

USER'S MANUAL

CIRCA-FLEX formwork for walls





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CIRCA-FLEX FORMWORK

The **CIRCA-FLEX** system is based on a range of modular formworks with variable radius used for curved structures cast on site. The curvature radius of panels can be easily adjusted by using screw adjusters.

The versatility of the SVELT formwork allows carrying out walls with oval or "S" shaped base and even linear walls, also in combination with P300 formwork system. The application fields of **CIRCA-FLEX** formworks are mainly related to large sewage and water treatment plants, but they are also ideal for creating circular silos or piers and also semicircular combined structures in civil construction.

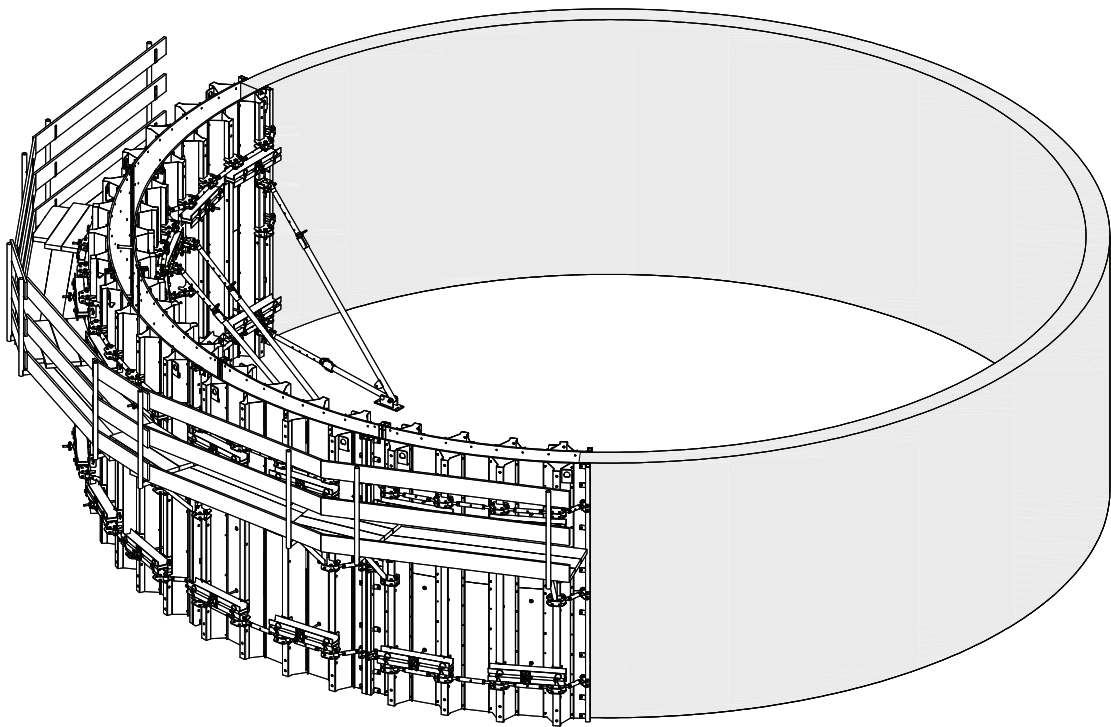


Fig. 1

DIRECTIONS

USER TRAINING

- The instructions given in this User Manual are intended for users of the products manufactured by Pilosio SPA. The rules for assembly and usage are explained in order to ensure a correct use of the products.
- All users of the products supplied should be familiar with the contents of this document, with particular reference to the safety instructions.
- Workers who find it difficult to consult the documentation accompanying the product and this User Manual must be instructed in this regard by the client.
- The client must ensure that the User and Assembly Manuals, the design documents and the product information sheets, supplied by Pilosio, are present on the construction site and made known to the workforce.

CONSULTATION OF THE USER MANUAL

- The assembly and usage instructions contained in this Manual should be regarded as general in nature and, where necessary, should be supplemented with an assembly and usage manual for specific applications.
- The illustrations shown should be regarded as examples of assembly in the various phases of installation and therefore not exhaustive with regard to all the safety regulations.
- Unless otherwise specified, all measurements are given in centimetres.
- Pilosio SPA reserves the right to update its products with the appropriate technical improvements without informing the client.

Key to symbols

-  Warning/danger/precautions to be taken
-  Remarks/advice
-  Instruction /Action to be carried out
-  Concept/information
-  Refer to additional specifications

DESIGN

- For any defect that, by dimensions and/or overloads, does not fall within the field of usage defined by the operating sheets, or for the usage of specific, temporary equipment, a design must be drawn up by a subject qualified to the legal standard for professional practice.
 - Other significant configurations and/or modifications that may become necessary during the work must be shown in the assembly working drawings.
 - Uses other than those shown in these instructions must be analysed and assessed by means of an additional static test and will require supplementary assembly and usage instructions.
-  Refer to the PILOSIO contact person or the Technical Department of Pilosio SPA in order to meet any requirement for dimensioning, geometric studies etc., not included in this manual.
 -  The use of Pilosio's formwork systems in combination with those of other manufacturers may lead to risks that could compromise the safety of workers.

GENERAL MEASURES

- All operations must be carried out by authorised and qualified personnel.
- The loading and unloading, assembly, transport, mounting and dismantling operations must be carried by appropriately trained and qualified personnel under the control of the Site Manager, who must ensure:
 - ▶ that the aforementioned operations are carried out up to standard and under safe conditions, following the instructions and designs supplied along with the equipment;
 - ▶ that the lifting-transport gear and the respective load gripping components, to be used for the transport and installation of formwork, are suitable for the purpose;
 - ▶ that all the components that make up the structures and equipment have been checked before use in order to eliminate any that, due to breakages, distortion or corrosion, cannot be guaranteed to be reliable;
- Pilosio products should be used on the basis of the instructions supplied in the technical documentation accompanying the product.

- Strictly comply with the instructions concerning the operation, safety and load-bearing capacity of the components.
- The stability of all the individual components and all sets of components must be ensured at every work phase.
- Regularly check the stability of joints and connections with screws or wedges, especially during the works or following significant weather events.

 Do not light fires and avoid the overheating of electrical equipment near formwork.

BASIC SAFETY INSTRUCTIONS

Transport

- Before carrying out handling operations, adequately surround the area in which the operation is to take place in order to prevent unauthorised personnel access.
- The handling operations must be scheduled by the Site Manager on the basis of the assembly sequence and the operating methods supplied by the manufacturer.
- Carry out handling and transport operations in accordance with the regulations in force in the country where the works are carried out. Use means of transport, lifting gear and accessories that comply with the regulations in force and are able to support the load and resist the stresses caused by these operations.
- If ramps are used for loading, ensure that these ramps are long, wide and resistant enough and have a sufficient degree of inclination.
- Before moving on means of transport, secured the load to the vehicle and check the locking devices in order to avoid sudden, hazardous shifts of the goods.
- Do not allow the load to lean, roll-over or become unbalanced during lifting and handling operations. Avoid sudden movements or violent bumps during lifting and setting down the load. Ensure that lifting accessories (pallets, straps or harness chains) do not damage units or protruding parts.
- Only use devices and accessories subject to regular checks and proper maintenance.
- For handling and transport, remove detachable items from the walls of formwork or attach them in ways that prevent them slipping or falling.

PPE [Personal Protection Equipment]

- For the safe use of Pilosio's products, comply with the regulations in force on matters of safety at work in the country where the construction site is located.
- Staff assigned to the operations of assembly, handling, mounting, control and dismantling of the structures must have access to suitable implements and, depending on the specific risks to which they are exposed, must make use of the personal protection equipment laid down by the regulations in force such as, for example: safety belts, work gloves, protective helmets and work boots.
- The phases of the operations during which the use of safety belts is required must be expressly specified in the POS, making clear the methods of connecting the belts to the fixed works.
- When, in order to allow the handling operation, the temporary removal of parapets is envisaged, specific instructions must be supplied on the appropriate operating methods.

Plumbing strut

- The adjustable props have the function of keeping upright and stabilising the formwork while it is awaiting casting; it is indispensable to arrange the attachment of the baseplates of the adjustable props by means of suitable anchors. Alternatively, it is possible to use suitable ballast positioned in correspondence with the plumbing strut.
- The formwork, when arranged in an oblique or vertical position, is isolated and subject to the action of the wind (EN 12812:2008), which can vary depending on the height and exposure. It is therefore advisable to reduce the time the formwork remains in this position to the minimum necessary.
- The number of props should be calculated on the basis of the size of the formwork and the intensity of the wind.

 The formwork can roll over for several reasons, such as: wind, bumpy support ground (uneven and malleable), incorrect manoeuvres of the crane, etc.

Formwork

- The assembly of the formwork must be carried out in such a way that all the loads are supported securely.
- In the course of the construction of the works, systems of structural chains and connections between the formwork must be provided as shown in the designs accompanying the formwork. These systems offer, at the time the equipment is used, adequate guarantees of resistance to the stresses transmitted by the formwork.
- The restraining devices must join the components in such a way that separation can only take place following a deliberate operation, excluding the possibility of any accidental deactivation of the devices.
- Service brackets are placed on the walls of the formwork, in order to enable operations of tightening the tie-rods and casting.

Service brackets

- A width greater than or equal to 60 centimetres is required if intended only for the passage of workers and a minimum of 120 centimetres if intended for the transport of materials.
- The service brackets, placed at a height of over 2 metres from the ground, must be provided on all sides toward the void of a solid and in good conditions guardrail.

Concrete casting

- Keep to the permitted pressures of the fresh concrete and casting speeds. If the speeds of casting are too high, it can lead to an overload on the formwork, with the consequent increase of deformations and the possible risk of collapse.

Stripping

- At the end of consolidation period, the Works Supervisor authorises the stripping.
- After connecting the lifting hooks, detach the formwork from the casting using the wooden wedges or a claw. DO NOT detach the formwork with the crane.
- During the stripping, pay particular attention in order not to compromise the stability of parts of the building.
- It is absolutely forbidden to strip any type of supporting framework when accidental and temporary loads weigh on the structures.

Maintenance

- Use only original Pilosio spare parts.

Construction site risk factors

For the safety of the workers, analyse the construction site risks with particular attention to the following aspects:

Factors of a physical nature	Noise
	Vibrations
	Climate and microclimate
Factors of a chemical nature	Dust
	Smoke
	Fumes and gas
	Products that are harmful on contact
Factors of a biological nature	Bacteria and viruses
	Insects
Factors connected to the organisation of the work	Manual handling of the loads
	Tiredness
	Posture
	Pace, Stress



Regulations of reference on safety matters

All operational and dimensional references shown in this Manual refer to the regulations in force on Italian territory. For application in other countries, comply with the regulations in force in that country.

TECHNICAL OVERVIEW

The technical instructions supplied by this Manual have been obtained by applying the measures contained in the European Regulations: Eurocode 0 (EC-0: EN 1990), Eurocode 3 (EC-3: EN 1993), Eurocode 5 (EC-5: EN 1995), Eurocode 9 (EC-9: EN 1999).

Specifically, the assessments were made with reference to the Ultimate Limit States. According to this approach, the checks of components are obtained by verifying that the calculation actions (E_d) are lower than the design resistances (R_d):

$$E_d \leq R_d$$

Definition of the actions

With reference to the Ultimate Limit States, the design load values (E_d) are obtained by amplifying the characteristic values of the permanent (G_k) and variable (Q_k) loads by means of an actions-side safety coefficient (γ_F) of 1.5. The variable actions, not considered as prevailing of the combination, are multiplied by the combination coefficient ψ_0 of 0.7.

$$E_d = \gamma_F \cdot \left[G_k + \left(Q_{1k} + \sum_{i=2}^n \psi_{0i} \cdot Q_{1k} \right) \right]$$

Resistance values of the components

Within this Manual, the resistance values are given for the various components, obtained by starting with the Laboratory test results and theoretical analysis. In the case of results obtained from experimental tests, the measures contained in EC-0 (EN 1990) were followed.

The safety factor η_d , which includes all the uncertainties not covered by the tests, has been assumed to be 1 in the case of steel components (EN 1990).

The material side partial safety coefficient γ_M , adopted for connection and anchorage systems, is assumed to be 1.25. This safety factor corresponds to the most cautious factor proposed by Eurocode 3 (EN 1993).

Steel	Wood
$\gamma_M = 1.25$	$\gamma_M = 1.3$
	$K_{mod} = 0.9$

R_d = design resistance

R_k = percentile resistance 5%

η_d = tests conversion factor

γ_M = material side safety factor.

$$\text{steel: } R_d = \eta_d \frac{R_k}{\gamma_M}$$

$$\text{wood: } R_d = K_{mod} \frac{R_k}{\gamma_M}$$

Use of the technical data of the manual

For simplicity of use, this Manual gives both the value of the “design resistance” or “design action” (R_d) and that of the allowable action on the component (A_{wl}), obtained by first applying the action-side safety coefficient (γ_F). For the calculation of the component of the formwork, this safety factor is assumed to be 1.5, both for permanent and variable loads.

R_d = design resistance

A_{wl} = allowable action on the component

$$A_{wl} = \frac{R_d}{\gamma_F}$$

In this way, it is enough to check that the action on a component, applied with its characteristic value (without multiplying coefficients), is lower than the value of the allowable action (A_{wl}).

$$E_k \leq A_{wl}$$

WALLS

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CIRCA-FLEX PANEL

- The **Circa-Flex** formworks are made of inner and outer panels shaped as circular sector, used to realized curved concrete walls.
- Maximum allowed pressure of fresh concrete is **60 kN/m²**.
- Each circular form is made of a 18mm thick plywood panel, with omega shaped steel profiles nailed at regular spans. The steel profile is obtained from 4mm thick steel sheet.
- Acting on the screw turnbuckles it is possible to give curved shape to the formwork.
- The fresh concrete pressure on the formwork is taken by transoms, attached to the omega profiles of the formwork by means of distribution beam supports, and by the D15 tie-rods tightened with D15 plates.
- Minimum feasible inner radius: R= 350 cm with 230-240 cm wide module R= 250 cm with 119-124 cm wide module.

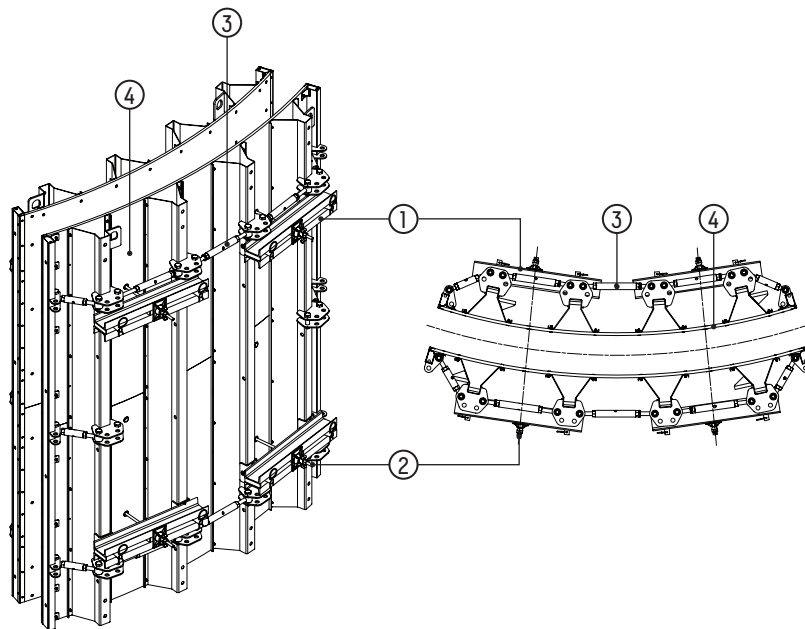


Fig. 2
 1_Circa-Flex transom
 2_D15 adjustable plate
 3_Circa-Flex turnbuckle
 4_Circa-Flex plywood

Plywood

- The cast containment panel is an 18 mm thick plywood, made up of 13 interwoven layers of Finnish birch. This multilayer has the best resistance and duration specifications on the market today.
- The outer protection on both sides of the plywood is ensured by phenolic protection of 220g/m² that eliminates the absorption of humidity.
- The edges are protected with paint.
- Guaranteed minimum number of uses: 50 per side (with the correct methods of use and regular maintenance).
- The holes of any riveting must be repaired with filling in order to avoid the absorption of water.

► Further specifications can be found in the section **Formwork maintenance** (page 65).

GENERIC ASSEMBLY INSTRUCTIONS

! The formworks are delivered straight.

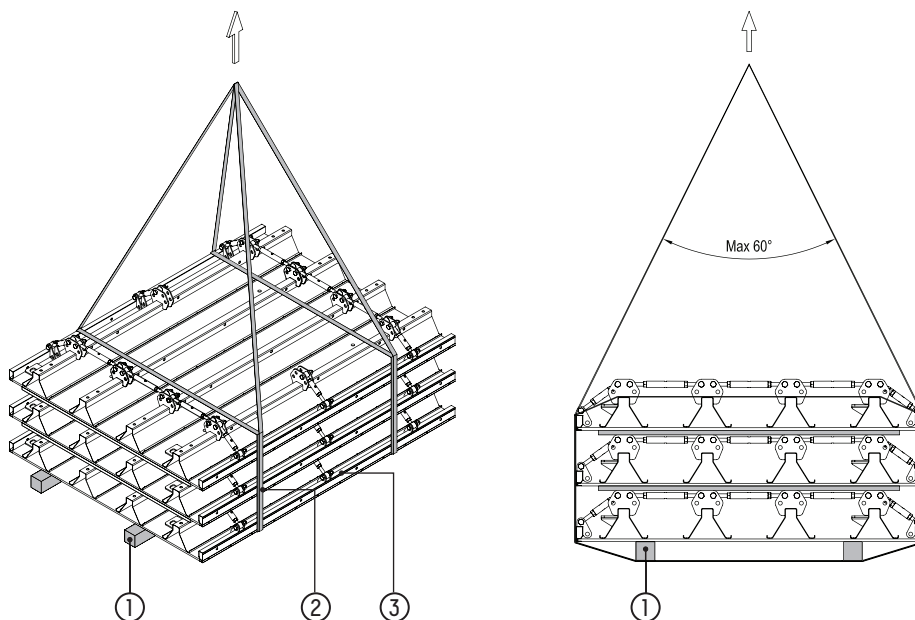
Pre-assembly

- Before assembly, it is necessary to check:
 - that the formwork's metal frame is not deformed (absence of cracks etc.);
 - that the plywood is clear of encrustations and is intact;
 - that the accessories for constructing the formwork are functioning (terminals, screw blocks, clamps, etc.);
 - that the lifting and handling devices are in a good state of repair and functioning perfectly;
 - that the service brackets are in good conditions of repair and efficient, above all as regards the connections with the formwork; the wooden boards must be free of mould, cracks and with few interconnecting nodes (contraction of the cross-section of the board less than 10%);
 - that the shoring elements are not deformed (with particular attention to the connection to the formwork, the ground connection stirrup and the block pins) and the welding is efficient.

Transport and handling

- Transport the formwork to the construction site by vehicles or lorries and store them depending on the internal organization of the site and its roadways.
- Transport and handle the formwork in packages secured with straps.

Fig. 3
1_Wooden joist
2_Strap
3_Circa-Flex panel



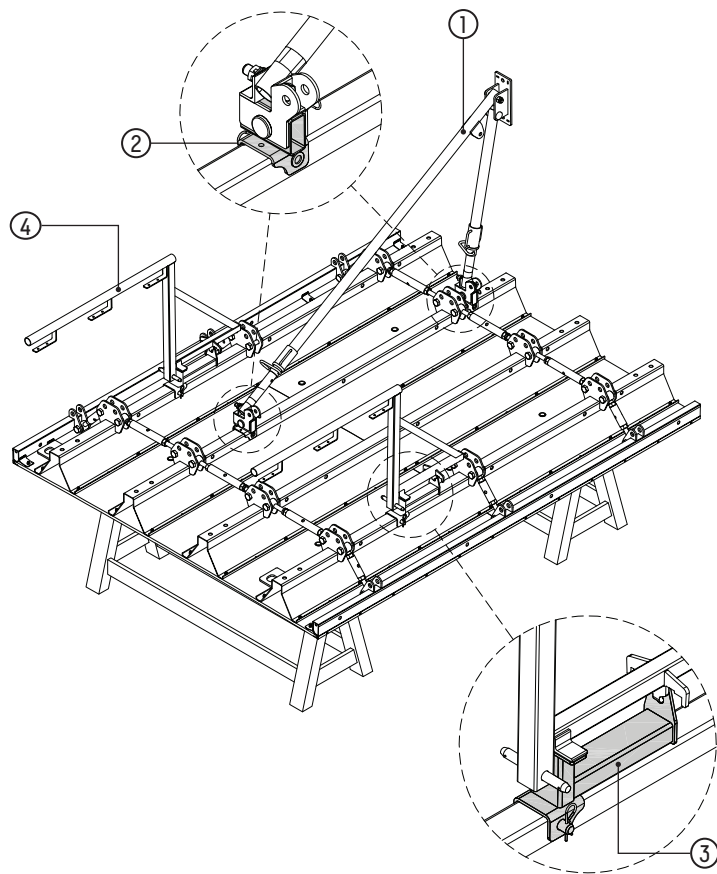
- Store accessories in crates or containers.
- Move the formwork packs and the containers with a forklift truck or with the lifting hooks of cranes.

Tracing

- For the proper placement of the formwork and optimum execution of the design instructions, it is recommended to mark the position of one face of the formwork on the layout. Usually inner formwork wall is realized before the outer one.

Positioning of plumbing strut and brackets

- Place two saw horses or supports on the installation area, in order to form a flat plane.
- Handle the **CIRCA-FLEX** panel with the aid of a crane (in accordance with the Safety Regulations) and arrange it above the supports, with the plywood facing the ground.
- The clamping of plumbing elements to **CIRCA-FLEX** panels is done on the ground.
- Connect the prop adapter to the panel ribs.
- Fix the tilt plate to the prop end.
- To adjust the extension of the push - pull, move the adjustment ring nut to the central position, in order to facilitate the following phase of making the formwork vertical.
- Carry out the rough adjustment of the extension of the plumbing element by inserting the scaffolding pin in the pierced ring on the prop coupling. This operation avoids the unthreading of the male pipe during handling and transport. In addition, it enables the prop to absorb both the forces of compression and traction.
- Apply the service bracket on **CIRCA-FLEX** panel omega profile by means of the working bracket adapter and connecting pins with cotter-pin.

**Fig. 5**

- 1_Push-pull prop
- 2_Push-pull prop connector
- 3_Working bracket connector
- 4_Working bracket

► For details on attachment, see section **Climbing brackets**, page 51.

☉ Apply props and service brackets as required by the design drawings.

Formwork

- ▶ Connect the crane's lifting cables to the dedicated slots on the steel profiles, with a maximum aperture angle of 60° (Fig. 6).
- ▶ Further specifications for the application of the lifting hook can be found in the section **Storage and handling**, page 48.
- ▶ Raise up the circular formwork element, move it to the place of use.

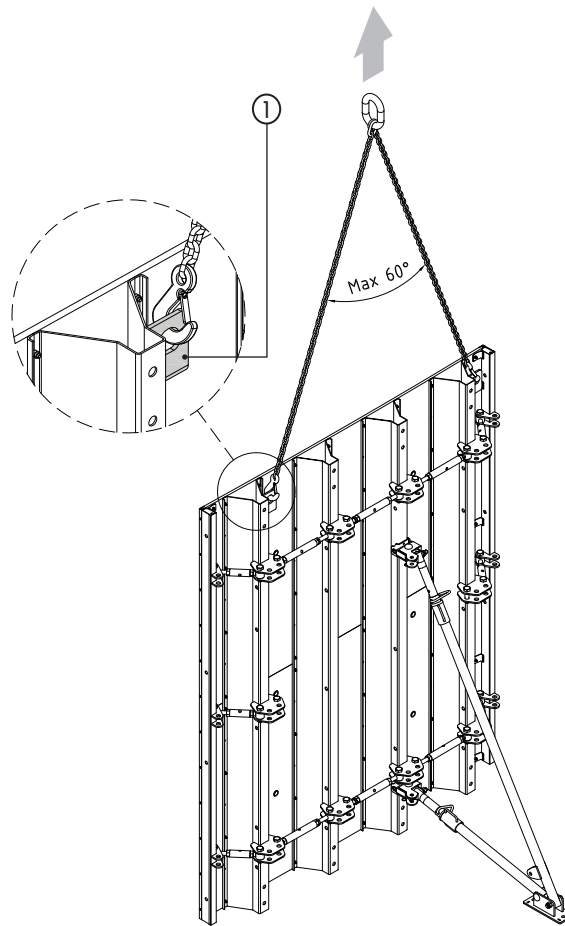


Fig. 6
1_Welded lifting hook

! Be sure against panel tipping.

► Place the **CIRCA-FLEX** formwork panel, hanged by the crane, in vertical position in front of the worker.

► Acting on the turnbuckles, modify the curvature of the panel in order to fit the desired shape. The use of a wooden template is advisable (Fig. 7_a). As an alternative, consider the tracing line as a reference for the curvature (Fig. 7_b).

! The spindles should be operated according to the numbers given in the image (Fig. 7_b).

! The rows of spindles must be operated simultaneously.

! Regular cleaning and greasing of the spindles eases the adjusting procedure later on.

It is possible to apply a rough regulation of curvature when the panel is in horizontal position, and then refine the shape in horizontal or vertical position using a template.

Fig. 7_a
1_Wooden template
2_Tracing line

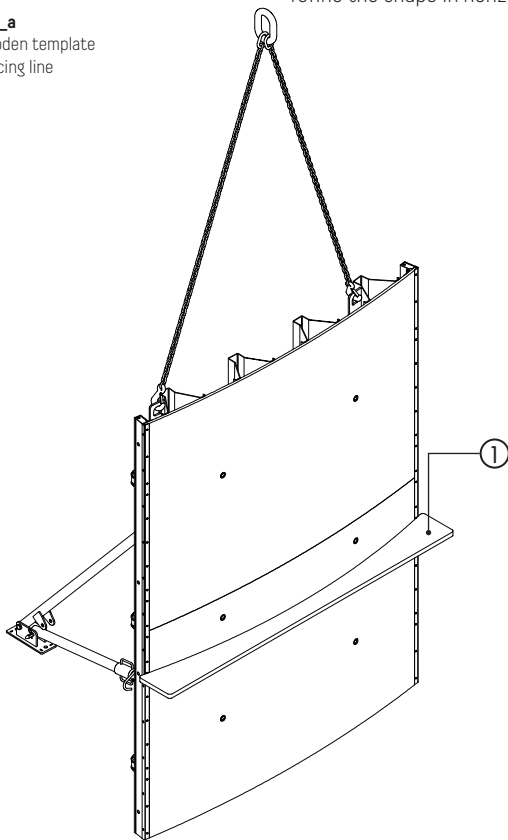
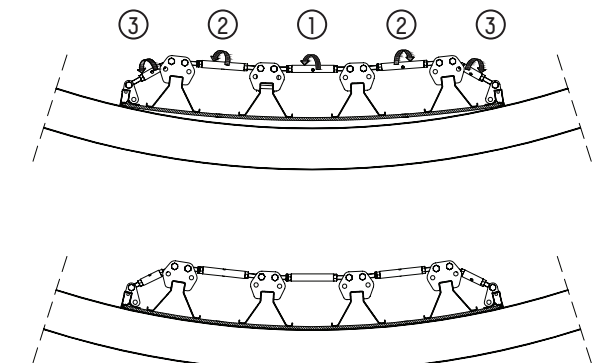
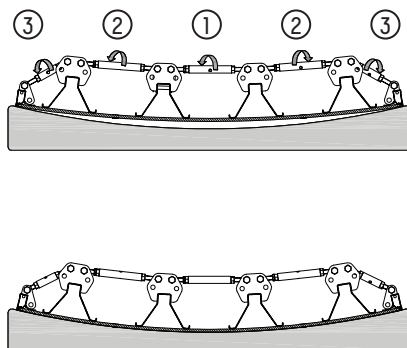


Fig. 7_b
Turnbuckle adjustment order



- Once the desired curvature is reached, fix the svelt transom on the omega profiles in correspondance of tie-rod connections.

