Modular supporting frames

VARIANT

USER MANUAL

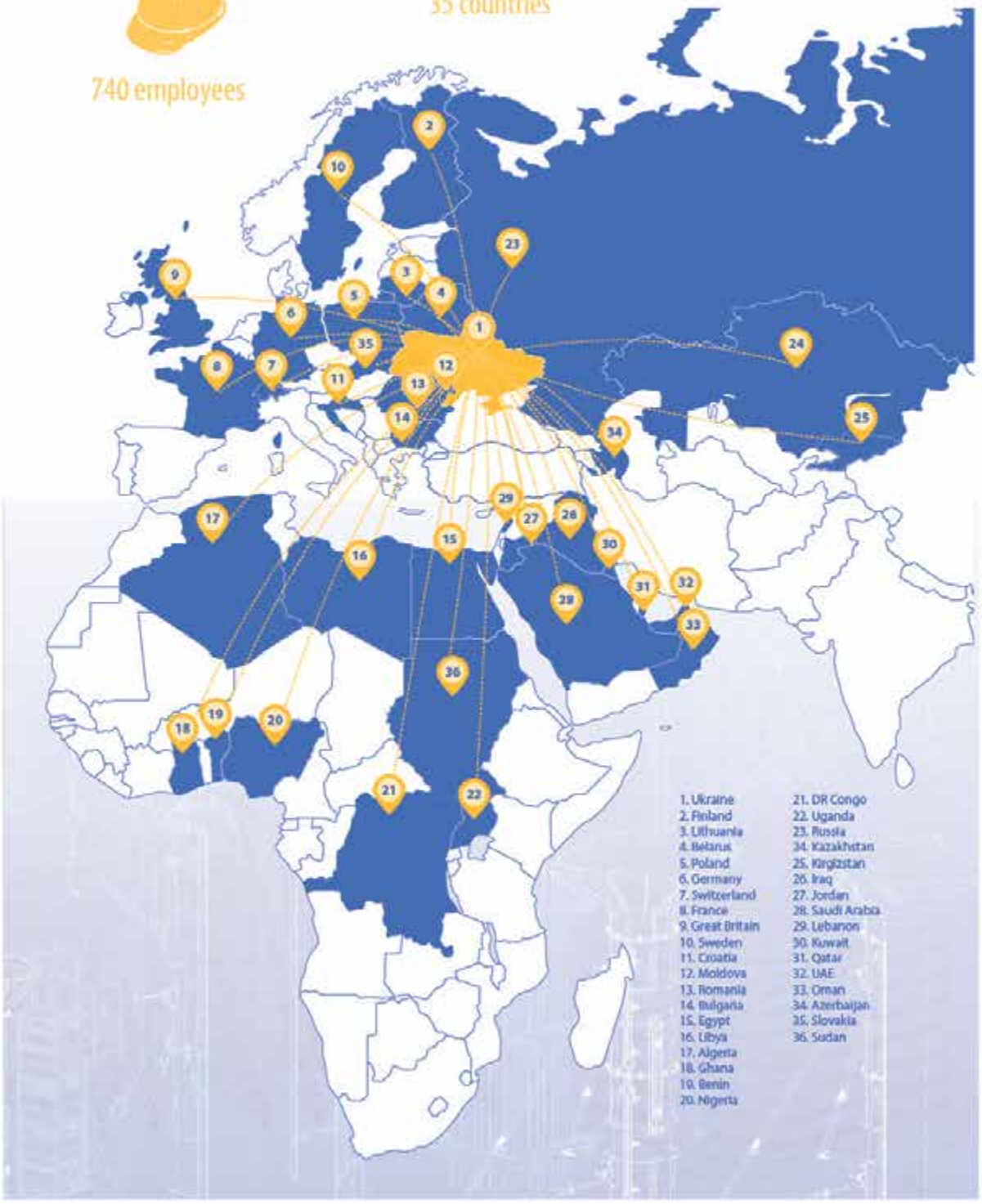
www.variant-factory.eu

ISO 9001
BUREAU VERITAS
Certification
N° 00000

3 continents

35 countries

740 employees



Contents

GENERAL INSTRUCTIONS

This user manual (method statement) is aimed at everyone who will be working with the «VARIANT» product or system it desupportingribes. It contains information on how to set up this system, and proper use it.

All persons working with the product desupportingribed herein must be familiar with the contents of this manual and with all the safety instructions it contains.

The customer is to ensure that the information materials provided by «VARIANT» are available to all users, and that they have been made aware of them and have easy access to them at the usage location.

Persons who are incapable of reading and understanding this booklet, or who can do so only with difficulty, must be instructed and trained by the customer.

