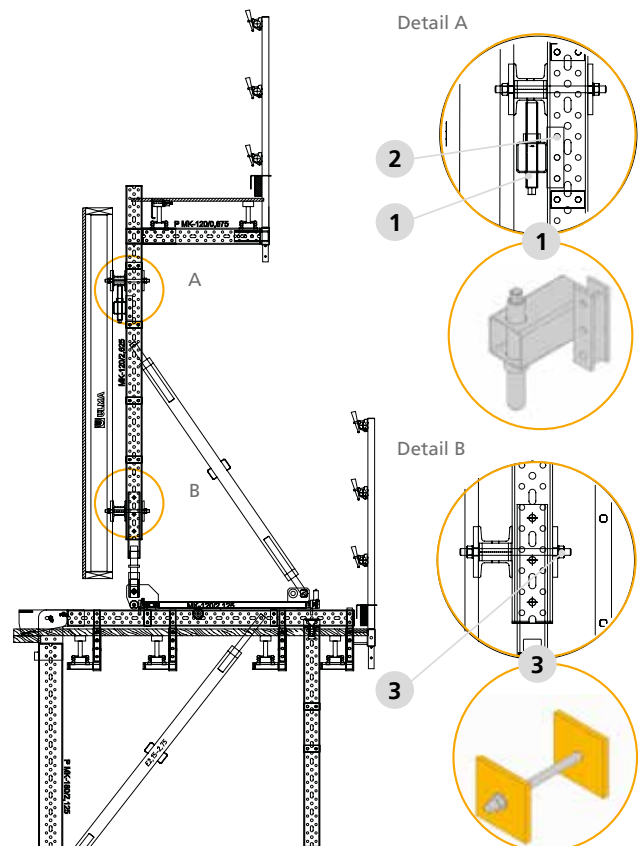


- 1 Push-Pull Waler Head
- 2 Pin D32 x 150 + Cotter Pin R/5
- 3 2 Pins E20 x 70
2 Cotter Pins R/5
- 4 Vertical Waler DU-120

3.7.2 ENKOFORM V-100 and ENKOFORM VMK panels

The connection between the panel and the vertical walers is obtained with the clamp M20 x 330 (2P-150 x 150).

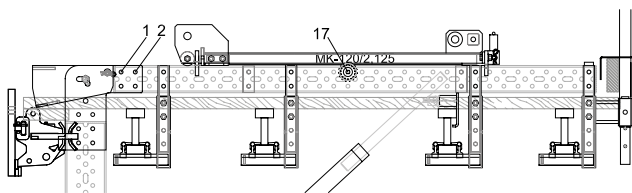
Is recommended put an adjustment jack in one horizontal waler in order to withstand the weight of the formwork.



- 1 Adjustment Jack MK-120
- 2 2 Bolts M16 x 90 DIN-931-8.8
2 Nuts M16 DIN-985-8
- 3 Clamp M20 x 330

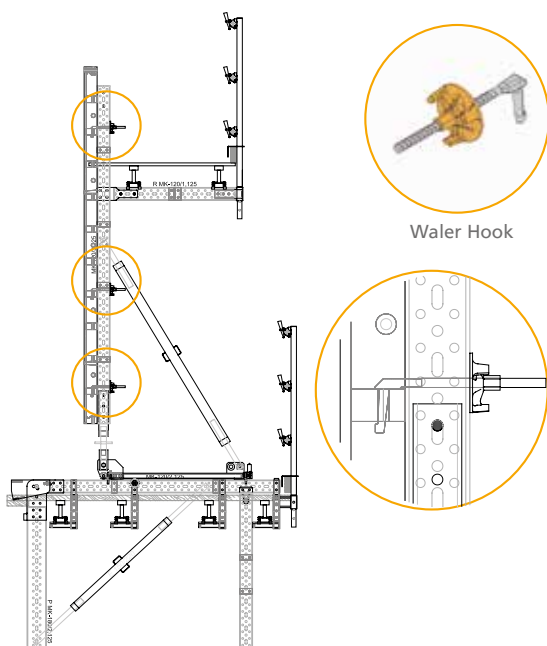


The **position of the gear** of the roll-back carriage MK-120 system upon the horizontal waler MK-120 is very important to ensure its correct range of movements. In ENKOFORM panels, it will be in position 17 (uphole of Ø 17):



3.7.3 ORMA panel assembly

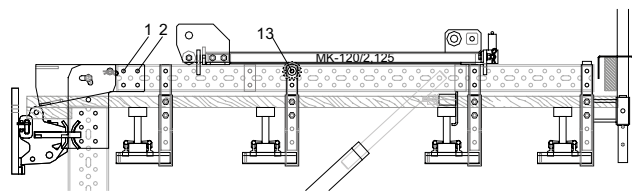
When ORMA panel is in direct contact with the vertical walers, the waler hook is used attached to the holes of the panel ribs.



Waler Hook

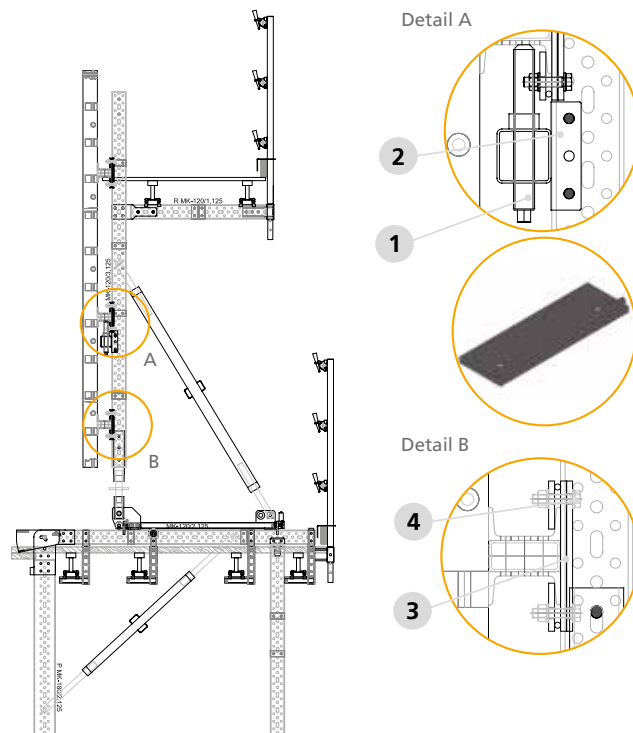


The **position of the gear** of the roll-back carriage MK-120 system upon the horizontal waler MK-120 is very important to ensure its correct range of movements. On ORMA panels over walers, it will be in position 13 (uphole of Ø 17):



3.7.4 ORMA panel + horizontal waler (MK-120, DU-100 DU-120) assembly

In the case, that horizontal walers (MK-120, DU-120 O DU-100) are placed between the ORMA panel and the climbing structure, the connection with the vertical walers is obtained with plate clamps DU-DU (4 per each connection) fastened with bolts between each other and adjustment jacks MK-120.



1 Adjustment Jack MK-120

2 2 Bolts M16 x 90 DIN-931 8.8
2 Nuts M16 DIN-985-8

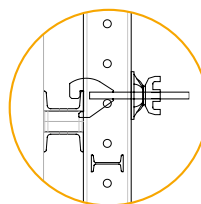
3 4 Plate Clamps DU-DU

4 4 Bolts M16 x 70 DIN-933-8.8
4 Nuts M16 DIN-934-8
8 Washers A16 DIN-125

If a waler DU-100 is used as horizontal waler, the waler fixing hook can also be used for the connection between the vertical and the horizontal waler.



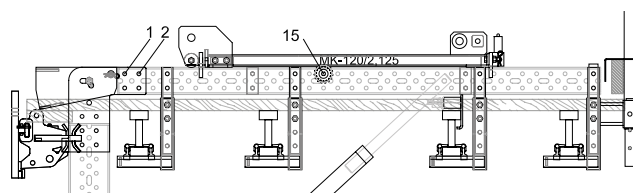
The Waler Fixing Hook can **ONLY** be used with the horizontal Waler DU-100, NOT with the DU-120 or MK-120.



Waler Fixing Hook

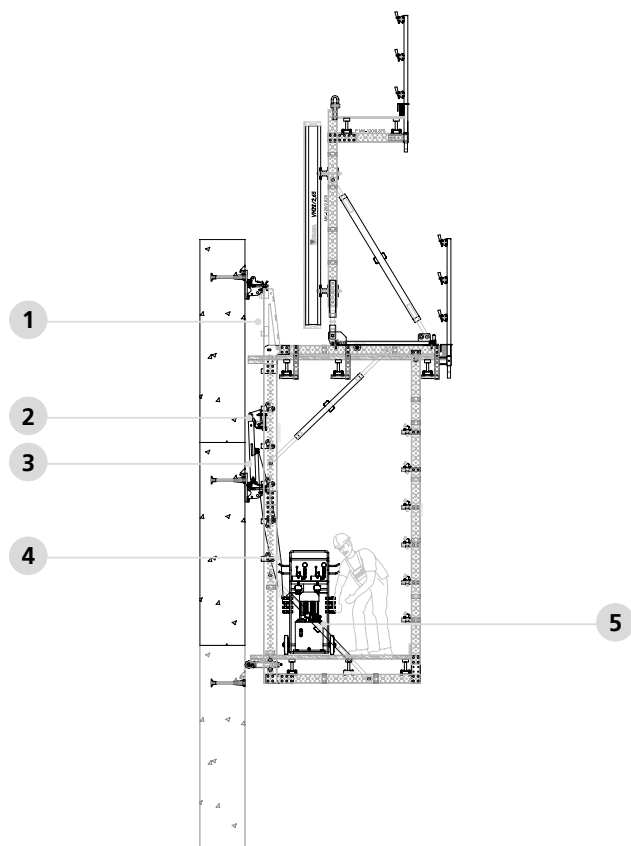


The **position of the gear** of the roll-back carriage MK-120 system upon the horizontal waler MK-120 is very important to ensure its correct range of movements. On ORMA panels over horizontal walers, it will be in position 15 (uphole of Ø 17):



3.8 ASSEMBLY OF THE HYDRAULIC CLIMBING SYSTEM

The hydraulic system in charge of lifting the climbing sets consists of the following elements:

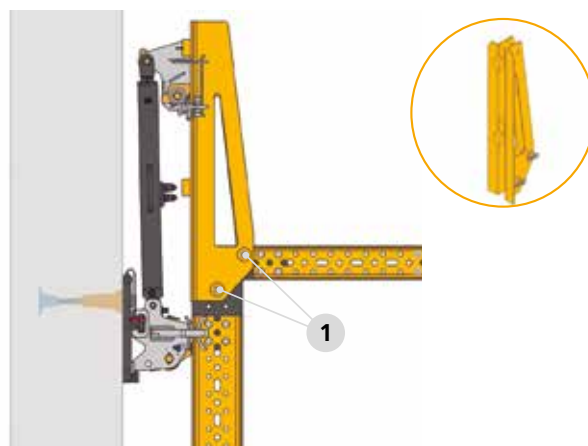
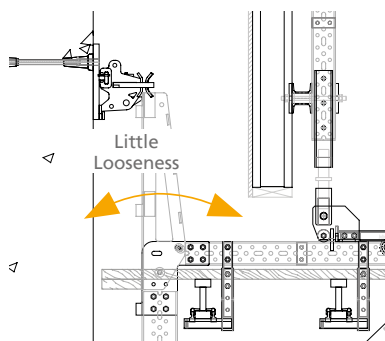


- 1 Initial Pushing Mast RKS
- 2 Climbing Head HWS
- 3 Cylinder HWS
- 4 Hoses
- 5 Hydraulic Power Unit HWS

3.8.1 Initial pushing mast RKS

During the hydraulic climbing phase, is fixed to the "Main Support RKS" by means of two bolts D20 x100 (included in the element). Once fixed it is prepared to push the RKS structure during the initial phase of climbing.

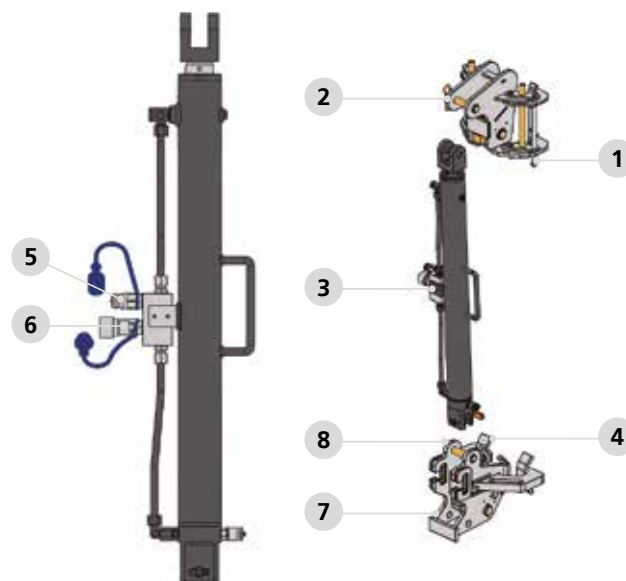
The element will have a small looseness that will facilitate threading the next head on hold.



- 1 2 Pins w/head D20 x 100
2 Cotter Pins R/5

3.8.2 Cylinder HWS

It is placed on a bolt incorporated in the LT HWS head and a "lower fixer pin" prevents from leaving its position. At the top the climbing head HWS (bolt D20 x 100 incorporated) is mounted.

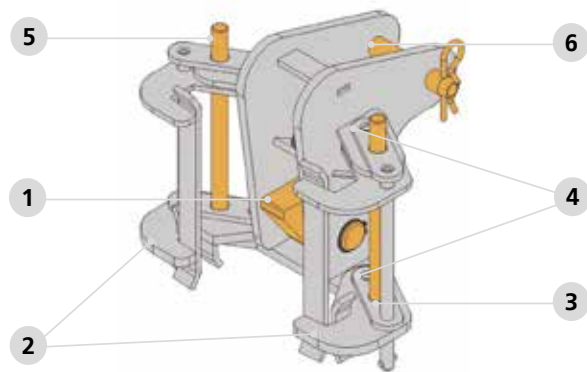


- 1 Climbing Head HWS
- 2 Cylinder-Climbing Head Connection Pin
- 3 Cylinder HWS
- 4 Bottom Fixing Pin
- 5 Fast male connection
- 6 Fast female connection
- 7 Head LT HWS
- 8 Cylinder-Head Connection Pin

3.8.3 Climbing head HWS

It is the element that exerts the force during the lifting process. To do this, the hydraulic cylinder is fixed to the upper part; the rotating claws are opened and inserted into the mast's guiding wings. Once the position of the claws is blocked the head is ready to lift the mast.

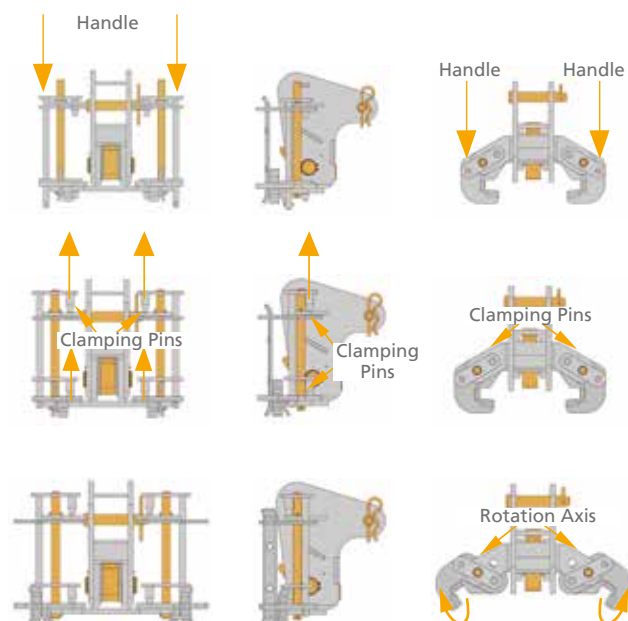
In the following image we see the main elements of a climbing head:



- | | |
|----------------|-------------------------------------|
| 1 Pawl | 4 4 Clamping Pins |
| 2 Swivel claws | 5 2 rotation axis |
| 3 2 Handles | 6 Hydraulic Cylinder Connection Pin |

The claws are responsible for guiding the climbing head during its movement on the mast. They rotate allowing you to remove or fix them from the mast.

Next images show the opening and locking operations of the claws:



To open the claws, the head is held by its two handles, raise the 4 clamping pins at the same time unlocking the claws and finally the claws are opened by turning with respect to the axis. To close the claws and lock them, the opposite process is performed.

The pawl, transmits the climbing force to the Mast, pushes the blocks during the extension of the cylinder allowing the free movement during the recovery.



Always check the correct operation of the pawl before assembling the climbing head on the mast. To do this, push the pawl with your finger and check that the release returns to its working position.

3.8.4 Power unit-cylinder hydraulic assembly

Once the cylinders are in place you will be connected to the hydraulic group using hydraulic hoses with quick connections. The group can be connected to 2 or 4 cylinders through its 4 outputs.

Different items with quick connect couplings are used to make all the necessary hydraulic connections:

- Output Line: Male Hose 7 m HWS
- Return Line: Female Hose 7 m HWS
- Bypass (only with 2 cylinder connection): Hose 1 m HWS (Male-Female)



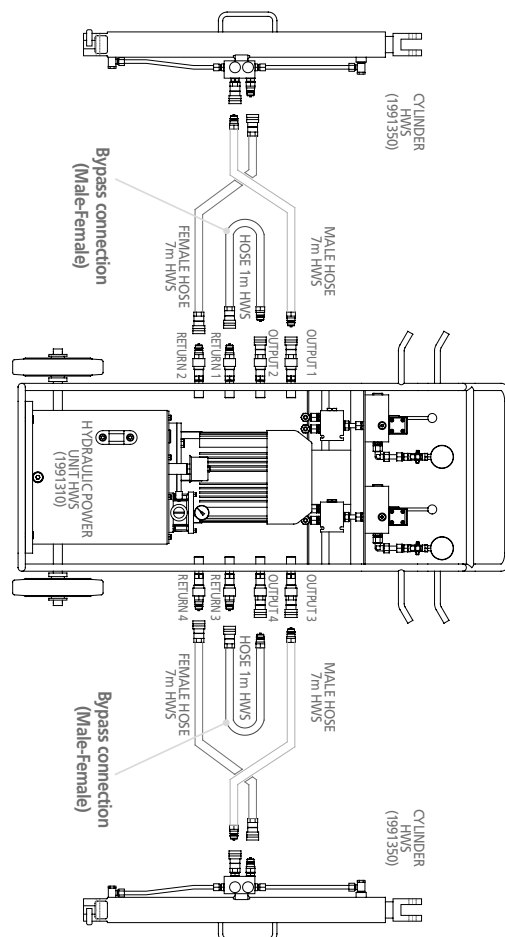
DO NOT USE this hydraulic system in cases where there is risk of exceeding the limit of 50 kN per cylinder. The couplers of the hoses must be protected with their "caps" when they are disconnected.

Hydraulic Power Unit HWS (1991310)

There are 2 possible connection types:

- **2 Cylinders connection**

This connection type enables an independent control of the cylinders.





In this type of connection a bypass connection must be done in order to close the hydraulic circuit.

This connection must be done by a Hose 1 m HWS provided by quick connection couplings male-female.

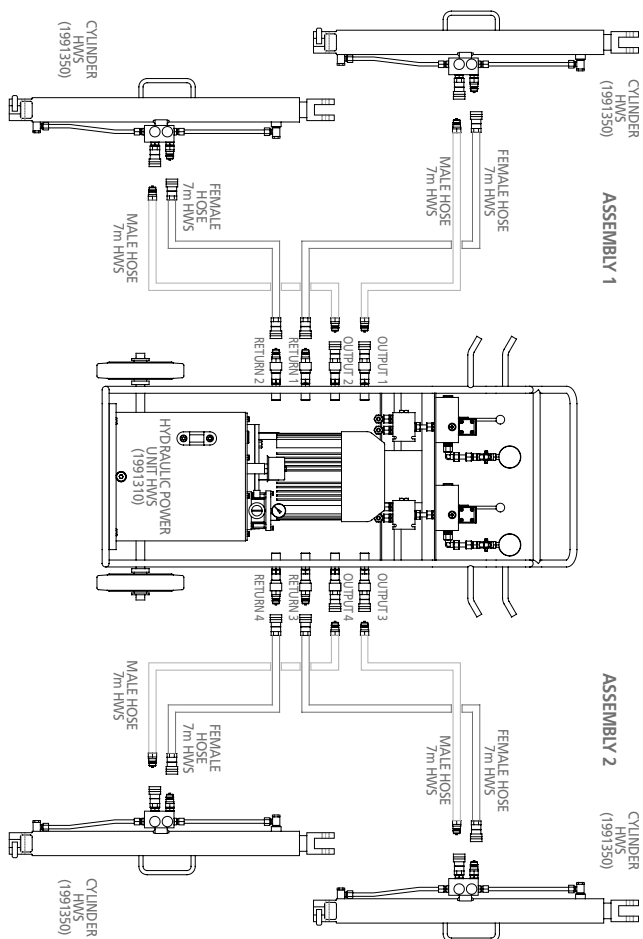


For further information consult the "User Guide – Hydraulic Lifting System HWS-RKS".

• 4 Cylinders connection

This connection type permits activating 4 cylinders "in pairs". One handle of the PU controls 2 cylinders connected to output 1, and the second handle the other cylinders connected to output 2.

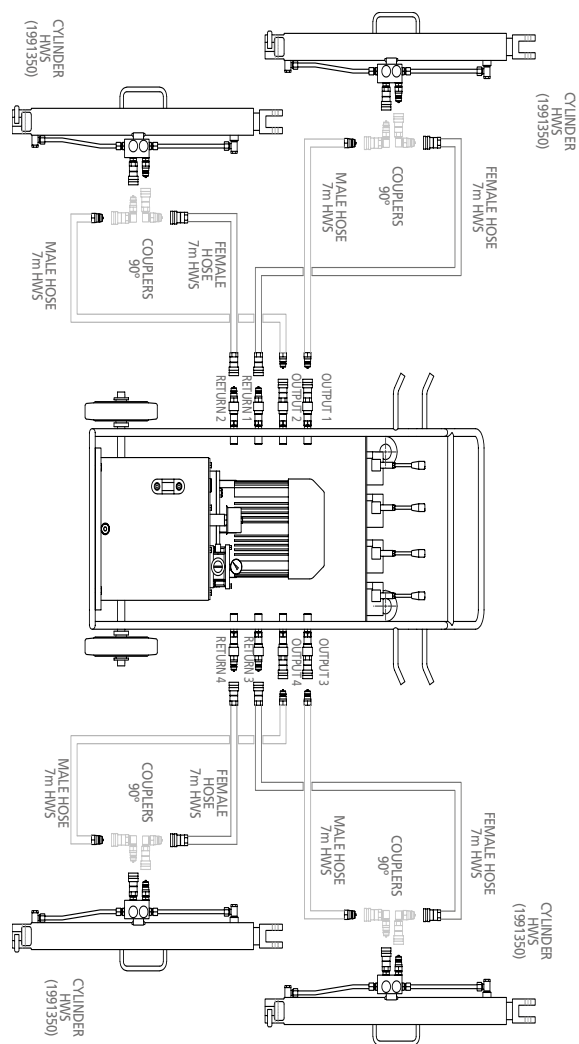
4 CYLINDERS CONNECTION RKS



Hydraulic Power Unit HWS 4P (1992275)

• Hydraulic Connections with 4 Cylinders

The cylinders (from 1 to 4) are connected independently. No need of by-pass connections in case or not connecting one cylinder. Each one of them is controlled by one handle.



3.9. HYDRAULIC SYSTEM SET UP

Before any system lifting, the following instructions must be taken into account:

3.9.1 Pumps and engines

Once all the necessary power connections are done, an engine start and stop must be done in order to ensure the engine's spinning direction, which is indicated on the casing.

3.9.2 Maximum pressure valve

Verify at the pressure gauge that the hydraulic power unit maximum pressure is 180 bar.

3.9.3 Electrical characteristics of the hydraulic system

It must be verified that the voltage of the supply connection corresponds to the power unit specifications.

MARKET	VOLTAGE (V)	FREQUENCY (Hz)	POWER (KW)	PLUG TYPE
EUROPE	360 V-440 3f	50	5.5	16 A 3P+T
USA	425 V-500 3f	60		



For further information consult the "User Guide – Hydraulic Lifting System HWS-RKS".