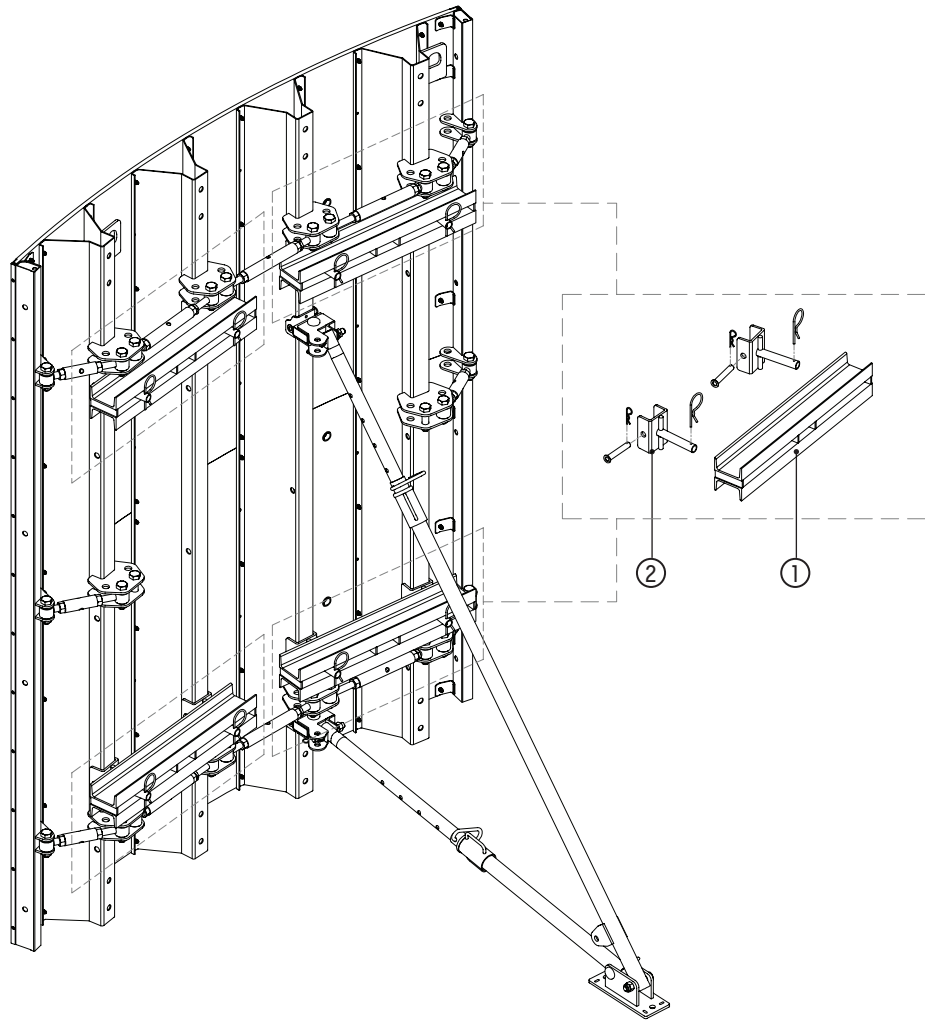


Fig. 8

1_Circa-Flex transom 8l
2_Circa-Flex beam support
complete

- Move the **CIRCA-FLEX** panel on the tracing line.
- Plug the tilt plate to the ground and check verticality with a plumb line.
- Once the operation has been completed, free the crane's lifting hook.
- Apply the stripper to the cast containment face (ref. section **Formwork maintenance**, page 65).
- Position the reinforcing envisaged in the structural design and then insert the D15 threaded bar with PVC spacers.

► Prepare the second wall of formwork, raise it with the crane, modify the curvature, place the **Circa-Flex** transoms and spray the stripper, as done for the first wall.

► Position the second wall of formwork in front of the first by means of the crane.

! Before detaching the crane's lifting hooks, it is necessary to connect the two walls of formwork at least by the first two horizontal rows of anchors by means of the threaded bars and plates.

► Complete the assembly by applying the leading parapets on the working brackets.

► Attach the floor battens and the wooden parapets to the bracket by using bolts.

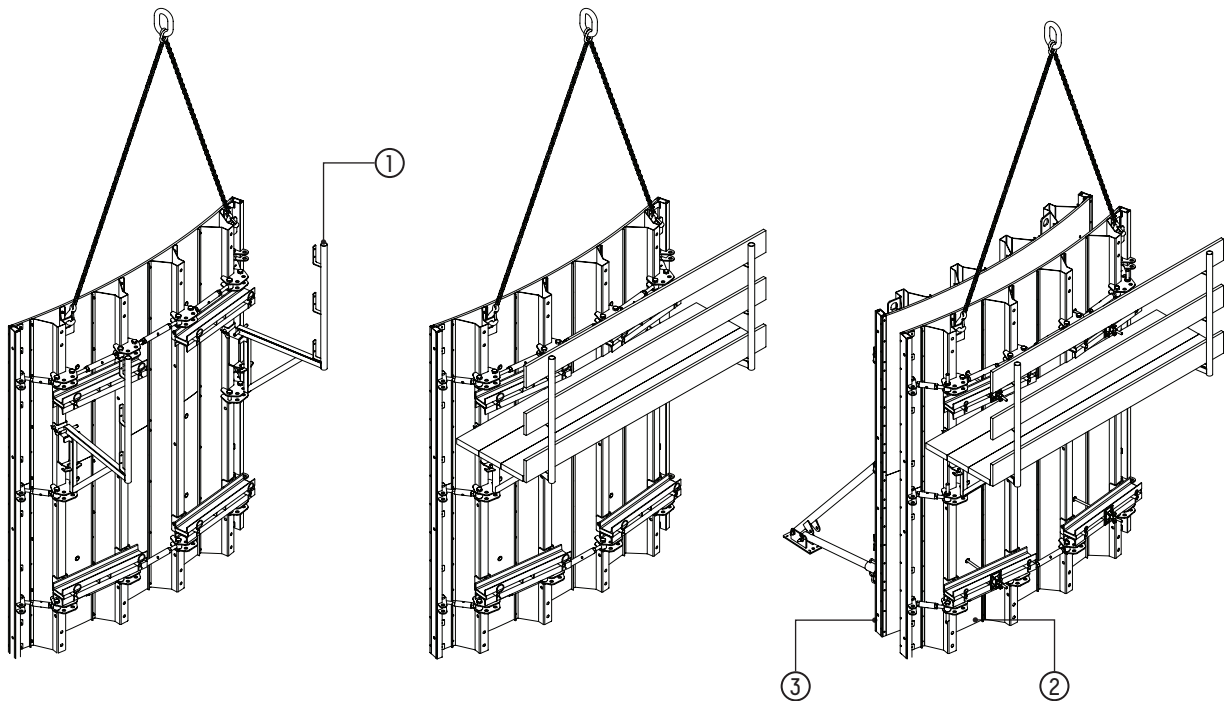


Fig. 10

1_Working bracket

2_CIRCA-FLEX outer panel

3_CIRCA-FLEX inner panel

► In order to determine the centre distance of the various models of plumbing strut depending on the height of the formwork and the dimension of the anchor, refer to the table in the section **Plumbing strut**, page 41.

☉ The positioning of the plumbing strut also on the second wall of formwork is useful in case it is necessary to quickly free the crane to carry out other work. In this case, lean the panel on the prop and carry out the cleaning and spreading of the stripper.

Subsequent walls

► To complete the assembly of the formwork, proceed as previously stated taking care to connect the next formwork to those previously installed with the appropriate devices and the needed infill element.

► Refer to sections **Assembly Systems** and **Infill Elements** for further information, respectively page 22 and 28.

Access to the service bracket

► Access to the working bracket is provided by installing a stepladder alongside the work level, or replacing the wooden floorboards with a metal floor provided with a trapdoor and steps, or installing a rope ladder alongside. Alternatively, the use of additional apparatus is possible, such as staging, scaffolding or suitable devices.

Combination with P300 system

► It is possible to attach CIRCA-FLEX formwork to P300 System by means of P300 aligning clamps.



For P300 system assembly instructions, please refer to dedicated User's Manual.

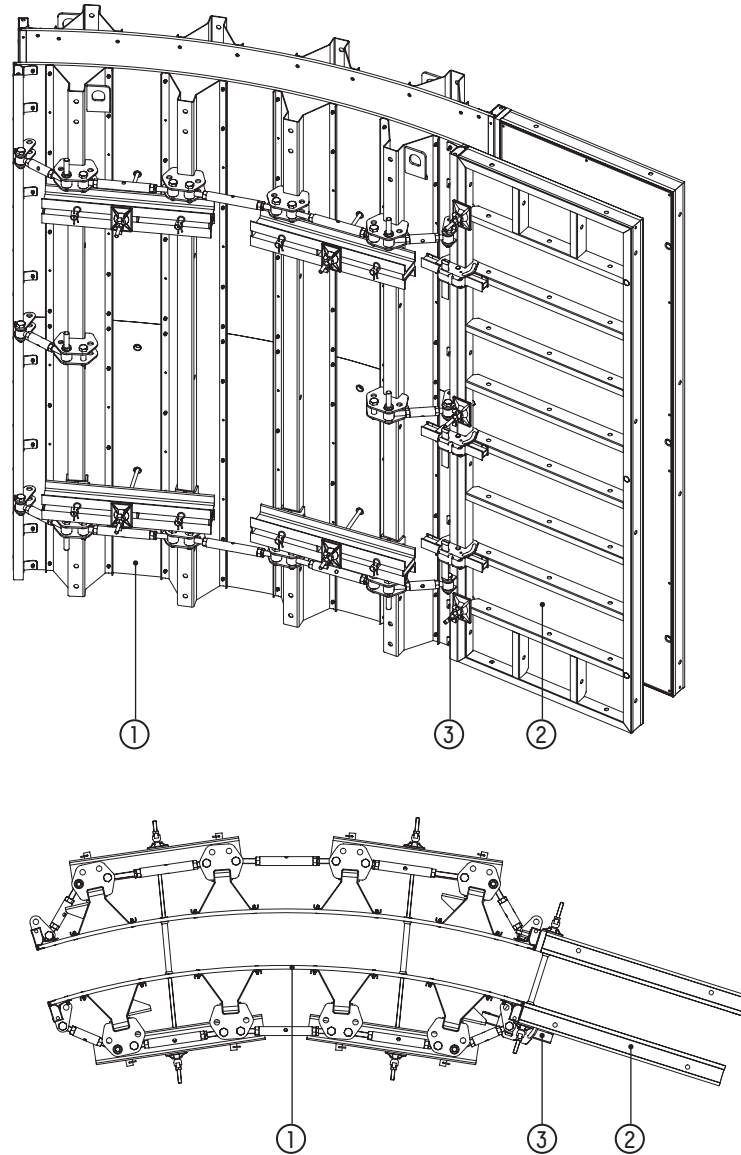


Fig. 11

- 1**_CIRCA-FLEX formwork
- 2**_P300 formwork
- 3**_P300 aligning clamp

Stripping

- Once the setting times have been reached, the Works Supervisor authorizes the stripping.
- Dismantle the connecting blocks and attach the formwork free of props to the crane's cables, unscrew the waler plates and the threaded bars.
- Detach the formwork wall from the casting by using wooden wedges or claws.
- Clean the formwork covering of any residual concrete.
- Remove the formwork with the aid of the crane and move it for other use or transport it to the dedicated storage area, on wooden joists, for dismantling.
- The dismantling of walls with plumbing strut is done in a similar way. The removal phases envisage:
 - attach the cables of the crane to the lifting points;
 - removal of the anchors of the tilt plate of the props;
 - elimination of any residual concrete;
 - spreading the stripper on the casting surfaces.

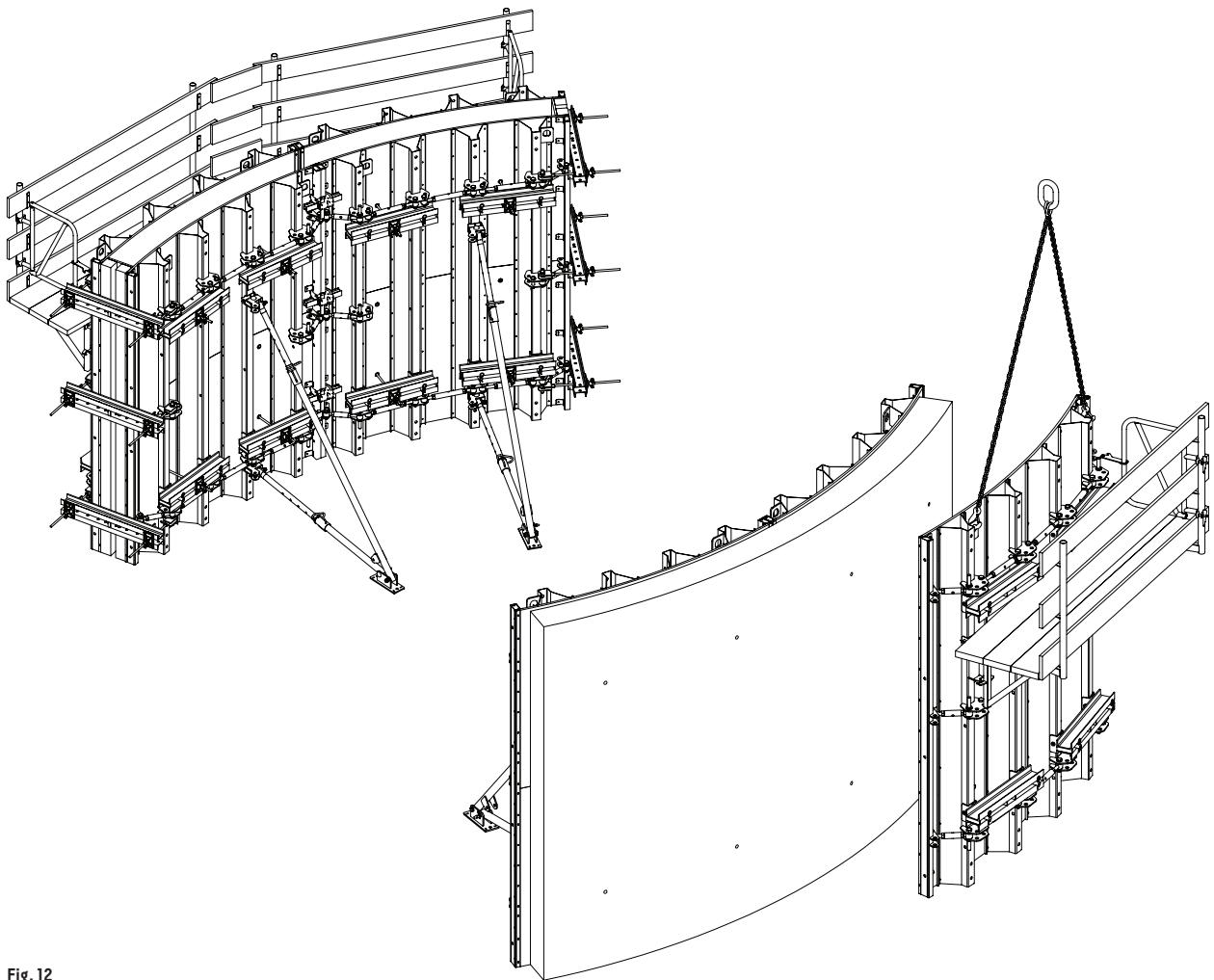
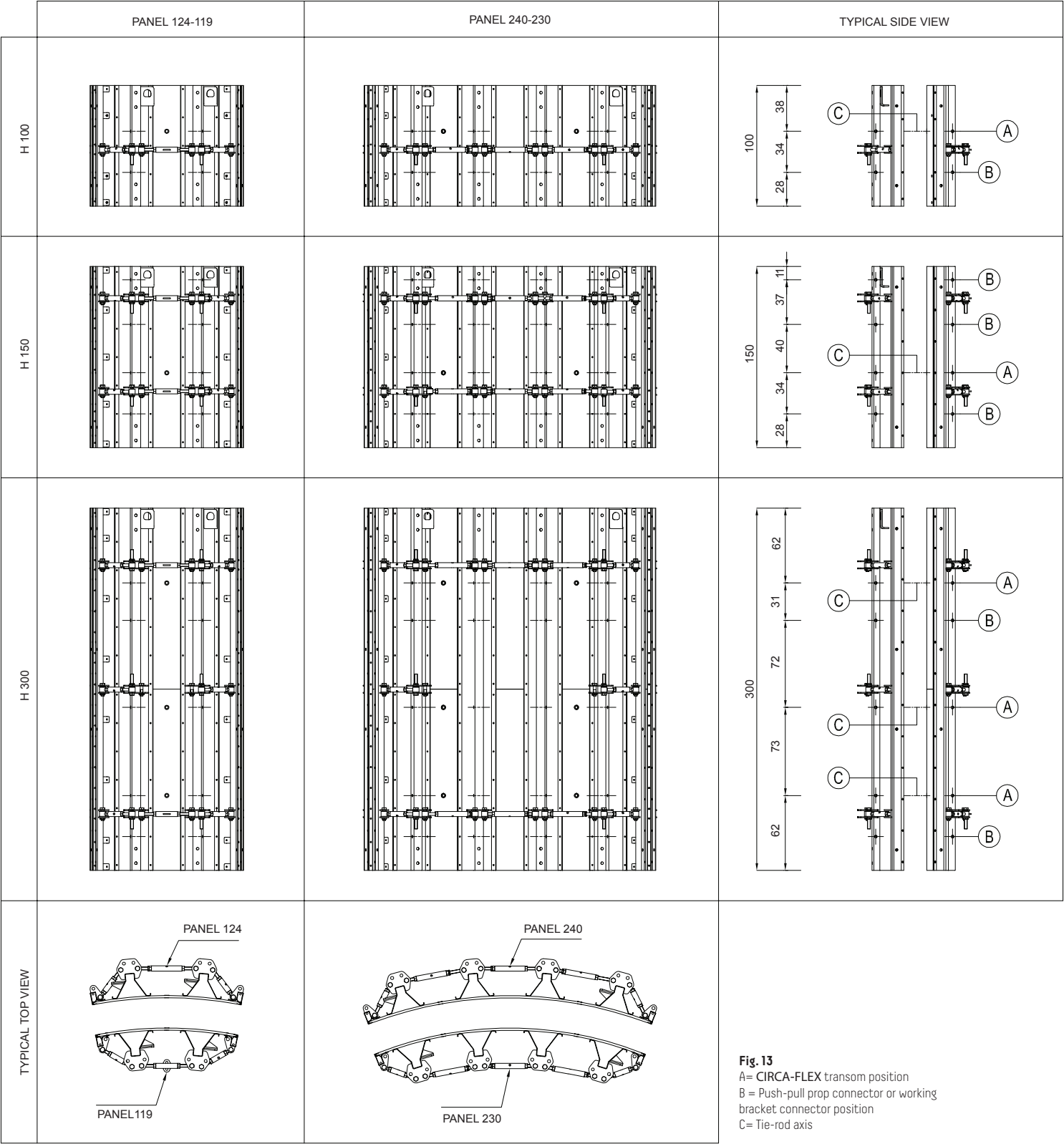


Fig. 12

Remarks and warnings

- In the operations of assembly, casting and stripping, all the Safety Regulations in force in the country where the construction site is located must be observed.

CIRCA-FLEX PANELS
DIMENSIONS



ASSEMBLY SYSTEMS

Different connections are available in function of the radius of curvature and infill elements. Usually, inner panels are connected without interposition of infill elements, while outer panels are joint with additional infill elements.

ASSEMBLY WITHOUT INFILLS

The CIRCA-FLEX formwork system enables elements to be connected, without infills, in two ways:

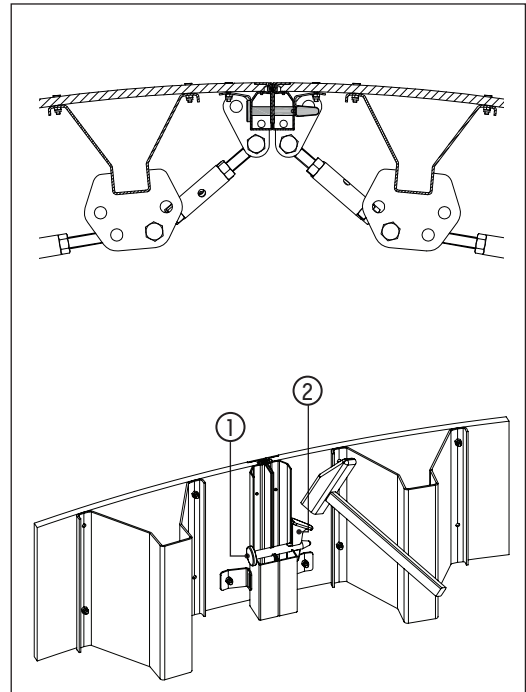
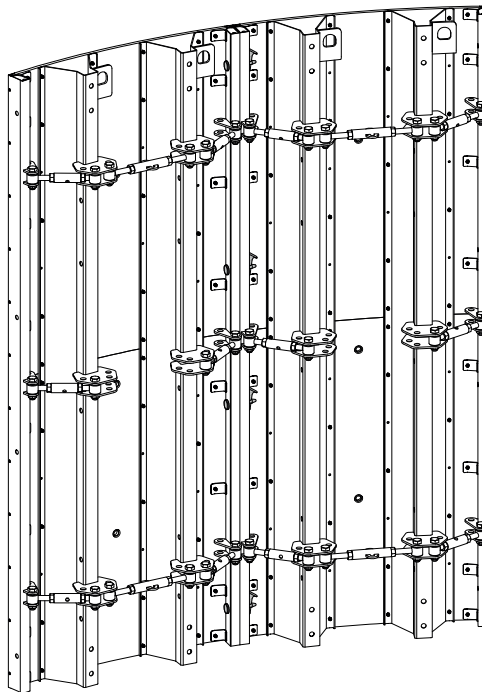
- Pin and wedge connection
- P300 aligning clamp

Pin and wedge

The connection system with pin and wedge:

- is very simple and economical;
- enables the formwork to be connected vertically, in correspondence with the holes on the perimeter sections of the formwork;
- offers high tensile strength and high durability thanks to galvanization.

Fig. 14_a
1_P300 pin
2_P300 wedge

**Pin and wedge assembly:**

- Insert the pin in correspondence with the holes on the perimeter sections of the formwork to be connected, insert the blocking wedge and make secure with a hammer.
- The wedge has a sloped head to make striking it easier.
- For a panel height of 3 meters, 4 connections with pin and wedge are needed (all the holes in the vertical perimetral profile have to be fitted).

Pin and wedge	R_d [kN]	A_{wl} [kN]
Tensile strength	6,4	4,3
Weight: 0,48 [kg]		
Code: 581010 (pin) - 581100 (wedge)		

P300 aligning clamp

The P300 aligning clamp connection system:

- enables the connection of the formwork at any point on the frame, both vertically and horizontally;
- offers high tensile strength;
- no detachable parts;
- galvanized.

! This solution can be used in case of bigger radius of curvature.

P300 aligning clamp	R_g [kN]	A_{wl} [kN]
Tensile strength	18,5	12,3
Shear	18,3	12
Weight: 6 [kg]		
Code: 556000		

Panel height [cm]	N° of P300 aligning connectors
$H < 150$	2
$H \leq 300$	3

Tab. 2

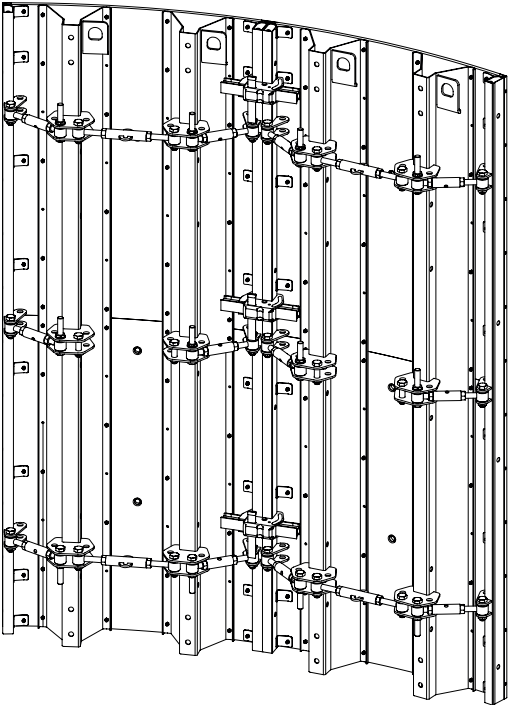
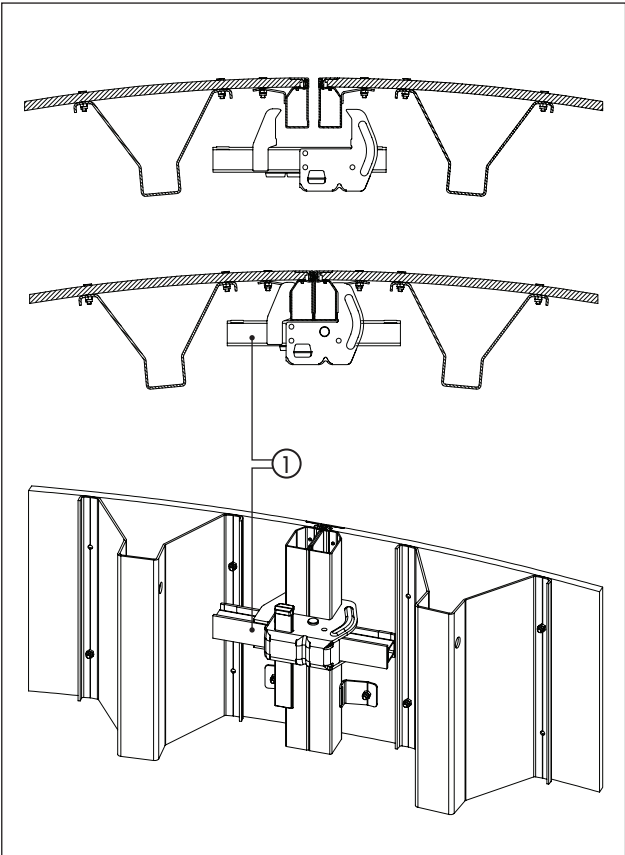


Fig.14_b
1_P300 aligning clamp



ASSEMBLY WITH INFILLS

- The CIRCA-FLEX formwork system enables elements to be connected, with trapezoidal infills, in two ways:
- P300 screw aligning clamp
- Threaded bar and nuts
- Closure elements are made of wooden spars.

P300 screw aligning clamp

- The screw aligning clamp allow the assembling the infill elements to the formwork.
- wooden spars up to a maximum measurement of 12 cm are allowed.
- In order to connect any type of infill element, 2 clamps every 3 metres of height are sufficient.
- In case of large infill elements, in order to allow the uniform distribution of load, it is necessary to add the tie-rod bars and respective D15 walers or swivel plates, on UPN 80 beams as reinforcement (Reinforcing U channel).