Always observe all construction safety regulations and other safety rules applying to the application and using of our products in the country and/or region in which you are operating.

In the relevant technical documentation and formwork usage plans, «VARIANT» shows the workplace safety precautions that are necessary in order to use the «VARIANT» products safely in the usage situations shown. In all cases, users are obliged to ensure compliance with national laws, Standards and rules throughout the entire project and to take appropriate additional or alternative workplace safety precautions where necessary.

The customer is responsible for drawing up, documenting, implementing and continually updating a hazard assessment on every construction site. This document serves as the basis for the site-specific hazard assessment, and for the instructions given to users on how to prepare and use the system. It does not substitute for these, however.

This manual can also be used as a generic method statement or incorporated with a site-specific method statement.

The equipment/system must be inspected by the customer before use, to ensure that it is in suitable condition. Steps must be taken to rule out the use of any components that are damaged, deformed, or weakened due to wear, corrosion or rot.

The customer must ensure that this product is erected and dismantled, reset and generally used for its intended purpose under the direction and supervision of suitably skilled persons with the authority to issue instructions. These persons' mental and physical capacity must not in any way be impaired by alcohol, medicines or drugs.

The equipment/system must be assembled and erected in accordance with the applicable laws, Standards and rules by suitably skilled personnel of the customer's, having regard to any and all required safety inspections.

Many of the illustrations in this user manual show the situation during formwork assembly and are therefore not always complete from the safety point of view.

Combining our formwork systems with those of other manufacturers could be, but needs to be checked by customer compatibility «VARIANT» product/system with other independently under its responsibility.

It is not permitted to modify«VARIANT» products because of a safety risk.

Only original «VARIANT» components may be used as spare parts. Repairs may only be carried out by the manufacturer or authorized facilities.

We reserve the right to make alterations in the interests of technical progress.

WARNING NOTES

«VARIANT» products and systems must be set up in such a way that all loads acting upon them are safely transferred.

Do not exceed the permitted fresh-concrete pressures. Excessively high pouring rates lead to formwork overload, cause greater deflection and risk causing breakage.

The stability of all components and units must be ensured during all phases of the construction work.

All connections must be checked regularly to ensure that they still fit properly and are functioning correctly. It is very important to check all supportingrew-type connections and wedge-clamped joins whenever the construction operations require (particularly after exceptional events such as storms), and to tighten them if necessary.

Remove any loose parts or fix them in place so that they cannot be dislodged or fall free.

It is strictly forbidden to weld «VARIANT» products – in particular anchoring/tying components, suspension components, con-nector components and castings etc. – or otherwise subject them to heating. Welding causes serious change in the microstructure of the materials from which these components are made. This leads to a dramatic drop in the failure load, representing a very great risk to safety. The only articles which are allowed to be welded are those for which the «VARIANT» literature expressly points out that welding is permitted.

If a person or object falls against, or into, the side-guard component and/or any of its accessories, the component affected may only continue in use after it has been inspected and passed by an expert.

Provide safe workplaces for those using the formwork (e.g. for when it is being erected/ dismantled, modified or repositioned etc.). It must be possible to get to and from these workplaces via safe access routes.

Fire-sources are not permitted anywhere near the formwork. Heating appliances are only allowed if properly and expertly used, and set up a safe distance away from the formwork.

The work must take account of the weather conditions (e.g. risk of slippage). In extreme weather, steps must be taken in good time to safeguard the equipment, and the immediate vicinity of the equipment, and to protect employees.

Do not strike the formwork until the concrete has reached sufficient strength and the person in charge has given the order for the formwork to be struck.

When striking the formwork, never use the crane to break concrete cohesion. Use suitable tools such as timber wedges, special pry-bars or system features such as «VARIANT» stripping corners.

When striking the formwork, do not endanger the stability of any part of the structure, or of any supporting affolding, platforms or formwork that is still in place.

Observe all regulations applying to the handling of formwork and supportingaffolding.

SYSTEM OVERVIEW

The system of modular supporting frames by Variant is used for forming single-sided walls such as retaining walls, dam walls etc. Shear forces which appear on the formwork shutters due to fresh concrete pressure, are held and redistributed on the base by means of modular supporting frames and diagonal anchors. Single sided supporting system allows walls with the required pouring-height up to 8,00 m to be formed.