3.10. USE

3.10.1 Hydraulic lifting process

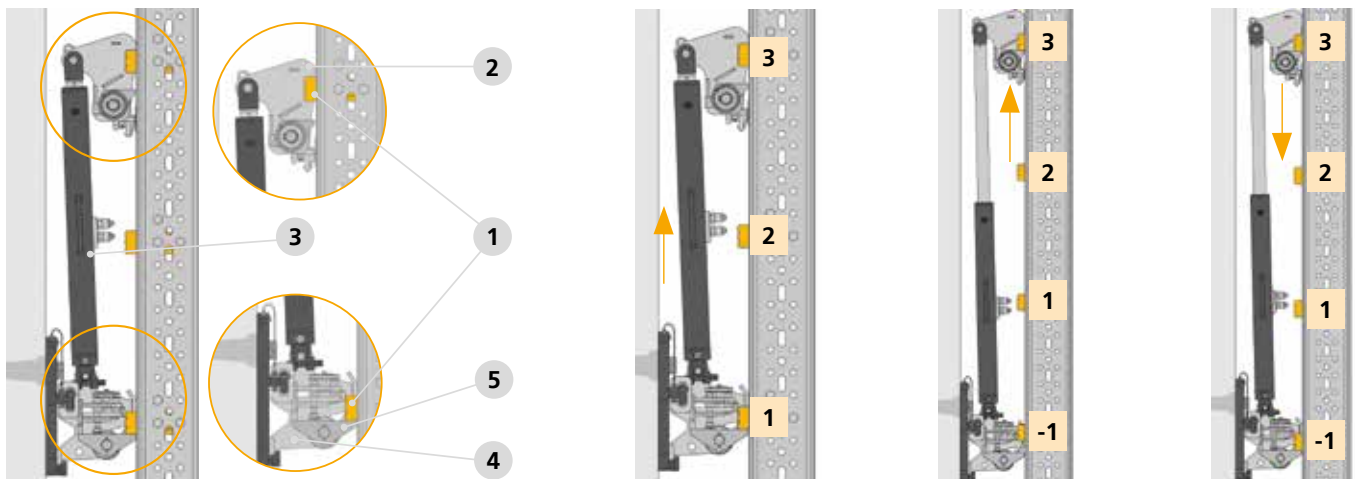
The RKS system can be lifted up hydraulically by using all the following elements: Masts, climbing heads HWS, cylinders HWS and power unit HWS.

The climbing head HWS is connected to the upper end of the hydraulic cylinder and is guided along the mast.

Hydraulic cylinders transmit the necessary load to lift up the assembly through the climbing heads HWS. The force of the cylinder is transferred to the mast through the contact between the mast's self-climbing blocks LT HWS and the pawl of the climbing heads HWS.

The main elements taking part in one cycle of the cylinder of the climbing process are shown below in

- 1 Self-Climbing Block LT HWS
- 2 Climbing Head HWS
- 3 Cylinder HWS
- 4 Head LT HWS
- 5 Pawl



Before any system lifting, the following instructions must be taken into account:

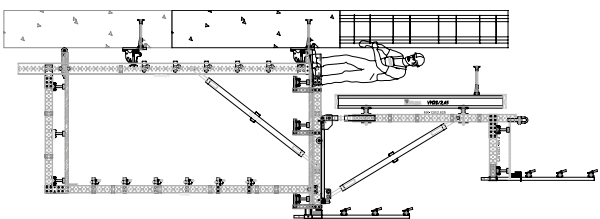
- Ensure that all contact surfaces between **masts and climbing heads** are **clean and greased** in order to ease the movement between them.
- Supervise that every hydraulic connection is correct.
- Verify that the **initial pushing mast RKS** is in a lifting position, that it can **swing correctly** respect its axis of rotation and **is properly greased**.
- Verify that the self climbing block LT HWS are correctly positioned, oriented and the distance between them is the required one.
- Verify that the structure to be lifted does not put in danger any person nearby.

- Verify that the structure to be lifted will not interfere with any object during the climbing process and does not snag with any possible existing structure nearby.
- Ensure that all lateral accesses to platforms are closed avoiding any accidental fall.
- Worker assistance is required at all times during lifting movements in order to check the cylinders, the brackets and the Heads LT HWS under control and act on them when necessary.
- Workers must know and control that every climbing step described is correctly carried out.

At the end of the lifting process it must be verified:

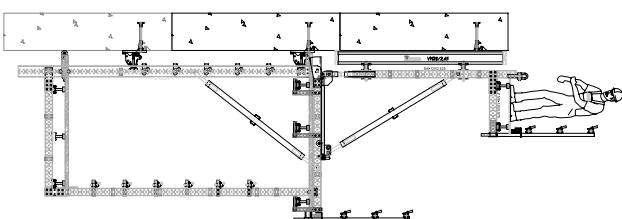
- The main support RKS block rest onto the head LT HWS's pawl.

STRUCTURE WORKING STEPS ONE ANCHOR PER POURING HEIGHT



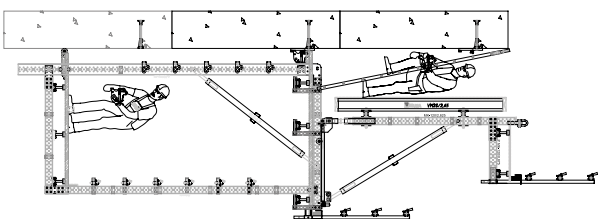
Reinforcement

- Stripping the roll-back carriage MK-120.
- Perform the steel reinforcement work from the main platform.



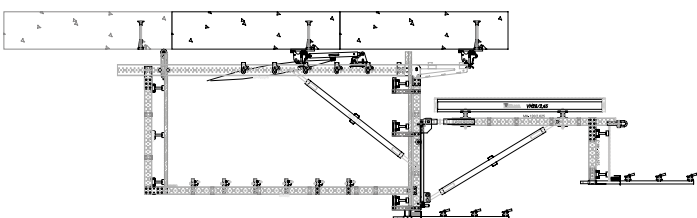
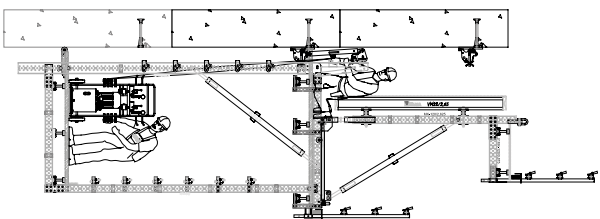
Pouring

- Plumb and lock the formwork.
- Stay the formwork.
- Pouring the concrete from the pouring platform.



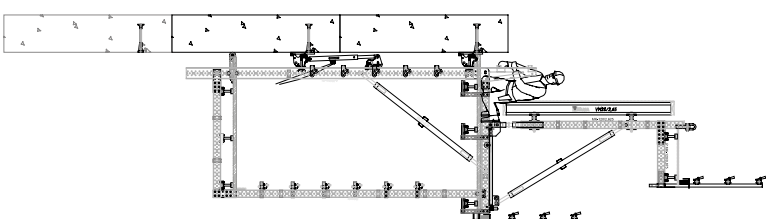
Lifting preparation

- Stripping and lock the formwork.
- Recover the lower anchor using the mast shoe RKS to release it.
- Placing anchors on hold.
- Place the cylinders HWS and climbing head LT HWS.
- Connect the power unit with the cylinders HWS.
- Place the initial pushing mast RKS in a climbing position.



Lifting

- Start lifting the structure.



Reinforcement preparation

- Disconnect and collect all connections.
- Remove the initial pushing mast RKS.
- Place the additional profile RKS in working position.

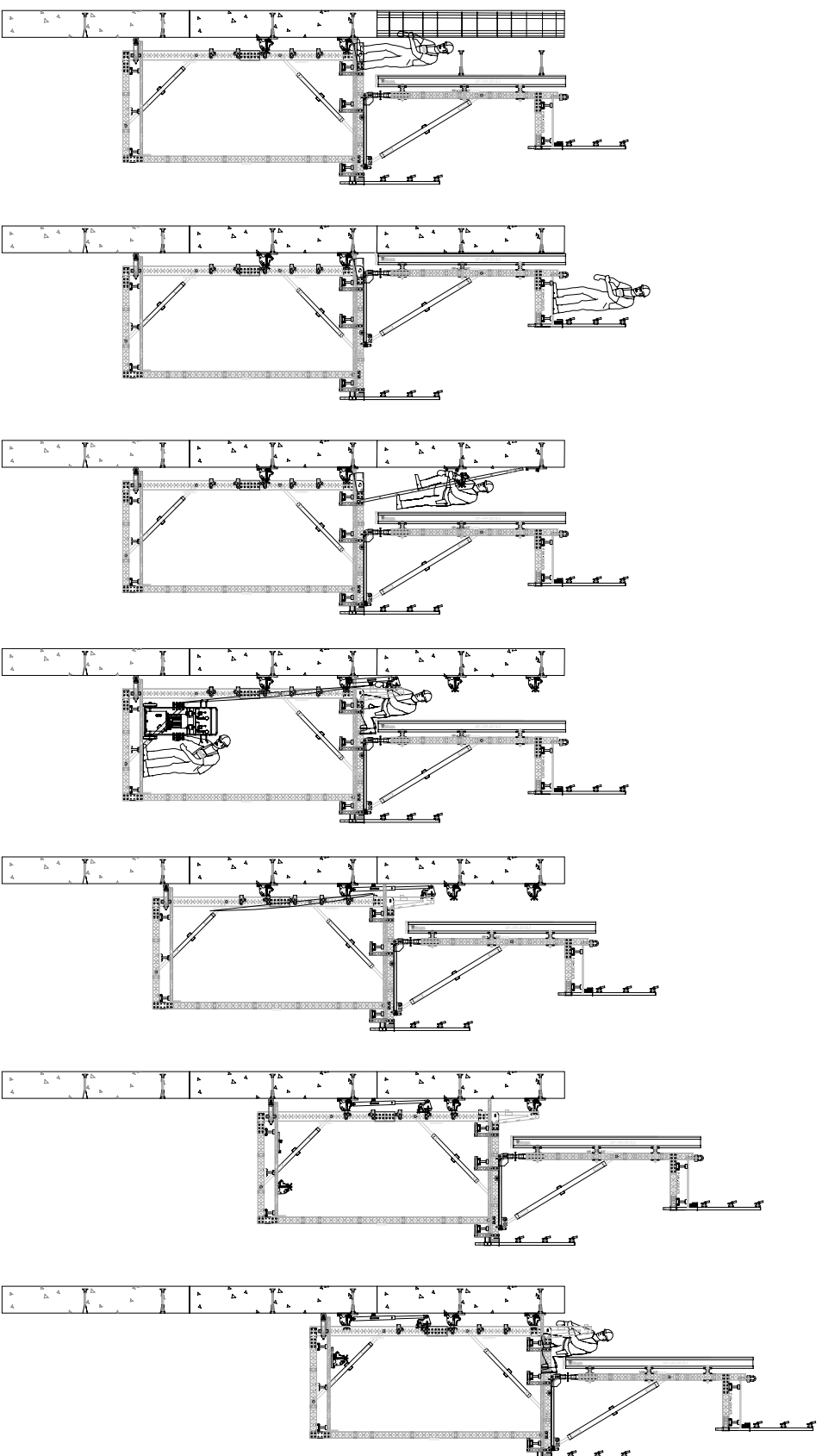


Follow the instructions of the hydraulic system detailed in this user guide.



This operation is made from the contiguous assembly control platform.

STRUCTURE WORKING STEPS DOUBLE ANCHOR PER POURING HEIGHT



Reinforcement

- Stripping the roll-back carriage MK-120.
- Perform the steel reinforcement work from the main platform.
- Recover the lower anchor using the mast shoe RKS to release it.

Pouring

- Plumb and lock the formwork.
- Stay the formwork.
- Pouring the concrete from the pouring platform.

Lifting preparation

- Stripping and lock the formwork.
- Placing anchors on hold.
- Place the cylinders HWS and climbing head LT HWS.
- Connect the power unit with the cylinders HWS.
- Place the initial pushing mast RKS in a climbing position.

Lifting

- Start lifting the structure.



This operation is made from the contiguous assembly control platform.

- Half way up when the mast shoe RKS is near the lower wall bracket stop the climbing and remove the anchor.
- Once the anchor and the wall bracket are removed, continue with the climbing.

Reinforcement preparation


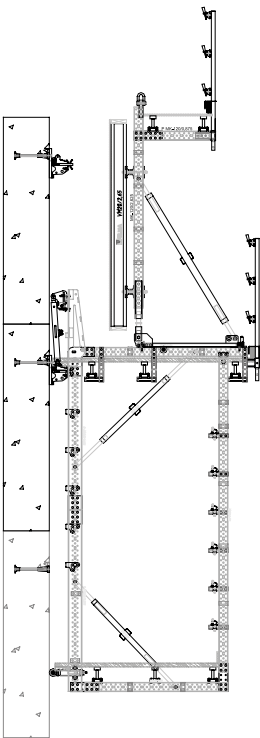

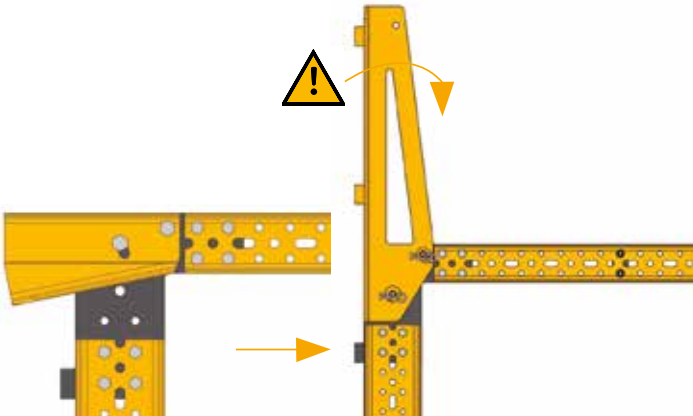

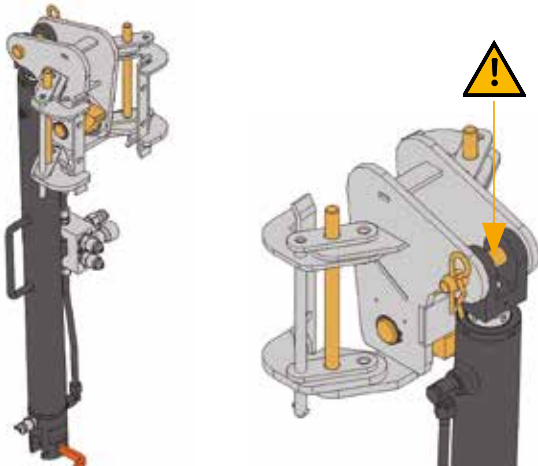
- Disconnect and collect all connections.
- Remove the initial pushing mast RKS.
- Place the additional profile RKS in working position.




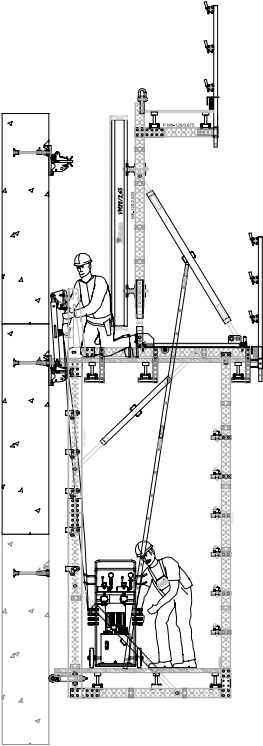

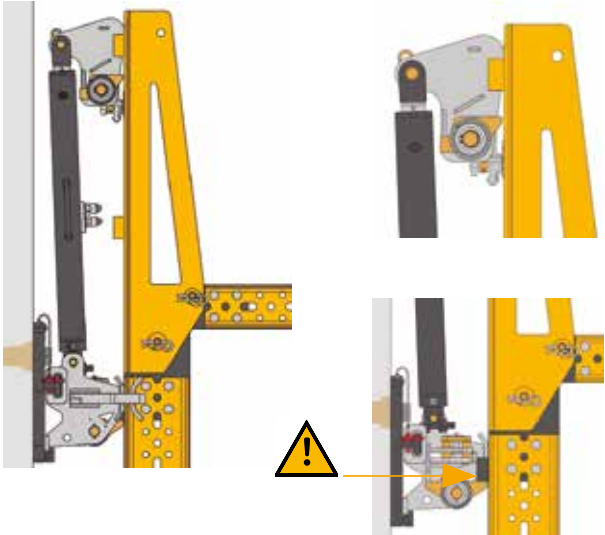

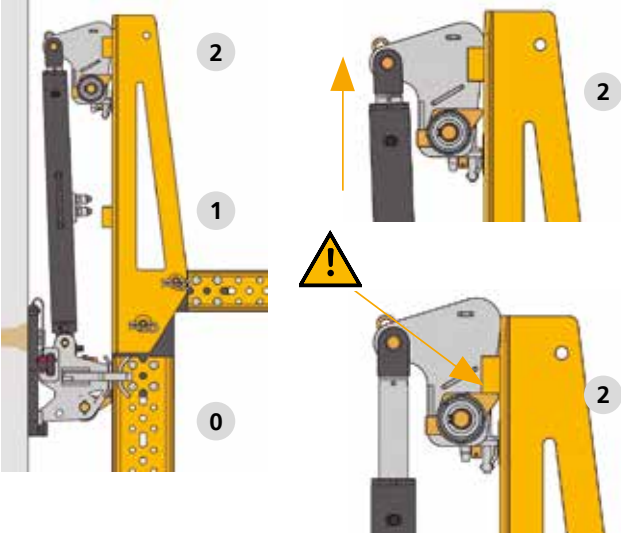
Follow the instructions of the hydraulic system detailed in this user guide.

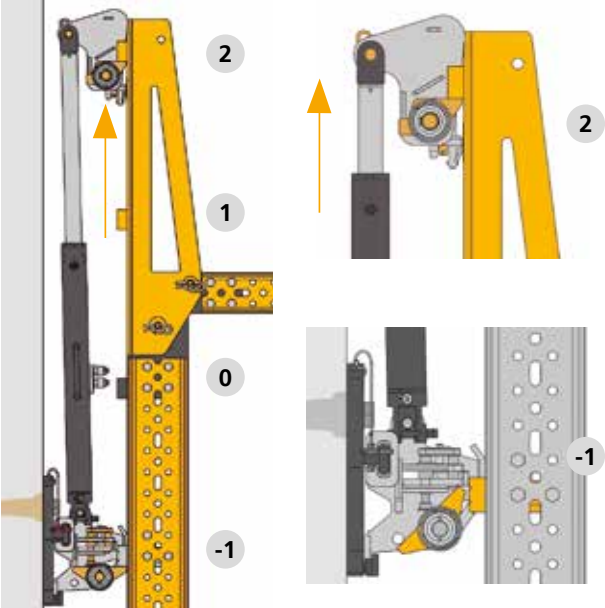

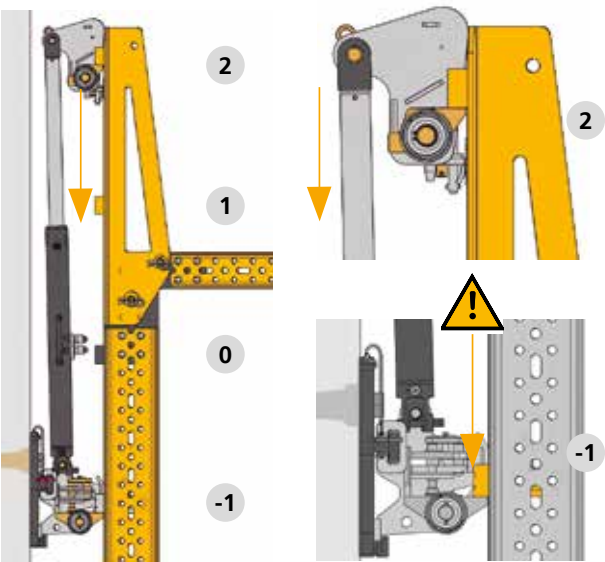

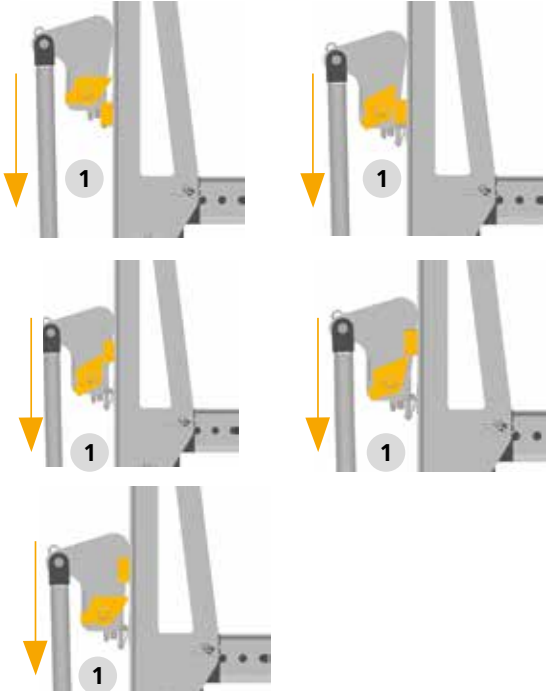


For safety reasons, it is very important to follow the explained climbing steps. **DO NOT SKIP ANY STEP.**
At the first lifting check that the cylinders support the weight when the power unit is stopped. For that purpose, lift the panel 5 cm, stop the power unit, wait and observe.