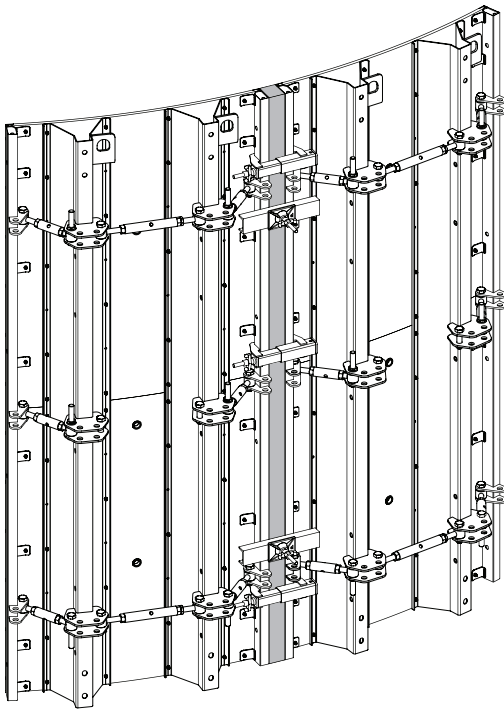
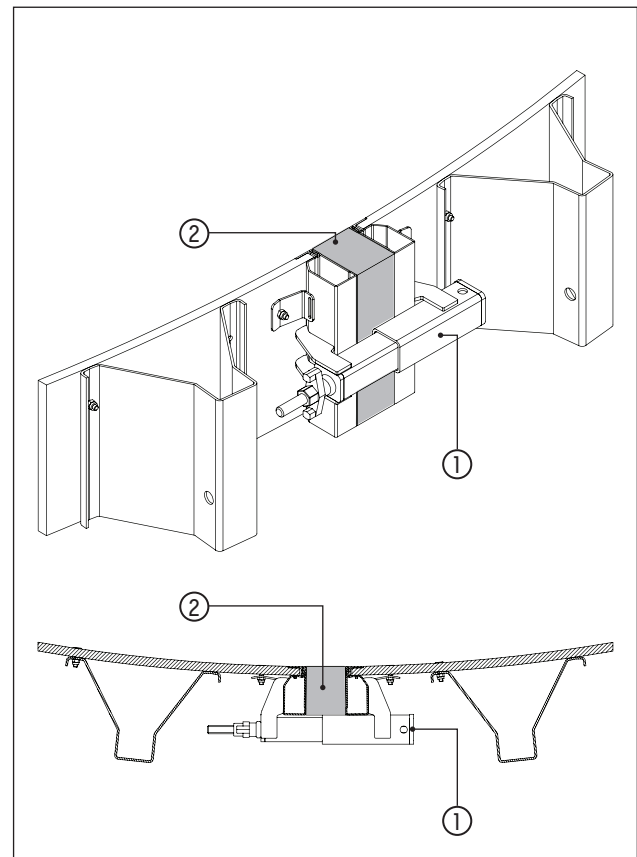


Fig. 15
1_P300 screw aligning clamp
2_Wooden spar



P300 Screw aligning clamp	R_d [kN]	A_{wl} [kN]
Tensile strength	29,3	19,5
Weight: 4,3 [kg]		
Code: 556020		

Tab. 3

Threaded bar and nuts

- As an alternative to connection with P300 screw aligning clamp, the **CIRCA-FLEX** system enables compensation to be created by using threaded bars complete with nuts and washers.
- In case of large infill elements, in order to allow the uniform distribution of load, it is necessary to add the tie-rod bars and respective D15 walers or swivel plates, on UPN 80 beams as reinforcement (Reinforcing U channel)
- Technical specifications:
 - Threaded bar $\varnothing$ 15 mm
 - D15 nut, length 35 mm (CH 27) - code: 583910
 - Washer 20x54 for tie-rod - code: 15R18GZ

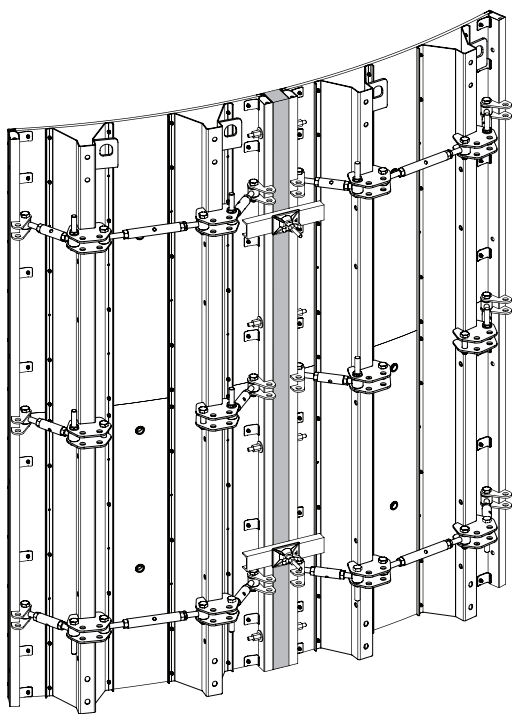
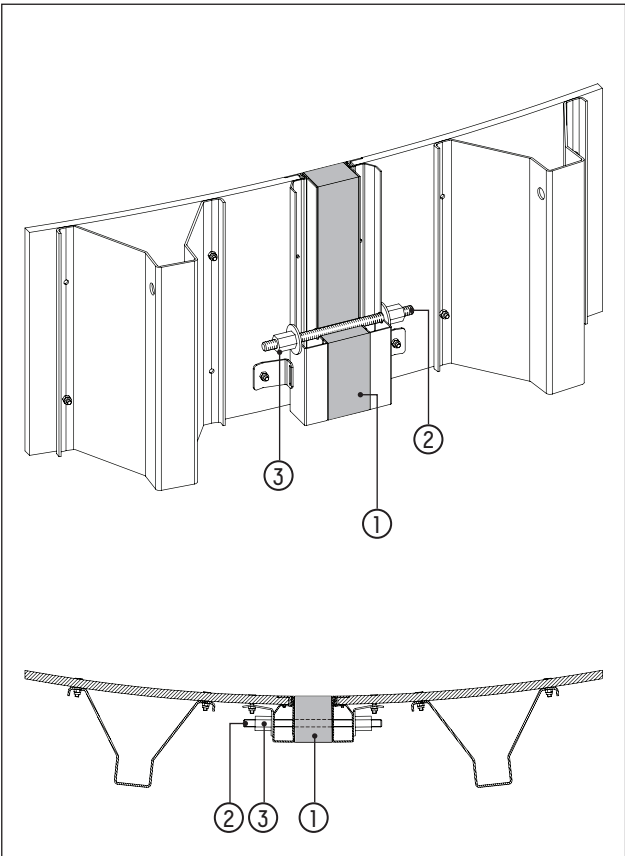


Fig. 16
1_Infill spar
2_D15mm threaded bar
3_D15 nut and washer 20x54 for tie-rod

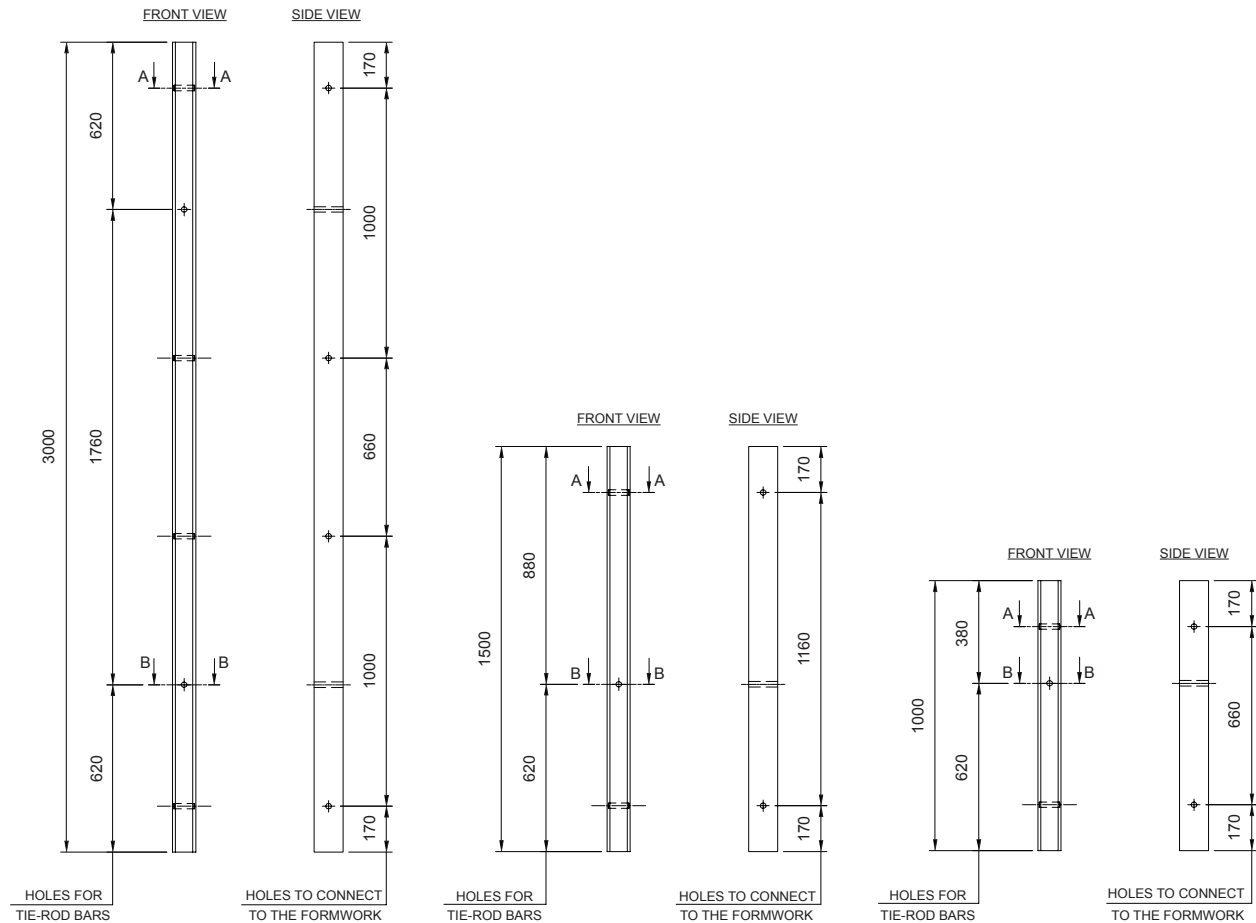
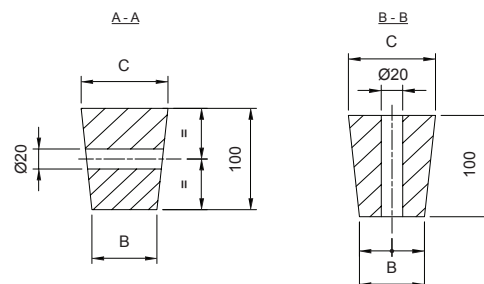


Threaded bar and nut	R_d [kN]	A_{wl} [kN]
Tensile strength	12,4	8,3
Threaded bar weight: 1,42 [kg/m]		
Weight of nut and washer: 0,13 [kg]		

Tab. 4

Application of infill spar

- In the case of the application of wooden infill bars (trapezoidal cross section), make appropriate holes in the spar to allow connection to the formwork wall with bar and nuts.
- In case of large infills both inside and outside, drill tie-rod anchoring holes too.
- For dimensioning of trapezoidal infill, please refer to the section "Infill elements", page 28.

**SECTION VIEWS**

Additional lateral turnbuckle

- It is possible to stiffen the connection between adjacent CIRCA-FLEX panels applying an additional lateral turnbuckle as displayed in the Fig. 18.

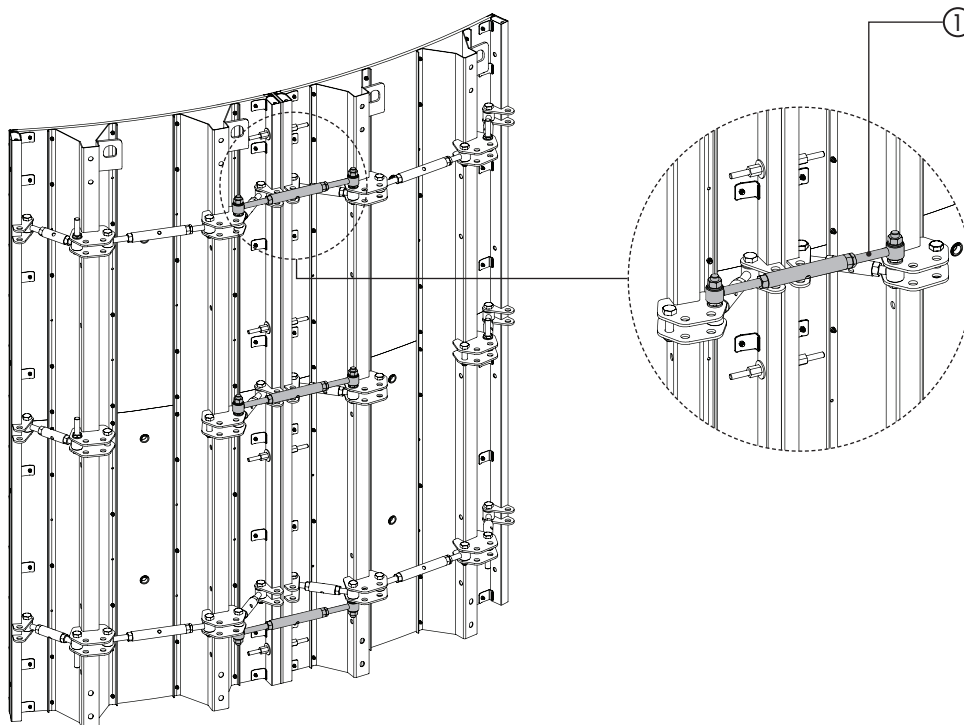


Fig. 18
1_Turnbuckle

INFILL ELEMENTS

- Svelt system is flexible: different radius and wall thicknesses can be obtained with the interposition of the appropriate infill element.

Dimensioning of infill elements

- The infill element has to be shaped with trapezoidal cross section.
- The following tables indicate the section dimensions of infill elements (Tab. 1 and Tab. 2):
 - **Outer infill:** "B" indicates the short side of the trapezoidal cross section (Fig. 19_a).
 - **Inner infill:** "C" indicates the long side of the trapezoidal cross section (Fig. 19_b).

Fig. 19_a
Outer infill

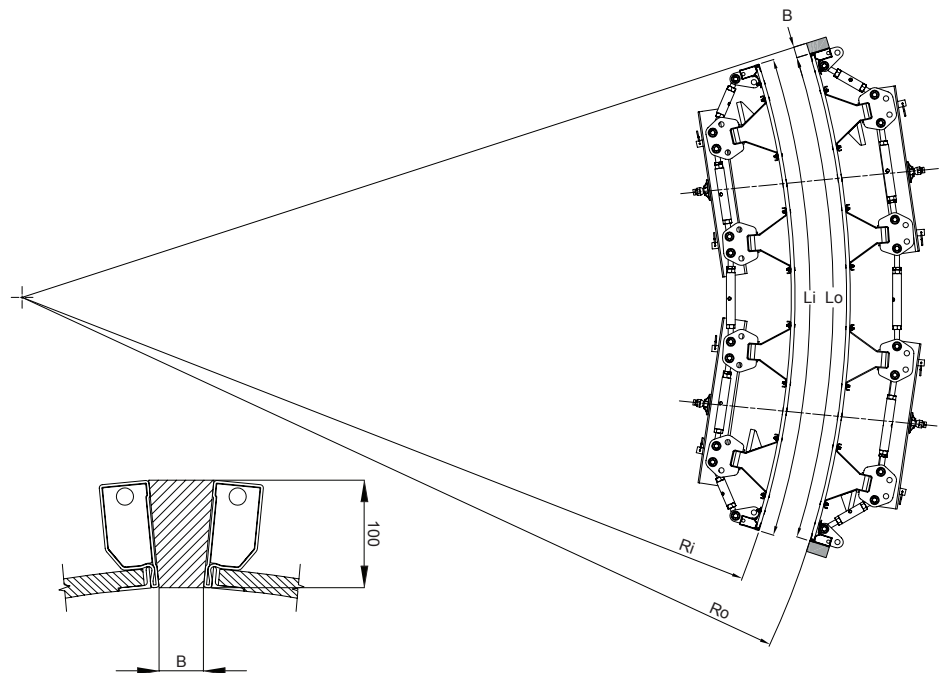
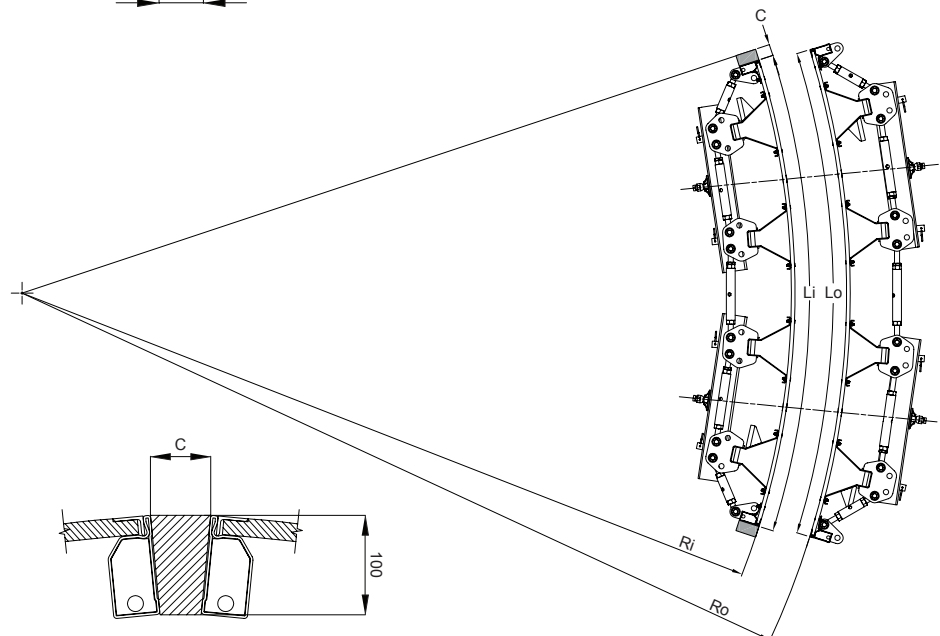


Fig. 19_b
Inner infill



INFILLS FOR STANDARD PANELS
(230-240 CM)

Lo [m]	Li [m]	Minimum Inner Radius [m]
2.4	2.3	3.5

value	B - outer infill element [mm]
value	C - inner infill element [mm]

Inner Radius [m]	Wall thickness t [m]				
	0.2	0.25	0.3	0.35	0.4
3,5	31	64	97	130	163
3,75	23	53	84	115	145
4	15	44	73	101	130
4,25	8	35	62	89	116
4,5	2	28	53	79	104
4,75	3	21	45	69	94
5	8	15	38	61	84
5,25	12	10	31	53	75
5,5	16	5	25	46	67
5,75	19	0	20	40	60
6	23	4	15	34	53
6,25	26	8	10	29	47
6,5	28	11	6	24	42
6,75	31	14	2	19	36
7	33	17	1	15	31
7,25	36	20	5	11	27
7,5	38	23	8	7	23
7,75	40	25	11	4	19
8	41	27	13	1	15
8,25	43	29	16	2	12
8,5	45	31	18	5	8
8,75	46	33	20	8	5
9	48	35	23	10	2
9,25	49	37	25	13	1
9,5	51	38	27	15	3
9,75	52	40	28	17	5
10	53	41	30	19	8
10,5	55	44	33	23	12
11	57	47	36	26	16
11,5	59	49	39	29	19
12	61	51	41	32	23
12,5	62	53	44	35	26
13	64	55	46	37	28
13,5	65	56	48	39	31
14	66	58	50	41	33
14,5	67	59	51	43	36
15	68	61	53	45	38
15,5	69	62	54	47	40
16	70	63	56	49	41
16,5	71	64	57	50	43
17	72	65	58	52	45
17,5	73	66	60	53	46
18	74	67	61	54	48
18,5	74	68	62	55	49
19	75	69	63	57	51
19,5	76	70	64	58	52
20	76	70	65	59	53

Tab. 5

INFILLS FOR UNDERSIZE PANELS
(119-124 CM)

Lo [m]	Li [m]	Minimum Inner Radius [m]
1.24	1.19	2.5

value	B - outer infill element [mm]
value	C - inner infill element [mm]

Inside radius [m]	Wall thickness t [m]				
	0,2	0,25	0,3	0,35	0,4
2,5	45	69	93	117	140
2,75	37	58	80	101	123
3	29	49	69	89	109
3,25	23	42	60	78	96
3,5	18	35	52	69	86
3,75	13	29	45	61	77
4	10	24	39	54	69
4,25	6	20	34	48	62
4,5	3	16	29	43	56
4,75	0	13	25	38	50
5	2	10	21	33	45
5,25	4	7	18	29	41
5,5	6	4	15	26	37
5,75	8	2	12	22	33
6	10	0	10	19	29
6,25	12	2	7	17	26
6,5	13	4	5	14	23
6,75	14	6	3	12	21
7	16	7	1	10	18
7,25	17	9	1	7	16
7,5	18	10	2	6	13
7,75	19	11	4	4	11
8	20	12	5	2	10
8,5	21	15	8	1	6
9	23	16	10	4	3
9,5	24	18	12	6	0
10	26	20	14	8	2
10,5	27	21	16	10	4
11	28	22	17	12	6
11,5	29	24	18	13	8
12	30	25	20	15	10
12,5	30	26	21	16	12
13	31	27	22	17	13
13,5	32	27	23	19	14
14	33	28	24	20	16
14,5	33	29	25	21	17
15	34	30	26	22	18
15,5	34	30	26	23	19
16	35	31	27	23	20
16,5	35	31	28	24	21
17	36	32	28	25	21
17,5	36	33	29	26	22
18	36	33	30	26	23
18,5	37	33	30	27	24
19	37	34	31	28	24
19,5	37	34	31	28	25
20	38	35	32	29	26

Tab. 6

TIE-ROD SYSTEM

- ❗ In any case, do NOT warm up or seal the threaded bars of any diameter, necessary to make the tie-rods.
- ❗ It is recommended to seal the holes not used for the passage of tie-rods with suitable plastic plug, in order to make them practicable for the purpose.
- ❗ Arrange the tie-rods using the appropriate spacers in order to allow their recovery during the stripping phase (see the section **Installation of the tie-rods: available spacers** on page 35).

Application of tie-rods

- In order to distribute the stresses, the tie-rods have to be installed on **CIRCA-FLEX** transom 81, that is fixed to the vertical ribs of **CIRCA-FLEX** panels by means of svelt beam supports.
- 🔧 **CIRCA-FLEX** transoms 81 can be replaced by Steel Waling MX PS12 L100 or WY Anchor Waling NPU 12 L100.

Svelt transom 81 pinned
complete galvanized*

Weight [kg]: 29.5

Art: K673000810Z*

*Included:
K673100010Z - **Circa-Flex** beam
support complete - Qty. 2

Tab. 7

Steel waling MX PS 12 100

Weight [kg]: 25.3

Art: 68116100I

To be added:
K673100010Z - **Circa-Flex** beam
support complete - Qty. 2

Tab. 8

YP Anchor waling NPU 120 L.100

Weight [kg]: 27.0

Art: 68448221I

To be added:
K673100010Z - **Circa-Flex** beam
support complete - Qty. 2

Tab. 9

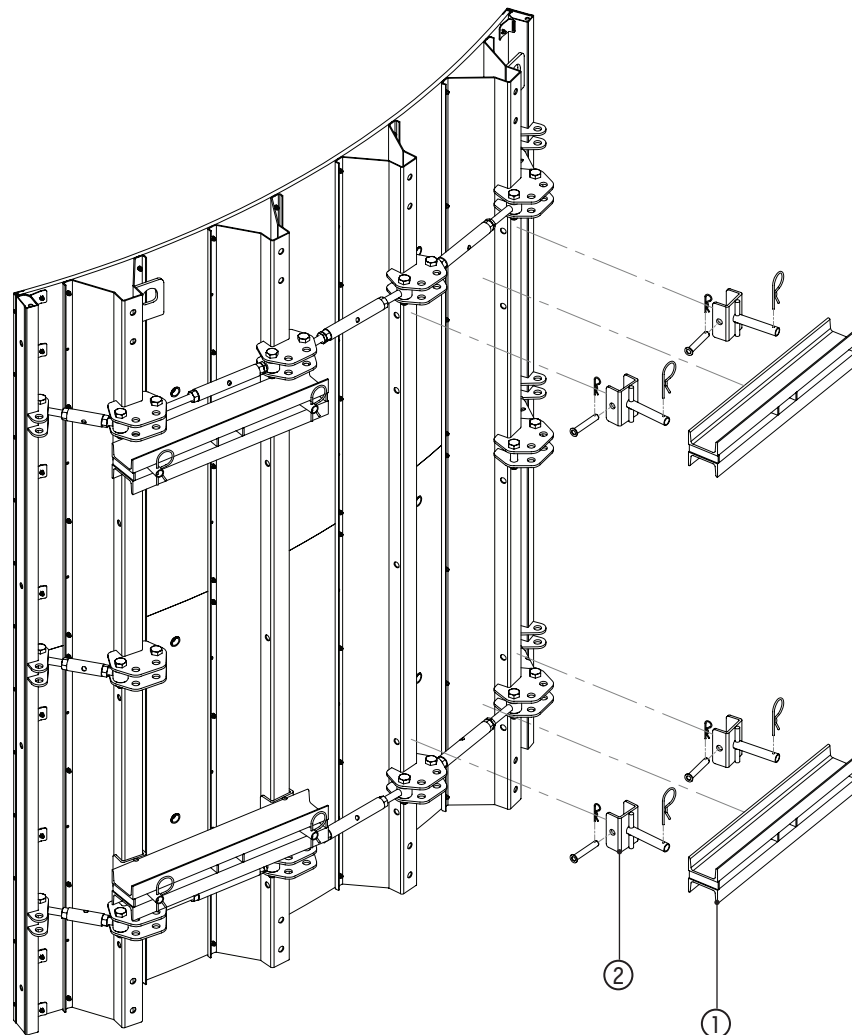


Fig. 20

1_Circa-Flex transom 81
2_Circa-Flex beam support
complete

- ☉ If needed, it is possible to arrange tie-rods outside concrete by using **Circa-Flex** outer tie-rod support fixed to **Circa-Flex** vertical ribs.

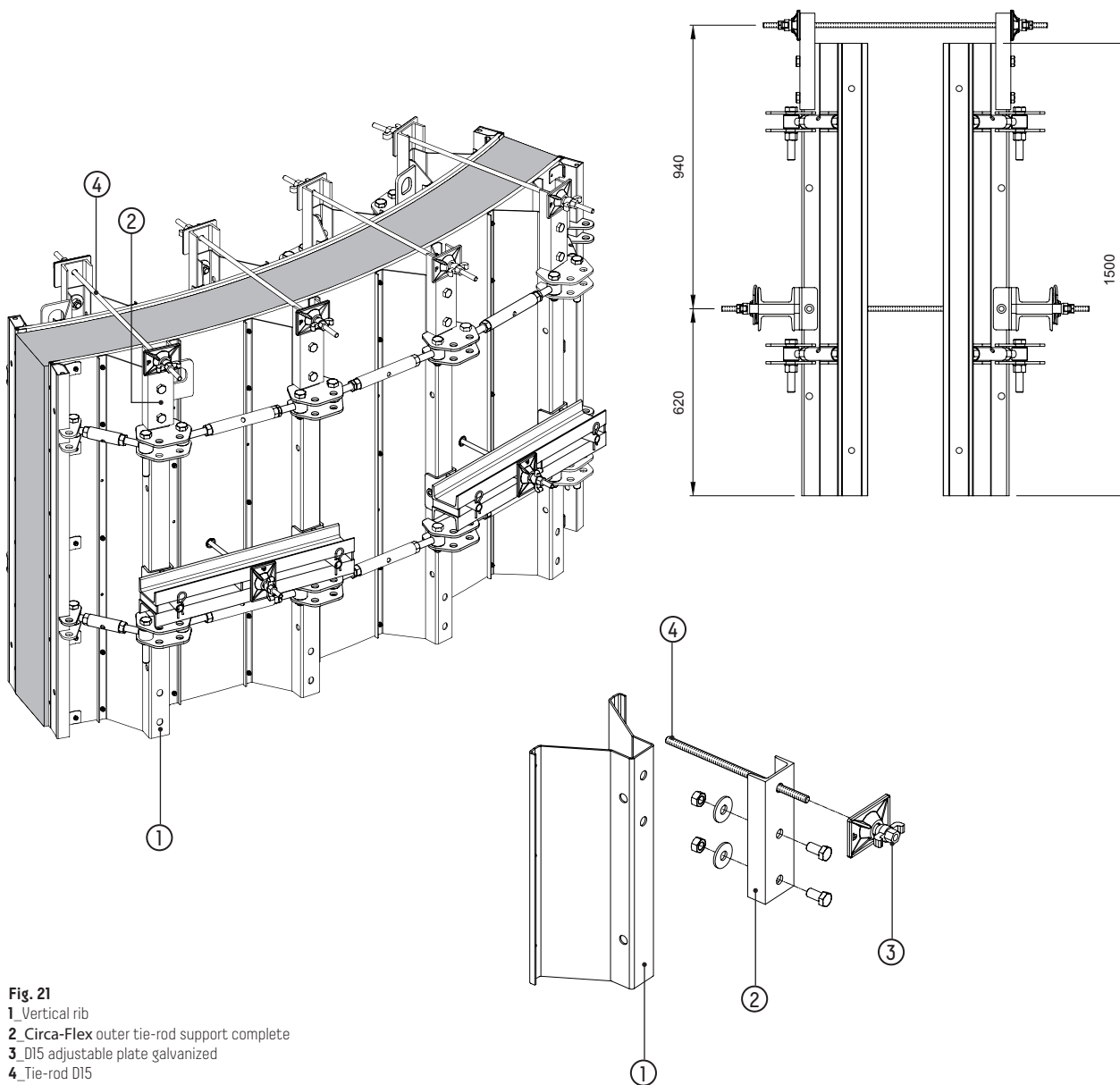


Fig. 21

- 1_Vertical rib
2_Circa-Flex outer tie-rod support complete
3_D15 adjustable plate galvanized
4_Tie-rod D15

Circa-Flex outer tie-rod support complete

Weight [kg]: 4.0

Art: 672000010

Tab. 10

D15 adjustable plate

- The tie-rod with D15 adjustable plate is made up of a $\varnothing 15$ threaded bar, tightened at the two ends by means of plate formed of a wing nut free to rotate on a moulded plate with dimensions of 100x140 mm.
- The D15 adjustable plate is advisable in the case of self-compacting concrete casting (SCC) since the high fluidity of this conglomerate bears significant actions on the tie-rod bars. In the case of the use of waler plates with large friction surfaces, these actions could make the scaffolding removal difficult and cause the abrasion of the support surfaces of the formwork.