The single-sided modular supporting system is used for forming:

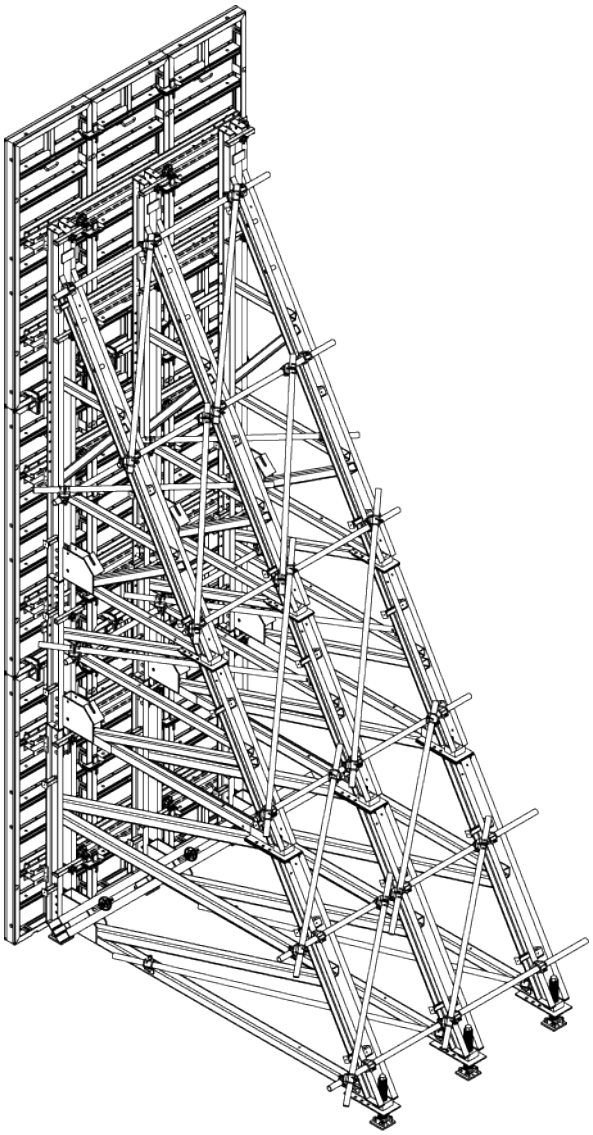
- Retaining walls;
- Dam walls;
- Stop-ends of walls with large thickness;
- Walls which are casted against rock faces or sheet piling walls;
- Walls of great thickness, in this case single-sided system is to be installed on both sides;
- Walls where there is no place for installation of opposite formwork shutter (double-sided system).

The single-sided modular formwork system consists of two main parts:

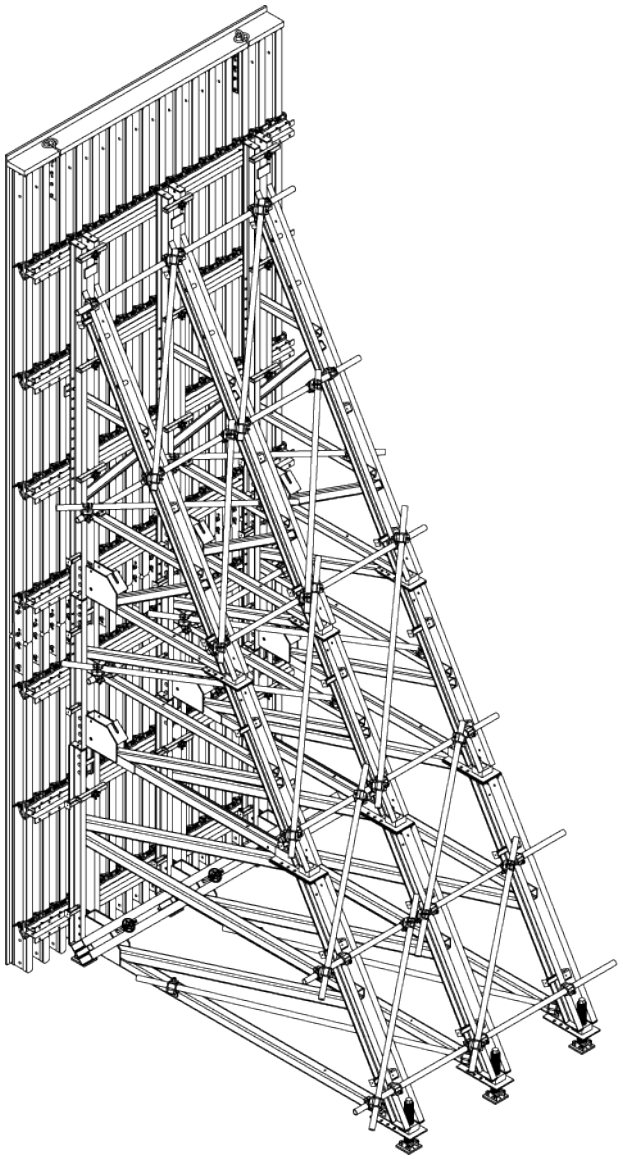
1. Wall formwork shutters, can be used either of:
- Framed formwork VARIMAX (for more details see VARIMAX user manual);
- Large-area formwork VERTEX 60 (for more details see VERTEX 60 user manual).