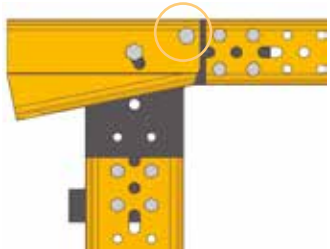
STEP	DESCRIPTION	SCHEME
1	<p>Retract the formwork and lock it. Place the heads LT HWS on hold.</p> <p> Verify that there is not any obstacle up to the next phase.</p>	
2	<p>Place the initial pushing mast RKS (1) in threading position. For this purpose, extract the pin D20 x 90, positioned the Initial pushing mast RKS vertically and insert the pin back into the corresponding hole to the "lifting" position.</p> <p> Verify that the Initial pushing mast RKS swings respect to its axis of rotation. If it cannot swings loosen the nut. (It must swing to the initial position due to its weight)</p>	 <p>Working Lifting</p>
3	<p>Assemble the cylinders HWS and climbing heads HWS using the pin.</p> <p> Ensure that the connection is properly done.</p>	

STEP	DESCRIPTION	SCHEME
4	<p>Pull the bottom fixing pin of the cylinder HWS.</p> <p>Rest the previous assembly onto the corresponding pin of the head LT HWS.</p> <div data-bbox="252 383 363 483"> </div> <p>Lock the bottom fixing pin and make the connection with head LT HWS. Check out all connections. Claws of climbing head must be facing the mast.</p>	
5	<p>Open the claws of the climbing head LT HWS as it has been explained in the chapter 3.8 (Lifting RKS).</p> <p>Lean the cylinder HWS and the climbing head HWS against the initial pushing mast RKS.</p> <p>Go around the inner wings of the mast with the claws of the climbing head HWS.</p>	
6	<p>Close and lock the claws of the climbing head HWS as it is explained in the chapter 3.8 (Climbing Head HWS).</p> <p>The wing of the pushing mast must be completely surrounded by the claws.</p> <div data-bbox="252 1671 363 1771"> </div> <p>Check out that the claws are correctly locked with the 4 clamping pins. Push-pull the climbing head HWS to verify that there is no risk of releasing the claws from the mast.</p>	

STEP	DESCRIPTION	SCHEME
7	<p>Connect the cylinders HWS to the power unit as explained in chapter 3.9 (Power Unit-Cylinder hydraulic assembly).</p> <p></p> <p>Verify that:</p> <ul style="list-style-type: none"> • All connections are all right. • For lifting the structure, the power unit and the operator must be placed on the contiguous set platform except to lift the last assembly which will be carry out using the necessary personal protective equipment. • Arrange the hoses to connect the cylinders HWS of the contiguous structure between the walls and the masts. Verify that during lifting any element block the hoses. • Before start climbing remove the lower anchorage from the platform. 	
8	<p>The cylinders HWS are completely retracted.</p> <p></p> <p>The structure rests onto the pawl of the head LT HWS.</p>	
9	<p>Extend the cylinders by activating simultaneously the handle of the power unit, until the pawls of the climbing heads LT HWS get in contact with the self-climbing blocks LT HWS.</p> <p></p> <p>Before going ahead with the climbing process, verify that the pawls of the climbing heads HWS are in contact with the self-climbing blocks LT HWS. The claws of the climbing heads HWS must always be CLOSED when working.</p>	

STEP	DESCRIPTION	SCHEME
10	<p>Activate the handles of the HWS power unit and keep on extending the cylinders HWS until the next self-climbing block LT HWS passes the pawl of the head LT HWS.</p>	
11	<p>Retract the cylinder HWS until the FOLLOWING self-climbing block LT HWS rests onto the pawl of head LT HWS.</p> <p> Before resting the structure at the pawl of the head LT HWS, verify that the pawl is at the correct position.</p>	
12	<p>Continue the retraction of the cylinders. During retraction, the pawl of the climbing head HWS comes across an intermediate self-climbing block LT HWS which must be passed and left behind. The pawl of the climbing head HWS starts rotating by beating the load of the spring. As the spring is compressed, it will always be acting on the pawl. Thanks to this, when the pawl of the climbing head HWS finishes passing the self-climbing block LT HWS, the pawl recovers its working position.</p> <p> Verify that the pawl of the climbing head HWS recovers its working position when finishing the retraction process.</p>	

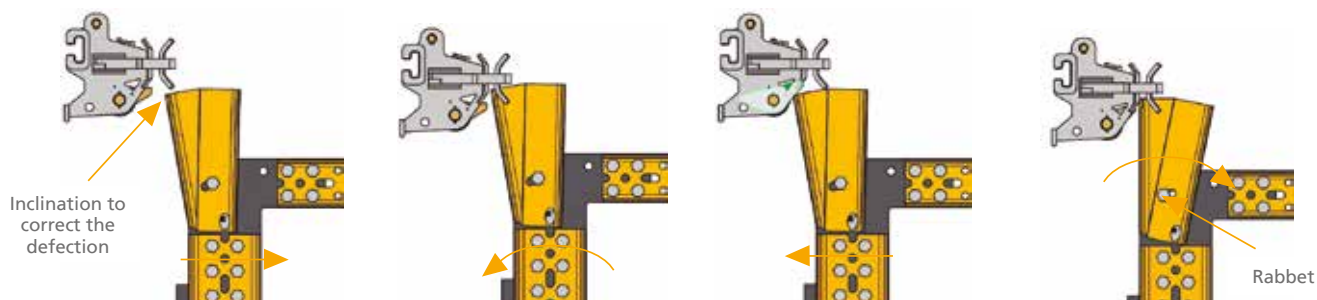
STEP	DESCRIPTION	SCHEME
13	<p>Repeat elevations as many times as needed till the top of the initial pushing mast RKS reaches the level of the anchor bracket on hold.</p> <div data-bbox="256 353 363 450"> </div> <p>Verify that the hoses do not get tangled with the platforms or with the wall.</p> <p>Verify that claws are CLOSED and FIXED.</p> <p>Verify that the Initial pushing mast RKS performs its function and the structure thread correctly in the anchor bracket on hold.</p> <p>In the last lifting step, THE LIFTING PROCESS will stop before the mast shoe RKS collides against the LT HWS head.</p>	
14	<p>Continue with the climbing process until the set is fully lifted.</p> <div data-bbox="256 1249 363 1346"> </div> <p>Make sure that the assembly is properly resting onto the pawl of the head LT HWS on its new working level and the pawls are correctly closed.</p>	
15	<p>Disconnect and collect all connections. Remove the cylinder HWS and climbing head HWS assembly from the lifted set, and transfer them to next set or level together with the power unit and hoses.</p>	

STEP	DESCRIPTION	SCHEME
16	<p>Remove the initial pushing mast RKS.</p> <p>Place the additional profile RKS in working position.</p> <p>For this purpose, extract the Pin D20 x 90, positioned the additional profile horizontally and insert the pin back into the corresponding hole to the working position (see chapter 3.1 additional profile and main support).</p>	 <p>Lifting</p>

• Hydraulic lifting without initial pushing mast RKS

When the RKS solution is without “Initial Pushing Mast RKS” (see chapter 2.4) and the pushing with the cylinder is performed from the platform, the “Additional Profile RKS” must be placed vertically during the climbing phase to thus facilitating the threading on the holding anchor.

For this, it is placed vertically and fixed with a bolt incorporated into the piece:



When the structure is deformed towards the opposite side of the wall, the inclination of the additional profile acts on the outer sliding plates correcting the deformation. On the contrary, when the deformation goes towards the side of the wall, the additional profile conforms to the shape of the inner sliding plates correcting the deformation.

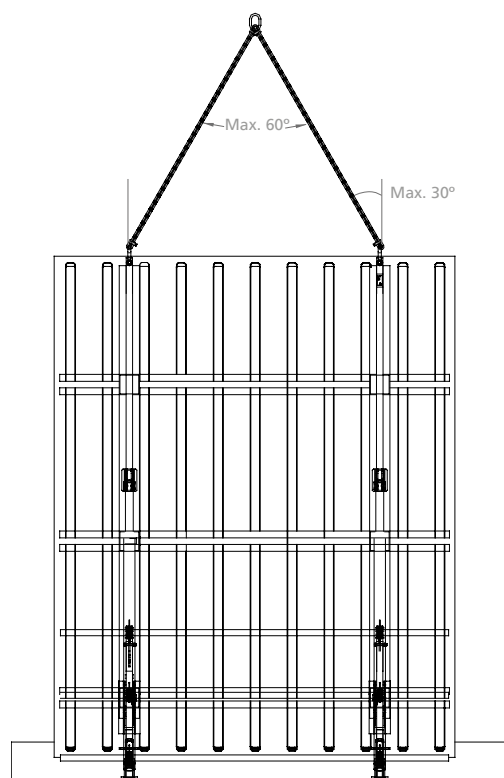
In order for the additional profile RKS to fulfil its marking function, the attachment of the M20 nut to the M20 x 100 screw must have a looseness of approximately 1 mm.

3.10.2 Lifting process by crane

The lifting process by crane, can be used to lift partial parts of the structure in the previous phases, when the structure is not complete or to lift the complete structure in case it is decided by crane availability.

This lifting is done by adding “Lifting Hook” to the structure to be lifted.

The lifting hook must not exceed the maximum angle of 60° between them.



• Lifting during the different steps of the assembly

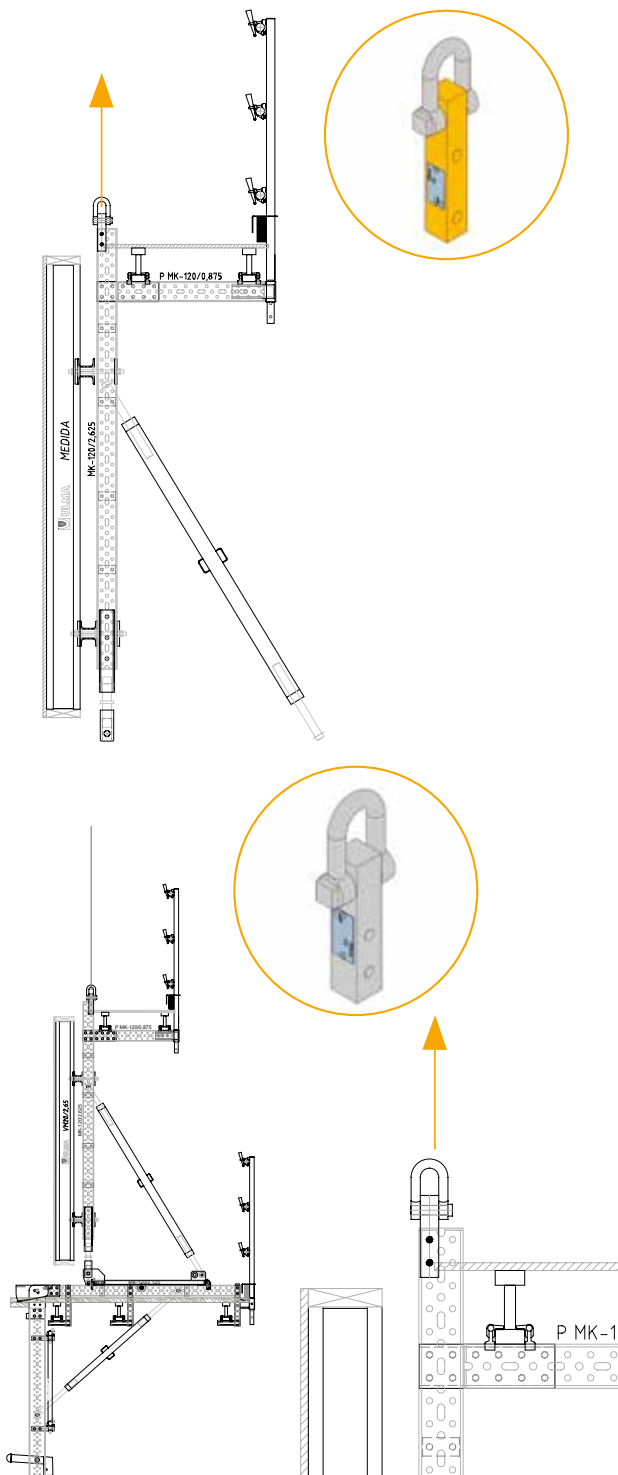
During the different step of the assembly, are different needs of lifting such as:

- Lifting of the formwork set.
- Lifting of the top part (initial structure of RKS with divided mast) of the divided mast's structure with the formwork.

In both cases, the lifting hook RKS can be placed in the upper part of the vertical waler.

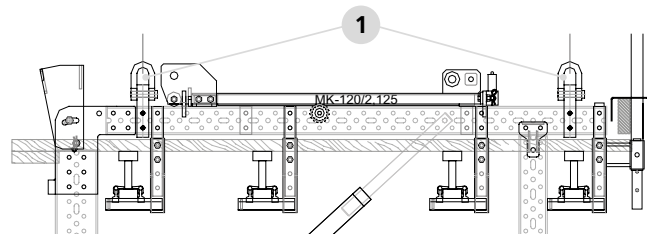
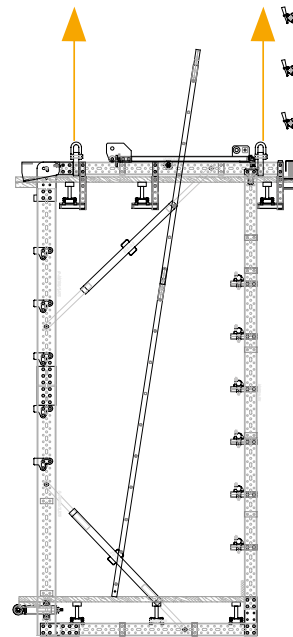
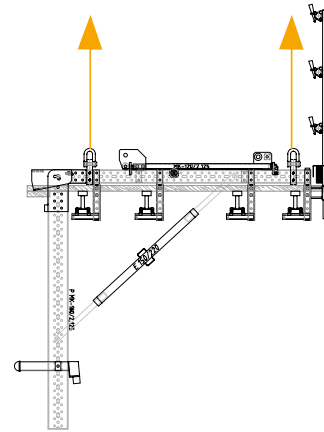
It is also possible to use the lifting hook MK.

The formwork must be retracted and blocked by means of the breaking pin carriage MK.



- Lifting of the top part of the divided mast's structure without the formwork.
- Lifting of the whole structure without the formwork.

Positioned and blocked the roll-back carriage system in an intermediate position by means of the breaking pin carriage MK. Put two lifting hooks RKS at the extremes of the horizontal MK waler of the main platform, placing in total 4 lifting hooks RKS for each assembly.

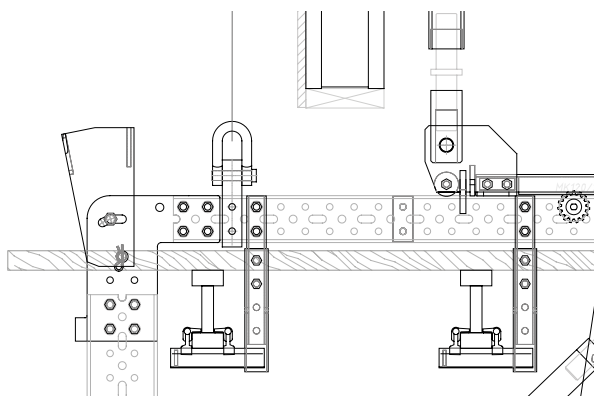
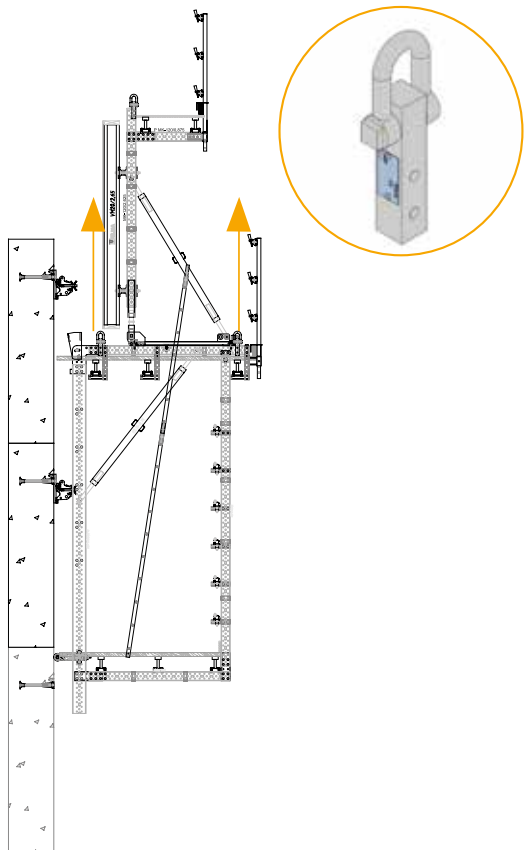


- 1** Lifting Hook RKS
2 Pins 16 x 100
2 Cotter Pins

- **Lifting in the different mounting phases**

The lifting of the structure with crane will be carried out by means of the proper "Lifting Hook".

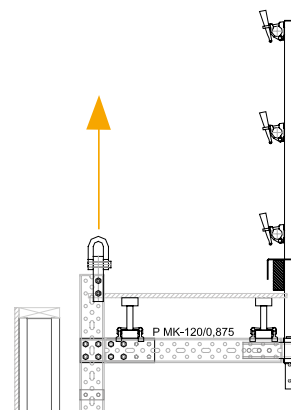
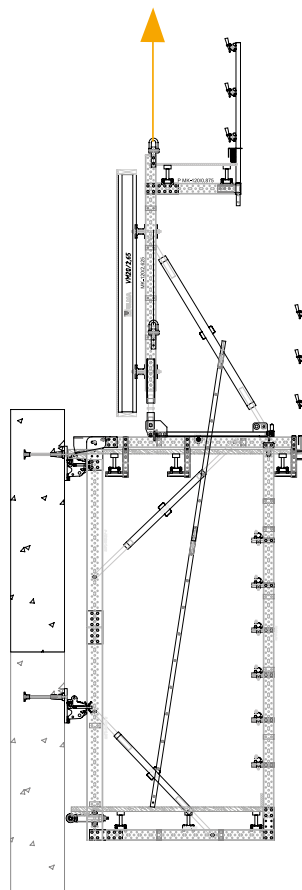
- **OPTION 1:** Place 2 lifting hooks RKS in each section, one in the front part of the formwork and another one in the back part.



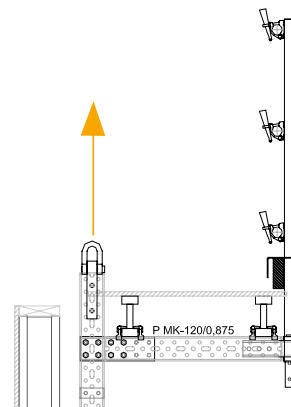
- 1 Lifting Hook RKS
2 Pins 16 x 100
2 Cotter Pins

- **OPTION 2:** Place 1 lifting hook RKS on the top part of the vertical waler of each section.

- **OPTION 3:** Place 1 lifting hook MK on the top part of the vertical waler of each section.



LIFTING HOOK RKS



LIFTING HOOK MK



The limiting element in all these lifting options are always the lifting hooks.

Before starting to lift any structure it must be verified that **the crane and lifting hook capacity** are enough to lift the weight of the structure.

The formwork must be retracted and blocked by means of the breaking pin carriage MK.

The procedure to follow is the same as described in chapter 3.10.1 (Hydraulic lifting process), with the exception that instead of using the hydraulic system, the lifting is performed with crane.

3.10.3 Stripping process

• Stripping elements

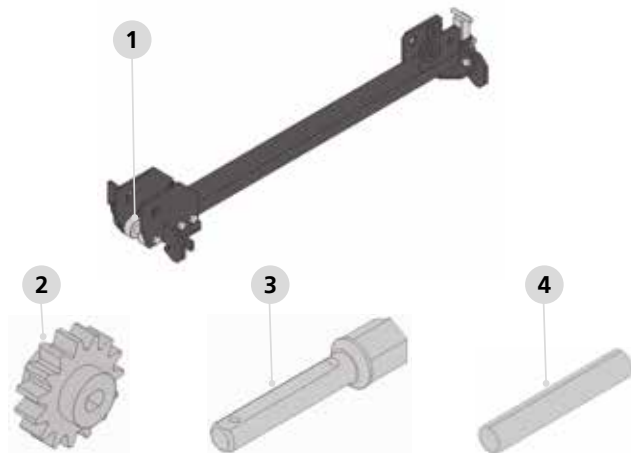
The roll-back carriage MK-120 system is placed directly on the main section waler MK-120. The carriage connects the vertical formwork (MK-120 or DU-120) to the front of the carriage and the Push-Pull prop at the rear for the plumbing.

It is a rack-gear system which allows retracting the carriage by 70 cm for formwork stripping.

The 2 front wheels help rolling through the MK waler.

The carriage is made up of 4 components:

ROLL-BACK CARRIAGE MK-120



- 1 Front wheels
- 2 Gear MK
- 3 Gear Shaft MK
- 4 Spring Pin 5x30 DIN1481

The gear MK along with the gear shaft are inserted into an upper Ø 17 hole of the waler MK-120 and fastened with the spring pin. The carriage with the incorporated rack is inserted into the waler. By operating the gear shaft, the rack and thus the carriage move. A wrench $\frac{3}{4}$ and socket $\frac{3}{4}$ width across flats 24 must be used to actuate the hexagonal gear shaft.



For carriage inclination more than 3° advise with the technical department.

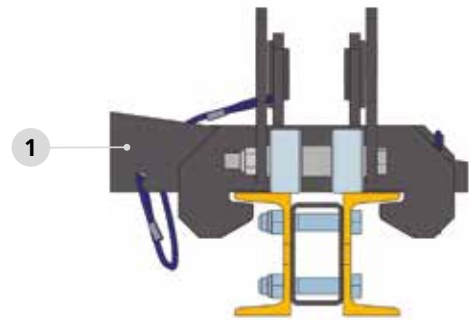
• Blocking system



The carriage has two blocking systems:

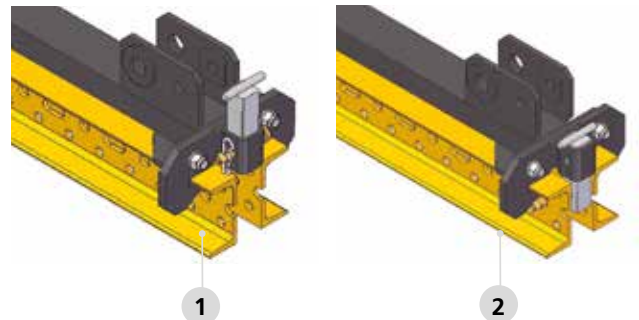
- The carriage provides a locking system with wedge for the "Working", "Climbing" and "Out of Service" cases.
- In the rear part a "Braking Pin" is also provided for blocking the system for "climbing" and "out of service" conditions. This system consists in a pin which can be positioned in two positions. Blocking position is reached positioning the pin in holes number 2 which are in line with the waler MK-120 holes. Positioning the pin in holes number 1 the carriage can move freely.

WEDGE BLOCKING



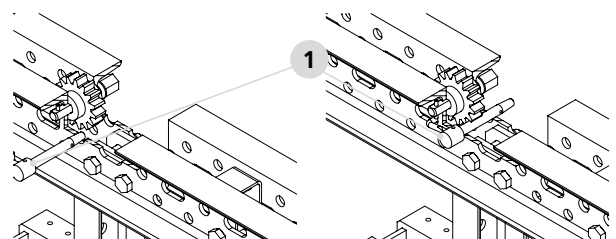
- 1 Wedge Locker

BRAKING PIN BLOCKING



- 1 Free Position (Hole 1)
- 2 Blocked Position (Hole 2)

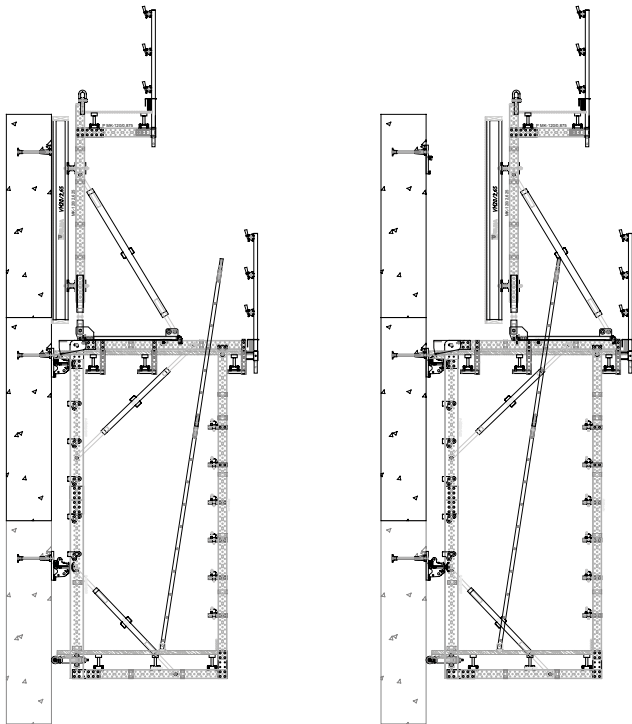
The "Gear Locker" is used as blocking element when the carriage is without the "Braking Pin":



- 1 Gear Locker

• Stripping process

The stripping process is performed by gears that are placed in the horizontal waler of the main platform and that actuates the roll-back carriage system by means of the telescopic ratchet wrench $\frac{3}{4}$ and socket $\frac{3}{4}$ width across flats 24.

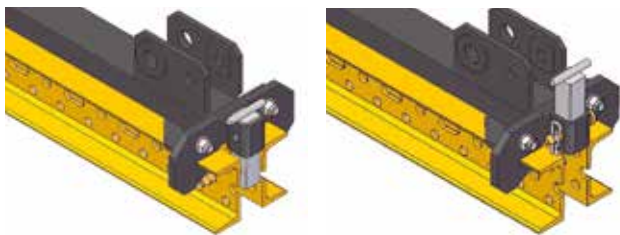


CONCRETE POURING POSITION

STRIPPING POSITION

The stripping process comprises the following steps:

- Place the breaking pin carriage MK in unblocked position.



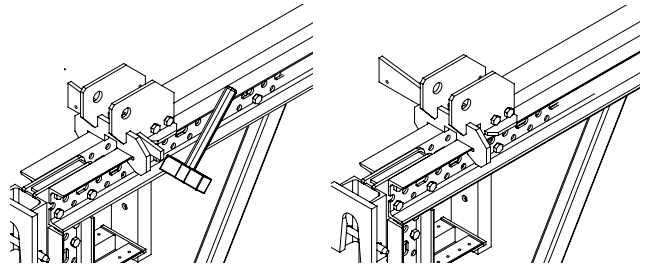
BLOCKED POSITION

FREE MOVEMENT POSITION



For out-of-service cases and whenever moving the climbing bracket with crane, always set the Breaking Pin Carriage MK to the blocked position.