! In case of “230-240” panels, tie rod connection should be made by adjustable plate since it allows an angle adjustment up to 14°.

Technical specifications:

- D15 adjustable plate: support plate 100x140 mm
- Threaded bar $\varnothing 15$ mm

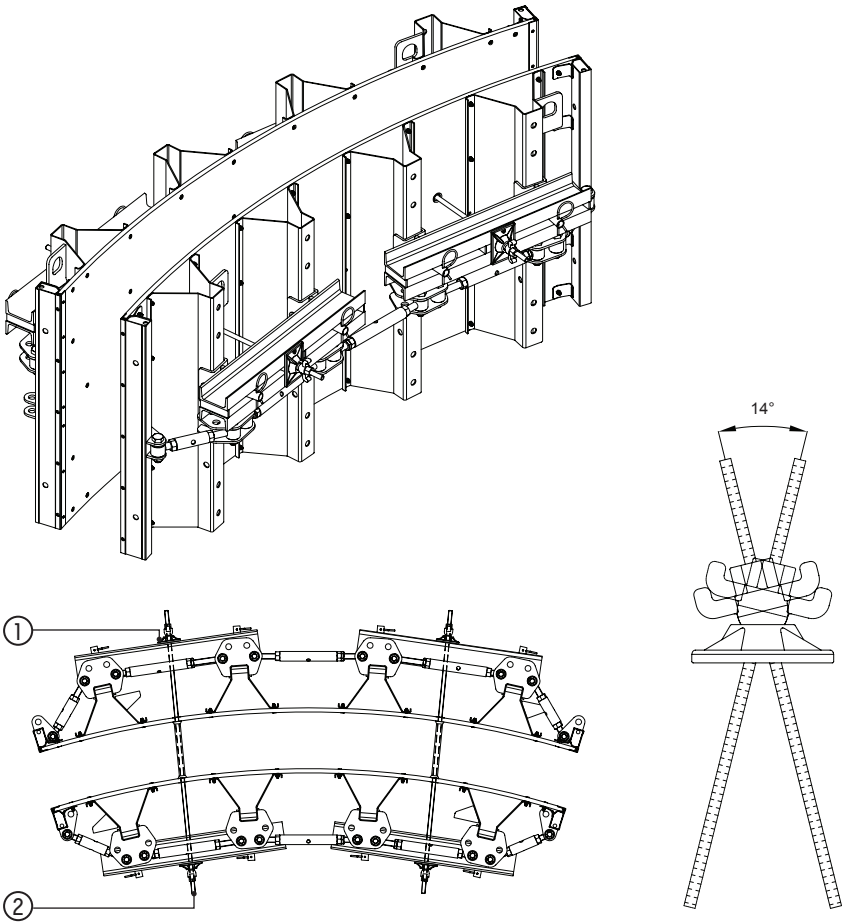


Fig. 21
1_D15 adjustable plate
2_D15 threaded bar

D15 adjustable plate galvanized	R_d [kN]	A_{wl} [kN]
Tensile strength	162	108
Weight: 1.2 [kg]		
Code: 583905		

Tab. 11

D15 plate

- The tie-rod with D15 plate is made up of a $\varnothing 15$ threaded bar, tightened at the two ends by means of plate formed by a circular plate ($\varnothing 130$ mm) with incorporated threaded nut.
- The D15 plate is provided with two wings useful for facilitating the tightening, which can be done by hand or with a lever.

Technical specifications:

- D15 plate: support plate $\varnothing 130$ mm
- Threaded bar $\varnothing 15$ mm

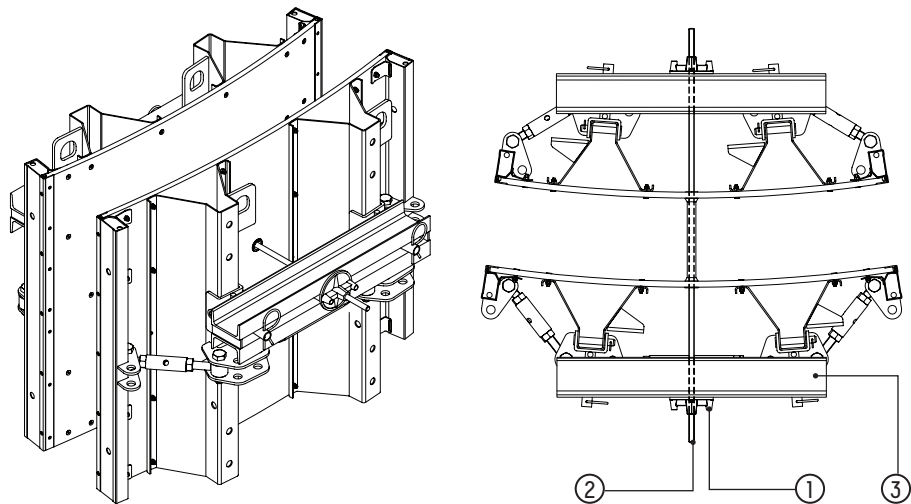


Fig. 22
1_ D15 plate
2_ D15mm threaded bar
3_ Circa-Flex transom 81

D15 plate galvanized	R_d [kN]	A_{wl} [kN]
Tensile strength	157	105
Weight: 1.2 [kg]		
Code: 583900		

Tab. 12

Standard configuration

- In standard configuration, casting height up to 3m is considered.
- Maximum fresh concrete pressure on **Circa-Flex** formwork: 60kN/m².

Panel height [m]	Concrete height [m]	N. of D15 tie-rods for each formwork panel	
		Panel width [cm]	
		240-230	124-119
1	1	2	1
1.5	1.5	4	2
3	3	4	2

Tab. 13

INSTALLATION OF THE TIE-RODS: AVAILABLE SPACERS

- The spacer is a device that is installed in order to protect the threaded bar from the concrete and make it possible to recover it at the time of scaffolding removal.
- Three types of spacer are available, depending on the intended use of the work and the costs:
 - PVC tube with 2 cone spacers
 - Pre-finished spacer
 - Water stop
- PVC stoppers are provided to seal the holes following stripping (not provided).

PVC tube with 2 cone spacers:

- Spacer composed of a disposable PVC tube spacer and 2 recoverable cone spacers placed in contact with the formwork.
- The PVC tube is supplied in bars (L=200 cm) and cut on site depending on the thickness of the wall to be constructed.
- After the stripping of the wall, it is possible to remove the PVC cones and fill in the holes.

Technical specifications:

- Tube diameter: external $\varnothing$ 26 mm
- Tube diameter: internal $\varnothing$ 22 mm

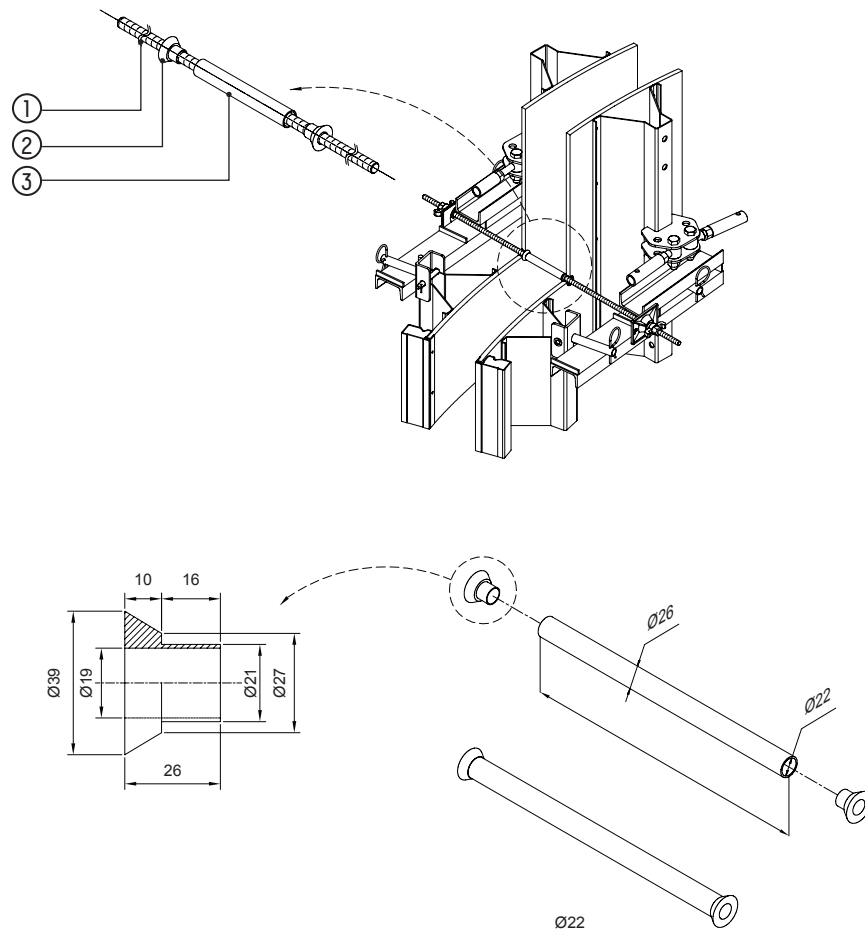


Fig. 23

- 1_Tie-rod D15
2_Spacer PVC cone
3_Spacer

Prefinished spacer

- Spacer made up of moulded tube in recycled plastic, supplied to the measure required to create the various thicknesses of the wall.
- The external surfaces of the spacer is corrugated so that it is fully immersed in the casting.

Given the spacer emerges on the surface, the pointing of the wall is not easy.

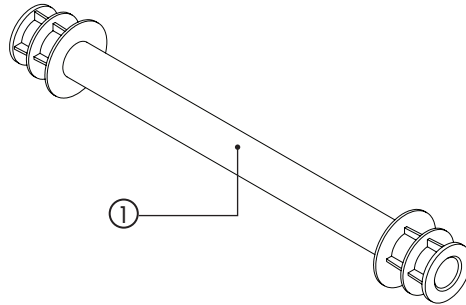


Fig. 24
1_Prefinished spacer

D15 Water stop

- Spacer made up of two opposing threaded parts, in which the threaded bars are screwed, and a central separator.

It is used in the event it is not necessary to provide continuity between the internal and external parts of constructions that, for example, contain polluting liquids or similar.

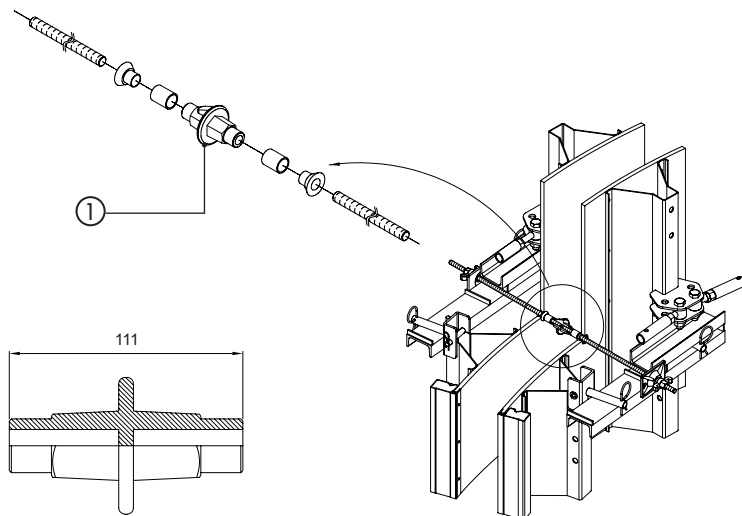


Fig. 25
1_Water stop type G

WALL OVERLAP

- The **Circa-Flex** panels connector allows to joint overlapped panels in correspondence of vertical steel reinforcement.
- One connector, with its 4 nuts and washers, has to be installed at each vertical rib of **Circa-Flex** panels.
- Maximum fresh pressure on **Circa-Flex** formwork: 60kN/m².

Panel **CIRCA-FLEX** connector complete*

Weight [kg]: 4.6

Art: 674000010

*Included:

- 15D20NZ - Nut M20 UNI 5588 galvanized - Qty. 4
- 15R20GZ - Washer 22X60 UNI 6593 galvanized - Qty. 4

Tab. 14

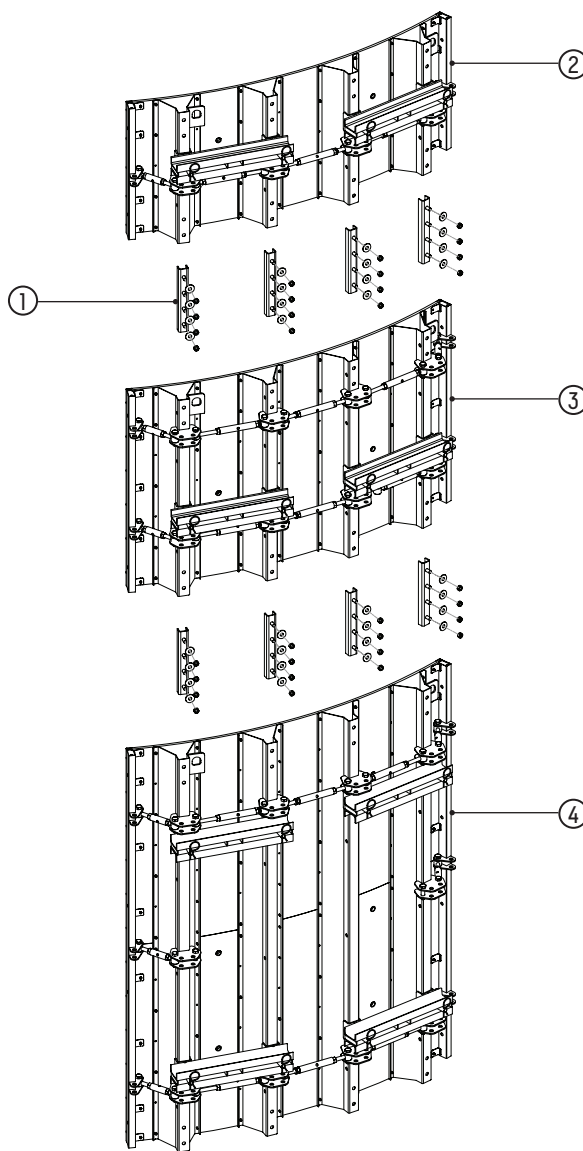


Fig. 26

- 1_Circa-Flex panels connector complete
- 2_Circa-Flex outer panel 240x100
- 3_Circa-Flex outer panel 240x150
- 4_Circa-Flex outer panel 240x300

- For casting heights more than 4m: additional tie-rods have to be installed in the lower formwork (Tab. 15).

Tab. 15

Cast height Hc [m]	N. of tie-rods								
	Total panel height [m]								
	H=6m		H=5,5m			H=4,5m		H=4m	
	H ₁ =3m	H ₂ =3m	H ₁ =3m	H ₂ =1,5m	H ₃ =1m	H ₁ =3m	H ₂ =1,5m	H ₁ =3m	H ₂ =1m
3m < Hc ≤ 6m	3	2	3	1	1	3	1	2	1

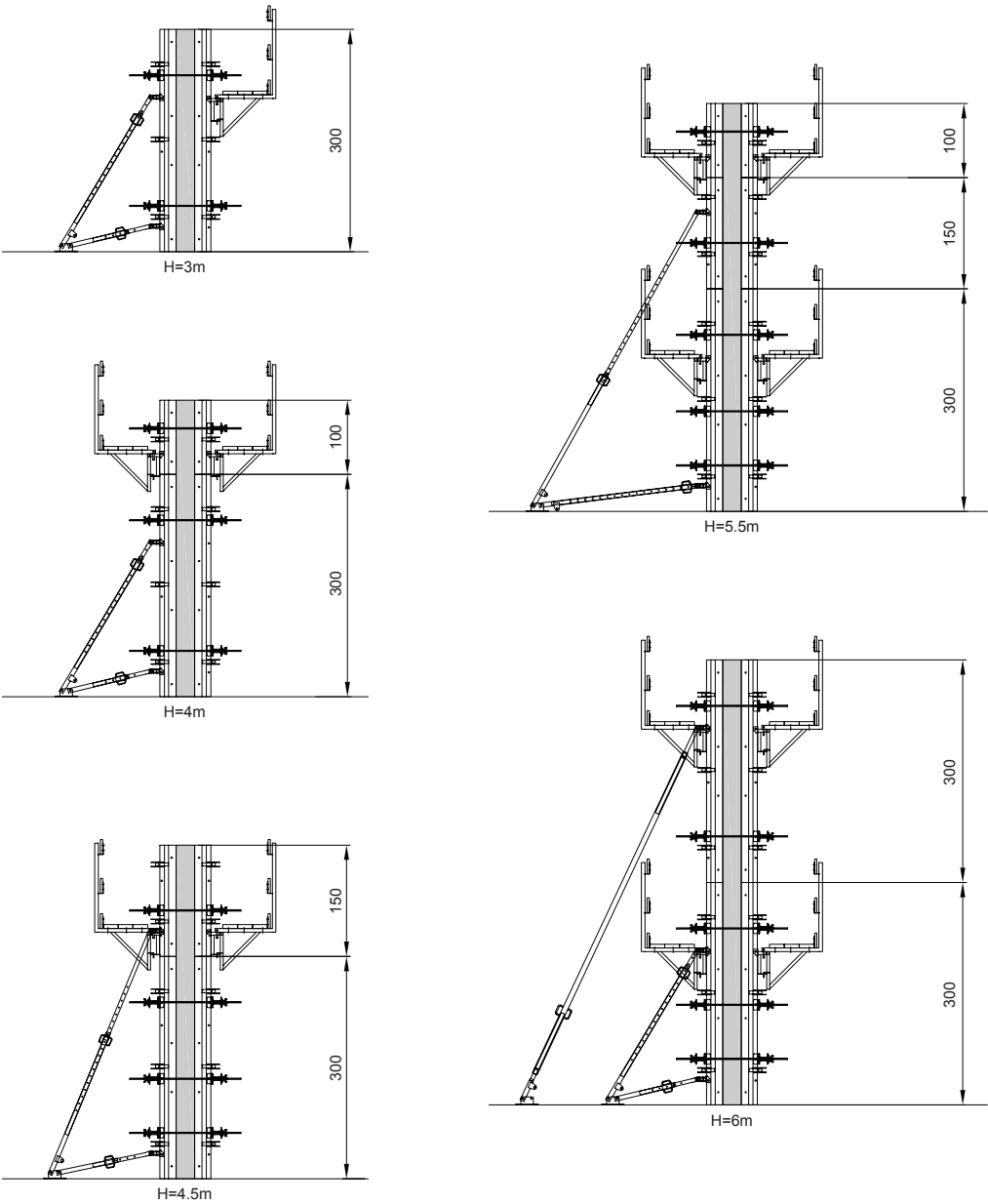
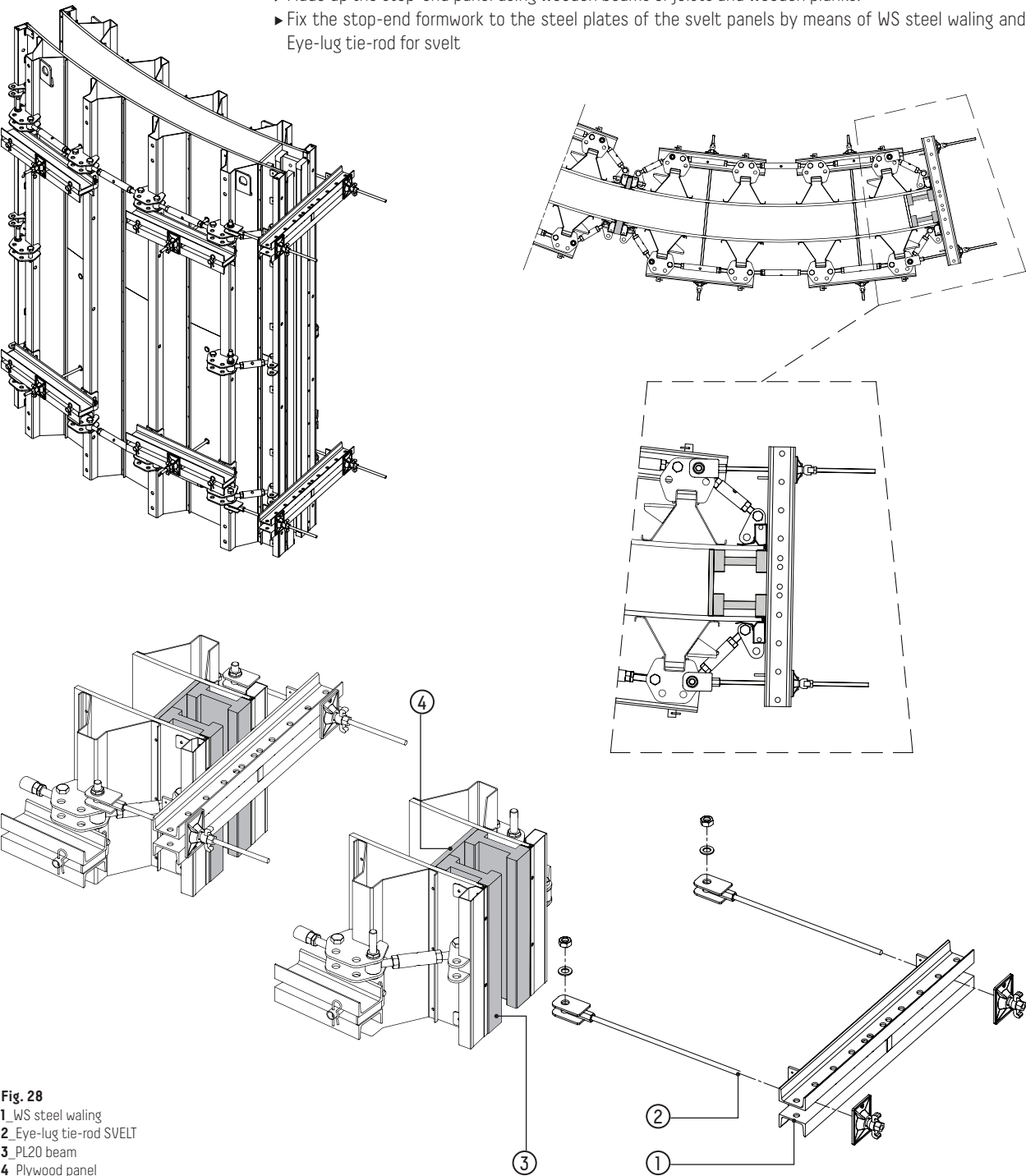


Fig. 27

STOP ENDS

- CIRCA-FLEX system provide quick and simple solutions to realize stop-end formworks, using system elements.
- ▶ Made up the stop-end panel using wooden beams or joists and wooden planks.
- ▶ Fix the stop-end formwork to the steel plates of the svelt panels by means of WS steel waling and Eye-lug tie-rod for svelt



Eye-lug tie-rod svelt galv complete*	R_d [kN]	A_{wl} [kN]
Axial load	30	20
Weight: 3 [kg]		
Code: K674000060Z - *INCLUDED: D15 Adjustable plate, M24 nut and washer		

Tab. 16

► In case of stop-end surface made of two or more wooden joist (size 10x10cm) and plywood, the design chart is the following:

Stop end	Concrete pressure	Wall thks [cm]	n. of walings WS10	
$H \leq 3m$	Up to 60kN/m ²	$s \leq 52cm$	2	
		$52 cm \leq s \leq 70cm$	3	Use 124-119 format of panel and additional turnbuckle for the 3rd anchor point
$H > 3m$	Constant = 60kN/m ²	$s \leq 42cm$	2	
		$42 cm \leq s \leq 55cm$	3	Use 124-119 format of panel and additional turnbuckle for the 3rd anchor point

Tab. 17

❗ In case of 3 walings, stiffen the panel connecting the middle turnbuckle. In this case, the use of little size panels is needed.

Fig. 29

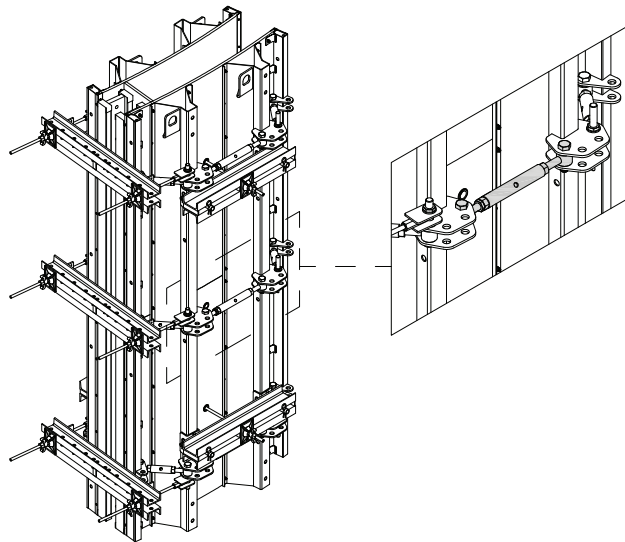


Fig. 30_A

1_Hex coupler D15

Fig. 30_B

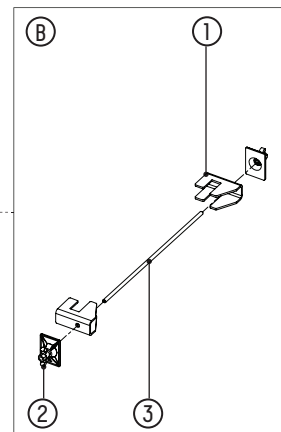
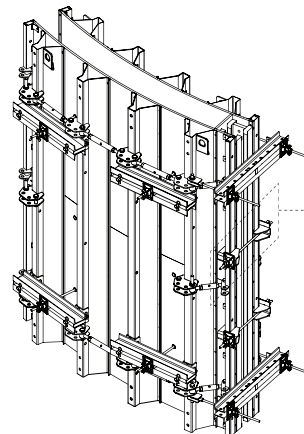
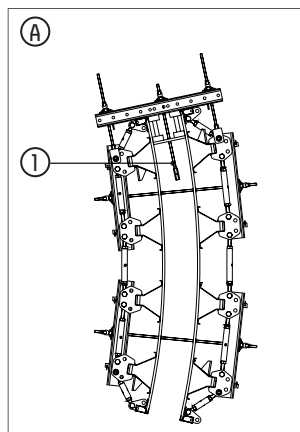
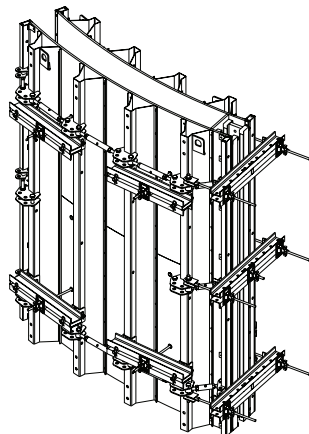
1_P300 mobile anchor

2_Tie-rod D15

3_D15 adjustable plate galvanized

❗ In case of greater wall thickness, the use of additional central tie-rod fixed to rebars is advisable. As an alternative, it is possible to contrast concrete pressure with spindle struts fixed to the reinforcing walings.