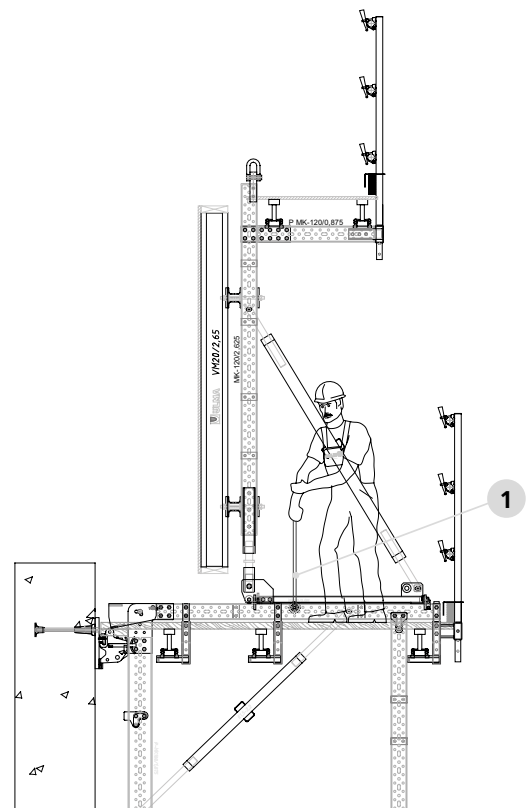
- Hit the wedge with a hammer to unblock the roll-back carriage.



BLOCKED ROLL-BACK CARRIAGE

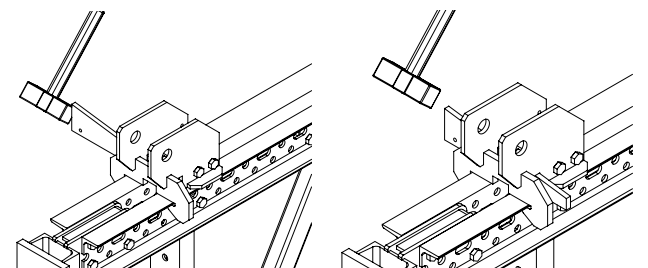
UNBLOCKED ROLL-BACK CARRIAGE POSITION

- Use the telescopic ratchet wrench $\frac{3}{4}$ and the socket $\frac{3}{4}$ width across flats 24 to turn the head of the axis thus moving the carriage to its subsequent position.



- 1 Handle Screw TR53
Socket $\frac{3}{4}$ Width Across Flats 24

- Hit the wedge with a hammer to block the roll-back carriage.

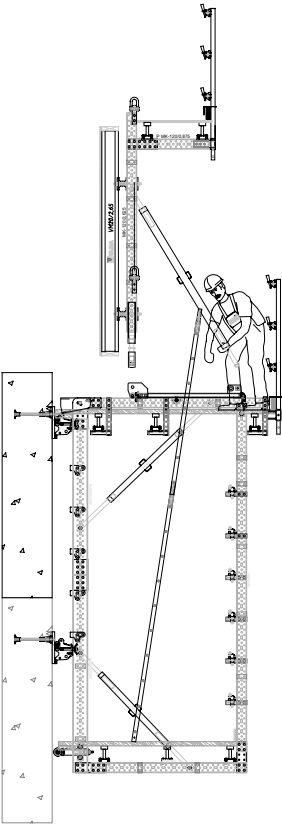
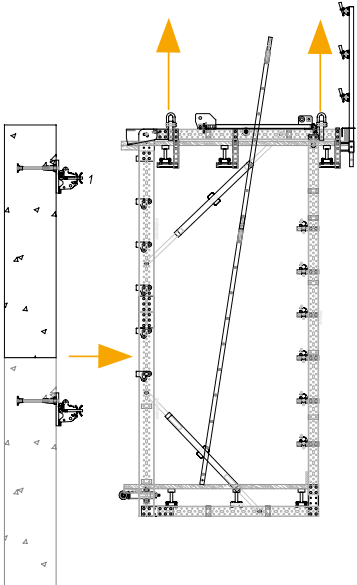


UNBLOCKED ROLL-BACK CARRIAGE

BLOCKED ROLL-BACK CARRIAGE

3.11 DISASSEMBLY

Once the work at the building fulfilled, will proceed to dismantle the rail climbing system. To do this, the structure is lowered to the ground by a crane and then dismantled.

STEP	DESCRIPTION	SCHEME
1	<p>Strip and retract the formwork.</p> <p>Place the sling in the lifting hook assembled in a vertical waler.</p> <p>Drop the formwork from the roll-back carriage MK-120.</p> <p>Lift the formwork and leave it in the formwork.</p> <p>Disassemble the formwork.</p>	
2	<p>Place the roll-back carriage system center in the horizontal waler and block it.</p> <p>Place the lifting hook in the horizontal waler and fasten it by bolts.</p> <p>Open the head LT HWS's claws.</p> <p>Lift and remove the structure.</p>	

4. FEATURES

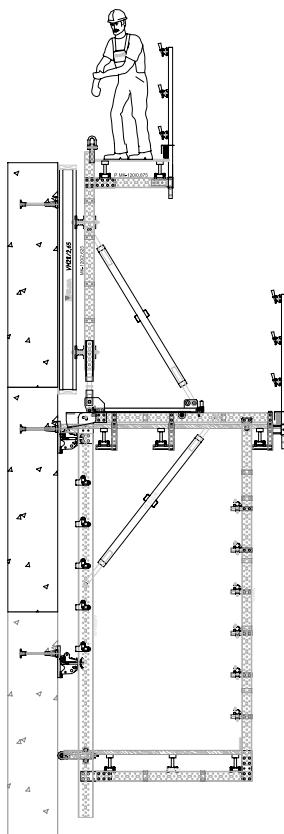
4.1 MAXIMUM SIZE OF FORMWORK PANEL

The maximum size of the formwork panel depends on the structure configuration and on the live load considered for each application. Therefore, a study must be done for each case with the particular configuration of each project.

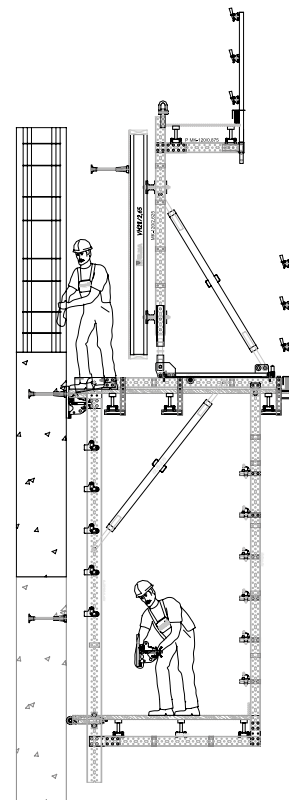
As “general criterion” the different components of the structure have been designed under the following load conditions:

These loads are applied to **four different states of the structure**:

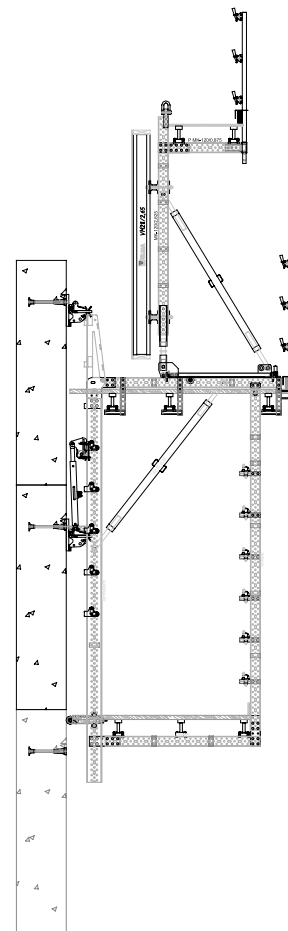
- The roll-back carriage MK-120 in concrete pouring position, where the formwork is plumbed in the wall.
- The roll-back carriage MK-120 retracted, where the formwork is in back position in order to enable the steel reinforcement works
- Threading position, where the structure is lifting to the next step, just when the structure is on the verge to thread in the anchor on hold and with the roll-back carriage MK-120 retracted.
- Out of service, with maximum wind speed, the workers must leave the works in the structure.



CONCRETING POSITION



RETRACTED POSITION



STRUCTURE THREADING



The features described in this section correspond to a double-sided wall formwork structures.

The table below shows the loading and wind conditions that have been applied in the standard solutions defined in chapter 2.1.

		STEEL REINFORCEMENT	CONCRETING	CLIMBING	OUT OF SERVICE
		Roll-back carriage retracted	Roll-back carriage pouring position	Threading	Roll-back carriage pouring position
LIVE LOAD	Concrete pouring platform	0 kN/m ²	1.5 kN/m ²	0 kN/m ²	0 kN/m ²
	Upper intermediate platform	0 kN/m ²	0 kN/m ²	0 kN/m ²	0 kN/m ²
	Main platform	3/2 * kN/m ²	2 kN/m ²	0.75 kN/m ²	1.5 kN/m ²
	Cone recovery platform	0.75 kN/m ²	0 kN/m ²	0 kN/m ²	0 kN/m ²
WIND	All the structure	0.25 kN/m ² (72 km/h)	0.25 kN/m ² (72 km/h)	0.15 kN/m ² (55 km/h)	Vmax**

* 3/2 kN/m², applied 3 kN/m² in front of the formwork and 2 kN/m² behind the formwork

** Vmax: Wind pressure corresponding to 29 m/s basic wind velocity, terrain category IV and at 100 m height from the ground, (1.26 kN/m²), according with UNE-EN 1991-1-4

Notes:

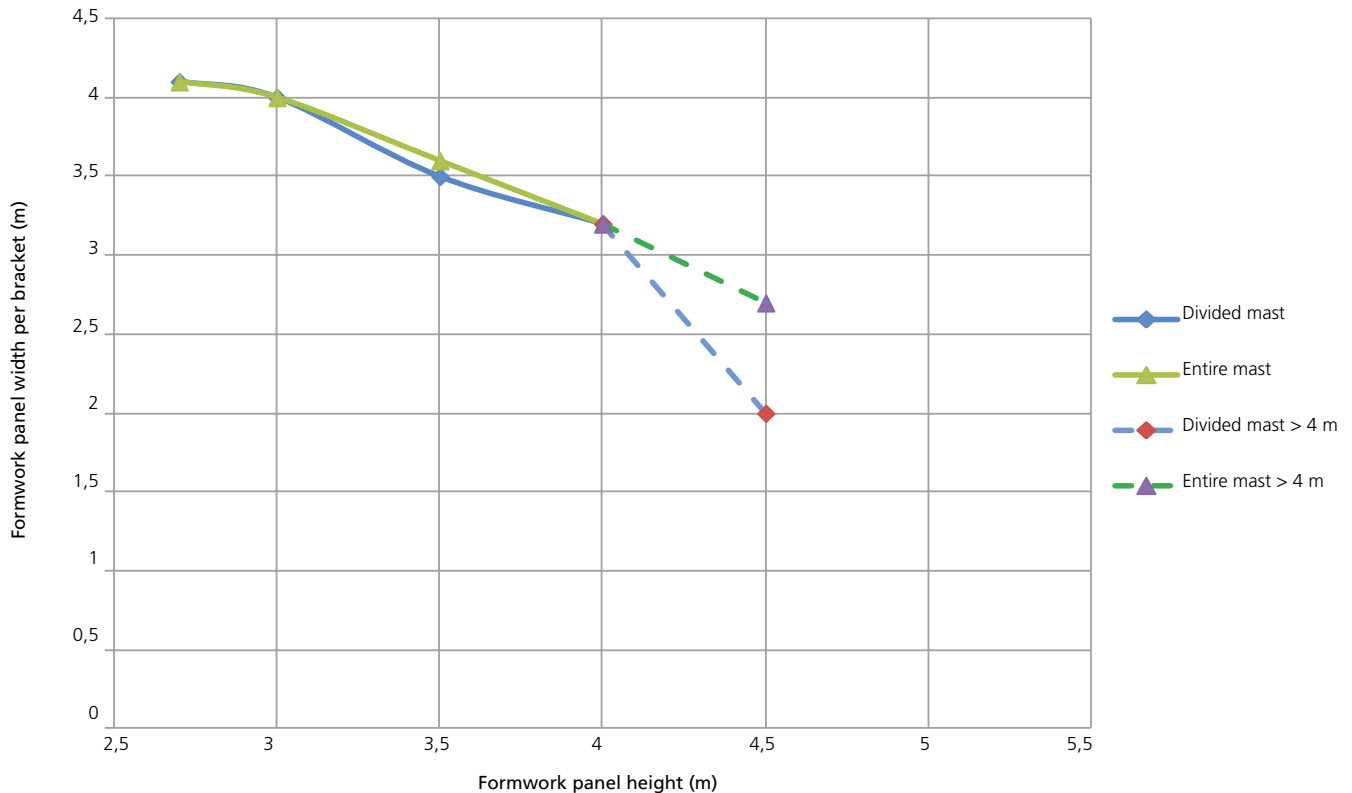
- * The maximum lifting load is 0.15 kN/m², which corresponds to a wind speed of 55 km/h.
- * For wind speeds above 72 km/h, all activities on the climbing structure are abandoned and the workers leave the platforms. Moreover, it is necessary to move the formwork towards the wall and block the roll-back carriage with the "Braking pin" (see details in chapter 3.10.3).

In the below chart, the relation between panel height and influence width of the different sections of the rail climbing system with described loads is shown. It is assumed that the length of the working platforms and the formwork panel width is the same.

These charts are valid only for a working height below 100 m.

RKS + INITIAL PUSHING MAST RKS

HEIGHT-WIDTH LIMITS FORMWORK



Entire line: Valid for one and double anchor per pouring height.
Discontinuous line: Valid only for double anchor per pouring height.



This graph corresponds only to the load conditions described above and can be used as an “illustrative values”. **For other conditions the height-width limits can be different**, hence, a study must be made for each case with the particular configuration of each project.

The RKS configuration without the “Initial Pushing Mast RKS” shown in the chapter 2.4 is based on other loading conditions; in the following table the load and the winds applied in each platforms are shown:

		STEEL REINFORCEMENT	CONCRETING	CLIMBING	OUT OF SERVICE
		Roll-back carriage retracted	Roll-back carriage pouring position	Threading	Roll-back carriage pouring position
LIVE LOAD	Concrete pouring platform	0 kN/m ²	1.5 kN/m ²	0 kN/m ²	0 kN/m ²
	Upper intermediate platform	0 kN/m ²	0 kN/m ²	0 kN/m ²	0 kN/m ²
	Main platform	3/2 * kN/m ²	2 kN/m ²	0.75 kN/m ²	1.5 kN/m ²
	Control platform	0 kN/m ²	0 kN/m ²	1.5 kN/m ²	0 kN/m ²
	Cone recovery platform	0.75 kN/m ²	0 kN/m ²	0 kN/m ²	0 kN/m ²
WIND	All the structure	0.25 kN/m ² (72 km/h)	0.25 kN/m ² (72 km/h)	0.2 kN/m ² (64 km/h)	Vmax**

* 3/2 kN/m², applied 3 kN/m² in front of the formwork and 2 kN/m² behind the formwork

** Vmax: Wind pressure corresponding to 29 m/s basic wind velocity, terrain category IV and at 100 m height from the ground, (1.26 kN/m²), according with UNE-EN 1991-1-4

Notes:

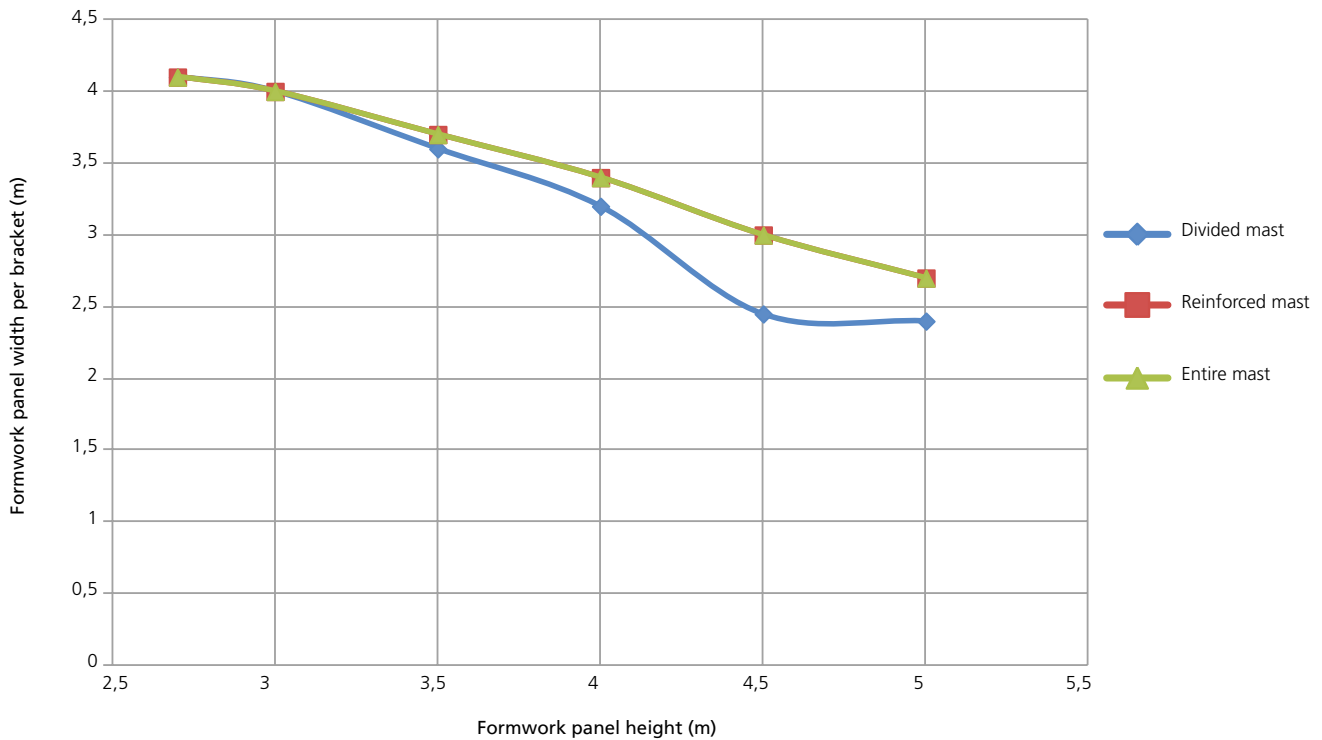
- * The maximum lifting load is 0.2 kN/m², which corresponds to a wind speed of 64 km/h.
- * For wind speeds above 72 km/h, all activities on the climbing structure are abandoned and the workers leave the platforms. Moreover, it is necessary to move the formwork towards the wall and **block the roll-back carriage** (see for details in chapter 3.10.3).

In the below chart, the relation between panel height and influence width of the different sections of the rail climbing system without “Initial Pushing Mast RKS” is shown. It is assumed that the length of the working platforms and the formwork panel width is the same.

This chart is valid only for a working height below 100 m.

RKS WITHOUT INITIAL PUSHING MAST

HEIGHT-WIDTH LIMITS FORMWORK



This graph corresponds only to the load conditions described above and can be used as an “illustrative values”. **For other conditions the height-width limits can be different**, hence, a study must be made for each case with the particular configuration of each project.

4.2 HYDRAULIC SYSTEM LIMITATIONS

Each hydraulic cylinder is capable of applying its maximum load on the head LT HWS where it is positioned. The weight of the structure to be lifted must be considered to avoid any problems when lifting.

Working load of Cylinder HWS: 50 kN.

4.3 CLIMBING AND FIXING ELEMENTS LIMITATIONS

The limits of the climbing and fixing elements are shown in the following table.

CLIMBING AND FIXING ELEMENTS	MAXIMUM SERVICE VERTICAL LOAD (F _y)	
	Steel reinforcement, concreting and out of service	Climbing
	F _y = 66 kN	F _y = 50 kN
	F _y = 66 kN	F _y = 50 kN
	/	F _y = 50 kN
	/	F _y = 50 kN
	/	F _y = 50 kN

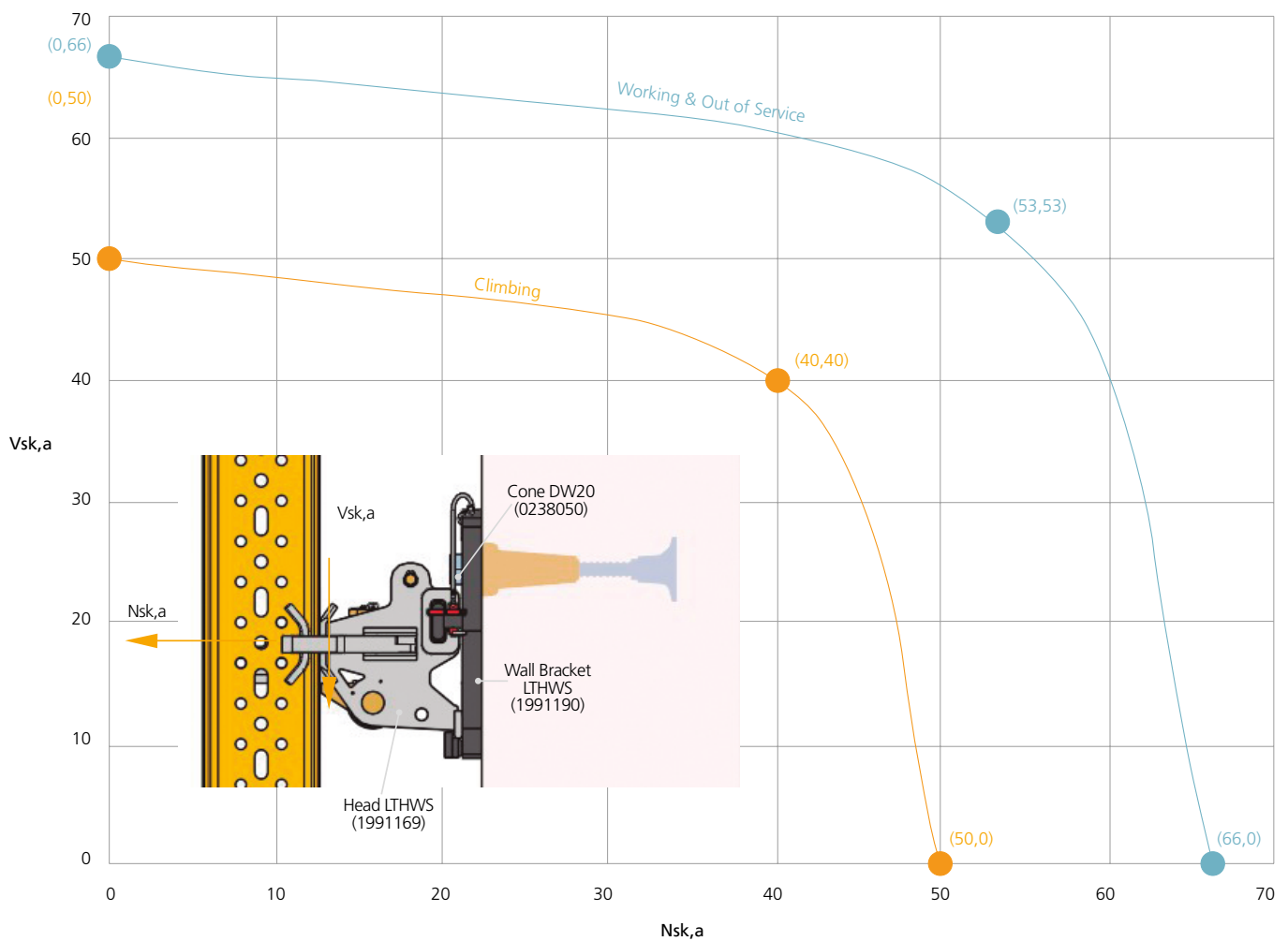
4.4 ANCHOR BRACKET LIMITATIONS

For each application, the loads to be supported by the brackets must be analyzed. This load analysis should include self weight loads, live loads and wind loads:

The bracket strength will depend on the following factors:

- Concrete strength
- Cone DW20/M30 strength
- Tie rod DW20 strength
- Bolt M30 strength
- Anchor length
- Edge effects

Accordingly, bracket limits will vary in each case and a proper study should be carried out. In any case loads **MUST NEVER** exceed the following values:



The anchor must be placed according with their specifications, in order to assure the correct transmission of the loads. Only ULMA original components must be used to withstand the structure.

5. COMPONENTS AND ACCESSORIES

CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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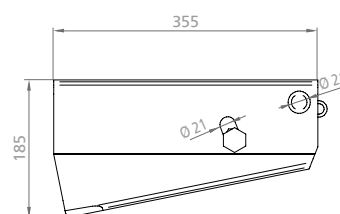
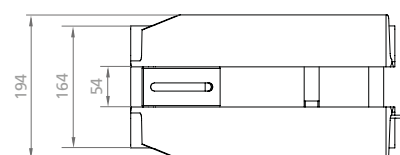
MAIN ELEMENTS RKS

1991270 13.2 ADDITIONAL PROFILE RKS

During roll-back movements, this element is placed horizontally and serves as a guide to the roll-back carriage MK-120 at the front.

It can also be used during the climbing process in the case of "WITHOUT Initial Pushing Mast RKS" solutions, placing it vertical.

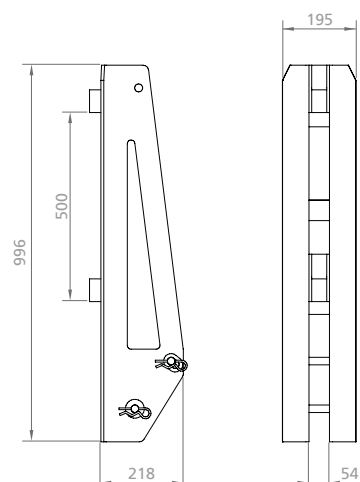
In any of the solutions is always used for climbing with crane.



1992210 32.9 INITIAL PUSHING MAST RKS

Element used during the hydraulic climbing of the structure. Its two main functions are:

- Extend the mast in its upper part, being the element on which it is pushed in the initial phase of climbing. The cylinder is placed on the top head and pushes on the top of the "Initial Pushing Mast RKS", thus raising the structure.
- Facilitate the threading of the structure in the next head on hold.



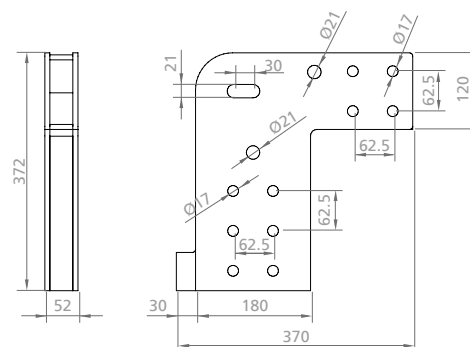
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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MAIN ELEMENTS RKS

1991260 13 MAIN SUPPORT RKS

It has the function of supporting the whole structure (together with the formwork) in the anchorage in the working and out of Service conditions, through the block that incorporates.

It also serves to join the horizontal waler of the main platform with the vertical mast.



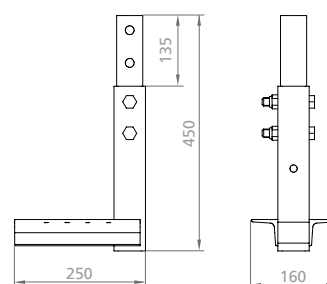
1992400 7.1 PLATFORM SUPPORT BMK

Elements used in the main platform to support the timber beams VM-20 or the longitudinal walers MK-120 (depending on the solution adopted).

The "Platform Rear Support" is differentiated by its possibility of incorporating the "Handrail Post 1.5".

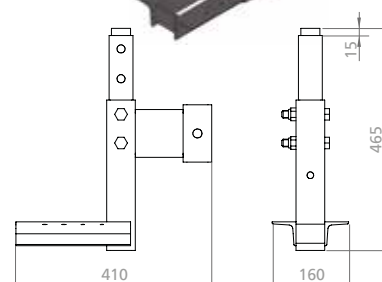
By varying the position of its 2 bolts, it retracts or extends the support, thus adapting to the different platform solutions and remaining at the same level:

- Retracted: Single or double timber beam VM + plank or plywood
- Extended:
 - Waler MK-120 + timber beam VM + plank or plywood
 - Profile MK-180 + timber beam VM + plank or plywood



1992409 8.9 PLATFORM REAR SUPPORT BMK

Note: In case of MK-180 is not the same level.



CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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MAIN ELEMENTS RKS

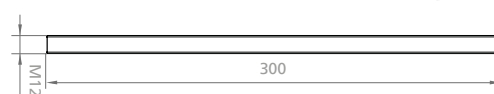
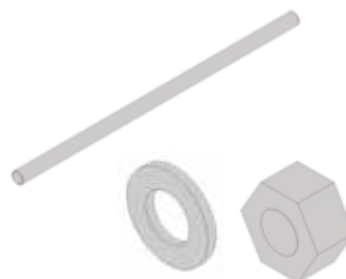
0249911	0.010	SCREW 6x60 DIN-7505-A
9371441	0.015	SCREW 6x90 DIN-7505-A

They are used to fasten the plywood to the timber beam VM-20.



1901823	0.26	THREADED ROD M12X300
0241204	0.020	NUT M12 DIN-934-8
0241201	0.010	WASHER A12 DIN-125

These elements are used to fasten two timber beams VM to the Platform Support in the case that this configuration is used.



1991250	14	MAST SHOE RKS
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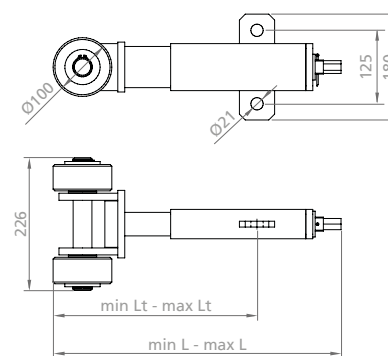
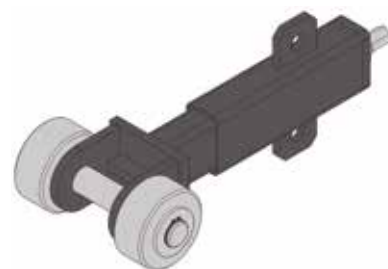
Element located just below the lower anchorage to facilitate retrieval / removal of the LT HWS head.

By means of a regulating screw that supports the two wheels of the element in the wall, it absorbs the horizontal reaction of the inferior anchorage, allowing to remove it with facility.

It is operated by an hexagonal wrench of 19.

Code	min. Lt	max. Lt
1991250	284	417

Code	min. L	max. L
1991250	427	560

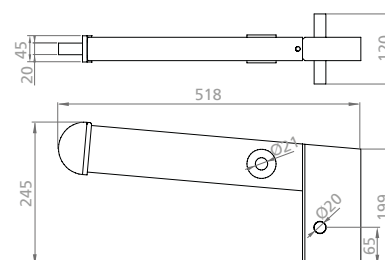


1991240	9.9	SWINGING SHOE RKS
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When the RKS is used from the beginning of the execution of the wall, the firsts pouring heights are performed with the upper part of the divided mast that works as a bracket.

This structure works like a climbing bracket. The "Swinging Shoe RKS" placed on the mast acts as an inferior support on the wall.

In the working position, it has a small incline of 5 ° to make sure that the element does not tilt while it is working.



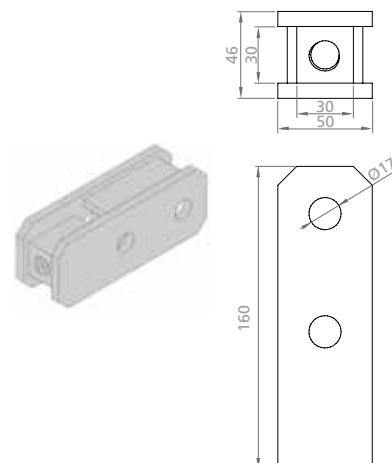
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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MAIN ELEMENTS RKS

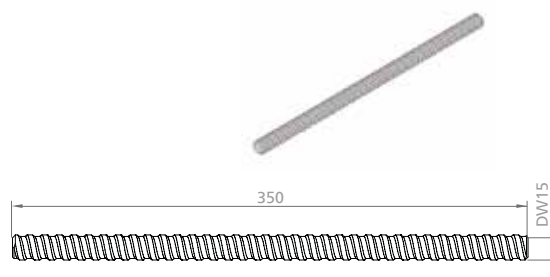
1991290 1.4 MK WALER FRONT CONNECTOR This element is used only in some applications of divided mast in order to increase the stiffness of the joint.

This is achieved joining one waler MK-120 parallel to the mast at the same height of the orthogonal joint MK-180.

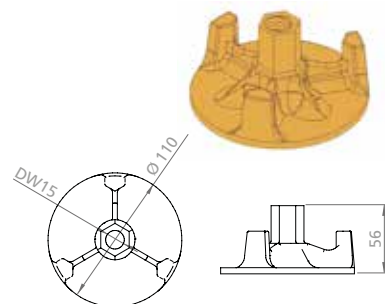
The waler MK-120, must be joined by 4 connectors + 4 Short Pins 0.35 and 4 plate nuts 15.



1861033 0.60 SHORT PIN 0.35



7238000 0.73 PLATE NUT 15



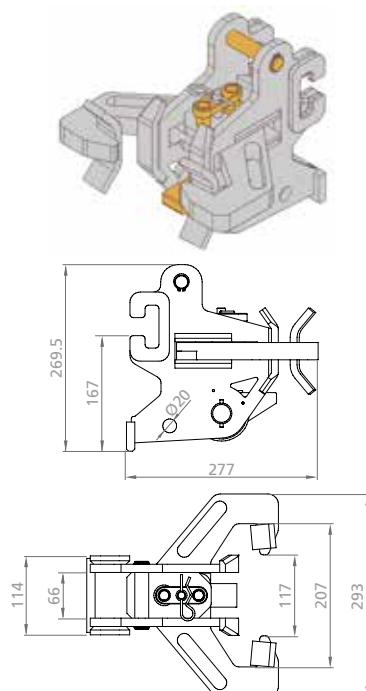
ANCHORS

1991169 17.5 HEAD LT HWS


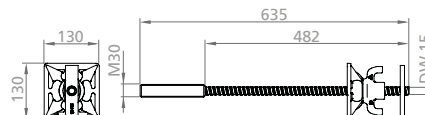

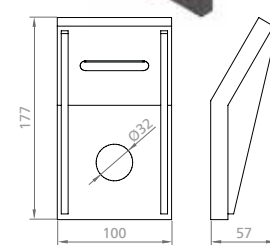

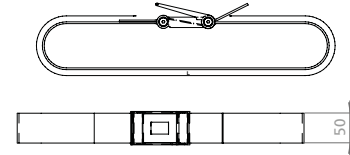
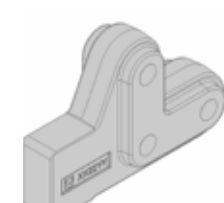
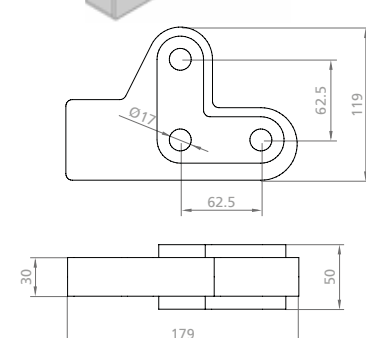
Guidance and support element of the entire RKS structure.

The "claws" support the horizontal forces of the structure and serve as guides along the mast in its upwards movement.

The vertical load transmitted by means of the "self-climbing blocks" is supported at rest by the "pawl". In the upward direction it allows the upwards movement of the self-climbing block LT HWS.



CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
ANCHORS				
1991190	9.6	WALL BRACKET LT HWS	<p>Bracket used in RKS to permit the fixing of the structure to the wall.</p> <p>The red positioning pin of the wall bracket LT HWS is used in the horizontal regulation of the head LT HWS for correcting the possible errors in the positioning of the cones embedded in the concrete.</p> <p>It is fixed directly to the cone embedded in the concrete with a "Bolt M30 x 90 DIN-931 8.8".</p>	
0243092	0.72	BOLT M30 x 90 DIN-931-8.8		
0238050	2	CONE DW20/M30	<p>The assembly formed by "Cone + Tie Rod + Fix Anchor" is the part of the Anchor embedded in the concrete, on which the " Wall Bracket LT HWS " and the " Head LT HWS " will be attached.</p>	
0234013	0.37	TIE ROD 20/0.13		
0234018	0.51	TIE ROD 20/0.18		
0234023	0.65	TIE ROD 20/0.23		
0234028	0.79	TIE ROD 20/0.28		
0234033	0.93	TIE ROD 20/0.33		
0234038	1.1	TIE ROD 20/0.38		
0234050	1.4	TIE ROD 20/0.50		
0234600	1.7	TIE ROD 20/6		
0238025	0.97	FIX ANCHOR DW20		
0238045	0.32	CONE POSITIONER M30	<p>Element used to position the anchorage on the modular formwork by means of nails.</p> <p>It is used in cases where the cone cannot be fixed with screw.</p> <p>The assembly / disassembly on the cone is realized by means of a key ALLEN 12 mm.</p>	

CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE				
ANCHORS								
1991225	2.2	CONE-WALER CONNECTOR M30	<p>The cone-waler connector M30 is a rod formed by M30 and the rest DW20.</p> <p>The cone-waler connectors are used to support the anchor elements over the ORMA formwork panels, by means of the hole made in the wood of the formwork.</p>	 				
0333016	3	WIND SLING FIXER M30	<p>It prevents the overturning of the upper part of the divided mast under windy conditions. The structure is fixed to the wall with a sling.</p> <p>The structure is fixed to the wall with a sling between the horizontal waler of the main platform and to the anchor cone of the previous pouring stage.</p>	 				
0333018	2.8	WIND SLING 12 (5T)	<table><tr><th>Code</th><th>L</th></tr><tr><td>0333018</td><td>12000</td></tr></table>	Code	L	0333018	12000	 
Code	L							
0333018	12000							
1991375	3.3	SELF-CLIMBING BLOCK LT HWS	<p>Element to withstand the weight and vertical loads acting on the RKS system during the hydraulic climbing process.</p> <p>During the climbing there is always one self-climbing block LT HWS resting on the head LT HWS's pawl or the climbing head HWS, which transfers the forces to the anchoring support.</p> <p>The number of blocks in the masts varies depending on the pouring height and used structure.</p>	 				

CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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CLIMBING

1991300 13.9 CLIMBING HEAD HWS

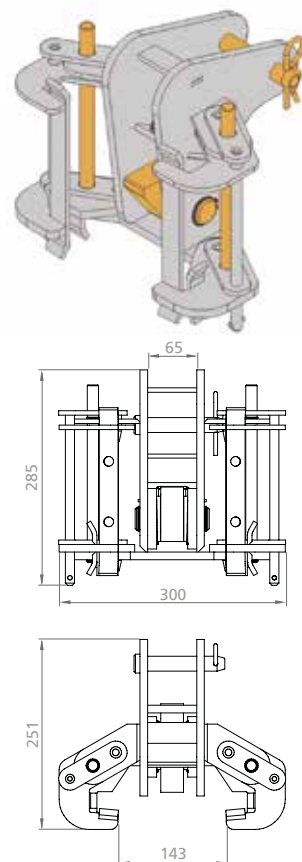
Element that exerts the necessary force on the bracket during the lifting process.

Its 2 main elements are:

These are the 2 main elements of the climbing head HWS:

- **Pawl:** It transfers the climbing load to the mast. It works in the same way the bracket, allowing the movement of the head on the way down and pushing the blocks on the way up.
- **Claws:** They are the parts in charge of guiding the climbing head's movements on the mast. The climbing head can be fixed or unfixed from the mast only by rotating the claws.

Once connected the climbing head to the hydraulic cylinder and mounted on the mast, it is ready to raise the structure.



CLIMBING

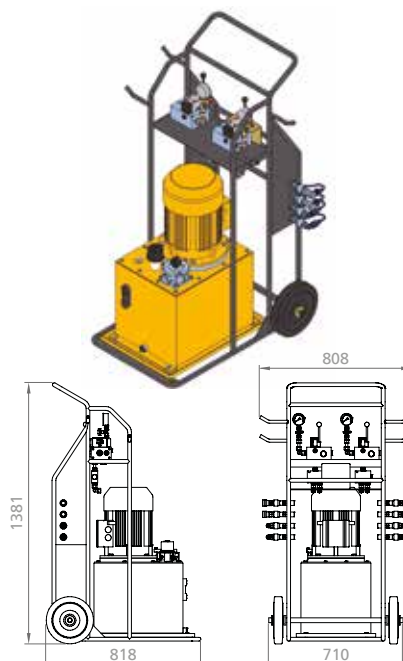
1991310 130 HYDRAULIC POWER UNIT HWS


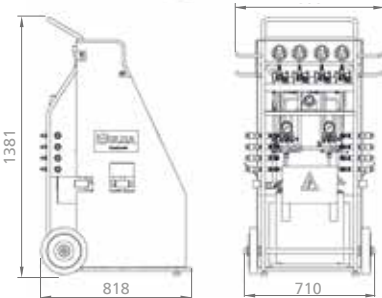


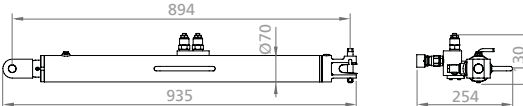



The power unit (PU) is the element in charge of pumping the oil to the cylinders. It includes 2 independent outputs, which are capable to activate up to 4 cylinders at the same time.

Every movement of the lifting process is controlled by the power unit.

The retraction and extension of the cylinders HWS is made by activation the 2 handles. Each handle controls two outputs of the power unit.

Thanks to an incorporated trolley, the PU is portable and can easily be moved throughout the building to lift up the HWS sets.



CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
CLIMBING				
1992275	130	HYDRAULIC POWER UNIT HWS	<p>The power unit (PU) is the element in charge of pumping the oil to the cylinders. It includes 4 independent outputs, which are capable to activate up to 4 cylinders at the same time.</p> <p>Every movement of the lifting process is controlled by the power unit.</p> <p>The retraction and extension of the cylinders HWS is made by activation the 4 handles. Each handle controls one outputs of the power unit.</p> <p>Thanks to an incorporated trolley, the PU is portable and can easily be moved throughout the building to lift up the HWS sets.</p>	 
1991345	0.20	PLUG FEMALE 3P+T 400V 16A	Female plug for HWS group power supply (the group has a male plug).	
1991350	28.4	CYLINDER HWS	<p>It is the element in charge of pushing the climbing head HWS.</p> <p>Its working load is 50 kN.</p> <p>It is fixed to the head LT HWS by a connection pin and a bottom fixing pin avoids it from getting out of its position.</p>	 
1991311	7	MALE HOSE 7 m HWS	These elements are in charge of sending the hydraulic oil from the power unit to the cylinders.	  
1991312	7	FEMALE HOSE 7 m HWS		
1991320	4	HOSE 1 m HWS		

CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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CLIMBING

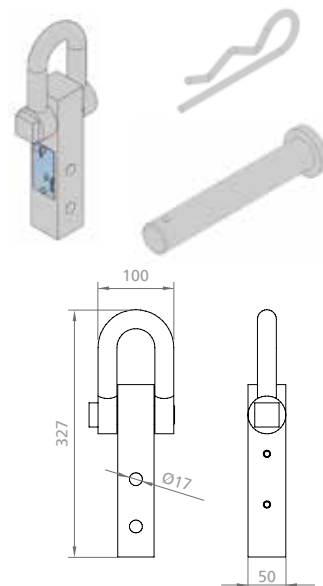
1991274	6.1	LIFTING HOOK RKS
1861627	0.17	PIN 16 x 100
9370571	0.015	COTTER PIN R/3

This is the lifting item of the structure.

For vertical waler formed by MK-120 walers the lifting hook RKS must be used which is fastened by 2 pins 16 x 100 and 2 cotter pins R/3.

For vertical waler formed by MK-120 walers the lifting hook RKS must be joint by 2 pins 16 x 100 and 2 cotter pins R/3, besides the lifting hook MK must be joint by 2 pins E20 x 70 and 2 cotter pin R/5.

For vertical waler formed by DU-120, the waler lifting hook must be used which is fastened to the waler by 2 pins E20 x 70 and 2 cotter pins R/5.

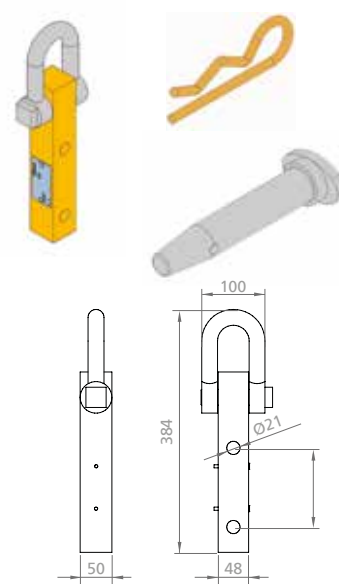


1991360	6.8	LIFTING HOOK MK
0252070	0.29	PIN E20 x 70
0250000	0.030	COTTER PIN R/5

Each lifting hook is designed to bear a maximum load of 31 kN (27 kN weight with 60° inclination). The maximum weight of the assembly that the lifting hook can withstand depends of the number of lifting hook uses.

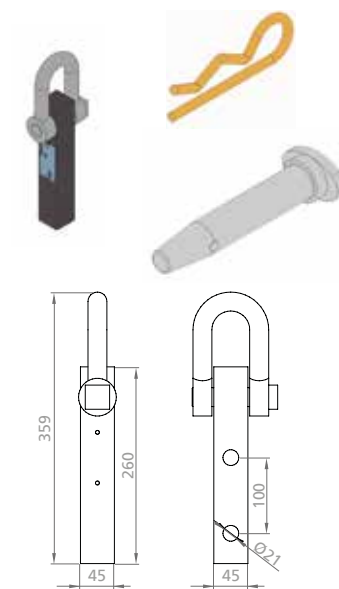
CARGA MAX. DE USO MAX. WORKING LOAD MAX. TRAGFÄHIGKEIT	3100 kg (6800 lbs)	UULMA ULMA C y E.S.Coop. Otadui,3 - Apdo.13 20560 OÑATI (SPAIN)
ANGULO MAX. DE ESLINGAS MAX. CHAIN ANGLE MAX. NEIGUNGS- WINKEL	30°	RIOSTRA MK (RKS) GRILLETE IZADO RKS 1991274 LIFTING HOOK RKS FAHRRIEGELKRANÖSE RKS



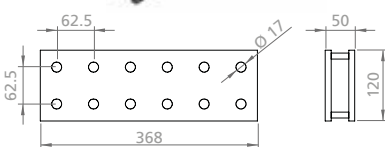

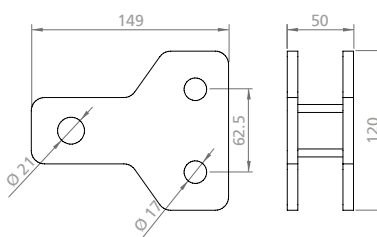

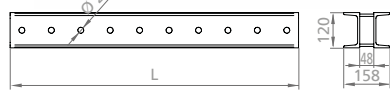
CARGA MAX. DE USO MAX. WORKING LOAD MAX. TRAGFÄHIGKEIT	3100 kg (6800 lbs)	UULMA ULMA C y E.S.Coop. Otadui,3 - Apdo.13 20560 OÑATI (SPAIN)
ANGULO MAX. DE ESLINGAS MAX. CHAIN ANGLE MAX. NEIGUNGS- WINKEL	30°	RIOSTRA MK GRILLETE IZADO MK 1991360 LIFTING HOOK MK FAHRRIEGELKRANÖSE MK



0331010	6.1	WALER LIFTING HOOK
0252070	0.29	PIN E20 x 70
0250000	0.030	COTTER PIN R/5

CARGA MAX. DE USO MAX. WORKING LOAD MAX. TRAGFÄHIGKEIT	3100 kg (6800 lbs)	UULMA ULMA C y E.S.Coop. Otadui,3 - Apdo.13 20560 OÑATI (SPAIN)
ANGULO MAX. DE ESLINGAS MAX. CHAIN ANGLE MAX. NEIGUNGS- WINKEL	30°	RIOSTRA DU GRILLETE IZADO VELA 0331010 WALER LIFTING HOOK FAHRRIEGELKRANÖSE