🕒 In order to avoid cross deformations of stop end, it is possible to apply an outer tie-rod by using "P300 mobile anchor".



PLUMBING STRUTS

- The adjustable push-pulls, standardized for all the Pilosio formwork for walls systems, are designed to resist both compression and traction.
- The adjustable plumbing struts have the function of stabilizing the formwork against the actions of wind and keeping them perfectly vertical.
- It is possible to incline the plumbing strut to various angles and attach the formwork at various heights.

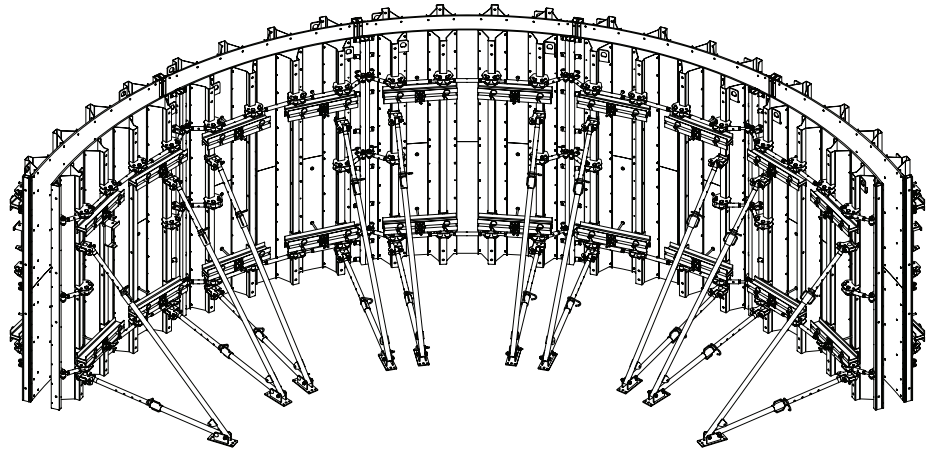


Fig. 31

Assembly instructions

- ▶ The plumbing struts are installed on the formwork wall while this is still in the phase of assembly on the ground.
 - ▶ Wall plumbing props can be attached to the formwork in two different ways:
 - Props attached to the **CIRCA-FLEX** omega profiles with push-pull prop connector complete with pin and cotter-pin. (Fig. 35).
 - Props attached to the **CIRCA-FLEX** transom by the use of strut head MX on push-pull prop (Fig. 36)
 - ▶ The prop is completed by the installation of the prop tilt plate (Fig. 37), necessary to fix it to the ground.
- ⓘ As a general rule, minimum two plumbing struts have to be installed on the first formwork module of a wall and at least one on the following modules, attached to the first one.
- ⚠ The distance between plumbing struts of the various models is evaluated in function of the height of the formwork (Tab. 18).
- **Strut length up to 450 cm (configuration type A, B and C in Fig. 32 and Fig. 33):**
 - ▶ To adjust the extension of the strut, it is recommended to move the adjustment ring nut to the central position, in order to facilitate the following phase of making the formwork perpendicular. Then carry out the rough adjustment of the extension of the strut by inserting the scaffolding pin in the perforated ring on the prop coupling. This operation avoids the unthreading of the male tube during handling and transport and also makes the element suitable to absorb both the forces of compression and traction.
 - ▶ Position the formwork wall vertically. Fix the strut tilt plate to the ground and check it is perpendicular by means of the fine adjustment of the screw ring nut.
 - **Strut length between 530 - 700 cm (configuration type D and E in Fig. 33 and Fig. 34):**
 - ▶ The adjustment of the strut extension is achieved by rotating the shaft of the prop, which adjusts the two screws located at the ends of the prop.
 - ▶ Position the formwork wall vertically. Fix the strut tilt plate to the ground and check it is perpendicular by means of the fine adjustment of the screw ring nut.

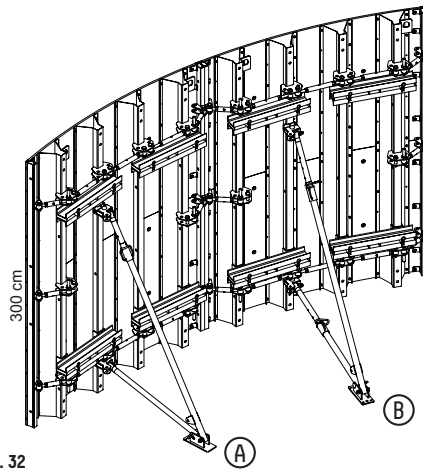


Fig. 32

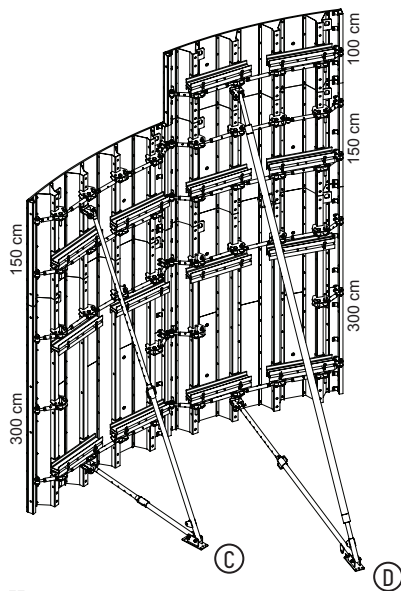


Fig. 33

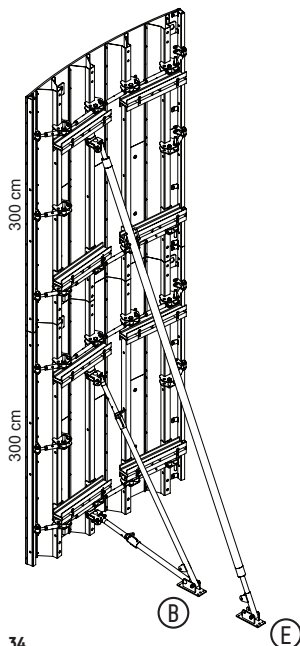


Fig. 34

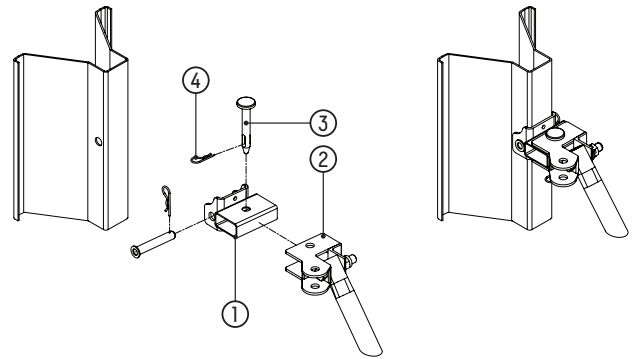


Fig. 35

- 1_Push-pull prop connector CIRCA-FLEX complete
- 2_Push-pull prop head
- 3_P300 galvanized pin
- 4_Cotter pin

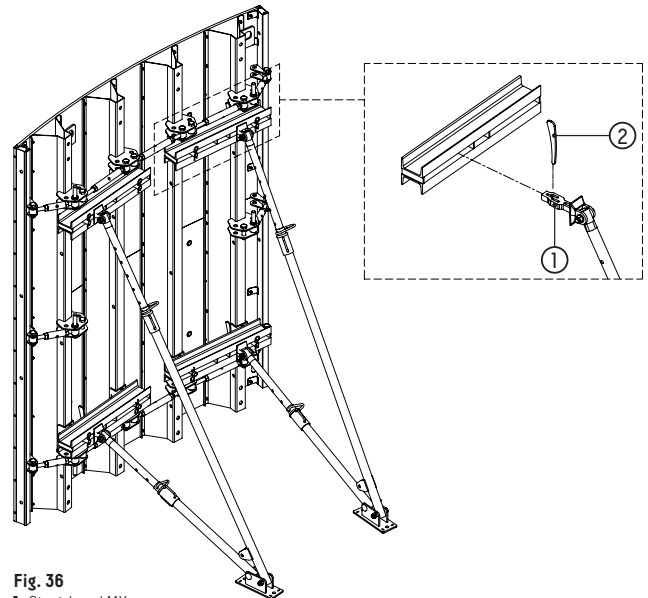


Fig. 36

- 1_Strut head MX
- 2_Accessory wedge MX

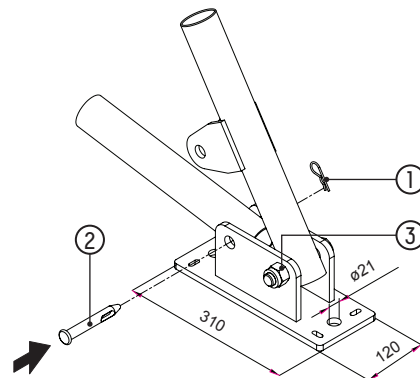


Fig. 37

- 1_Cotter pin $\varnothing 3$
- 2_P300 Pin
- 3_M20x100 screws and M20 self-locking nut

Notes_Dimensions in mm

- Refer to the following tables to determine the center distance of the various models of plumbing struts depending on the height of the formwork and the dimension of the anchor.

As a general rule, minimum two plumbing struts have to be installed in the first formwork module of a wall and at least one on the following modules, attached to the first one.

- The table shows the maximum distance between struts depending on the height of the wall to be constructed and the strut type and extension (Tab. 18). The values have been evaluated with reference to the calculation scheme in Fig. 38, in accordance to the EN 12812 (Wind pressure $q_k = 0.65 \text{ kN/m}^2$, with $q_k = q_{ref} \cdot c_e \cdot c_p \cdot c_d$ where $q_{ref} = 0.2 \text{ kN/m}^2$, $c_e = 2.5$, $c_p = 1.3$, $c_d = 1$).
- N_k , E_k and R_k are working loads for maximum allowed distance between struts.

Plumbing struts configuration	H_w wall [cm]	H_p push-pull prop [cm]	adjustable push-pull [cm]	lower arm type [cm]	max distance between struts [m]	axial action N_k [kN]	upward action E_k [kN]	horizontal action R_k [kN]
A/B	300	207	210-360	110-150	4.0	10.2	9.0	7.8
C	400	328	300-460	210-360	3.5	9.0	7.8	9.0
C	450	333	300-460	210-360	2.4	8.0	6.8	7.0
D	550	478	530-700	210-360	4.0	16.5	15.1	14.3
B+E	600	207	210-360	110-150	4.0	14.4	12.4	9.5
		507	530-700		4.0	14.3	12.6	6.1

Tab. 18

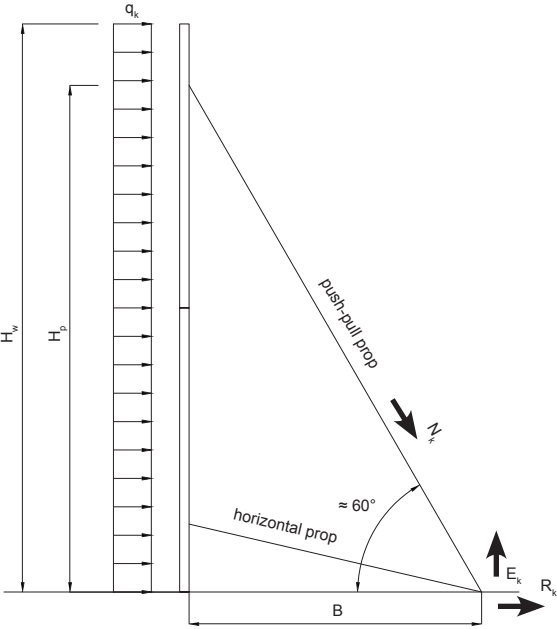


Fig. 38
Calculation diagram

Quick anchor

- The use of the quick anchor allows a rapid fastening of the tilt plate of the strut to the ground.
- This device, properly installed, allows to achieve the resistance to traction and shear summarized in Tab. 19, depending on the type and the curing of the concrete in which the fastening is made.

Quick anchor		Ripe concrete C 20/25		Fresh concrete $f_{ck,cube} \geq 14 \text{ N/mm}^2$	
		R_d [kN]	A_{wl} [kN]	R_d [kN]	A_{wl} [kN]
H90	Tensile strength N	9.6	6.4	7.3	4.8
	Shear strength V	27.2	18.1	20.3	13.5
H130	Tensile strength N	19.2	12.8	14.2	9.5
	Shear strength V	53.7	35.8	40.2	26.8

Tab. 19

Method of use:

1. perforate with drill H>90/130 mm;
2. clean the hole;
3. attach the disposable coil to the quick anchor, with the flap up;
4. insert the quick anchor in the hole, hitting with a hammer until it reaches the notch on the shaft of the anchor;
5. screw with allen key until completely tight.

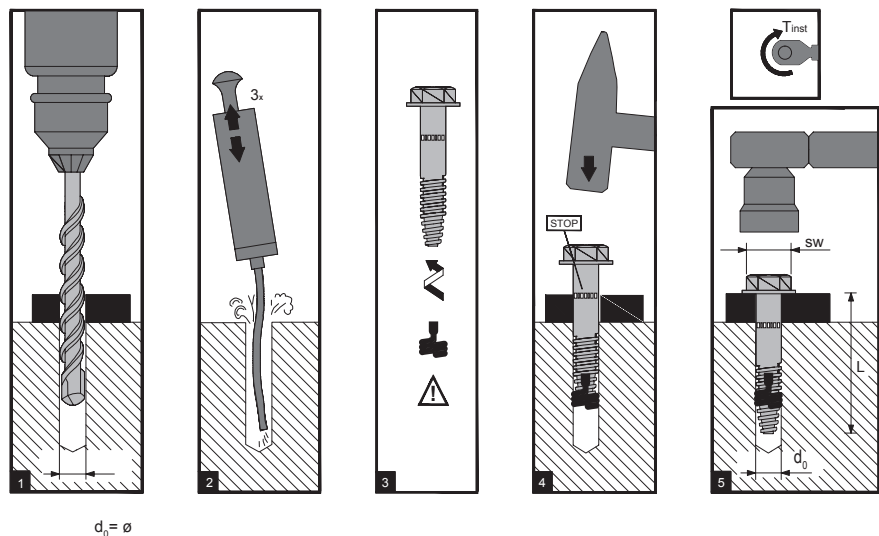


Fig. 39

Description	Art.	d_0 [mm]	sw [mm]	t_{inst} [Nm]	L [mm]
Quick anchor H90	15T1690HZ	$\varnothing 16$	24½	180	90
Quick anchor H130	15T16130HZ	$\varnothing 16$	24½	180	130
Coil for quick anchor	15MOLLAHZ	consumable items			

Tab. 20

⊙ The fixing of the strut must be enough resistant in order to ensure balance with regard to the maximum amount of lifting stress expected.

! For stress actions greater than the resistance that can be obtained with the quick anchor, it is necessary to use anchors with greater mechanical specifications.

- The use of one quick anchor for each tilt plate, fixed on fresh concrete ($f_{ck,cube} \geq 14 \text{ N/mm}^2$), allows adopt the following maximum distances between struts (Fig. 144)

Maximum distance between struts [m]

				Wind pressure	
				0.65 [kN/m ²]	
				Strut distance [m]	
H _w wall [cm]	H _p push-pull prop [cm]	adjustable push-pull [cm]	lower arm type [cm]	H90	H130
300	207	210-360	110-150	2.1	4.2
400	328	300-460	210-360	1.7	3.3
450	333	300-460	210-360	1.3	2.5
550	478	530-700	210-360	1.6	3.1
600	207 507	210-360 530-700	110-150	1.5	3.0

Tab. 21

WORKING BRACKETS

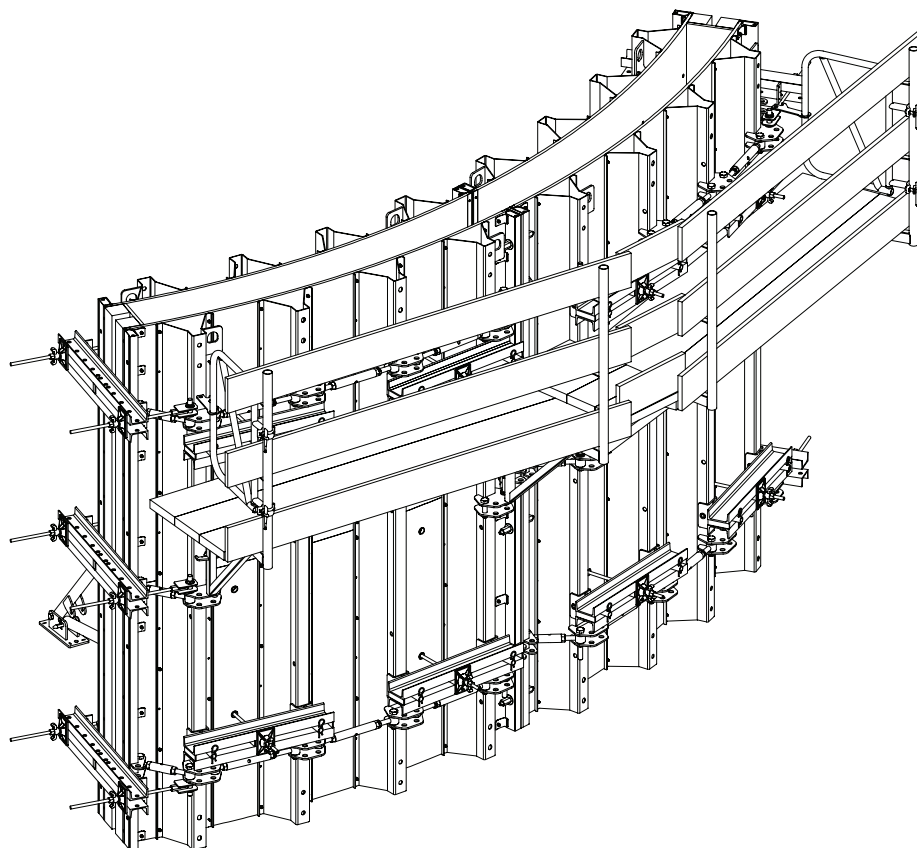


Fig. 40

Technical specifications of the components

- **Support clamp of the working bracket:** spar with tubular cross-section in steel tube $\varnothing 48,3 \times 3,2$ mm. The support clamps may be applied with maximum spacing of 2 m.
- **Floor boards:** for spacing between the brackets up to 2 m, boards with minimum sections of 20x5 cm can be used.
- **Parapets:** made with tube ($\varnothing 48,3 \times 3,2$ mm) and joint or, for spacing between the clamps up to 2 m, with wooden boards with minimum cross-sections of 20x3 cm.
- **Toeboards:** for spacing between the brackets up to 2 m, wooden boards with minimum cross-sections of 20x3 cm can be used.



By reducing the spacing of the clamps, it is possible to reduce the dimensions of the boards accordingly.

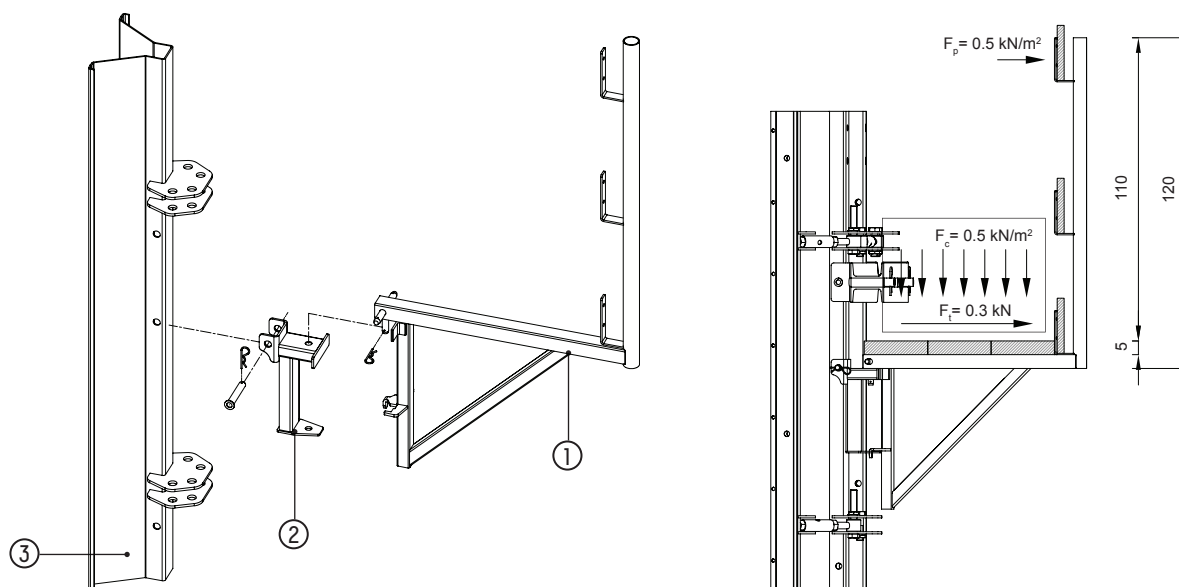
Working bracket complete	A_{wl}
Uniform distributed load on the bracket (F_c)	1,5 kN/m ^{2*}
Concentrated load on the parapet (F_p)	0,5 kN (>0.3 kN*)
Concentrated load on the toe-board (F_t)	0,3 kN (>0.15 kN*)
Weight: Π [Kg]	
Code: K591005	

Tab. 22

*Loads according to EN12811

Attachment elements:

- **Support clamp of the bracket to vertical formwork:** the bracket is equipped with pins useful for its installation to the working bracket connector. This device allows the fixing on the SVELT omega profile. The security of the attachment is guaranteed by the use of cotter-pins (Fig. 41).
- **Wooden boards of the bracket walkway:** the walkway boards are attached with roundhead screws M8x120 and nuts.
- **Parapets:** made of tube and joint elements or wood lining, inserted in the appropriate slots of the bracket and attached with 5x30 chipboard screws or equivalent.
- **Toeboards:** made with wooden boards, inserted in the appropriate slots of the brackets and attached with 5x30 chipboard screws or equivalent.
- **Head attachment:** made with tube and joint elements, in boards or with the appropriate head parapet attached to the bracket with appropriate clamp.

**Fig. 41**

- 1_Working bracket complete
 2_Working bracket connector
 CIRCA-FLEX complete
 3_Vertial rib

Working bracket connector Circa-Flex complete*

Weight [kg]: 3.1

Art: K674000030

*Included: K673100020 - Circa-Flex beam support pin complete - Qty. 1

Tab. 23

Access to service bracket

- Access to the service bracket is provided by installing a stepladder alongside the work level, or replacing the wooden floorboards with a metal floor provided with a trapdoor and steps, or installing a rope ladder alongside. Alternatively, the use of additional apparatus is possible, such as staging, scaffolding or suitable devices.

STORAGE AND HANDLING

Handling of formwork walls

- All Circa-Flex panels are equipped with 2 crane slots located on a steel plate welded to the steel profile.
- The crane slots allow attachment of crane slings for lifting and shifting panel units.

Crane slot of CIRCA-FLEX panel	Awl [kN]	Safety factor
Bearing capacity	20	2

Tab. 24

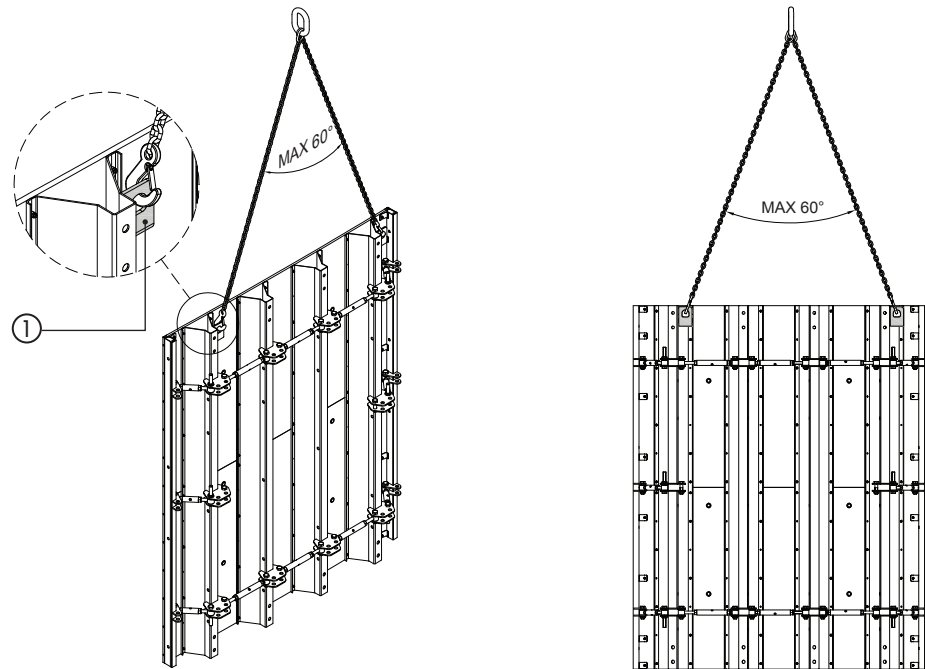


Fig. 42
1_Welded lifting slot

Handling of stacks

- When moving stacks, crane ropes must be installed crosswise to the Circa-Flex steel profiles.
- One stack should not exceed 4 panels. It is advisable to stack 3 panels.

! When moving stacked panels make sure they are straight (without radius).

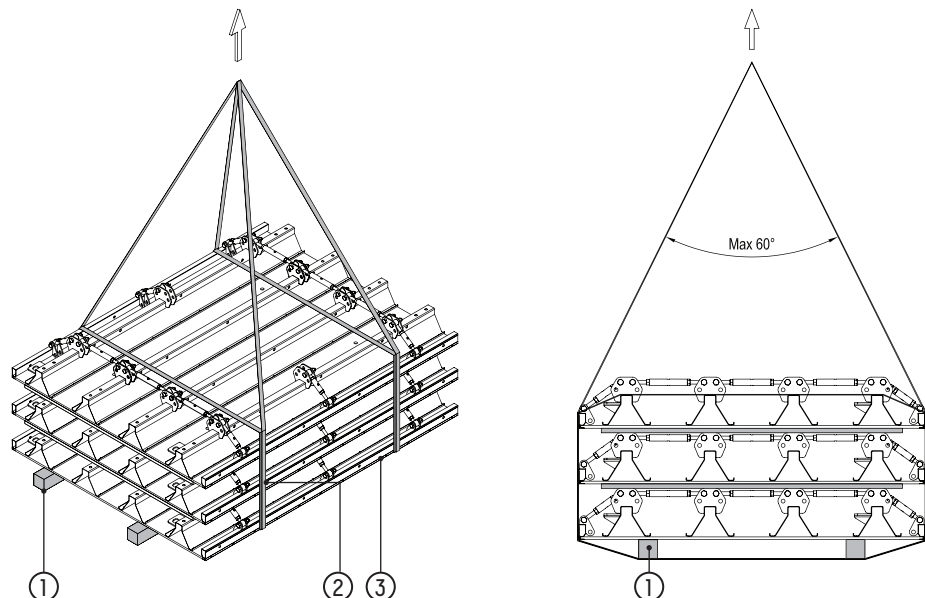


Fig. 43
1_Wooden joist
2_Strip
3_Circa-Flex panel

For handling operations consider a standard configuration rough weight of 60kg/m².

Handling with crane

The effective capacity of a chain depends on the angle at the top and is determined dividing the vertical capacity by the factor of the increase in the load.