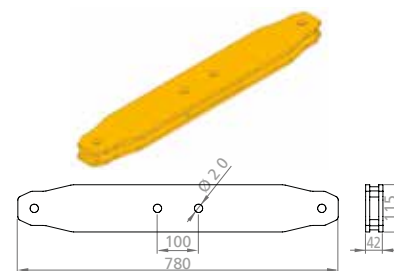


CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
WALERS				
1990209	29.4	WALER MK-120 / 1.125	<p>This is the common element for all applications. The MK waler is formed by two UPN-120 profiles face to face.</p> <p>Its main characteristic is the double row of holes, used for all the required connections.</p> <p>The external holes are Ø 17 mm. On the central row Ø 20 mm hole and 45.5 mm rabbet alternate.</p> <p>The waler step between holes is 62.5 mm for the external holes and 125 mm for the central holes.</p> <p>All the walers start with a Ø 20 mm hole in both ends.</p>	
1990211	35.5	WALER MK-120 / 1.375		
1990213	41.9	WALER MK-120 / 1.625		
1990215	47.9	WALER MK-120 / 1.875		
1990217	54	WALER MK-120 / 2.125		
1990219	60	WALER MK-120 / 2.375		
1990221	68	WALER MK-120 / 2.625		
1990223	75	WALER MK-120 / 2.875		
1990225	81	WALER MK-120 / 3.125		
1990227	87	WALER MK-120 / 3.375		
1990229	93	WALER MK-120 / 3.625		
1990231	101	WALER MK-120 / 3.875		
1990233	107	WALER MK-120 / 4.125		
1990235	113	WALER MK-120 / 4.375		
1990237	120	WALER MK-120 / 4.625		
1990239	126	WALER MK-120 / 4.875		
1990241	132	WALER MK-120 / 5.125		
1990243	140	WALER MK-120 / 5.375		
1990245	146	WALER MK-120 / 5.625		
1990247	152	WALER MK-120 / 5.875		
1990395	6.5	ORTHOGONAL JOINT MK	<p>Element used to join the walers MK-120 of the different platforms to the mast.</p> <p>The orthogonal joint MK, can be used also to join longitudinally two walers MK-120.</p>	 
1990590	1.8	AXIAL NODE M D20 MK	<p>Node used to join the "Waler MK-120" that made the "vertical closures" between the different platforms.</p>	 
0111100	26.5	WALER DU-120/1	<p>These are walers consisting of double UPN-120 profiles at a distance of 48 mm and Ø 20 holes.</p> <p>They are used as:</p> <ul style="list-style-type: none"> • Vertical waler of any formwork. • Horizontal waler for ORMA formwork. • Longitudinal waler for platforms. 	 
0111150	39.7	WALER DU-120/1.5		
0111200	53	WALER DU-120/2		
0111250	66	WALER DU-120/2.5		
0111300	79	WALER DU-120/3		
0111350	93	WALER DU-120/3.5		
0111400	106	WALER DU-120/4		
0111450	119	WALER DU-120/4.5		
0111500	133	WALER DU-120/5		
0111600	159	WALER DU-120/6		

CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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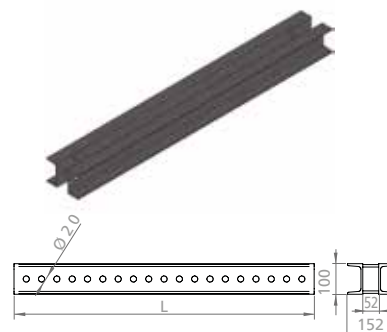
WALERS

1960221	13.5	STRIPPING WALER CONNECTOR	Item used to join DU-120 walers longitudinally and thus obtain other lengths. It is placed in the centre of the profiles and fastened with four pins E20 x 70.
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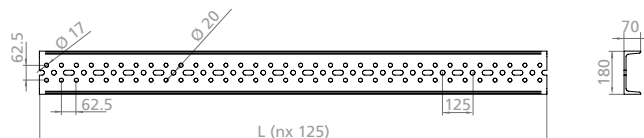
1960005	10.3	WALER DU-100/ 0.5	These are walers consisting of double UPN-100 Profiles at a distance of 52 mm and Ø 20 holes. Their main applications are "horizontal Waler" of ENKOFORM V-100 and ORMA panels.
1960007	15.4	WALER DU-100/ 0.75	
1960010	20.5	WALER DU-100/ 1	
1960012	25.8	WALER DU-100/ 1.25	
1960015	31.1	WALER DU-100/ 1.5	
1960020	41.6	WALER DU-100/ 2	
1960025	52	WALER DU-100/ 2.5	
1960030	63	WALER DU-100/ 3	
1960037	78	WALER DU-100/ 3.75	
1960050	104	WALER DU-100/ 5	
1960060	125	WALER DU-100/ 6	

Code	L
1960005	500
1960007	750
1960010	1000
1960012	1250

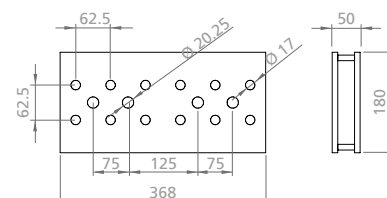


PROFILES

1990015	38.9	PROFILE MK-180 / 1.875	The profiles MK-180 are used to make up the mast which is the main part of the climbing.
1990017	44.1	PROFILE MK-180 / 2.125	
1990019	49.3	PROFILE MK-180 / 2.375	The mast is made up of 2 Profiles MK-180 spaced 52 mm. The used element to joint 2 profiles is the spacer tube MK-120/52 (1990200).
1990021	55	PROFILE MK-180 / 2.625	
1990023	60	PROFILE MK-180 / 2.875	They can also be used to form the longitudinal walers of the main platform.
1990025	65	PROFILE MK-180 / 3.125	
1990029	75	PROFILE MK-180 / 3.625	The profile MK-180 has the same pattern around its middle axis as the MK-120.
1990037	96	PROFILE MK-180 / 4.625	
1990045	117	PROFILE MK-180 / 5.625	
1990053	138	PROFILE MK-180 / 6.625	
1990061	159	PROFILE MK-180 / 7.625	
1990069	180	PROFILE MK-180 / 8.625	
1990085	222	PROFILE MK 180 / 10.625	



1991200	11.5	ORTHOGONAL JOINT MK-180	Element used to join longitudinally "Profiles MK-180" to make up the divided mast.
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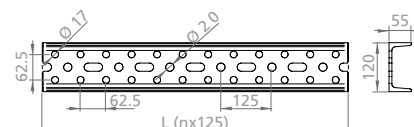
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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PROFILES

1990103	4.6	PROFILE MK-120 / 0.375
1990104	6	PROFILE MK-120 / 0.50
1990105	7.5	PROFILE MK-120 / 0.625
1990106	9.1	PROFILE MK-120 / 0.750
1990107	10.7	PROFILE MK-120 / 0.875
1990109	13.8	PROFILE MK-120 / 1.125
1990111	16.9	PROFILE MK-120 / 1.375
1990113	20	PROFILE MK-120 / 1.625
1990115	23.1	PROFILE MK-120 / 1.875
1990117	26.2	PROFILE MK-120 / 2.125
1990119	29.3	PROFILE MK-120 / 2.375
1990121	32.4	PROFILE MK-120 / 2.625
1990123	35.6	PROFILE MK-120 / 2.875
1990125	38.6	PROFILE MK-120 / 3.125
1990127	41.8	PROFILE MK-120 / 3.375
1990129	44.8	PROFILE MK-120 / 3.625
1990131	48	PROFILE MK-120 / 3.875
1990133	51	PROFILE MK-120 / 4.125
1990135	54	PROFILE MK-120 / 4.375
1990137	57	PROFILE MK-120 / 4.625
1990139	60	PROFILE MK-120 / 4.875
1990141	63	PROFILE MK-120 / 5.125
1990143	67	PROFILE MK-120 / 5.375
1990145	70	PROFILE MK-120 / 5.625
1990147	73	PROFILE MK-120 / 5.875

Except in the case of small lengths lower than 0.875 m, most "Profiles MK-120" are distributed as walers.

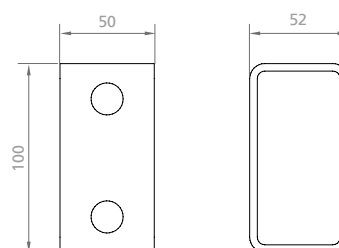
In case of using profiles, the waler should be conformed by joining them with "Spacer Tube MK-120/52" in the most convenient places.



1990200	0.46	SPACER TUBE MK-120/52
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Element used to conform "Walers MK" by means of "Profiles MK", separating them 52 mm.

It is joint to the waler by the bolt M16 x 90 and nut M16 DIN-985-8.



0241690	0.17	BOLT M16 x 90 DIN-931-8.8
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0241600	0.030	NUT M16 DIN934 8.8
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CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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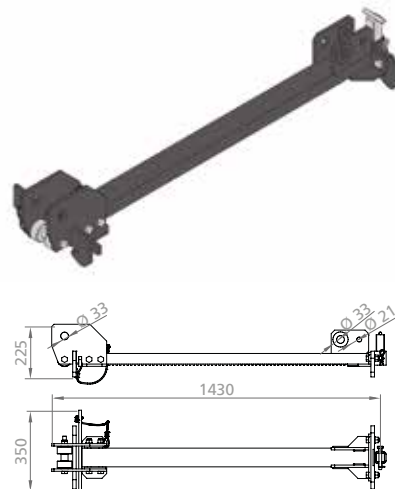
STRIPPING ELEMENTS

1991444 38.5 ROLL-BACK CARRIAGE MK-120 The carriage MK is the element in charge of retracting the formwork. It is a rack-gear system that slides over the horizontal waler MK-120 of the main section. The front rollers help the carriage to slide easier.

Its front part is the one in charge of joining the carriage to the vertical waler. At the rear is where the push-pull prop that balances the formwork is placed.

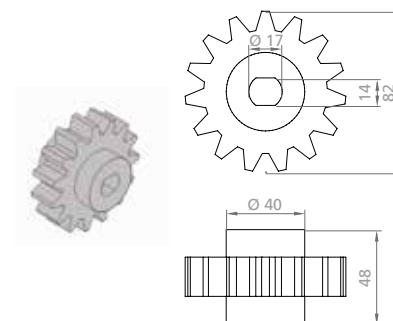
It has 2 blocking systems: "Front wedge" and "Rear Braking Pin".

The "Pin" is located in the corresponding hole of the "Waler MK-120" and the "Gear" is fixed by the "Spring Pin".

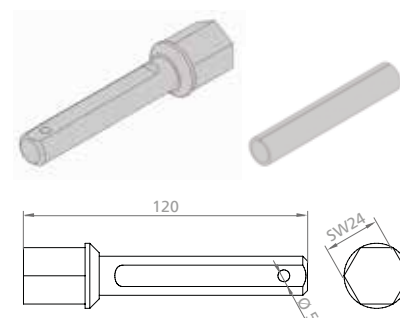


1991456 0.80 GEAR MK

Activating the "Gear Shaft" by means of the "Telescopic Ratchet Wrench+ Socket" key moves the carriage allowing a retraction of the formwork of 70 cm.



1991457 0.33 GEAR SHAFT MK
9071300 0.025 SPRING PIN 5 x 30 DIN 1481



9700225 3.9 TELESCOPIC RATCHET WRENCH ¾ This item is used to actuate on the
9700226 0.26 SOCKET ¾ WIDTH ACROSS FLATS Gear of the "Roll-Back Carriage MK-120"



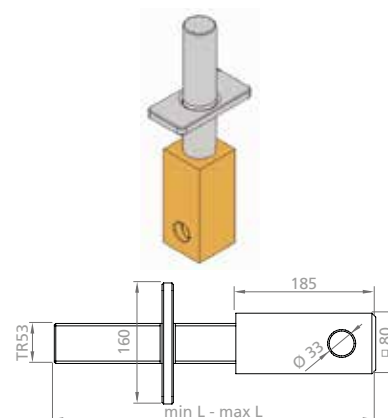
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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VERTICAL WALER ELEMENTS

0302020 10.8 WALER SCREW TR53 x 6

It is the element used to regulate the height of the vertical waler. The regulation range is:

Code	min. L	max. L
0302020	362	435



0253215 1.1 PIN D32 x 150
0250000 0.030 COTTER PIN R/5

Element used to join the waler screw to the stripping carriage.



1991570 13.5 WALER MK-120 SCREW BRACKET
0335153 0.29 PIN W/HEAD D20 x 100
0250000 0.030 COTTER PIN R/5

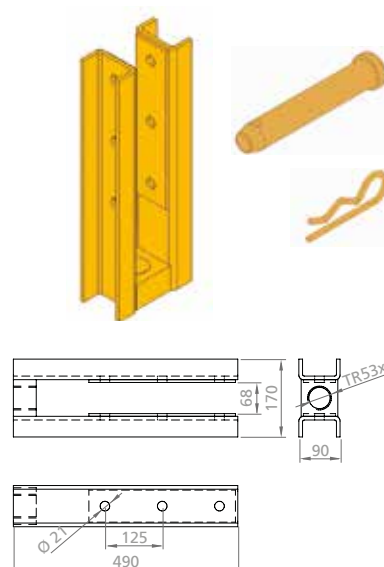
Element that connects the Vertical Waler and the "Waler Screw TR53 x 6".

Depending which vertical waler, we will use:

- Waler MK-120 screw for vertical waler.
- MK-120 waler screw TR53 x 6 for vertical waler DU-120.


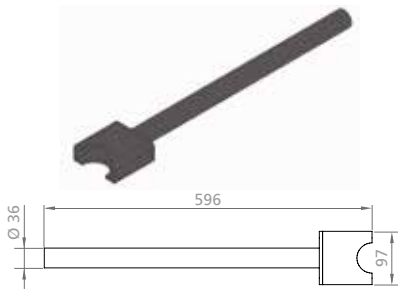
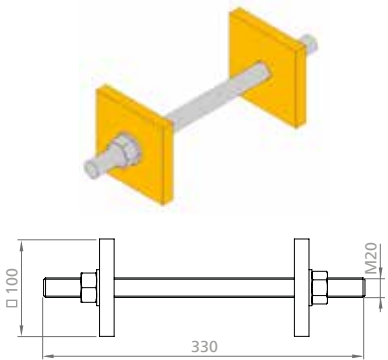
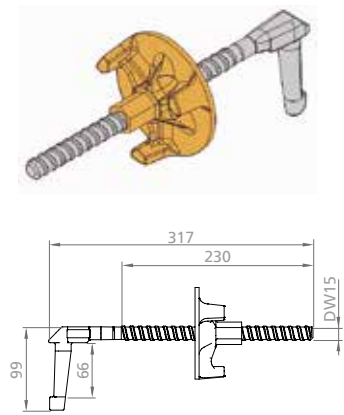
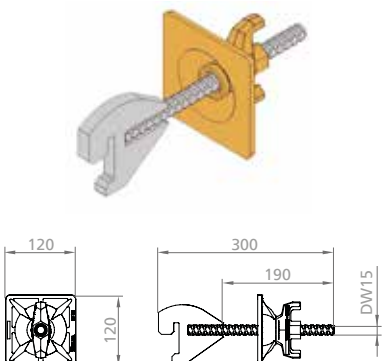
In the first case the joint is made by "Pin W/Head 20 x 100".


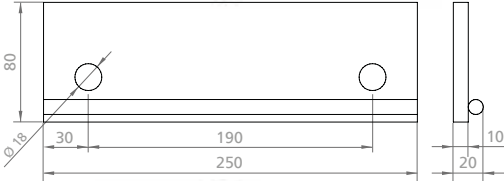

In the second case it is done by "Bolt M18 x 120" and it is necessary to add "Bushing D40 d20 L47".



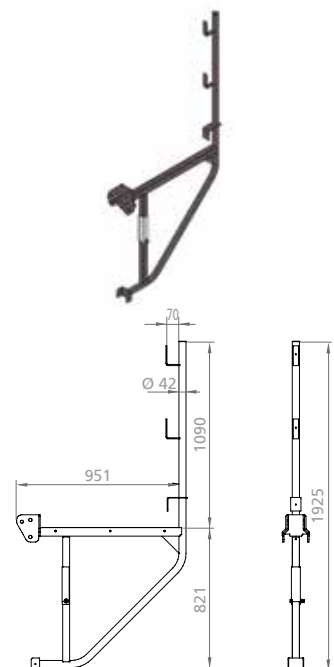
0302022 12.3 WALER SCREW BRACKET TR53 x 6



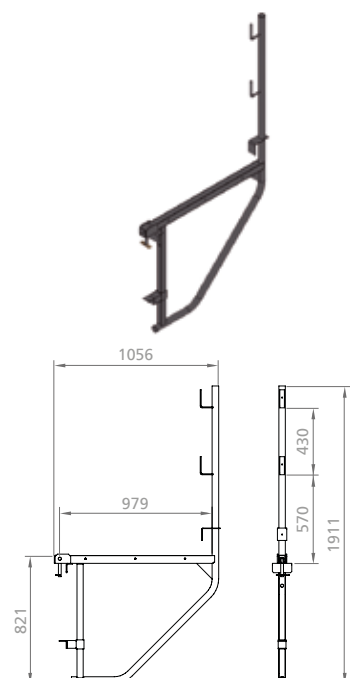
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
VERTICAL WALER ELEMENTS				
0661505	0.35	BUSHING D40 D20 L47		
0241812	0.28	BOLT M18 x 120 DIN-931-8.8		
0241800	0.025	NUT M18 DIN-934-8.8		
0241801	0.020	WASHER A18 DIN-125		
0331013	2.6	HANDLE SCREW TR53	This item introduced into the plates of the waler screw TR53 x 6 facilitates their manual manipulation in the vertical adjustment process.	
0260000	3.2	CLAMP M20 x 330 (2P-100 x 100)	<p>Tying component between two walers.</p> <p>Its main application is to tie the vertical waler (DU-120 or MK-120) to the horizontal walers (DU-100 or MK-120) of the formwork panel, ENKOFORM.</p> <p>Moreover, it is used to tie the walers of the main platform MK-120 to the platform support BMK (1992400) and platform rear support BMK (1992409).</p>	
0260001	6.1	CLAMP M20 x 330 (2P-150 x 150)		
1991587	6.4	CLAMP M20 x 400 (2P-150 x 150)		
1900448	1.4	WALER HOOK	<p>It is used to tie the ribs to the horizontal waler or to the vertical waler when the last one is directly placed against the ORMA formwork.</p> <p>It comprises a hook that is positioned over the holes in the ribs. The fixed plate nut incorporated in the component is used to tighten it over the waler.</p>	
0333004	2.3	WALER FIXING HOOK	<p>Part used to join a DU-100 waler to another DU-120 or MK-120 waler.</p> <p>It is commonly used to connect the vertical waler to the horizontal waler of the formwork (ENKOFORM V-100).</p>	

CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
VERTICAL WALER ELEMENTS				
0919259	1.7	PLATE CLAMP DU-DU	<p>Item used to join two walers at 90°.</p> <p>It is used to join the horizontal ORMA walers with the vertical walers.</p> <p>It is set by "Bolt M16 x 70".</p>	  
0241670	0.14	BOLT M16 x 70 DIN-933-8.8		
0241600	0.030	NUT M16 DIN-985-8.8		
0241601	0.015	WASHER A16 DIN-125		

1960255	16.2	WALKWAY BRACKET E V-100	<p>Element used to form the pouring platform directly on the formwork.</p> <p>The type of bracket depends on the formwork used, ORMA or ENKOFORM.</p>
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1861094	14.8	ORMA WALKWAY BRACKET
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CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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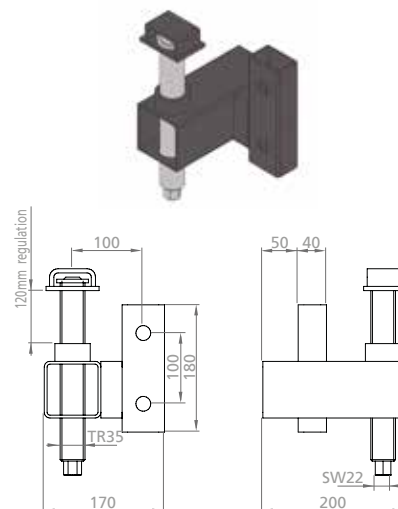
VERTICAL WALER ELEMENTS

0333005 6.1 ENKOFORM ADJUSTMENT JACK Components used to hold the weight and adjust the height of the formwork panel.

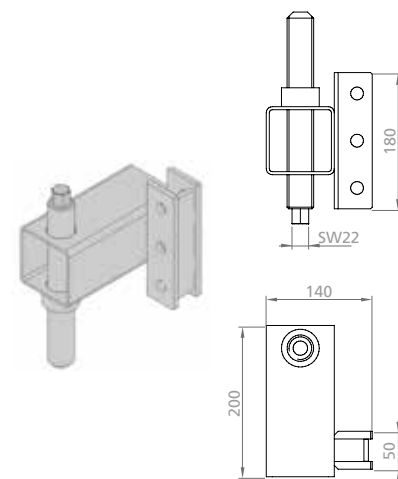
Is necessary to use it when the formwork is joined to the vertical waler by the clamp M20 x 330 (2P-150 x 150) or by the plate clamp DU-DU, in order to withstand the formwork's weight.

The most suitable position is the second or third row of horizontal walers.

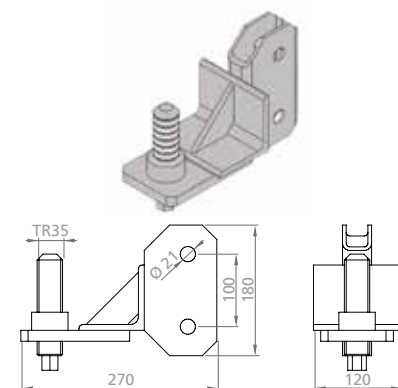
The type of adjustment jack depends on the formwork used.



1991567 5.8 ADJUSTMENT JACK MK-120



0333006 5.9 ORMA ADJUSTMENT JACK



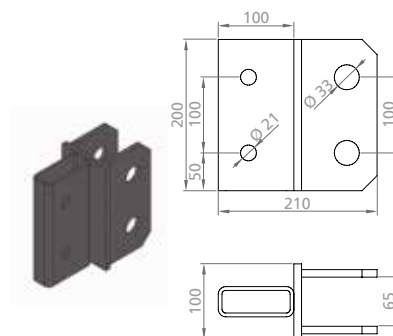
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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VERTICAL WALER ELEMENTS

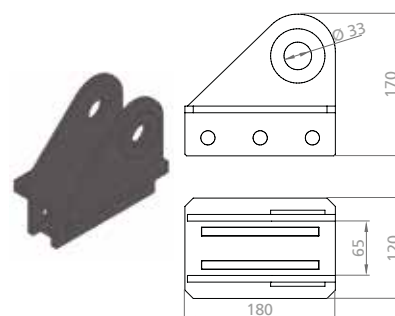
0331009 6.7 PUSH-PULL PROP WALER HEAD Element used to join the push-pull prop TR63 x 6 with the MK-120 vertical waler.

The "Push-Pull Prop Waler Head" is joined to the "Vertical Waler DU-120" using "Pins E20 x 70".

The "Push-Pull Prop Head MK-120" is joined to the "Vertical Waler MK-120" using "Bolts M16 x 90".



1991439 4.9 PUSH-PULL PROP HEAD MK-120

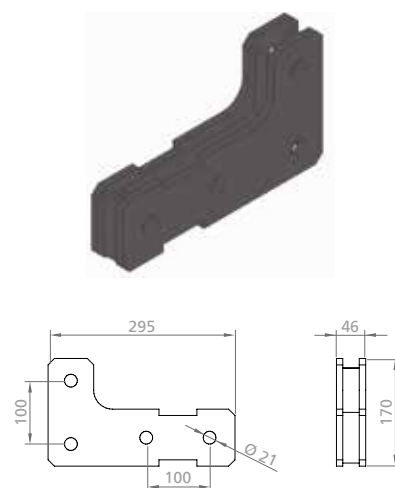


1901795 5.7 UNIVERSAL HEAD

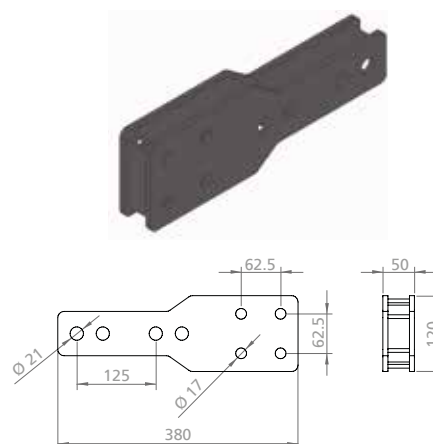
Elements used for the conformation of pouring and upper-intermediate platforms.

For vertical waler DU-120, the "Universal Head" joins the vertical waler to the platform fastened with 4 "Pins E20 x 70".

In the case of vertical waler MK-120, "Axial Node M2-d20 MK" joins the vertical waler to the "platform fastened with 4 "Bolts M16 x 90 and 2 Pins E20 x 70".



1991458 5.1 AXIAL NODE M 2-D20 MK



CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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PUSH-PULL PROPS

1960210	10.6	PUSH-PULL PROP E 0.51-0.75
1960100	14.1	PUSH-PULL PROP E 0.75-1.05
1960110	18.8	PUSH-PULL PROP E 1-1.55
1960115	24.1	PUSH-PULL PROP E 0.51-2.2
1960130	33.4	PUSH-PULL PROP E 2.15-2.75
1960125	38.1	PUSH-PULL PROP E 2.7-3.3
1960410	45	PUSH-PULL PROP E 3.25-4

These are the elements which complete the system and withstand the loads.

They are joint to the structure with 2 pins E20 x 70 (1 to each side).

They rigidize the main platform and the platform of recovery of cones to the mast.

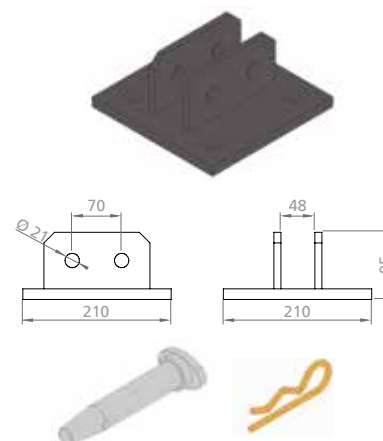
Code	min L	max L	D
1960210	510	750	70
1960100	750	1050	70
1960110	1000	1550	70
1960115	1510	2200	70
1960130	2150	2750	90
1960125	2700	3300	90
1960410	3250	4000	90



1960545	6.8	PUSH-PULL PROP E SHOE 2 D20 x 48
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These shoes are used to stabilize the panel of the vertical formwork on the ground at the first pouring stage along with the push-pull prop E.

The push-pull prop is joint to the base with the pin E20 x 70 y the cotter pin R/5.

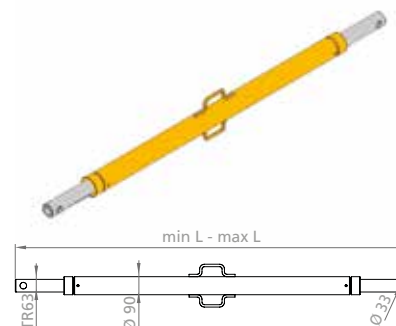


0252070	0.29	PIN E20 x 70
0250000	0.030	COTTER PIN R/5

1991514	41.7	PUSH-PULL PROP TR63 1.52-2.2
0333014	46.6	PUSH-PULL PROP TR63 2.04-2.72

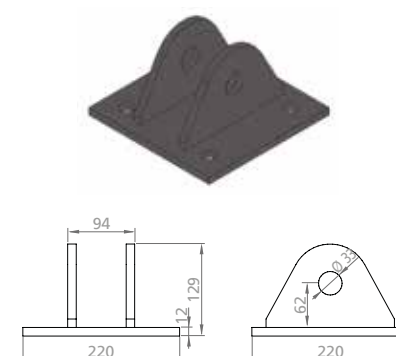
They are used to stabilize the formwork. Its joins the roll-back carriage in the side and to the vertical waler in the upper side with pins D32 x 150.

Code	min. L	max. L
0333014	2040	2720
1991514	1520	2200



0333055	7	PUSH-PULL PROP SHOE TR63
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These shoes are used to stabilize the panel of the vertical formwork on the ground at the first pouring stage along with the push-pull prop TR63. The push-pull prop is joint to the base with the pin D32 x 150 y the cotter pin R/5.



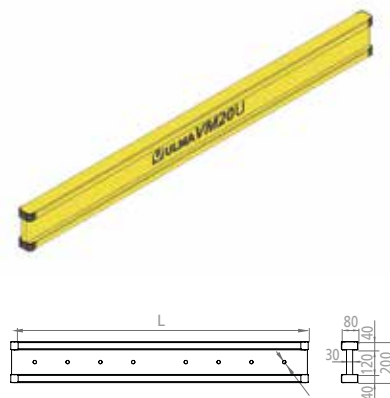
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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PUSH-PULL PROPS

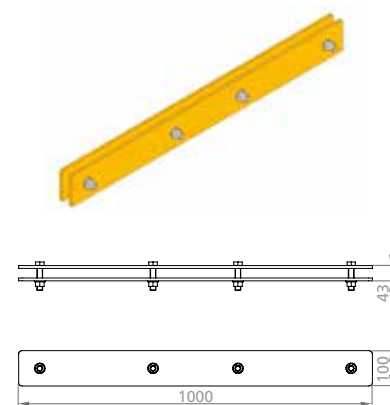
0253215	1.1	PIN D32 x 150		
0250000	0.030	COTTER PIN R/5		



1940191	7.3	TIMBER BEAM VM 20/1.45	Secondly woven elements (attached perpendicular to the walers) that form the surface support of the system's formwork.	
1940172	9.5	TIMBER BEAM VM 20/1.9		
1940197	10.8	TIMBER BEAM VM 20/2.15	Timber beams are used to deck all working platforms.	
1950129	12.3	TIMBER BEAM VM 20/2.45		
1940196	13.3	TIMBER BEAM VM 20/2.65	They have got "I" shape with a measure of 200 x 80 mm. Both edges are protected by plastic corners.	
1940144	14.5	TIMBER BEAM VM 20/2.9		
1950130	16.5	TIMBER BEAM VM 20/3.3		
1940146	18	TIMBER BEAM VM 20/3.6		
1950112	19.5	TIMBER BEAM VM 20/3.9		
1940178	22.5	TIMBER BEAM VM 20/4.5		
1950113	24.5	TIMBER BEAM VM 20/4.9		
1940149	29.5	TIMBER BEAM VM 20/5.9		
1940181	30	TIMBER BEAM VM 20/6		
1940182	32.5	TIMBER BEAM VM 20/6.5		
1940183	35	TIMBER BEAM VM 20/7		
1940192	39.5	TIMBER BEAM VM 20/7.9		
1940167	40	TIMBER BEAM VM 20/8		

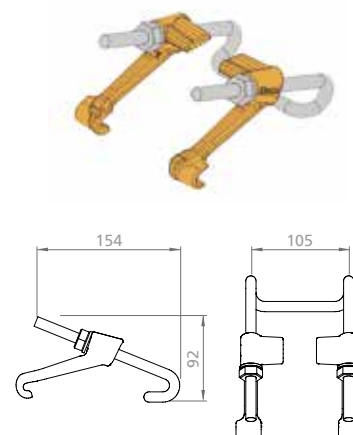


1960305	13.2	BEAM VM-20 CONNECTION PLATE	Component used to join two timber beams longitudinally (bolts included).	
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1960375	0.81	WALER-VM-20 CLAMP 2T	This element joins the timber beam VM-20 to the "Waler MK-120" or "waler DU" perpendicularly, in a fast and effective way.	

The beam must be placed over the wings of the UPN profile of the waler.

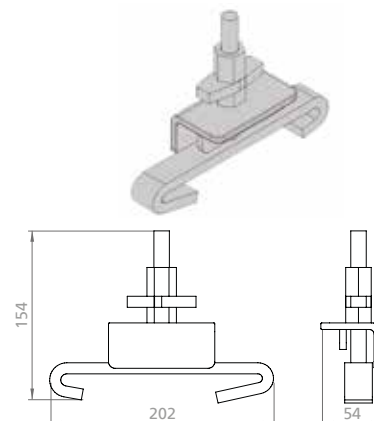


CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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PUSH-PULL PROPS

1960345	1.3	WALER-VM20 ANGULAR CLAMP	This joining element allows joining the "Beam VM-20" to the "Waler MK-120" or "Waler DU" forming and angle.
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This angle can go from 74 ° to 106 °.

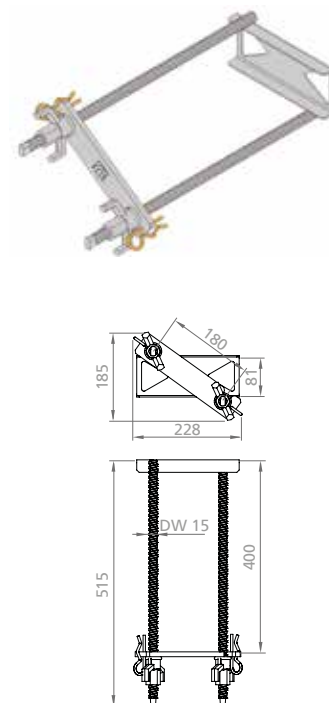


0335295	3.9	CONNECTOR VM-VM	Component used to join two timber beams VM-20 one under the other.
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Allows a joint angle between the Timber beams VM-20 between 0 ° and 110 °.

The connection is made with 2 wing nut 15 and 2 cotter pin R/5 included in the item. The cotter pin R5 avoids releasing the nut.

The connector allows from 0 ° to 110 ° angle between timber beams VM-20.



7251132	15	3 LAYER PLYWOOD 2000 x 503 x 27	The platforms can be performed by means of wooden planks in which case the minimum dimensions that they must have is at least 15 x 5 cm and class resistance C24 according with EN 338. The following ULMA standards 3 layers board can also be used:
7251136	18.5	3 LAYER PLYWOOD 2500 x 500 x 27	

- 3 Layers Plywood 2000 x 503 x 27
- 3 Layers Plywood 2500 x 500 x 27

The plywood will be fastened to the timber beam with the screw 6 x 60.

0249911	0.010	SCREW 6 x 60 DIN-7505-A	The plank will be fastened to the timber beam with the screw 6 x 90.
9371441	0.014	SCREW 6 x 90 DIN-7505-A	

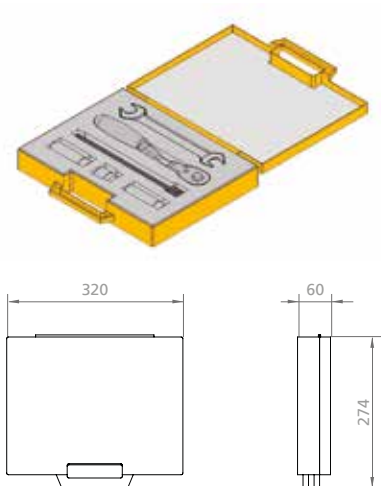


CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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PUSH-PULL PROPS

1960450 2.3 TOOLKIT CASE

This toolkit case includes the necessary tools to screw the elements to be tied to the timber beams VM-20.

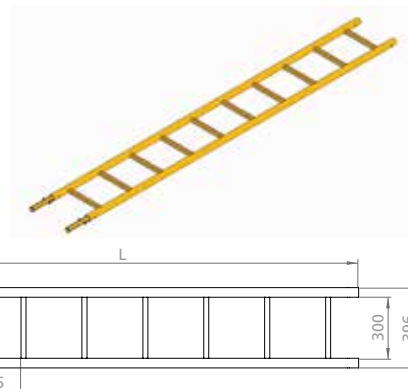


LADDER-HANDRAIL-BRACING

0333008 14.1 LADDER C2.1
0333009 19.4 LADDER C3

They are the main items to provide access between the different working platforms.

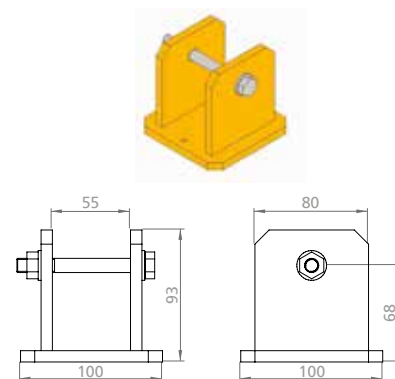
The "Ladder C2.1" and the "Ladder C3" can be used interconnected or separately depending on the pouring height.



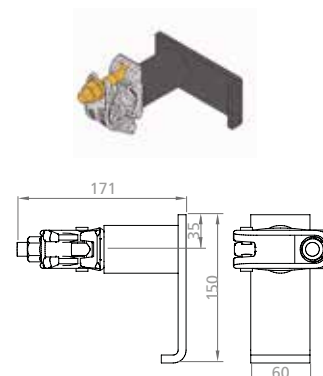
0333010 1.6 LADDER FIXER

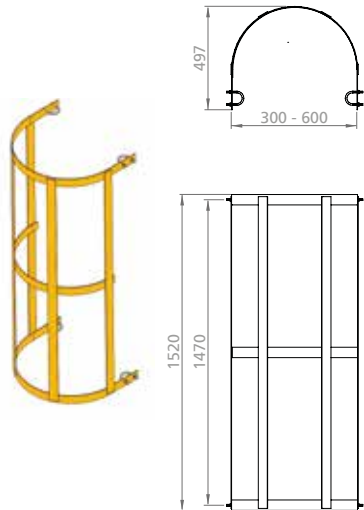
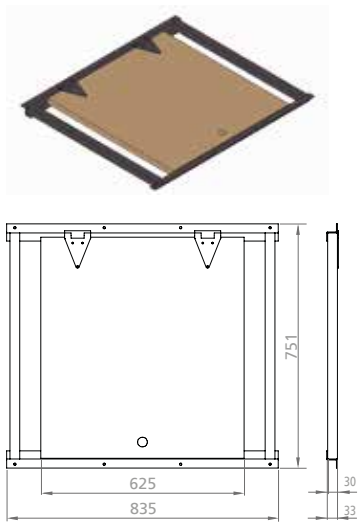
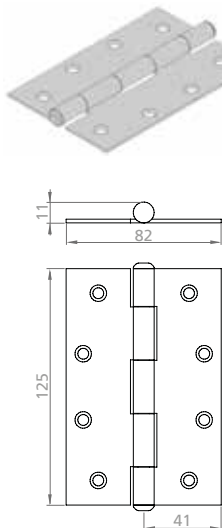

The "Ladder Fixer" serves to fix the ladder at the bottom on the work platforms.

The "Ladder Hanger", serve to fix the ladder in its upper part to the working platforms.



0333011 1.6 LADDER HANGER



CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
LADDER-HANDRAIL-BRACING				
0333012	13.1	LADDER PROTECTION	When the height is above 2.5 m, ladder protection must be placed.	
0333013	11.7	LADDER HATCH	The ladder hatch is nailed to the board of the working platforms and it facilitates access between them.	
1991235	0.22	HINGE 82 x 125 D5.75	<p>These elements are used when it is necessary to make the ladder hatch on site.</p> <p>A piece of plywood will be cut and the hinges will be fixed to the plywood.</p> <p>To fix the hinge and the hatch handle 6 x 60 screws should be used.</p>	
0919125	0.30	HATCH HINGE		

CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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LADDER-HANDRAIL-BRACING

0919126 0.20 HATCH HANDLE



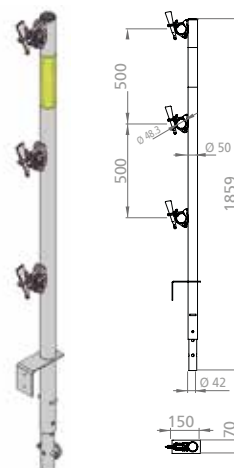
0249911 0.012 SCREW 6 x 60 DIN-7505-A



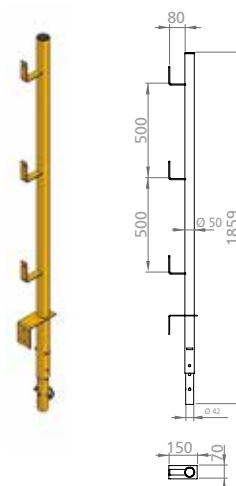
2211156 9.6 HANDRAIL POST 1.5

They form part of the security of the jobsite. They are placed vertically and separated certain distance.

There are different models. The "Handrail Post 1.5" is used in conjunction with the tube and "Handrail Post 1.5 wood" with plank, to complete the closure.



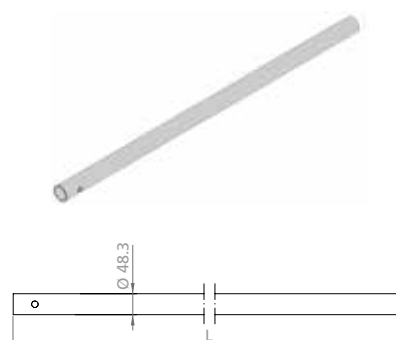
2211185 8 HANDRAIL POST 1.5 WOOD

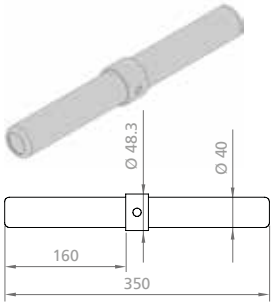
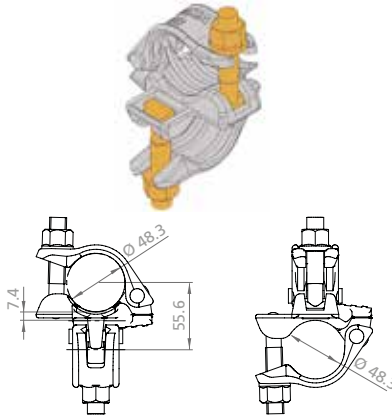
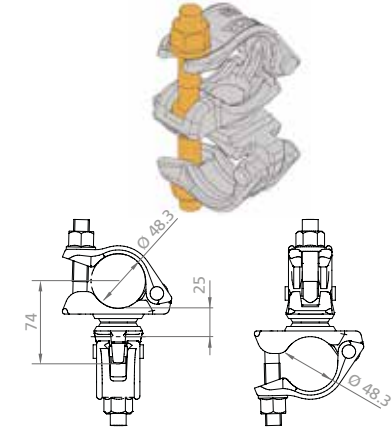
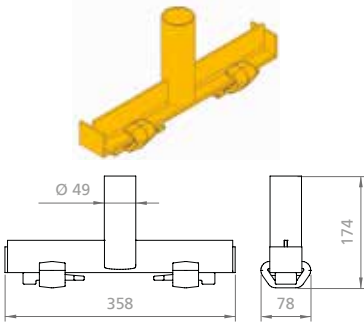
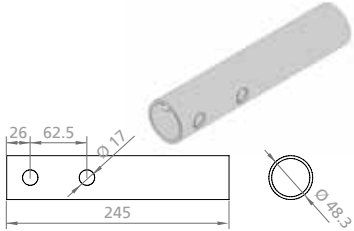


2125288 1.8 TUBE 48/0.5
2125289 3.7 TUBE 48/1.1
2125290 5.5 TUBE 48/1.6
2125291 7 TUBE 48/2.1
2125647 8.7 TUBE 48/2.6
2125249 11.4 TUBE 48/3.1
2125648 12.1 TUBE 48/3.6
2125250 14.6 TUBE 48/4.1
2125251 18 TUBE 48/5
0200600 20 TUBE 48/6

It is used as a handrail of the different platforms and also for initial bracing in the mounting phase of the bracket.

Once the handrail post 1.5 are fixed, the Ø 48 tube are fixed to them by the wedge or by the coupler 48/48 to the "external closure".



CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
LADDER-HANDRAIL-BRACING				
2125312	1.3	RIGHT ANGLE COUPLER 48/48	Spigot used to connect two Ø 48 tubes lengthwise to obtain the required length.	
2125148	1.2	RIGHT ANGLE COUPLER 48/48	<p>Elements used to join two Ø 48 tubes.</p> <p>The right angle coupler is used to join two tubes perpendicularly.</p> <p>The swivel coupler is used to join two tubes at different angles.</p>	
2125147	1.3	SWIVEL COUPLER 48/48		
0260505	3.4	SIMPLE BRACING	<p>This element is placed in the wing walers. Allows placing the tubes in cross, for bracing the formwork on that side.</p> <p>Another application of this piece is to tie the ladder to the horizontal waler.</p>	
1990570	0.82	HANDRAIL HEAD MK	<p>Tube used to support the couplers and to brace the platforms.</p> <p>It is fastened to the waler with 2 bolts M16 x 90 and 2 nuts M16.</p>	

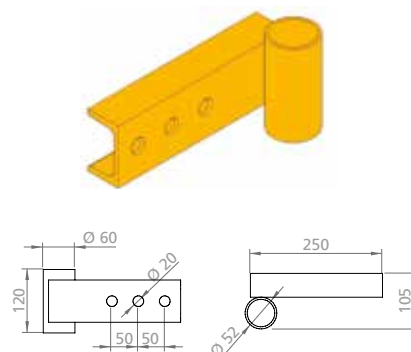
CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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LADDER-HANDRAIL-BRACING

0121004 2.9 HANDRAIL SOCKET D50

This element allows placing the "Handrail Post 1.50" at the end of the waler, to be able to mount the handrails.

It can be mounted from inside the waler by means of "Pins E20 x 70" or externally using "Bolts M20 x 100".



0252070 0.29 PIN E20 x 70
0250000 0.030 COTTER PIN R/5



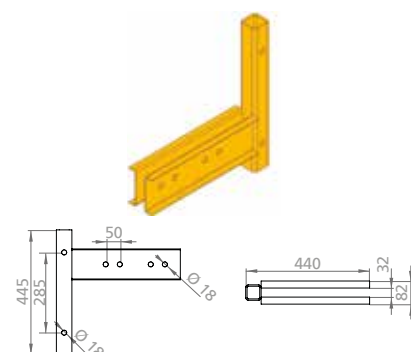
0242010 0.35 BOLT M20 x 100 DIN-931-8.8
0242008 0.070 NUT M20 DIN-985-8.8



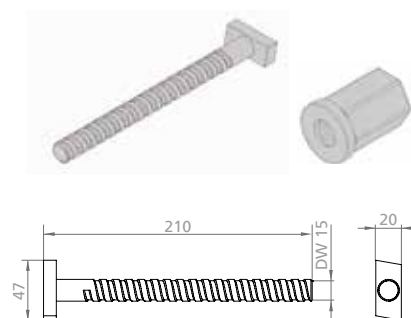
2211165 6.9 VM HANDRAIL SUPPORT

This element is used to support the handrail Post 1.5 at the end of the "Timber Beams VM-20", to be able to mount the handrails.

Element that allows to place the "foot railing 1.50".



1861122 0.39 PANEL BOLT
7238001 0.22 HEXAGONAL NUT 15



BOLTS AND PINS

0252070 0.29 PIN E20 x 70
0250000 0.030 COTTER PIN R/5



0241690 0.17 BOLT M16 x 90 DIN-931-8.8
0241608 0.035 NUT M16 DIN-985-8

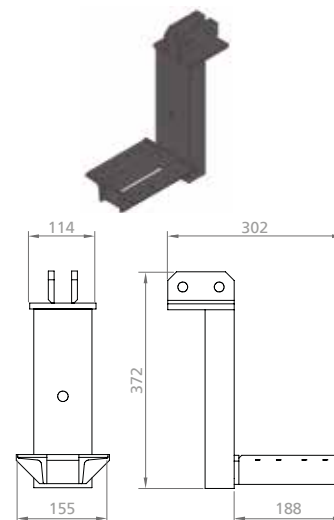


CODE	WEIGHT Kg	NAME	DESCRIPTION	PICTURE
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PREVIOUS VERSIONS

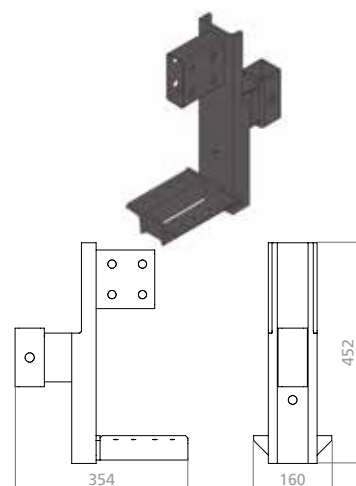
1991427 7.7 PLATFORM SUPPORT MK-120 This element's function is the same than "Platform Support BMK (1992400)".

The difference is that this support is not telescopic, so you cannot put the platform to the same level for different platform configurations.



1991434 9.3 PLATFORM BACK SUPPORT MK-120 This element's function is the same than "Platform Rear Support BMK (1992409)".

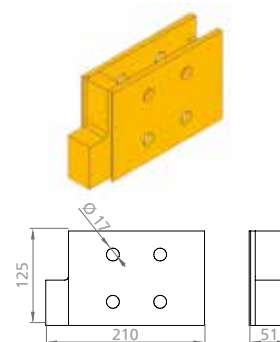
The difference is that this support is not telescopic, so you cannot put the platform to the same level for different platform configurations.