- ❗ The use of chains with top angles greater than 60° should be avoided since beyond this limit the capacity varies noticeably, even with small variations of the top angle or of the general use conditions.
- 🔍 Refer to the PILOSIO contact person or the Technical Department of PILOSIO SPA in order to meet any requirement for dimensioning, geometric studies, etc., not included in this manual.

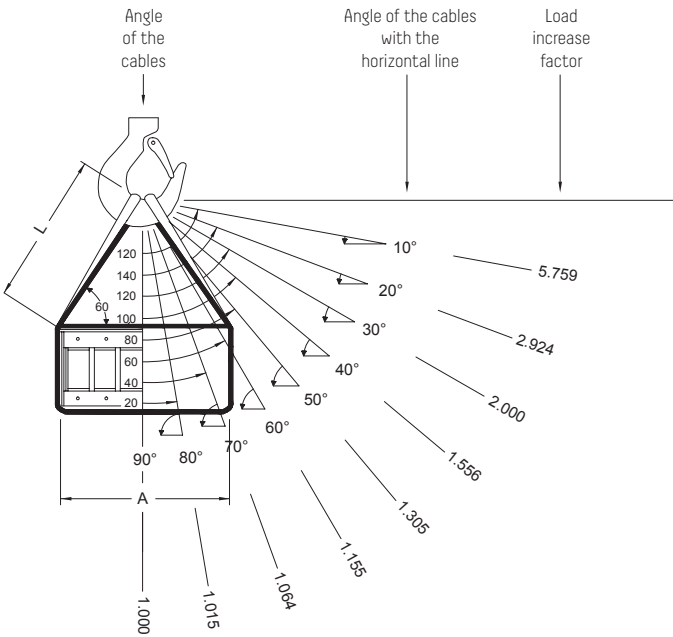


Fig. 61

COMBINATIONS WITH P300 SYSTEM

- It is possible to combine Svlt curved formworks to P300 frame formwork system, in order to satisfy all kind of geometries.
- The connection of the two types of formwork is made with P300 aligning clamps.

► For further information about P300 formwork system, please refer to the dedicated User's Manual.

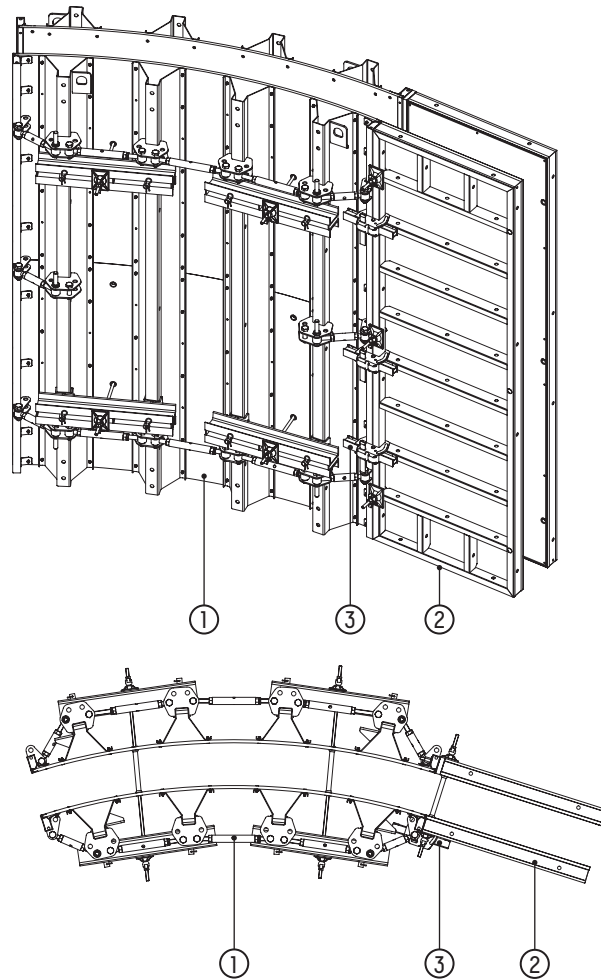


Fig. 44
1_ Circa-Flex formwork
2_ P300 formwork
3_ P300 aligning clamp

CLIMBING BRACKETS

CLIMBING BRACKET 150 A

pag. 52

The support brackets are systems that enable a level to be created to support the formwork for constructing walls of significant heights, with the consequent division into a vertical sequence in the casting phases.

! The details of these devices are described in the **Climbing Bracket** User Manual.

CLIMBING BRACKET 150A

Main features

- Climbing bracket for double sided walls.
- 150 cm wide.
- Fixed to concrete wall by means of Climbing cone D15.
- Formwork and climbing bracket can be shifted at the same time by the crane.

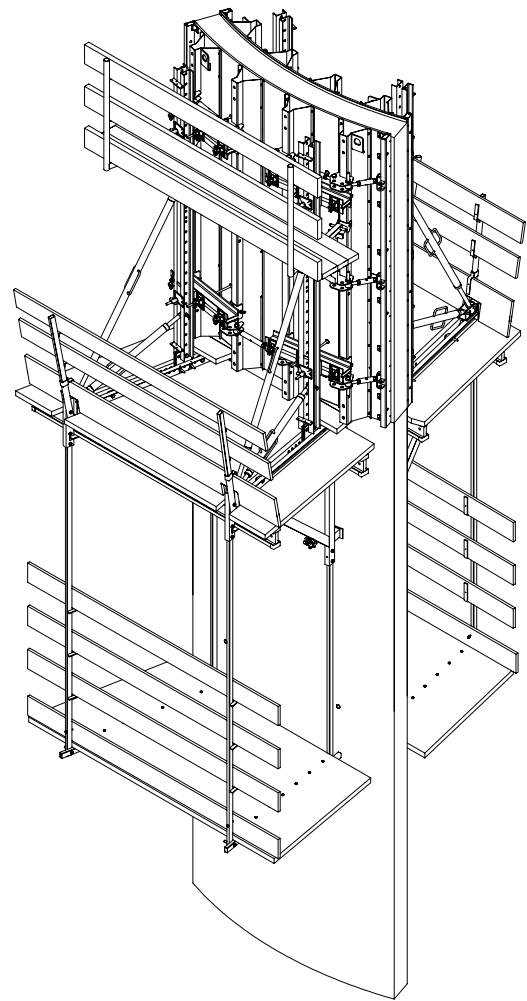
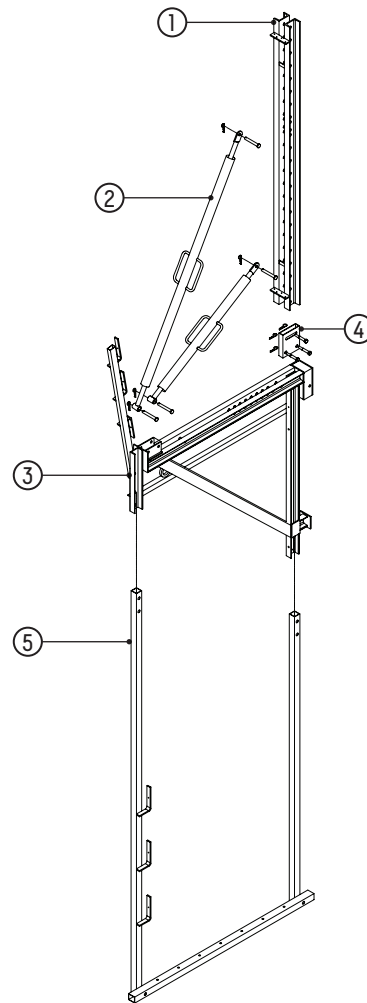
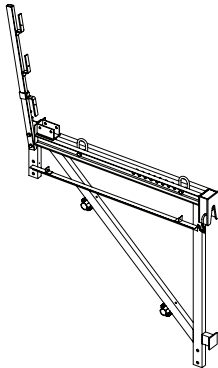


Fig. 45

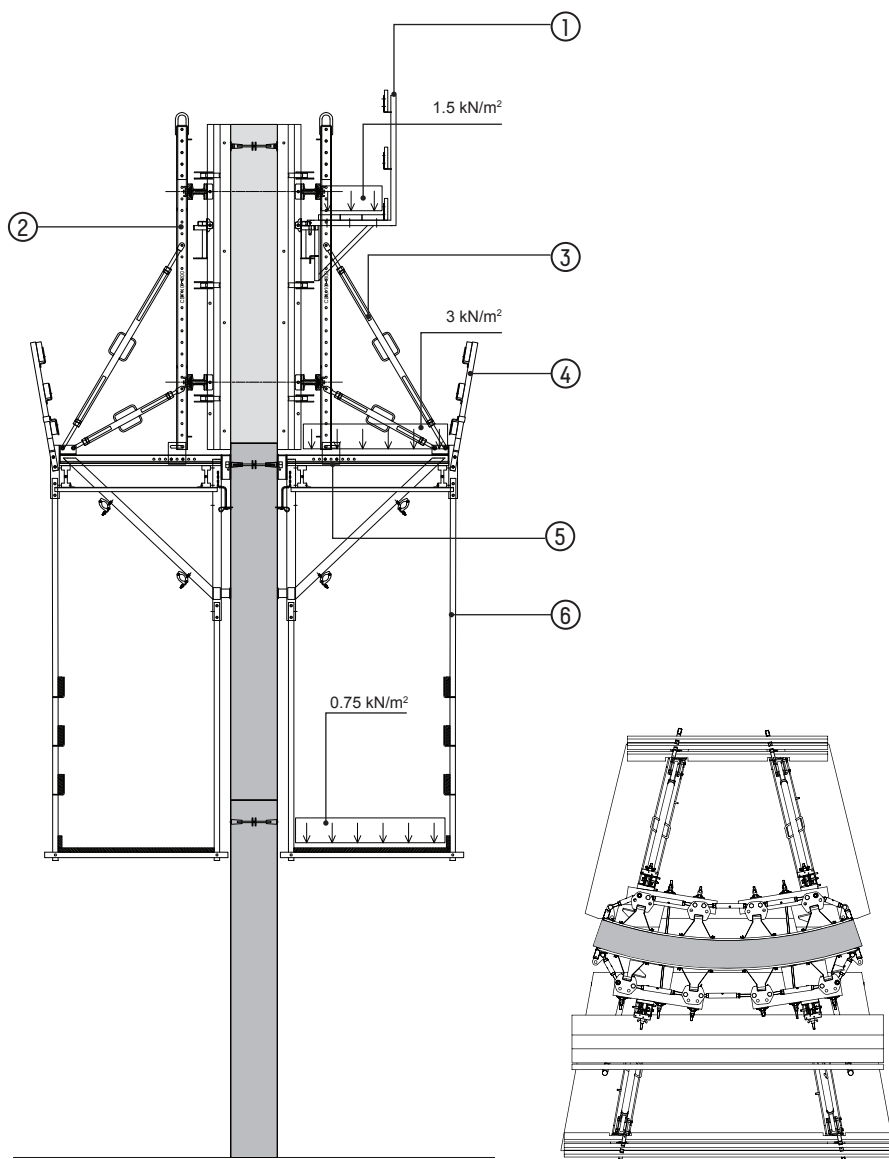
- 1_Vertical waling MX
2_Spindle strut MX TYPE B
3_Climbing bracket 150A
4_Lifting plate for climbing bracket 150 A
5_Suspension platform profile

Climbing Bracket 150A	L [cm]	Weight [kg]	Code
Working bracket complete		11.0	K591005
Climbing bracket 150A MX	150	73.5	68445A15I
Suspension platform profile	150	28.5	68446003I
Lifting bracket for steel waling		6.4	68700037
Lifting plate extended climbing bracket		5.7	68446030

Tab. 25

Design loads

- on main platform: 3 kN/m^2
- on service bracket: 1.5 kN/m^2
- on lower bridge: 0.75 kN/m^2

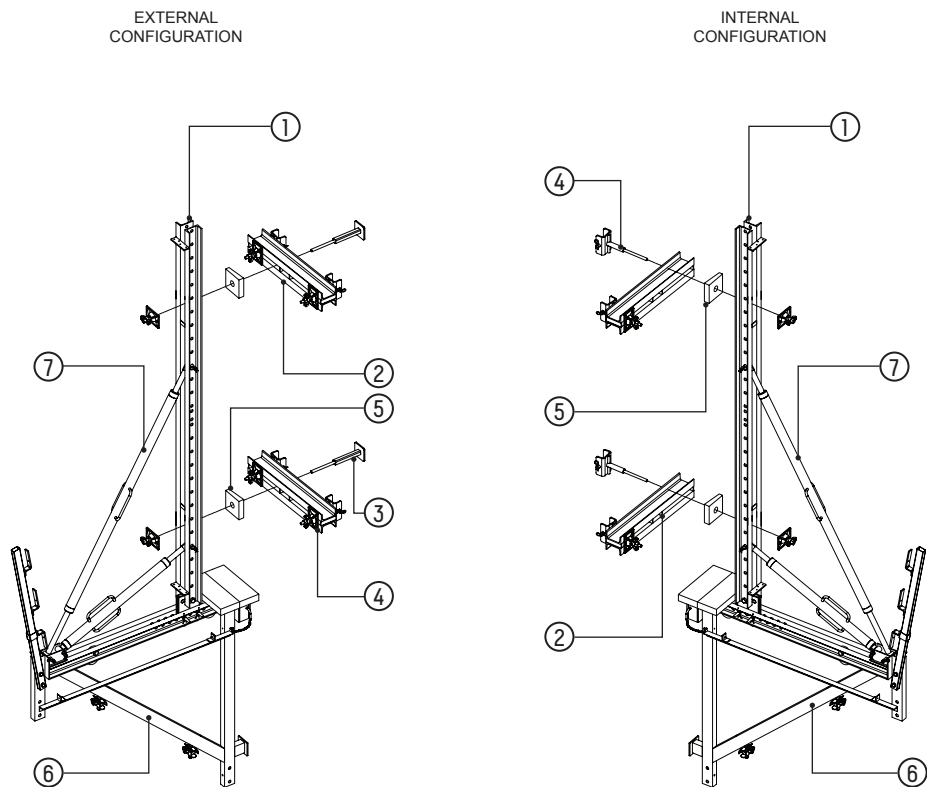
**Fig. 46**

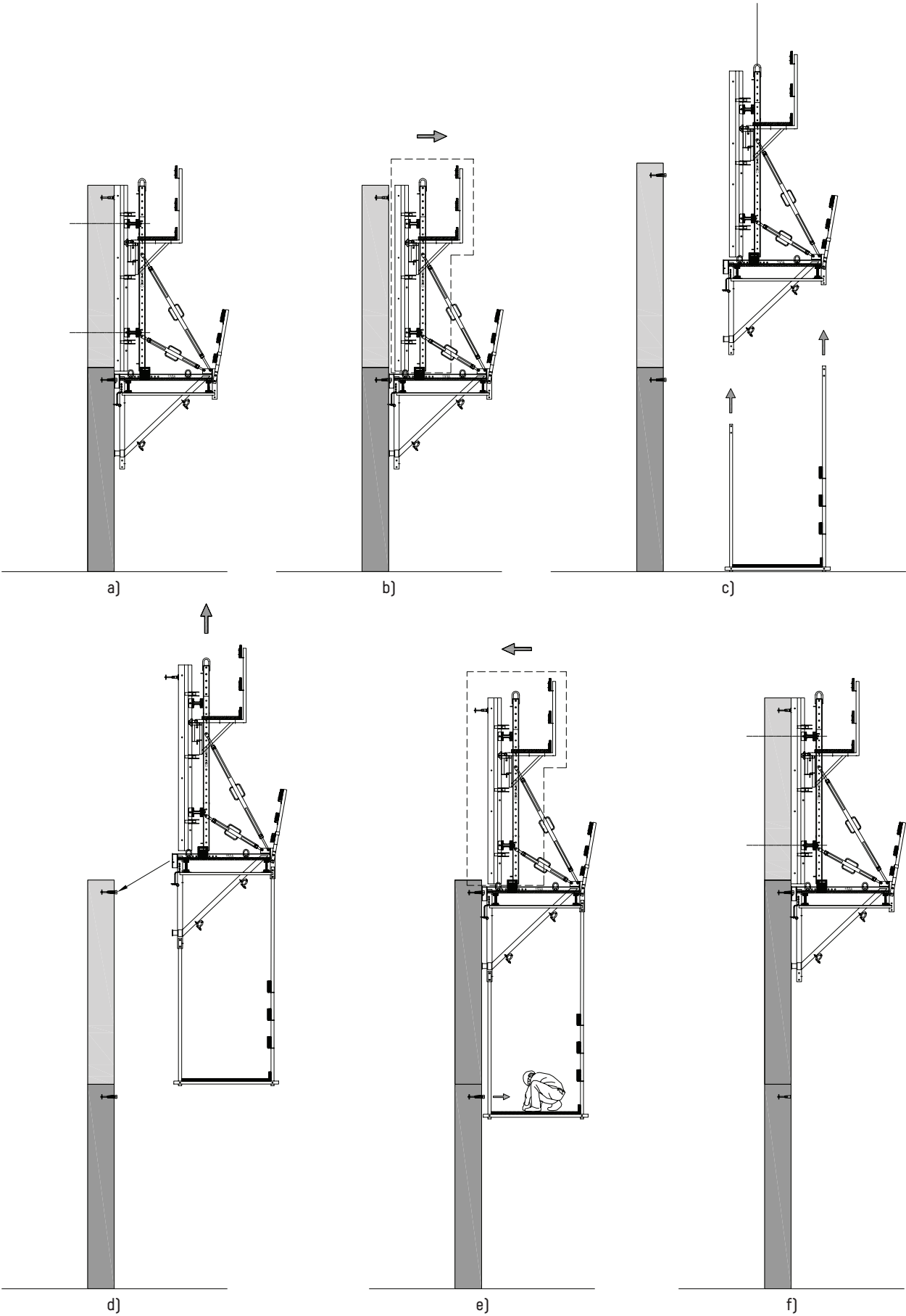
- 1_Working bracket complete
- 2_Vertical waling MX
- 3_Spindle strut MX square profile - TYPE B
- 4_Climbing bracket 150A
- 5_Lifting plate for climbing bracket 150A
- 6_Suspension platform profile

Basic assembly

- Fix the lifting plate for climbing bracket and a vertical waling on the formwork. In dismantling phase, formwork can be retracted for few centimeters in order to move the whole system to the next stage.
- Vertical walings are placed on horizontal auxiliary walings, and they are fixed to the formwork by means of "Circa-Flex fixing tie-rod shoring beam" or "Circa-Flex prop clamp". Note that a wooden infill has to be placed between the vertical waling and the horizontal auxiliary waling.
- Connect plumbing struts on the vertical walings.

! In case of necessity to have more working space on the bracket during the dismantling phase, it is recommended to disassemble the formwork from the bracket. Therefore, the formwork has to be placed on the ground while the bracket moves to the next stage. Finally, replace the formwork on the bracket.





RETAINING WALLS

WALLS UP TO 3.0 M
WALLS HIGHER THAN 3.0 M

pag. 58
pag. 62

The single sided walls can be realized with **Circa-Flex** system elements and additional frames, suitable for all Pilosio wall formworks.

The main elements for single sided walls are:

- Vertical walings
- Anchor walings
- Frames
- Anchor devices

WALLS UP TO 3.0 M

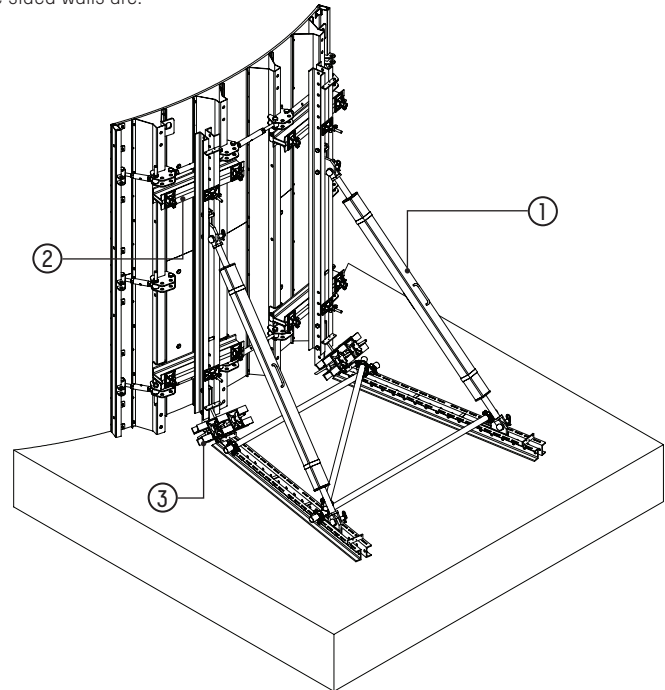


Fig. 48

1_DETAIL A
(Fig. 48_a)

2_DETAIL B
(Fig. 48_b)

3_DETAIL C
(Fig. 52_d)

Vertical waling

- The vertical walings are design with holes in order to fix the spindle struts with different inclinations and realize a stiff and resistant frame for single sided walls.
- Different lengths to guarantee flexibility and economy.
- Walls up to 3.0 m can be realized using vertical walings.
- Connect the vertical walings to the horizontal auxiliary walings of the formwork (**Circa-Flex transom 81**) by means of "**Circa-Flex fixing tie-rod shoring beam**". (Fig. 48_b)

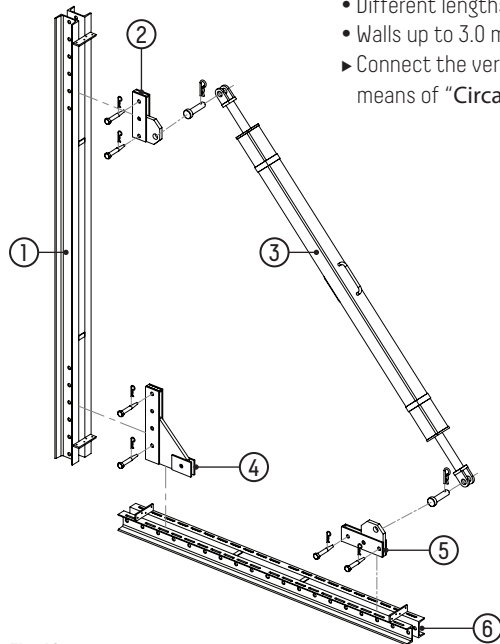


Fig. 48_a

- 1_Steel waling MX PS 12
- 2_YP pressure head
- 3_Spindle strut MX TYPE A
- 4_YP anchoring shoe
- 5_YP supporting shoe
- 6_Steel waling MX CDL KD 10

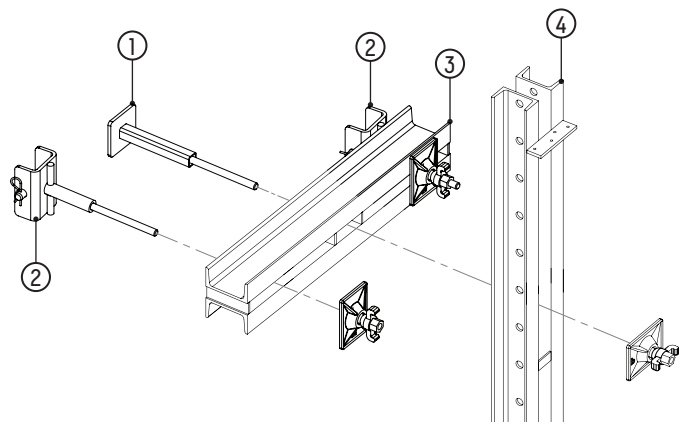


Fig. 48_b

- 1_Circa-Flex fixing tie-rod shoring beam
- 2_Circa-Flex prop clamp
- 3_Circa-Flex transom 81
- 4_Verical waling MX

Anchor waling

- The anchor waling is used to distribute the anchoring action of the single sided formwork wall among
- the anchor points and to guarantee an inclination equal to 45° of the anchor with respect to the horizontal direction.
- Different lengths and sections of anchoring beams are available in order to satisfy different needs in terms of resistance and to guarantee flexibility and economy.
- The same type of anchor waling is used for vertical frames realized with vertical walings and spindle struts or with supporting frames.



Notice that Anchor walings can also be replaced by Steel walings MX.

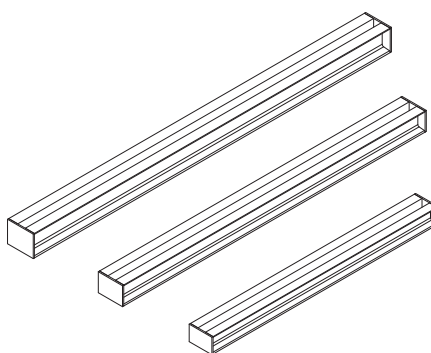


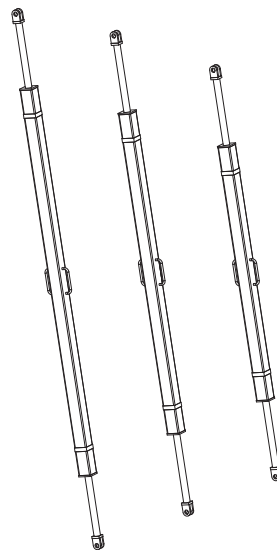
Fig. 49

Code	Description: anchor waling	L[cm]	Weight [kg]
68448224I	YP anchor waling NPU 100 L.75	75	17.5
68448212I	YP anchor waling NPU 100 L.200	200	42.4
68448214I	YP anchor waling NPU 100 L.300	300	63.6
68448225I	YP anchor waling NPU 120 L.75	75	22.0
68448226I	YP anchor waling NPU 120 L.200	200	55.2
68448227I	YP anchor waling NPU 120 L.300	300	83.0
68448228I	YP anchor waling NPU 160 L.75	75	31.3
68448229I	YP anchor waling NPU 160 L.200	200	78.6
68448230I	YP anchor waling NPU 160 L.300	300	117.0

Tab. 26

Spindle struts

- High resistance.
- The double type of clamp at the ends gives high flexibility of use. It is suitable to clamp to steel walings without additional plates.
- The use of spindle struts allows to realize retaining walls up to 3.00m with the use of one strut, with fresh concrete pressure up to 50kN/m².
- One or two spindle struts can be applied on walings.

**Fig. 50**

Design of struts						
Spindle strut MX	Reference length [cm]	Length [cm]	End clamp type	Weight [kg]	Max allowed compression A _{wl} [kN]	code
Circular section	100-150	100-150	B	12.5	70	68440610IT
	100-150	100-150	B	16.8	70	68440710IT
	150-200	150-200	B	21.8	70	68440715IT
	200-250	200-250	B	26.2	70	68440720IT
	250-300	250-300	B	29.4	70	68440725IT
	305-355	305-355	B	35.0	63	68440730IT
Square section	200	175-250	A	42.0	183	68441A20I
	250	225-300	A	48.0	169	68441A25I
	300	275-350	A	63.0	153	68441A30I
	350	325-400	A	70.0	134	68441A35I
	400	375-450	A	75.0	118	68441A40I
	450	425-500	A	80.0	113	68441A45I
	200	175-250	B	43.0	183	68441B20I
	250	225-300	B	48.0	169	68441B25I
	300	275-350	B	63.0	153	68441B30I
	350	325-400	B	70.0	134	68441B35I
	400	375-450	B	75.0	118	68441B40I
	450	425-500	B	80.0	113	68441B45I

Tab. 27

Plates for element connection

Fig. 51_a
1_YP pressure head
2_YP anchoring shoe
3_YP supporting shoe
4_Steel waling MX PS 12
5_Steel waling MX CDL KD 10
6_Strut type A
7_Strut type B

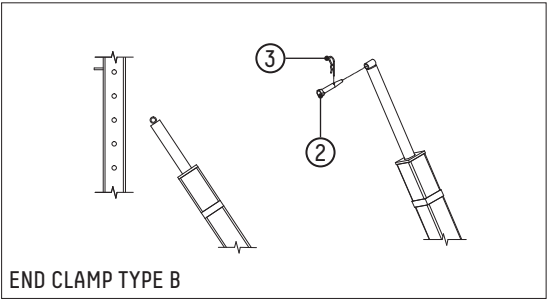
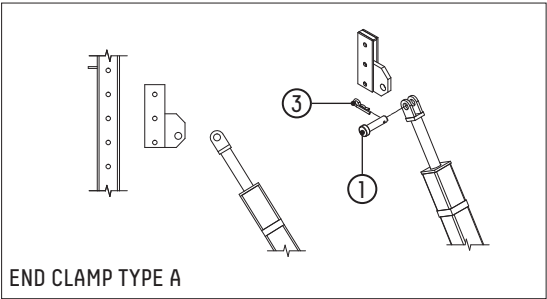
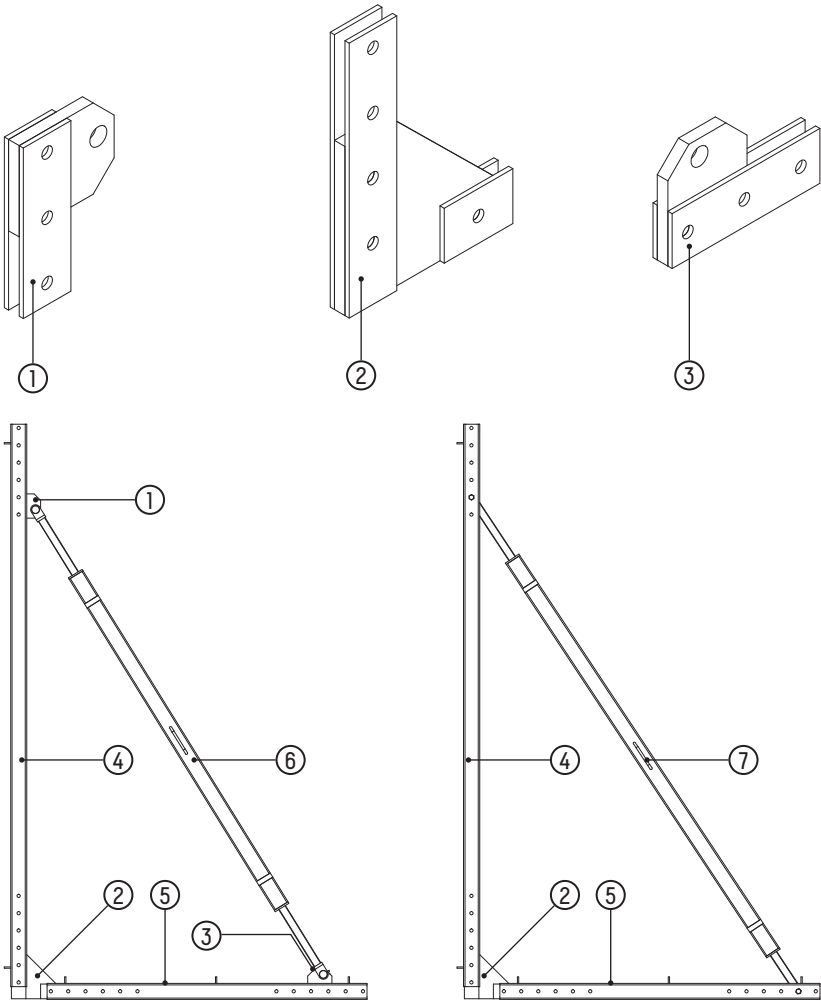


Fig. 51_b
1_Pin D30 L12
2_Connecting pin PS MX
3_Spring cotter

WALLS HIGHER THAN 3.0 M

The use of steel frames:

- enables to realize single sided walls with height up to 8m;
- reduces weight of elements;
- gives high modularity;
- fresh concrete pressure up to 50kN/m² is permitted.

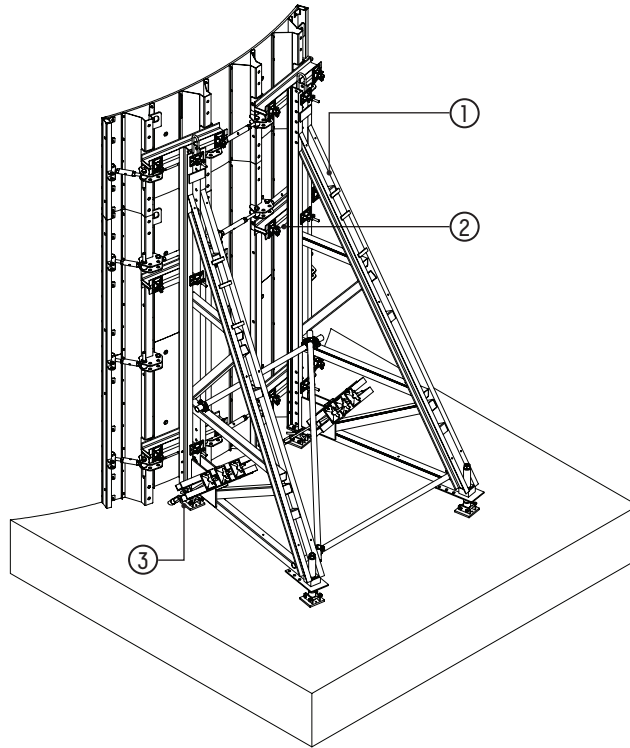


Fig. 52
1_DETAIL A
 (Fig. 52_a)
2_DETAIL B
 (Fig. 52_b)
3_DETAIL C
 (Fig. 52_c)

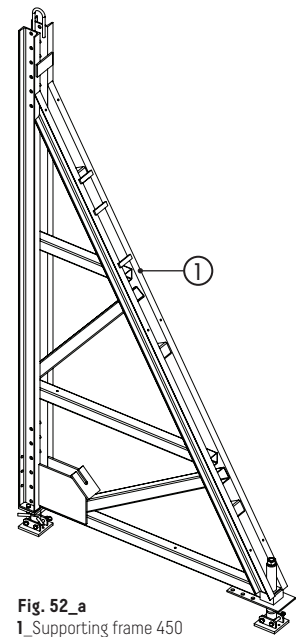


Fig. 52_a
1_Supporting frame 450

Assembly:

- Connect the frame to the horizontal auxiliary walings of the formwork (Circa-Flex transom 81) by means of "Circa-Flex fixing tie-rod shoring beam". (Fig. 52_b)

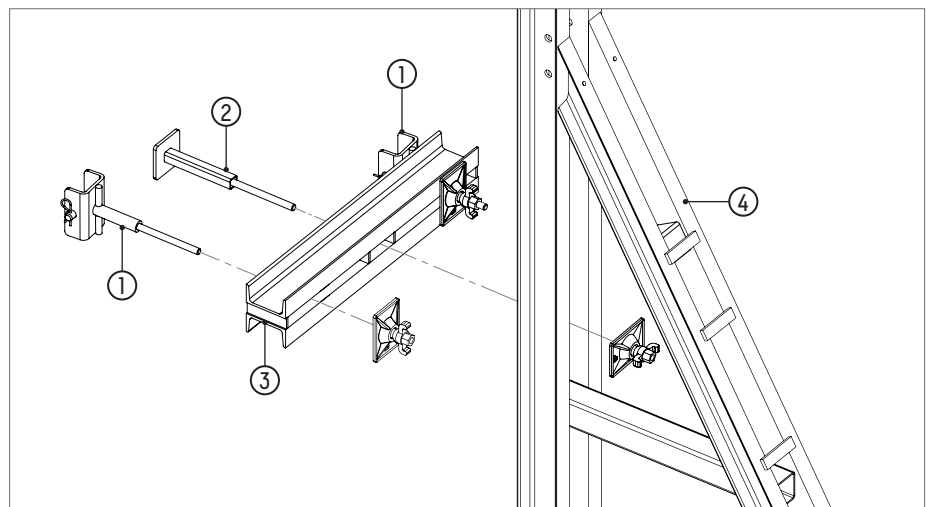


Fig. 52_b
1_Circa-Flex prop clamp
2_Circa-Flex fixing tie-rod shoring beam
3_Circa-Flex transom 81
4_Supporting frame

Supporting frame 450

Weight [kg]: 306.0

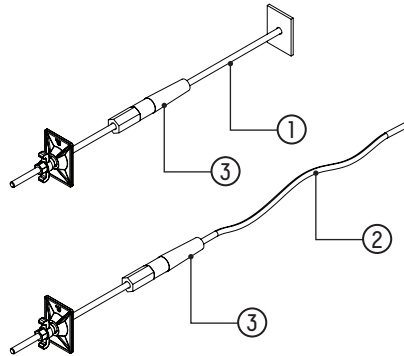
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Anchor devices:

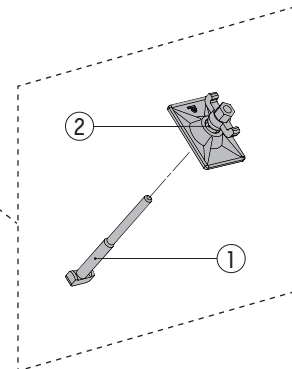
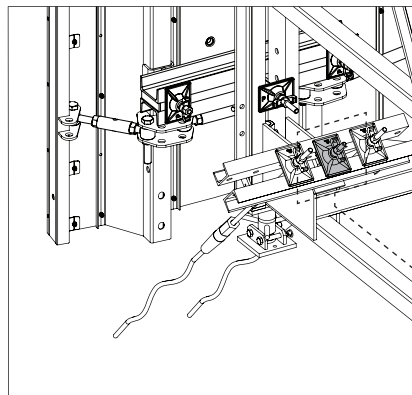
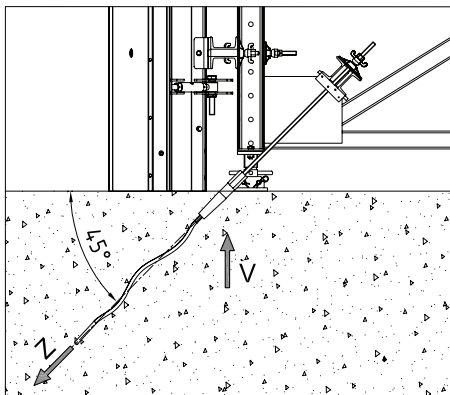
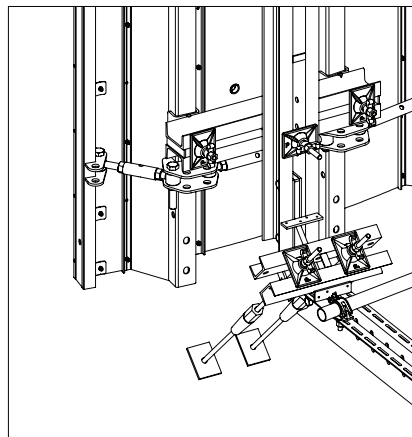
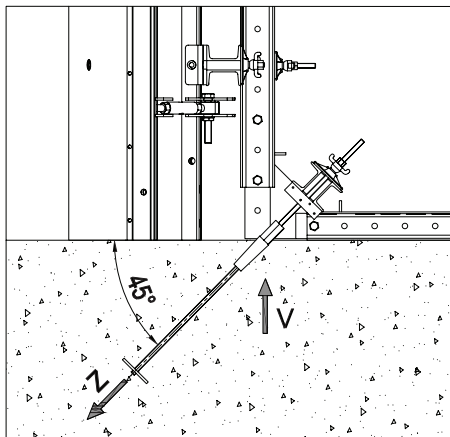
When subjected to fresh concrete pressure, support reactions V and Z have to be balanced (Fig. 52_d). For the specific reaction values refer to the PILOSIO contact person or to the Technical Department of PILOSIO SPA.

► Two main solutions for anchoring point are available (Fig. 52_c):

- stop anchor
- wobble anchor

**Fig. 52_c**

- 1_Stop anchor
2_Wobble anchor
3_She bolt

**Fig. 52_d**

- 1_Hammer end to fix frame anchor waling
2_D15 adjustable plate galvanized

FORMWORK MAINTENANCE

STRIPPING	pag. 67
EXTRAORDINARY MAINTENANCE	pag. 68
REPLACEMENT OF THE PLYWOOD PANEL	pag. 69

FORMWORK MAINTENANCE

- The steel profiles of the CIRCA-FLEX formwork are supplied with varnish finishing by immersion carried out following a careful procedure to clean the surfaces. These treatments, followed by kiln firing, ensures high durability.
- The standard cast containment panels have a protective phenolic layer that prevents the absorption of humidity and reduces the residue of concrete on the surfaces following the stripping of the panel from the casting. The number of reuses per side varies up to a maximum of 70, depending on the care taken in maintenance.

Plywood	
Thickness	18 [mm]
No. of layers	13
Phenolic protection	220 [gr/m ²]
Number of reuses per side	50-70

Tab. 29

- Thanks to these finishes, the panels for Pilosio's vertical formwork can be cleaned rapidly and the frames provide excellent anti-scratch performance.

Cleaning

- **Immediately after the casting:** eliminate any residue of the casting on the formwork frames.

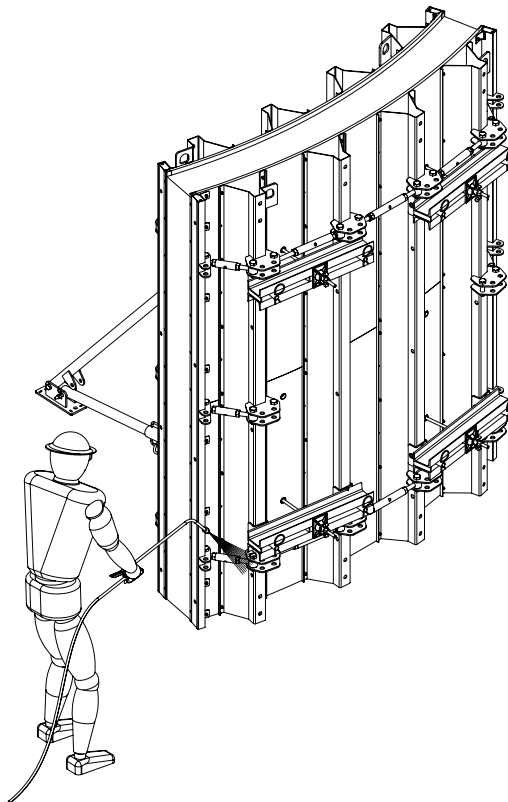


Fig. 53

- **Immediately after stripping:** eliminate any concrete residues from the formwork boarding with scraper or high-pressure water jet cleaner.

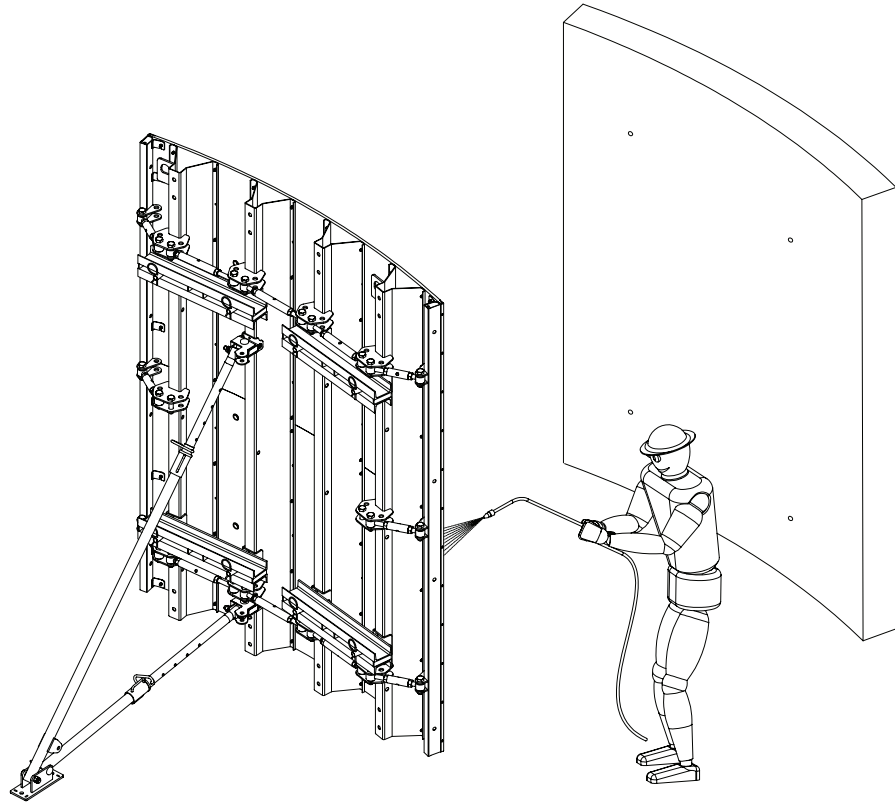


Fig. 54

- ❗ In the case of cleaning with high-pressure water jet cleaner, avoid carrying it out from too close or training the jet on the same point longer than necessary.
- ❗ Avoid directing the jet close to silicone finishes.
- ❗ Do not use brushes, abrasives and pointed objects on the formwork surfaces, in order not to compromise the surfaces of the boarding.

STRIPPING

- Before every use, apply a thin, uniform layer of stripper. The use of an appropriate "atomiser" devices is recommended.
- ❗ Avoid using too much stripper since it can compromise the quality of the concrete surfaces.

EXTRAORDINARY MAINTENANCE

In addition to the normal maintenance work, the instructions for extraordinary maintenance shown in the following sections should be followed with regard to formwork and accessories.

Small deformations, dents, detached welds etc. of the metallic frame of the formwork, the service brackets and the struts can be repaired with the typical methods of metalwork. If the deformations are significant, it is advisable to replace the items.

Hoisting accessories

Hoisting hooks and pins should be replaced even if the deformations are small.

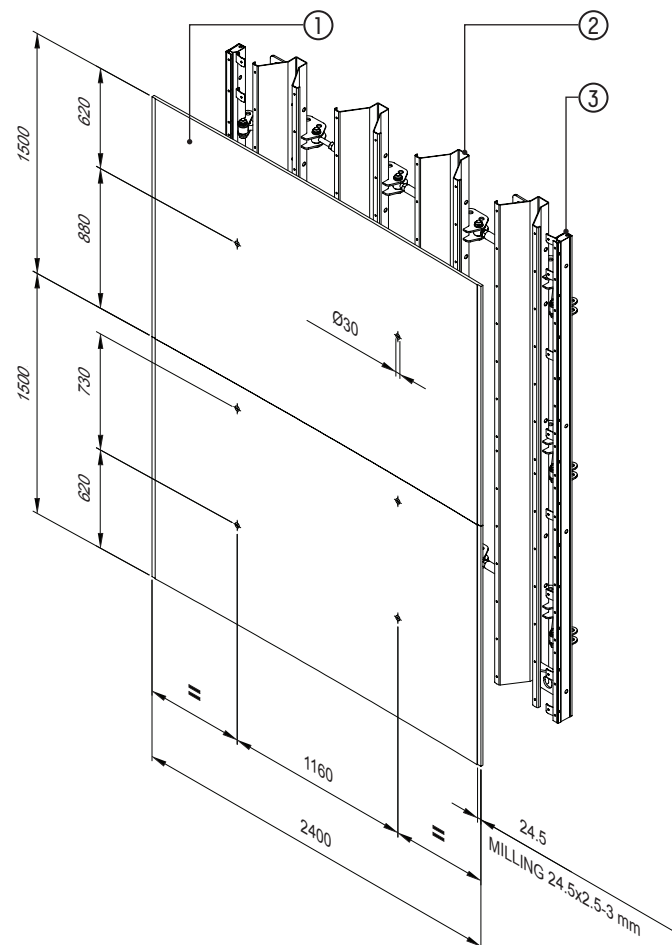
Plywood panel

Small deformations, holes etc. of the multilayer panel may be filled in. For the most effective repair, there are kits on sale that allow plywood wads to be applied to a site created around the damaged area by means of a suitable cutter.

- If the multilayered panel is severely compromised or there are swellings due to the absorption humidity etc. it is advisable to replace it with a new panel, following the instructions given below.

Warnings

- ❗ Do not use the hammer on metallic sections and the boarding.
- ❗ Make limited use of nails on the plywood surfaces.
- ❗ If necessary, use nails of a length $L < 60$ mm.
- ❗ Do not roll-over or allow the elements to fall.

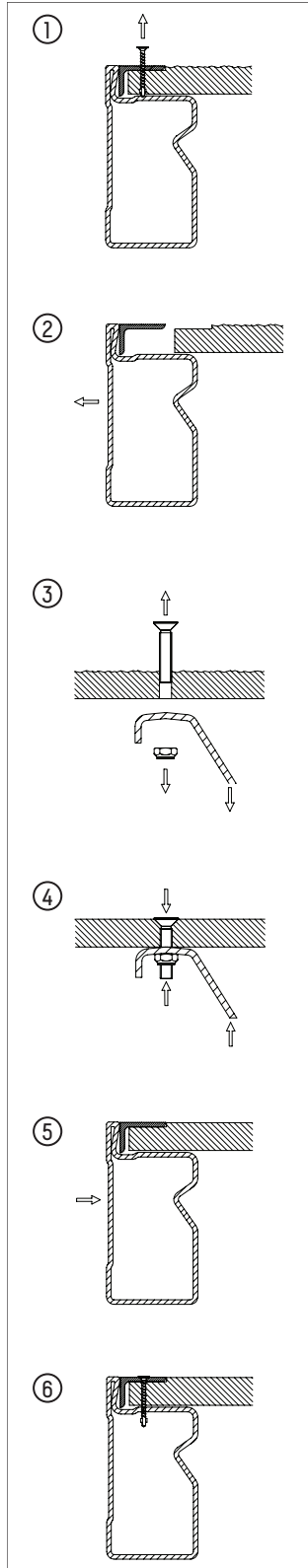
**Fig. 55**

1_Plywood panel

2_Vertical ribs

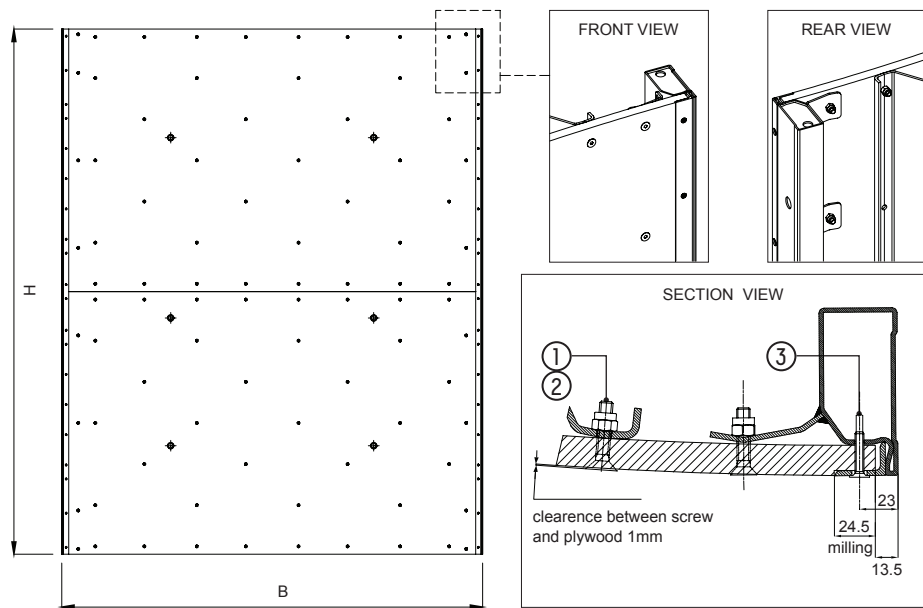
3_P300 profile

Notes _Dimensions in [mm]

REPLACEMENT OF THE PLYWOOD PANEL

- 1) Unscrew the lateral steel profiles.
- 2) Remove the lateral steel profile.
- 3) Unscrew the screws and the nuts from the omega frames and take them off.
- 4) Replace the plywood panel and fix the omega steel profiles by means of the screws and the nuts.
- 5) Fix in the two lateral steel profiles.
- 6) Fasten the 5,5x34,5 self-perforating screws in order to attach the plywood to the lateral profiles.

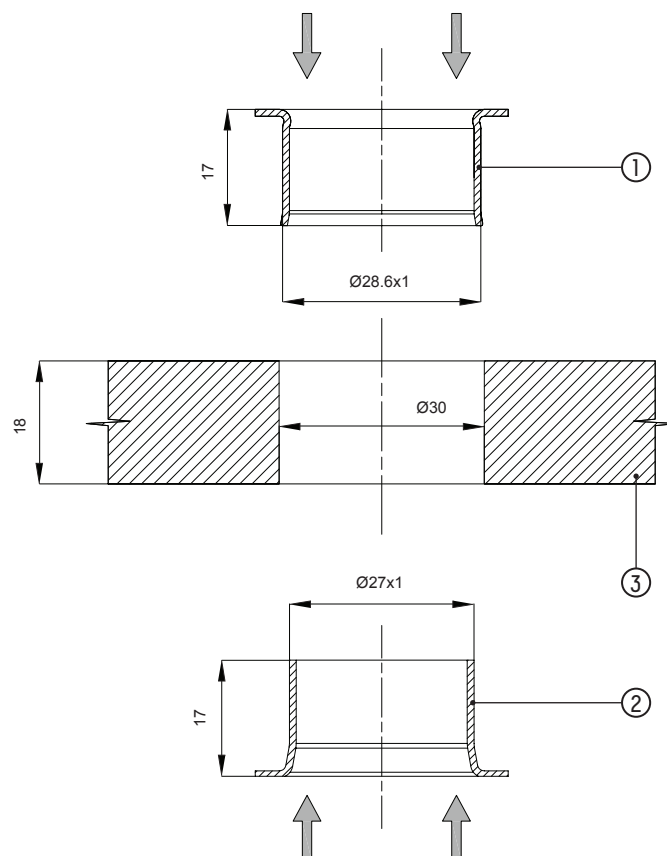
- The position and number of necessary holes and screws for each plywood panel is shown in Fig. 56.

**Fig. 56**

- 1_Screw M8x40 UNI 5933 galvanized
- 2_Self-locking nut M8 galvanized
- 3_Self threading screw Ø5.5x34

Panel dimensions BxH [cm]	Plywood dimensions (mm)	Plywood thickness (mm)	Total Plywood panels	Total bolts M8x40	Total screws Ø5.5x34.5mm
230x300	2273x1500	18	2	88	40
240x300	2373x1500	18	2	88	40
119x300	1163x1500	9+9	4	52	40
124x300	1213x1500	9+9	4	52	40
230x150	2273x1500	18	1	46	20
240x150	2373x1500	18	1	46	20
119x150	1163x1500	9+9	2	28	20
124x150	1213x1500	9+9	2	28	20
230x100	2273x1000	18	1	36	14
240x100	2373x1000	18	1	36	14
119x100	1163x1000	9+9	2	22	14
124x100	1213x1000	9+9	2	22	14

Tab. 29

REPLACEMENT OF THE PLYWOOD
PANEL**Fig. 57****1_** P300 protection bushing 28.6xl galvanized**2_** P300 protection bushing 28xl galvanized**3_** Plywood**Tab. 30**

P300 protection bushing 28xl galvanized

Weight: 0,012 [kg]

Art: 2055PG02

Tab. 31

P300 protection bushing 28.6xl galvanized

Weight 0,012 [kg]

Art: 2055PG14

TECHNICAL APPENDIX

PRESSURE OF FRESH CONCRETE IN FUNCTION OF THE CASTING SPEED

The pressure of fresh concrete is a basic parameter for the design of formwork, the tie-rods and struts. Together with the speed of casting, this parameter is fundamental for planning the construction site processing phases.

Depending on the speed of casting and the type of concrete, the diagram in Fig. 58 (DIN 18218:2010) enables the maximum pressure acting on the formwork and the corresponding level of hydrostatic pressure to be determined. It should be noted that the diagram given below concerns concrete with setting times of 5 hours.

Level of hydrostatic pressure: shows up to what level, at a placing rate v_b , the cast remains fluid with hydrostatic pressure. The level of hydrostatic pressure is obtained by intersecting the maximum permitted pressure on the curve for the type of concrete that is cast. Beyond this level, the pressure of cement remains constant.

$H_{\text{cast}} < h_s$: hydrostatic pressure

$H_{\text{cast}} > h_s$: up to h_s , the pressure on formwork is hydrostatic, beyond this level it is constant.

- If the casting time is longer than the setting time t_e , the cast level $h_e = t_e \cdot v_b$ exercises pressure on the formwork, whereas the cast level $(H - h_e)$ is self-bearing (Fig. 59).