1991370 4.1 SELF-CLIMBING BLOCK HWS

Element COMPATIBLE to "Self-Climbing Block LT HWS (1991375)" but:

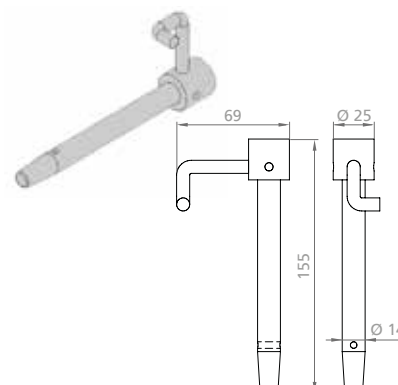
- It is not symmetrical. It can only be mounted in the position of the image.
- Use 4 "Bolt M16 x 90" instead of 3.



1991510 0.25 GEAR LOCKER MK

Used in versions of "Roll-Back Carriage MK-120" that do not have rear blocking system.

It is responsible for blocking the "Gear MK" that moves the "Roll-Back Carriage MK-120".



6. TERMS AND CONDITIONS OF USE

6.1. SAFE OPERATING GUIDELINES

6.1.1 General guidelines

- Strict adherence to all instructions included in the Project Plan, the Health and Safety Plan, and any further applicable technical and/or safety regulations is strongly recommended.
- All work activities must be carried out by qualified personnel under the oversight of a competent supervisor.
- All instructions for the proper use of the equipment employed on the worksite must be followed. Consult manufacturer or distributor operating manuals whenever applicable.
- Only approved auxiliary equipment and appropriate protective equipment – preferably Collective Protective Equipment (CPE) – are to be used.
- Personal Protective Equipment (PPE) must include the following: safety helmet, safety footwear, protective gloves, and tool belt. Further PPE – including reflective jackets, anti-fall harnesses with lifelines, safety glasses, Respiratory Protective Equipment (RPE), ear-plugs, etc. – should be used whenever conditions so require.
- Avoid heavy impacts on working platforms and panels. It is strictly forbidden to jump, abruptly unload material, or subject either the platforms or panels to similar stress.
- If the building site is located nearby high voltage power lines, it is recommended to work without using electricity whenever possible. If this is not possible, all appropriate safety measures outlined in the applicable standards must be taken.
- Under adverse weather conditions, all work with building material on the worksite should be halted.
- In the event of a storm with heavy winds, remove all equipment and material from the platforms, ensuring both before and after the storm passes that all ties, meshes, platform anchorages, etc. are properly secured.
- Before starting the stripping and dismantling process, ensure that all structural components (e.g. ties) are in place. If they are not, examine the entire structure before proceeding.
- Furthermore, ensure that no loose material remains on the structure (e.g. working platforms) that could fall and injure people below.
- The following measures must be taken to restrict access to the structure during erection, dismantling, and at any other time during which it is not in proper working condition (e.g. missing CPE): signposting, fencing, and the use of warning tape, barriers, or meshes to enclose and clearly demarcate the working area from zones of public passage.
- Employees and any third party accessing a structure without the CPE yet in place must use all PPE indicated to prevent falls from height and to be protected from falling objects.
- The purchaser or lessee of the structure shall inform and

instruct its employees to comply with all guidelines necessary for safe use.

- Any alterations to the structure must be executed under the oversight of a competent supervisor and must comply with the instructions in the operating manuals of the manufacturer or distributor.
- The purchaser or lessee shall conduct periodic inspections of the assembly to verify the correct installation of critical structural elements, as well as ensure that no employees or third party has removed or altered any other aspects of the structure.

6.1.2 Load cases

The following load cases are identified for the HWS sets:

- **Working Condition:** Unloading works can be done. These jobs can only be done when the wind speeds are below 72 km/h.
- **Climbing:** The whole assembly is being lifted. Lifting jobs can only be done when wind speeds are below 55 km/h.
- **Out of service:** Situation in which the maximum allowable wind speed of 72 km/h has been exceeded.



When facing an “Out of Service” case, the customer is responsible to take the following preventive measures to ensure the safety of workers on the building site:

- Place the formwork in concreting position (Against the wall).
- Block the roll-back carriage system MK by means of wedge and locking pin.
- Tie any loose object that are on the platforms.
- Evacuate all employees working on the RKS structures. Works must not continue on the RKS system.

The customer is responsible to check the wind speed and the live loads on the platforms at all times.

The use and the presence of persons on the RKS system are forbidden when the weather forecast reports a storm with lightening.

6.1.3 Maximum working loads

According to the load case, some maximum load conditions are specified to which the system can be submitted.

In each load case, permanent loads equal for all load cases and variable loads differing according to the load case are considered.

Subsequently, the loads to consider are specified:

- Permanent loads:
 - Self-weight of the structure
 - Self-weight of the formworks
 - Self-weight of the working platforms
- Variable loads:
 - Live loads on working platforms
 - Wind loads (according to Eurocode 1)

If applies, loads due to other working equipment must also be considered, for example, the static or dynamic loads of the

concrete placing booms and seismic loads depending on the geographical area in which the structure is located.

6.1.4 Anchorage strength

For each application, the loads acting on each anchor as well as the minimum strength which the concrete must have to hold the elevating structure are specified.

6.1.5 Specific aspect of the system RKS

For each application, the loads acting on each anchor as well as the minimum strength which the concrete must have to hold the elevating structure are specified.

- The entire structure with its components must get assembled according to the instructions and assembly drawings provided by ULMA. All bolts, connections, tie rods, pins, etc. must be assembled correctly.
- It is of utmost importance to embed the anchors into the concrete as indicated in the "User's Guide" in order to correctly transmit the loads from the structure to the concrete. The correct transmission of the reactions in the anchors to the concrete is responsibility of the customer. Only components supplied by ULMA are used to support and anchor the RKS system. ULMA cannot be held responsible for the use of material supplied by third parties.
- When introducing the head LT HWS into the bracket LT, remove ONLY 1 side positioning pin.
- After fixing bracket LT and Head LT are done check the following points:
 - The 2 positioning pins are correctly positioned and blocked with its respective cotter pins R/3.
 - The double pin of the head LT HWS is correctly positioned and locked with the cotter pin R/3.
 - The head LT HWS rest vertically on the lower part of the wall bracket LT HWS and horizontally in the horizontal support. NEVER support vertically the head on the horizontal support.
- The live loads and maximum values of reactions indicated in this guide must be respected. Likewise, the minimum concrete strengths indicated for the operation of the RKS system in the different load cases must be respected. The customer is responsible to control and check the concrete strength.
- For correct handling of the RKS system, the customer shall ensure at all times a minimum lighting of 100 lux in working areas, and particularly in areas where the cylinder operation is supervised.
- Travel sequences of the RKS system are carried out under the supervision of the person in-charge of the hydraulic installation. This person must be trained for the handling of RKS systems.
- Before starting to elevate the structure RKS, make arrangements to close the sides of the platform to avoid falls from height.
- The workers responsible for the operation of the RKS system shall remain in the areas specified in this guide. During

climbing, the access to any other area of the structure which is not the specified one is forbidden. Before starting any movement (formwork, masts, platforms) it must be ensured that no person is exposed to any danger and a clear sign to everybody that movement will start shortly must be given.

- The RKS system must never be used as elevators for material or persons. Only the absolutely necessary number of persons for the operation should remain on the working platforms.
- During the elevation of the structure or masts, when the cylinders and climbing heads are working, the workers responsible for the handling do not touch at any time components in motion or hydraulic power units, as this can lead to crushing and bruising injuries.
- During climbing operations, there are workers at each climbing unit to ensure:
 - The correct operation of each cylinder and climbing heads during each cylinder stroke.
 - That no parts of the moving structure can collide with parts of the rest of the structure.
- After each extension or retraction of the cylinder during the process of masts or platform elevation, it must be ensured that the pawl returns to its working position. Otherwise, the pawl must be placed manually in its working position by turning the lever of the climbing head before re-starting an extension or retraction.
- To prevent collision between several structures during elevation, special attention must be paid to the contiguous platforms and to any object which could interfere in the elevation movement of the system.
- When the climbing operations are finished, the hydraulic power units are switched off with the power switch.
- The RKS structure can also be lowered with the hydraulic system. But this movement is not automatic therefore this operation is carried out with caution and always under the supervision of personnel of ULMA.
- All working platforms of the RKS system are kept free from ice and snow, even when not in use. At temperatures below 0°C, carry out checks of the climbing heads and hydraulic power units with special care.
- Before moving the roll-back carriages, ensure that nobody remains between wall or steel reinforcement and formwork panel.
- When putting the formwork panels into concrete pouring position, it is very important to strictly follow the steps indicated below:
 - Move the panel close to the wall (2-3 cm from the wall) with the roll-back carriage.
 - Plumb the formwork panel with the push-pull prop.
 - Adjust the vertical position of the formwork panel with the levelling jack located at the bottom of the vertical waler.
 - Adjust the final position of the formwork panel with the tie rods.
- At the first lifting check that the cylinders support the weight when the power unit is stopped. For that purpose, lift the panel 5 cm, stop the power unit, wait and observe.

- For the correct dismantling and recovery of the anchorages, it is recommended to use lubricants which ease the subsequent extraction of the components of which the anchorage consists as well as to avoid possible concrete leaking into the anchorages.
- All electrical connections made to supply electricity to the hydraulic power units must be made in proper junction boxes, with air leak tight seals, which do not leave the electrical contacts in the open air.

6.1.6 Additional aspects for the formwork

• Formwork

- Place some racks to store or move the formwork panels which prevent their damage and ease the building site order, the panel cleaning and the transport to their area of operation.
- Ensure the fastening of plate nuts, and the correct positioning and anchorage of push-pull props to the ground.
- Special attention should be paid to the fastening of the wedges of the clamps, holding together the panel joints to prevent concrete laitance.
- Ensure the correct anchorage of the previous formwork set, before placing the next.
- Do not leave any part half-assembled or half-dismantled.
- It is forbidden to climb on formwork except in extraordinary cases duly studied and with appropriate protection systems in place.
- Before concrete pouring, make sure the formwork surfaces are clean.
- Clean panels after each use. Wire brushes are not suitable for cleaning as they are damaging the phenolic film of the plywood.
- It is important to state that the phenolic coating rarely suffers from the chemical and abrasive action of the concrete. But where it is already damaged, e.g. at holes and deteriorated areas, it must be thoroughly sealed to prevent any further damage to the plywood.
- Any cut edge of the plywood should be sealed as soon as possible, because cut edges soak up water from the concrete and swell, thus increasing in thickness.
- In general, it is not recommended to use nails or screws on the plywood.
- For storage, the panels should be stacked one on top of the other, placing wood runners between them. Use some sort of support to separate them from the ground, and provide shelter. Prolonged sun and rain exposure damages the panels.

• Release agent

- Release agent helps separating the formwork from the concrete, and thus increases the number of uses and the life span of the panel in general.

- It plays an important role for the quality of the concrete finishing because it prevents holes from air bubbles on the concrete surface and provides a uniform colour.
- Apply the release agent uniformly and in thin layers onto the panel, bearing in mind at all times the instructions for correct use.
- Thoroughly clean the panel surface before applying the release agent on it.
- Clean the metal frame and the panel off the release agent after every 4 to 5 uses.

• Concrete placement and compaction

- Comply with the maximum hydrostatic pressures according to the instructions of the respective formwork system.
- Continuously check the state of the formwork during concrete casting. Stop further casting in case of any incident.
- Place the concrete in uniform layers of 30 to 45 cm.
- For vertical concrete placement, cast the concrete from the least height above the formwork possible. Do never exceed 2 m height unless a pipe or tube or any similar accessory is used to channel the concrete. Deposit the concrete as near as possible to the formwork base, centring on one point without casting directly against the formwork.
- When casting with bucket, take special care of not hitting the formwork, and of complying with the maximum load-bearing capacity of the crane.
- Avoid concrete splashes on the panels as these will reflect on the finished surface.
- Use the appropriate method for concrete consolidation and compaction depending on the concrete consistency and its workability.
- The preferred consolidation and compaction method for wet cast-in-place concrete are poker vibrators. Use external vibrators only when the concrete cannot be accessed with poker vibrators and for parts moulded already in the workshop. External vibration requires a specific analysis.
- Completely immerse the poker 10 to 15 cm into the concrete, and put it into each area of concrete, only once. When concrete is poured in layers, place the vibrator into the previous layer to meld the two layers together.
- Never allow the vibrator to touch the formwork to prevent exceeding the considered loads.
- Immerse vertically or slightly inclined and quickly, but withdraw slowly.

• Concrete curing and formwork stripping

- Check that curing is sufficiently advanced for stripping without causing spilling at the concrete surface which destroys the finishing and can affect the strength and durability of the concrete.
- Increase the curing time of the concrete when facing fast drying and shrinkage due to evaporation from wind or low temperatures.

- The time span between casting and stripping shall be the same for all parts of the concrete structure. This is justified when a high finishing quality is aimed for because the tone of the concrete surface depends on how long the concrete surface is isolated from the outside.
- Ensure the absence of unauthorised people in the vicinity where stripping takes place.
- Once stripping is finished, place the formwork on a sort of support and proceed with its cleaning and dismantling, if it is not going to be used for further casts.

6.2. TRANSPORT, HANDLING, AND STORAGE

6.2.1 General guidelines

- Inform yourself about the hazards present on the building site and the preventive measures necessary to avoid them.
- Follow all instructions given by the project foreman.
- Ensure that there is adequate communication between all employees working together.
- Use equipment only when authorised, specifically trained, and informed as to proper use.
- Maintain a minimum safe distance from all mobile work equipment (including forklifts, lorries, cranes, and other construction machinery), as well as from areas that present a risk of falling objects.
- Do not stand, walk, or work under suspended loads, nor in the trajectory or in the vicinity of these loads.
- Protect material from collision and crushing during transport, handling, and storage.
- All material is to be packed for transport in appropriate containers such as wood or steel pallets, boxes, or strapped in bundles with a stable base.
- Strap bundles in a sufficiently stable manner so as to prevent them from moving and getting damaged. If necessary, protect the items with additional safeguards.
- When cutting straps, stand to one side and use gloves and safety glasses; guard against the danger of being cut by the strap or caught by the freed material.

6.2.2 Transport

- Ensure that material is stably loaded, complying with the instructions of the driver. Watch for balanced distribution on the lorry bed, make sure that all auxiliary items are properly fastened, etc.
- Keep your distance when opening the containers after transport to prevent injuries from falling objects.

6.2.3 Handling

• Manual load handling

Some ergonomic principles to be followed are as follows:

- Avoid making brusque movements.
- Before lifting the load, examine it to detect any sharp corners, dirt, etc. and decide, according to its shape, weight, and volume, the best way to get a secure grip on the load.
- Lift by separating your feet to shoulder distance, and crouch down by bending at the knees, never at the back.
- Use a mechanical lifting device and/or ask for help from co-workers when lifting heavy or awkward materials.

• Mechanical load handling

- Use only approved mechanical lifting devices appropriate for the operation.
- Check the condition of slings, cables, and any other lifting accessories before each use.
- After fastening the lifting accessories and before lifting begins, step back to a safe distance from both the load and any other materials which could be affected by the load.
- Comply with all instructions given by the specifically-trained equipment operator.
- The load is to be lifted gently, without any brusque movements.
- When conducting difficult or dangerous lifting operations, or when the crane operator lacks a view of the entire load trajectory, crane operations are to be directed by a signaller in constant communication with the operator by means of a previously agreed-upon code of signs.
- If necessary, use taglines to guide the load from a distance. Loads are never to be guided by hand whenever there is a danger that the rigger could be trapped by the load. Swinging and/or unforeseen movements of the load can cause serious accidents.

6.2.4 Storage

- Material must be stored properly if it is to be kept in good working condition.
- Whenever possible, store the material so that it is protected from environmental conditions, so as to prevent deterioration.
- Material of the same type and size should be stored together using equipment designed for such purposes, e.g. boxes, pallets, and the like.
- Ensure the stability of any stacks made, bearing in mind the following key points:
 - Load-bearing capacity of the ground
 - Uneven ground
 - All packages levelled

- Package or container support
- Package stability
- State of the straps used
- State and capacity of the containers used
- Do not stack full containers on top of empty or half-empty containers
- External conditions (wind, risk of another object hitting the stack, etc.)

6.3. INSPECTION AND MAINTENANCE

6.3.1 General guidelines

- ULMA is responsible for the delivery of the products, for sale or lease, in good working condition.
- Correct use, inspection, and maintenance of the products supplied is the sole responsibility of the buyer or lessee.
- Maintenance is to be carried out according to the legislation applicable in the country of use.
- Any treatment in violation of specifications – exceeding load-bearing capacities, collisions, etc. – can create serious defects in the product supplied.
- The buyer or lessee should periodically review the state of the product for anything broken, deformed, missing, cracked, severely corroded, worn, etc. Special care should be taken with more delicate components, notably those made of aluminium, and with any elements with a direct effect on personal safety.
- Any components not in proper working order should be promptly removed from the worksite.

6.3.2 Cleaning

- The buyer or lessee should periodically clean the product supplied, removing concrete residue, grime, etc.
- In addition to the functional areas – surfaces in contact with the concrete, areas of contact between pieces, drives, etc. – we also recommend that any structural elements – such as welded joints, thin zones, notches, etc. – that could be damaged by overloading or inadequate use, be cleaned so as to detect the possible defects indicated above.

6.3.3 Repair of damaged components

- The buyer or lessee can substitute any damaged elements provided that are easy to install, and that replacements are provisioned by ULMA and employed according to ULMA's instructions.
- If the buyer or lessee undertakes any repairs that entail modifications in the structural integrity of the product, including cuts, welds, rivets, the addition of foreign elements, etc., the buyer or lessee will take full responsibility for the effects of such modifications. It is strictly forbidden to make such repairs on any product leased from ULMA.

6.3.4 Maintenance of the RKS system

- Before assembling any system part, check that it is in good working condition (rust, deformation, etc.).
- Before the first climbing stage and at each subsequent stage, check that:
 - All hydraulic connections are correct.
 - The hydraulic system HWS works properly.
 - The heads HWS and climbing heads HWS work properly.
- Check monthly:
 - The correct state of the heads HWS and climbing heads HWS ensuring their proper working. Lubricate the joints of the climbing heads.
 - Check the correct arrangement and working of bolts, pins, wedges and joint components, in general.
 - State of hydraulic hoses (without holes or brittle rubber due to ageing, etc.) and tight connections of the hoses at the power unit and the cylinders.
- Special care is taken when handling (especially at assembly) the hydraulic cylinders, hydraulic power units, heads and climbing heads.
- All parts which get in contact during the climbing stage of the HWS system, should be properly lubricated to minimise the friction between mobile system parts, and consequently, possible live overloads in the system. The mobile components to be lubricated on the contact surfaces are:
 - Masts.
 - Climbing heads HWS.
 - Heads HWS.
- No alteration or change neither to the system components nor to the assembly of the HWS system is made without the approval and under the supervision of personnel of ULMA.
- All welding which affects the operation of the HWS system are carried out under the supervision of personnel of ULMA.

6.3.5 Maintenance of the hydraulic equipment

Preventive maintenance should be carried out on all equipment and accessories connected to the hydraulic power units in order to prevent possible breakdowns that could result in significant damage:

- Visually check all hose and tube connections to detect possible hydraulic fluid leaks.
- Verify that the equipment is capable of working at maximum pressure. The standard equipment working pressure is 160 bar, being its maximum 190 bar.
- Check there are not any leaks in the pressure gauges.

General maintenance frequency is described next:

- **External Cleaning:**
 - Monthly.
 - Enables an easy leak location and a quick intervention.
- **Air filter review:**
 - Monthly. Eventual cartridge change.
 - Cartridge Reference: MPFILTRI A7L10

- **Hydraulic fluid filter review (return):**

- Weekly.
- Cartridge should be changed when indicator gauge passes its limit (red zone) or once a year.
- Cartridge Reference: MPFILTRI MF1003A10HB

- **Hydraulic fluid filling:**

- Tank must be fulfilled when the level drops to the minimum. The use of different types of hydraulic fluid can cause some inconvenience. According to international standards, high quality fluids should be used.
- Hydraulic fluid: HLP-32

- **Hydraulic fluid Change:**

- Should be done every 2000-3000 working hours or once a year.
- It is recommended to clean the bottom of the fluid tank every time the hydraulic fluid is changed. It is not recommended to mix different types of hydraulic fluid.

NOTE: For further information consult the "User Guide – Hydraulic Lifting System HWS-RKS"

6.3.6 Inspection instructions for components with CE marking of ULMA Construction

Check the condition of the mentioned parts prior to each use. For more information, consult ULMA Construction.

The lifting appliance lifting hook MK (1991360), must be checked before each use to confirm the good working condition of the following parts:

COMPONENT / FEATURE TO CHECK	CORRECT WORKING CONDITION
Ring	Without deflection nor excessive wear
Square bar	Without deflection
Bolt	Without deflection
ID plate	Existing and readable

If the lifting appliance does not fulfil all defined requirements, it must be removed from service.

6.3.7 Inspection instructions with ce marking of equipment marketed by ULMA Construction

Equipment with CE marking marketed by ULMA Construction is checked following the instructions stipulated in the "User's Guide of the respective product".

7. LEGAL REFERENCES

- **Council Directive 89/391/EEC** of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work.
- **Council Directive 89/654/EEC** of 30 November 1989 on the minimum safety and health requirements for the workplace.
- **Council Directive 89/656/EEC** of 30 November 1989 on the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace.
- **Council Directive 90/269/EEC** of 29 May 1990 on the minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back injury to workers.
- **Council Directive 92/57/EEC** of 24 June 1992 on the implementation of minimum safety and health requirements at temporary or mobile construction sites.
- **Directive 92/58/EEC** of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work.
- **Directive 89/655/EEC** of 30 November 1989 concerning the minimum safety and health requirements for the use of work equipment by workers at work. Council Directive 95/63/EC of 5 December 1995 and Directive 2001/45/EC of the European Parliament and of the Council of 27 June 2001 amending formerly mentioned Directive.
- **Directive 2002/44/EC** of the European Parliament and of the Council of 25 June 2002 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration).
- **Directive 2003/10/EC** of the European Parliament and of the Council of 06 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise).
- **Directive 2006/42/EC** of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast).

8. APPENDIX

8.1. DECLARATION OF CONFORMITY

AGREEMENT STATEMENT

According to Directive 2006/42/CE concerning machines

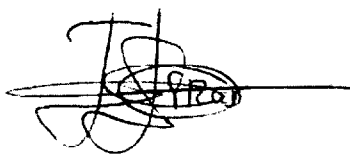
Hereby ULMA C y E, S.Coop., located in Paseo Otadui 3, 20560 Oñati, declares that the product whose code and name are mentioned below complies with the design and manufacturing aspects concerning people's safety required by the corresponding European directive, being this the valid statement until the product suffers any modification.

Code: **1991274**

Name: **LIFTING HOOK RKS**

Oñati, 4th February 2014

Signed



Iñaki Irizar, R&D Manager
Responsible for compile the technical file
Barrio Garibai nº 9, 20560 Oñati

Signed



Aitor Ayastuy , General Manager

DECLARATION OF CONFORMITY

According to Directive 2006/42/CE concerning machines

Hereby ULMA C y E, S.Coop., located in Paseo Otadui 3, 20560 Oñati, declares that the product whose code and name are mentioned below complies with the design and manufacturing aspects concerning people's safety required by the corresponding European directive, being this the valid statement until the product suffers any modification.

Code: **0331010**

Name: **WALER LIFTING HOOK**

Oñati, 28th January 2011

Signed



Ander Ollo, R&D Manager
Responsible for compile the technical file
Barrio Garibai nº 9, 20560 Oñati

Signed



Aitor Ayastuy , General Manager

DECLARATION OF CONFORMITY

According to Directive 2006/42/CE concerning machines

Hereby ULMA C y E, S.Coop., located in Paseo Otadui 3, 20560 Oñati, declares that the product whose code and name are mentioned below complies with the design and manufacturing aspects concerning people's safety required by the corresponding European directive, being this the valid statement until the product suffers any modification.

Code: **1991360**

Name: **LIFTING HOOK MK**

Oñati, 28th January 2011

Signed

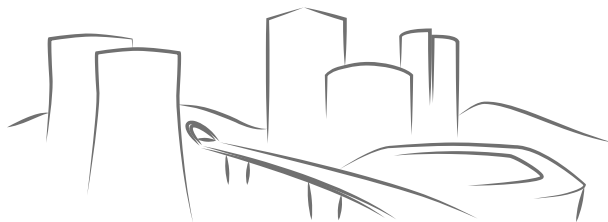


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From the beginning of your projects



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