*Lateral pressure of fresh concrete
according to Consistence Classes of the EN 206 – 1 (2001) regulations*

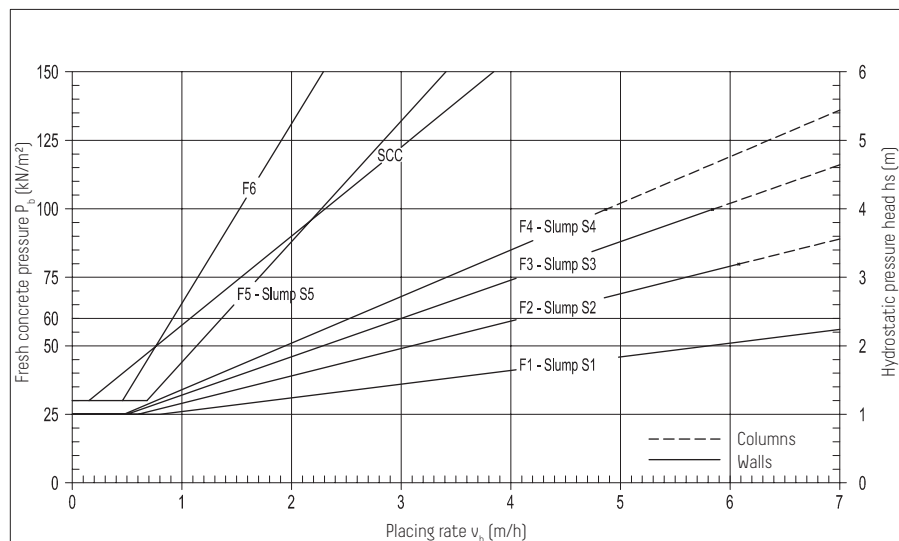


Fig. 58

Range of validity:
Specific weight of concrete: 25 kN/m³
Concrete setting time: 5 h
Waterproof formwork
Concrete temperature: +15 °C

Distribution of fresh concrete pressure over the height of the formwork

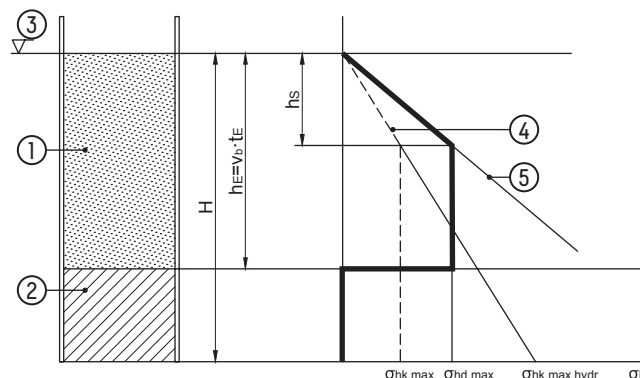


Fig. 59

1_Fresh concrete
2_Hardened concrete
3_Upper level of concrete
4_Hydrostatic pressure of fresh concrete P_b
5_Hydrostatic pressure of fresh concrete multiplied by g_f

Note:

With concrete of a consistency class F3 at 15°C, for maximum permitted pressure on formwork of 60 kN/m², the maximum speed of casting is 3 m/h. Up to the level $h_s = 2,4$ m, the progress of the pressure of the concrete on the formwork will be hydrostatic, above this level, the lower part of the casting (H-hs) will exercise constant pressure on the formwork.

- When the temperature of the concrete falls below 15°C, the resulting equivalent pressure is P_{bT} , modifying the maximum pressure P_b by 3% for each degree centigrade of difference, with the following relationship:

$$P_{bT} = \frac{P_b}{1 + 0,03 \times (15^\circ - T^\circ)}$$

- Having obtained the maximum equivalent pressure P_{bT} at the desired temperature, the maximum casting speed is obtained by returning to the graphic and intersecting the curve of the consistency class in correspondence with P_{bT} .

Eg.: With fresh concrete of F3 class at 5°C, in order to maintain constant the pressure $P_b = 60$ kN/m² on the formwork, the resulting equivalent pressure is determined at $T = 5^\circ\text{C}$.

$$P_{b5^\circ\text{C}} = \frac{60}{1 + 0,03 \times (15^\circ - 5^\circ)} = 46,15 \text{ kN/m}^2$$

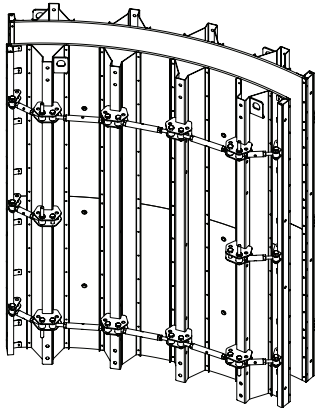
Returning to the graphic, the horizontal corresponding to $P_b 5^\circ\text{C} = 46,15$ kN/m² is intersected with the curve F3, obtaining a maximum raising speed of the casting of 2 m/h.

Up to the level $h_s = 1,8$ m, the progress of the pressure of the concrete on the formwork will be hydrostatic, above this level, the lower part of the casting (H-hs) will exercise constant pressure on the formwork.

ART. DIM. CM WEIGHT KG

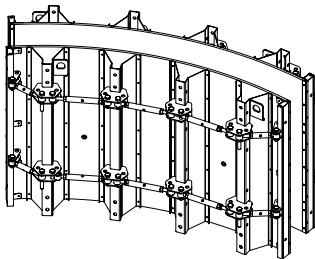
CIRCA-FLEX INNER PANEL 230X300 2 MAIN LINES
CIRCA-FLEX OUTER PANEL 240X300 2 MAIN LINES

671230300	230x300	440.0
671240300	240x300	443.0



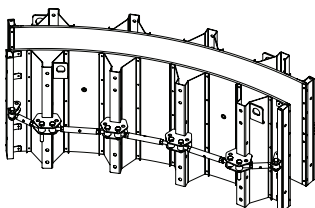
CIRCA-FLEX INNER PANEL 230X150 1 MAIN LINE
CIRCA-FLEX OUTER PANEL 240X150 1 MAIN LINE

671230150	230x150	261.0
671240150	240x150	241.0



CIRCA-FLEX INNER PANEL 230X100 1 MAIN LINE
CIRCA-FLEX OUTER PANEL 240X100 1 MAIN LINE

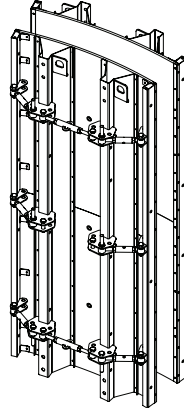
671230100	230x100	154.0
671240100	240x100	156.0



ART. DIM. CM WEIGHT KG

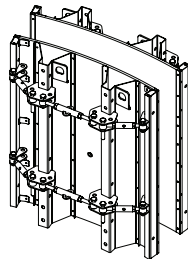
CIRCA-FLEX INNER PANEL 119X300 2 MAIN LINES
CIRCA-FLEX OUTER PANEL 124X300 2 MAINS LINE

671119300	119x300	258.0
671124300	124x300	260.0



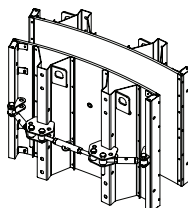
CIRCA-FLEX INNER PANEL 119X150 1 MAIN LINE
CIRCA-FLEX OUTER PANEL 124X150 1 MAIN LINE

671119150	119x150	134.0
671124150	124x150	135.0



CIRCA-FLEX INNER PANEL 119X100 1 MAIN LINE
CIRCA-FLEX OUTER PANEL 124X100 1 MAIN LINE

671119100	119x100	83.5
671124100	124x100	84.5

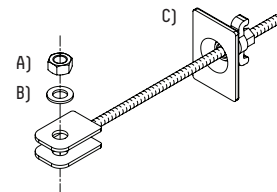


ART. DIM. CM WEIGHT KG

EYE-LUG TIE-ROD SVELT GALVANIZED COMPLETE

K674000060Z	-	3.0
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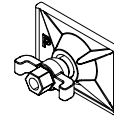
Complete with:
N° 1 nut M24 UNI 5588 galvanized (A)
N° 1 washer 25x44 UNI 6592 galvanized (B)
N° 1 D15 adjustable plate galvanized (C)



OUTER TIE-ROD ELEMENTS

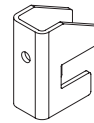
583905	-	1.2
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D15.0 mm adjustable plate galvanized (A)



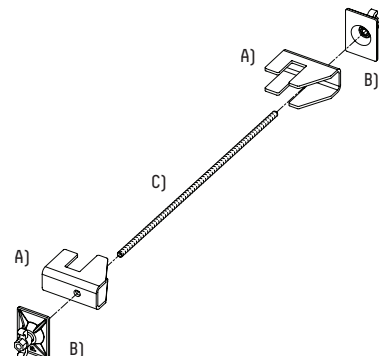
557021	-	2.6
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P300 mobile anchor (B)

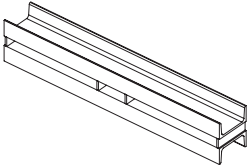
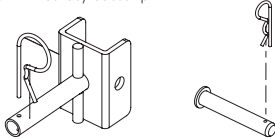
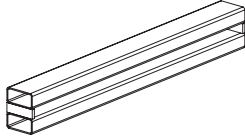
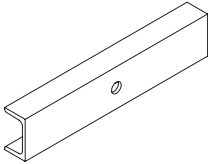
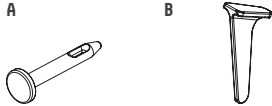
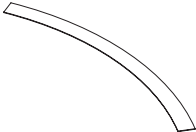
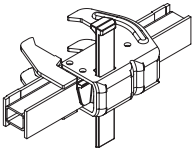
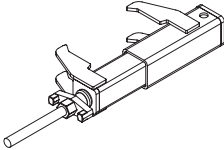
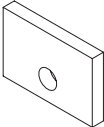
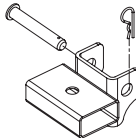
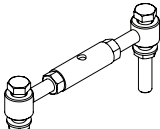
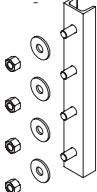
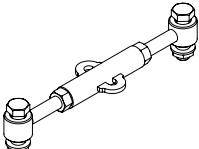
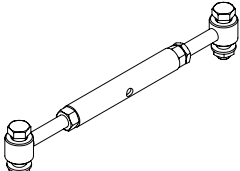
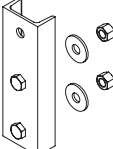


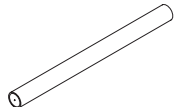
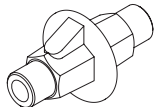
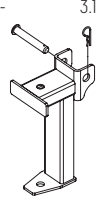
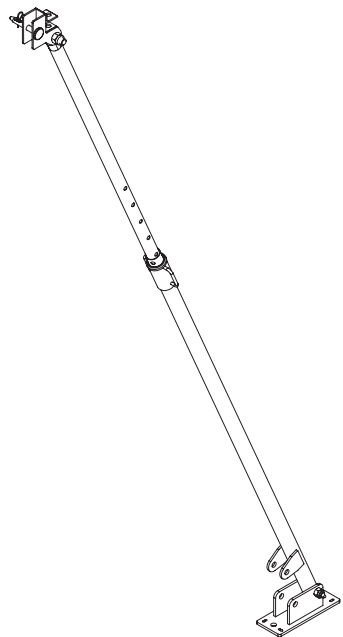
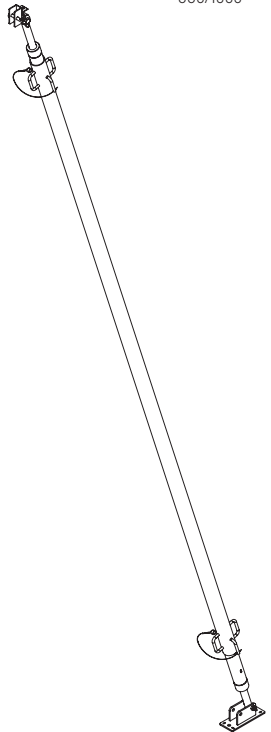
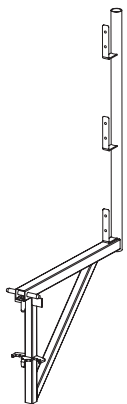
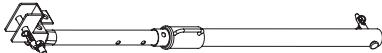
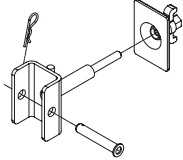
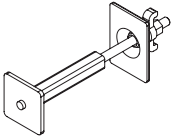
583025	ø 15x25 [mm]	0.37
583050	ø 15x50 [mm]	0.73
583075	ø 15x75 [mm]	1.05
583100	ø 15x100 [mm]	1.42
583150	ø 15x150 [mm]	2.20
583200	ø 15x200 [mm]	2.90
583250	ø 15x250 [mm]	3.55
583300	ø 15x300 [mm]	4.26
583400	ø 15x400 [mm]	5.68
583600	ø 15x600 [mm]	8.52

Tie-rod D15.0 mm (C)





ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG
CIRCA-FLEX TRANSOM 81			CIRCA-FLEX BEAM SUPPORT COMPLETE CIRCA-FLEX BEAM SUPPORT PIN COMPLETE			REINFORCEMENT CROSSBAR 80		
673000810	81	22.3	K673100010 K673100020 both with N° 1 safety cotter pin	- - 2.3 0.33		556080	80	8.8
								
CIRCA-FLEX REGULATING TEMPLATE			REINFORCING U CHANNEL (3 EACH INFILL PANEL)			P300 PIN GALVANIZED P300 WEDGE GALVANIZED		
678000101	-	-	554042	40	3.5	581010 581100	ø 19 [mm]x148 (A) - (B)	0.33 0.15
Custom made with radius as required by the project								
			P300 SCREW ALIGNING CLAMP			WING NUT D15.0 MM GALVANIZED		
556000	-	6.0	556020	-	4.3	583907	5.7x8.5	0.34
								
GALVANIZED PLATE 100X80X10 FOR TIE-ROD			PUSH-PULL PROP CONNECTOR SVELT COMPLETE			WASHER 20X54 FOR TIE-ROD		
582930	100x80x10	0.6	K674000020 N° 1 pin ø 20 [mm] L= 12 N° 1 safety cotter pin of 3 [mm]	- 1.6		15R18GZ	-	0.06
								
CIRCA-FLEX PANELS CONNECTOR COMPLETE			NUT D15 GALVANIZED			CIRCA-FLEX TURNBUCKLE 24-32 COMPLETE GALVANIZED		
674000010	-	4.6	583910	-	0.11	672240320	-	3.5
N° 2 nut M20 UNI 5588 Zn N° 4 washer 22x60 UNI 6593 Zn								
			CIRCA-FLEX TURNBUCKLE 29.5-47.5 COMPLETE GALVANIZED			CIRCA-FLEX TURNBUCKLE 38-58 COMPLETE GALVANIZED		
672000010	-	4.0	672295475	-	4.1	672380580	-	4.6
N° 2 screw M20x40 UNI 5739 Zn N° 2 nut M20 UNI 5588 Zn N° 2 washer 22x60 UNI 6593 Zn								
								

ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG
SPACER PVC CONE D22.0 M			PLUG D24.0 MM			PROPS		
SPACER PVC CONE D26.0 M			FLAT HEAD			ACCESSORIES		
584101	ø 22 [mm]	0.004	584024B	ø 24 [mm]	0.15	2059P825		1,5
584105	ø 26 [mm]	0.006				Push-pull prop head painted		
						2059P829		2,4
						18x16 bracket for shore		
						581010		0,33
						P300 galvanized pin		
						15COP3		0,01
						Cotter pin 3mm galvanized		
						15V20100PZ		0,3
						Screw M20x100 UNI 5737 galv.		
						15D20FZ		0,07
						Nut self stop M20 UNI 7473 galvanized		
								
SPACER D22.0 MM 200			WATER STOP					
SPACER D26.0 MM 200			TYPE G D15.0 MM L13					
584201	ø int. 22[mm]x200	0.5	583970	13	0.93			
584210	ø int. 26[mm]x200	0.7						
								
WORKING BRACKET CONNECTOR			PUSH-PULL PROP			PUSH-PULL PROP		
CIRCA-FLEX COMPLETE			COMPLETE			650/1000 GALVANIZED COMPLETE		
K674000030		3.1	591200	210/360	21.8	591315Z	650/1000	140.5
N° 1 pin ø 20 [mm] L= 12 mm			591201	300/460	25.0			
N° 1 safety cotter pin of 3 [mm]			591300	530/700	58.0			
								
WORKING								
BRACKET COMPLETE								
K591005		11.0						
N° 1 cotterpin ø 3 [mm] working bracket								
								
ADJUSTABLE ARM			CIRCA-FLEX PROP			CIRCA-FLEX FIXING TIE-ROD SHORING BEAM		
COMPLETE			CLAMP					
591205	110/150	9.0	K674000025		10.1	K674000035		3.0
591305	210/360	19.0						
								



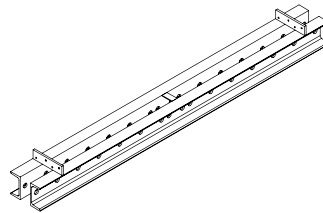
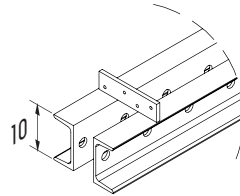
ART. DIM. CM WEIGHT KG

ART. DIM. CM WEIGHT KG

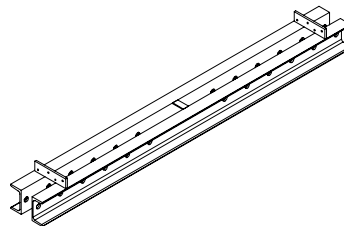
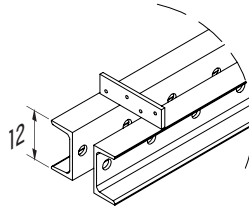
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**STEEL WALING
MX CDL 10**

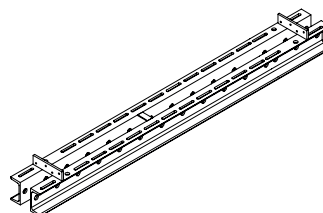
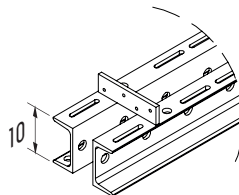
68115050IF	50	10.6
68115075IF	75	15.9
68115100IF	100	21.2
68115125IF	125	26.5
68115150IF	150	31.8
68115175IF	175	37.1
68115200IF	200	42.4
68115225IF	225	47.7
68115250IF	250	53.0
68115275IF	275	58.3
68115300IF	300	63.6
68115325IF	325	68.9
68115350IF	350	74.2
68115375IF	375	79.5
68115400IF	400	84.8
68115450IF	450	95.4
68115500IF	500	106.0
68115550IF	550	116.6
68115600IF	600	127.2

**STEEL WALING
MX PS 12**

68116100I	100	25.3
68116125I	125	31.6
68116150I	150	38.0
68116175I	175	44.3
68116200I	200	50.6
68116225I	225	56.9
68116250I	250	63.3
68116275I	275	69.6
68116300I	300	75.9
68116325I	325	82.2
68116350I	350	88.6
68116375I	375	94.9
68116400I	400	101.2
68116450I	450	119.5
68116500I	500	126.5
68116550I	550	139.2
68116600I	600	151.8

**STEEL WALING
MX PS CDL KD 10**

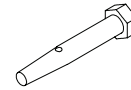
68115051IF	50	10.6
68115076IF	75	15.9
68115101IF	100	21.2
68115126IF	125	26.5
68115156IF	150	31.8
68115176IF	175	37.1
68115201IF	200	42.4
68115226IF	225	47.7
68115251IF	250	53.0
68115276IF	275	58.3
68115301IF	300	63.6
68115326IF	325	68.9
68115351IF	350	74.2
68115376IF	375	79.5
68115401IF	400	84.8
68115451IF	450	95.4
68115501IF	500	106.0
68115551IF	550	116.6
68115601IF	600	127.2

**CONNECTING PIN PS MAXIMIX
GALVANIZED**

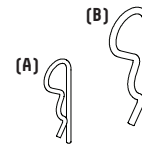
68300001IZ	-	0.3
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NOT INCLUDED:

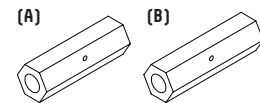
N. 1° Spring cotter 3.5 mm galvanized - 15COP35IZ

**A) SPRING COTTER 3.5 MM GALVANIZED****B) SPRING COTTER 6 MM GALVANIZED**

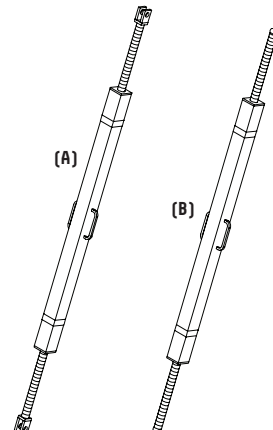
15COP35IZ	-	0.01
15COP6IZ	-	0.05

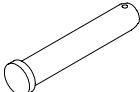
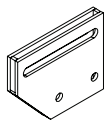
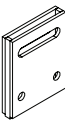
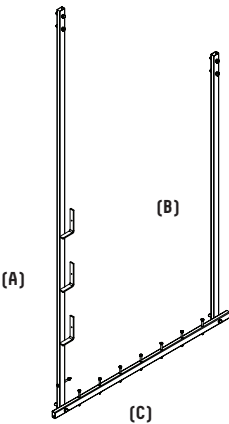
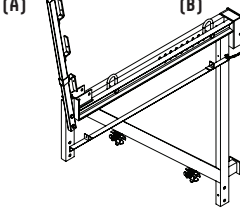
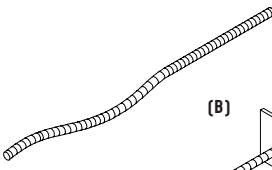
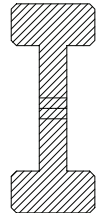
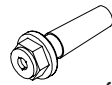
**A) HEX COUPLER D15 L9****B) HEX COUPLER D15 L10.5**

583920	-	0.4
583921	-	0.45

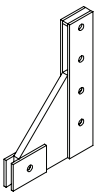
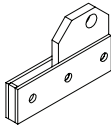
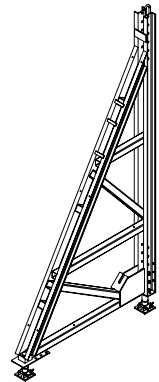
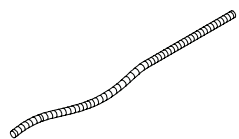
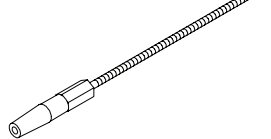
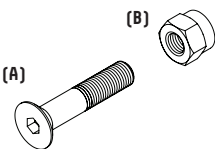
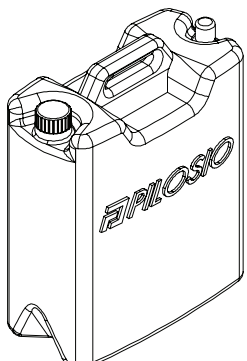
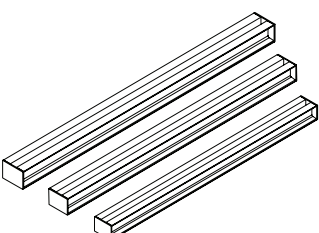
**SPINDLE STRUT MX
SQUARE PROFILE**

68441A20I	200 (A)	43.0
68441A25I	250 (A)	48.0
68441A30I	300 (A)	63.0
68441A35I	350 (A)	70.0
68441A40I	400 (A)	75.0
68441A45I	450 (A)	80.0
68441B20I	200 (B)	43.0
68441B25I	250 (B)	48.0
68441B30I	300 (B)	63.0
68441B35I	350 (B)	70.0
68441B40I	400 (B)	75.0
68441B45I	450 (B)	80.0
68441C20I	200 (C)	43.0



ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG
LIFTING BRACKET FOR STEEL WALING			PIN D30 MM GALVANIZED			LIFTING PLATE EXT. CLIMBING BRACKET 150A LIFTING PLATE FOR CLIMBING BRACKET 150A		
68700037		- 6.4	68300004IZ	L12 (D=30mm)	0.7	68446030	- (A)	5.7
			68300005IZ	L17 (D=30mm)	1.2	68446029I	- (B)	4.8
			each with: N°1 spring cotter 6mm galvanized -15COP6IZ					
								
COIL FOR QUICK ANCHOR			QUICK ANCHOR H130 QUICK ANCHOR H90					
15MOLLAHZ		-	15T16130HZ		0.25			
			15T1690HZ		0.177			
								
								
SUSPENSION PLATFORM PROFILE			CLIMBING BRACKET 150 A					
68446003I	150x330	28.5				68445A15I	-	73.5
N°1 box profile of 337 galvanized (A) N°1 box profile of 239 galvanized (B) N°1 box profile of 170 galvanized (C) N°4 screw M16x60 UNI 5739 galvanized N°4 self stop hex nut M16 UNI 7473 galvanized N°5 screw M10x100 UNI 5739 galvanized N°5 self stop hex nut M10 UNI 7473 galvanized N°2 screw M16x100 UNI 5739 galvanized N°2 self stop hex nut M16 UNI 7473 galvanized						N°1 bracket of 150A L=149 (A) N°1 guardrail post (B) N°2 screw M16x140 UNI 5739 galvanized N°2 self stop hex nut M16 UNI 7473 galvanized		
								
ANCHORING FITTINGS FOR CLIMBING SYSTEMS D15			PL20 BEAMS					
68446112	Stop anchor 15/12" (A1)	0.5				511180	180	8.30
68446008I	Stop anchor 15/16" (A2)	1.0				511195	195	8.97
68446009I	Stop anchor 15/40" (A3)	1.4				511245	245	11.27
583961	Wobble anchor D15.0 mm L55" (B)	0.82				511290	290	13.37
583983	PE sleeve D15.0 mm* (C)	0.01				511330	330	15.20
583981	Positioning cone D15.0 mm (D)	0.6				511360	360	16.60
583982	Nail plate D15.0 mm (E)	0.13				511390	390	18.00
583984	Climbing cone D15.0 mm (F)	1.28				511450	450	20.73
						511490	490	22.50
						511590	590	27.20
*lost material								
								
								
								
								
								



ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG	ART.	DIM. CM	WEIGHT KG
YP			YP			SUPPORTING		
ANCHORING SHOE			SUPPORTING SHOE			FRAME 450		
684000061	-	14.5	684000071	-	7.5	684000081	-	306.0
								
YP			YP			SHEBOLT		
ANCHOR WALING			PRESSURE HEAD			SELF THREADING		
684482241	NPU 100 L75	15.9	583961	D15.0mm L55	0.82	583964	D15.0mm	1.75
684482101	NPU 100 L100	21.2	585951	D20.0mm L70	1.82	585954	D20.0mm	2.5
684482111	NPU 100 L150	31.8	586984	D26.5mm L80	3.64	586983	D26.5mm	4.7
684482121	NPU 100 L200	42.4						
684482131	NPU 100 L250	53.0	A) SCREW M8X40 UNI 5933 GALVANIZED			DISMANTLING		
684482141	NPU 100 L300	63.6	B) SELF-LOCKING NUT M8 GALVANIZED			OIL		
684482151	NPU 100 L350	74.2	15V0840SZ	- (A)	0.02	07605533	ø 5.5x34.5 [mm]	0.01
684482161	NPU 100 L400	84.8	15D08FZ	- (B)	0.01			
684482171	NPU 100 L450	95.4				DISMANTLING		
684482181	NPU 100 L500	106.0	PUMP FOR THE APPLICATION			OIL		
684482191	NPU 100 L550	116.6	OF DISMANTLING LIQUID			150ILDIS	-	22.3
684482201	NPU 100 L600	127.2	150ILPOM	-	4.0			
684482251	NPU 120 L75	20.3	capacity 11 Lt.			tank 25 Lt.		
684482211	NPU 120 L100	27.0						
684482261	NPU 120 L200	54.0						
684482271	NPU 120 L300	81.0						
684482221	NPU 140 L100	34.0						
684482281	NPU 160 L75	28.5						
684482231	NPU 160 L100	38.0						
684482291	NPU 160 L200	76.0						
684482301	NPU 160 L300	114.0						



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