2. Supporting Modular Frame Unit (SM- frame unit), which intended to hold shear loads of fresh-concrete pressure and redistribute them on the base. Applicable for both wall formwork systems VARIMAX and VERTEX 60.

Permitted load of fresh concrete up to 50 kN/m²



With Varimax height 8.00 m



With Vertex 60 height 8.00 m

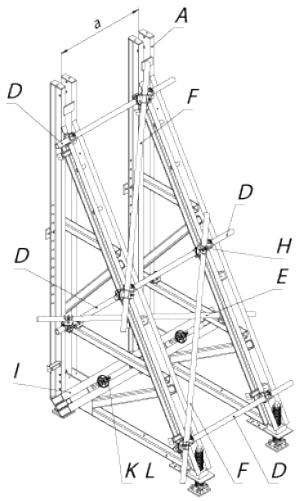
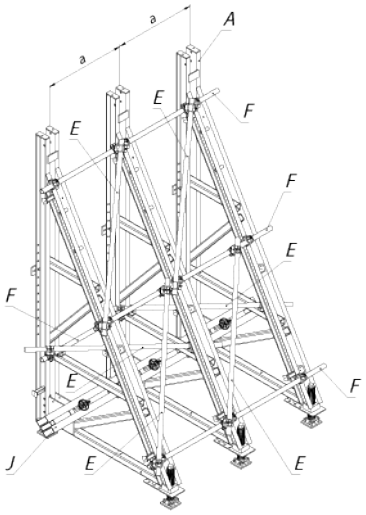
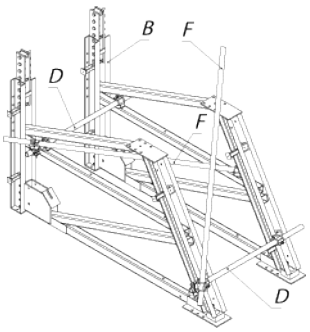
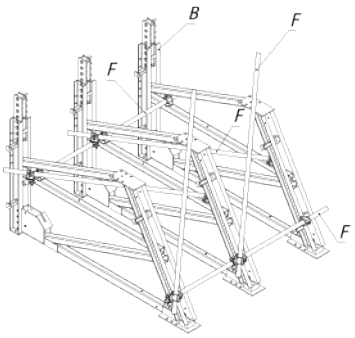
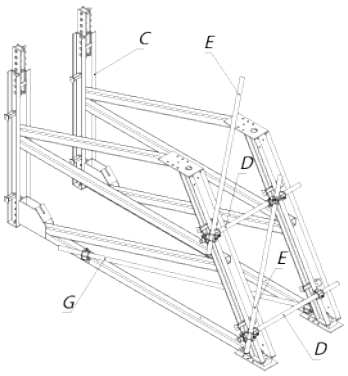
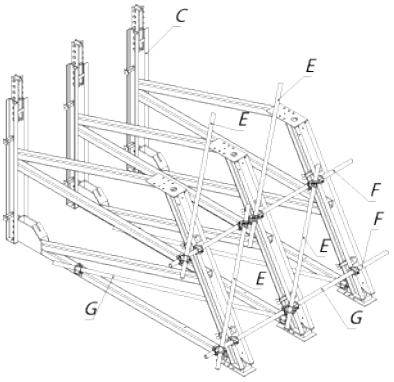
SUPPORTING MODULAR FRAME UNITS (SM- FRAME UNITS)

The SM - frame units are assembled in identical fashion for use with Large-Area formwork or Framed formwork.
The SM - frame units must be correctly braced with scaffold tubes to have stated load bearing capacity.

As far as the height of the concrete wall increases, the concrete mixture pressure grows. Choice of applicable frames depends on the concreting height.
The distance between the support frames is to be determined depending on the actual pressure of the concrete mixture.

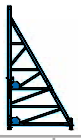
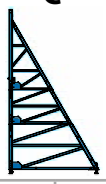
The supporting modular frame units are formed by combining of supporting or attachable frames in one block by means of bracing. The modular units shall be correctly braced with scaffold tubes to attain the stated capacity. Adaptability of the supporting modular frame units allows to form single-sided walls up to the required pouring height from 3.00 to 8.00 m by combining:

- Supporting frame 4.50 m;
- Attachable frame 1.50 m;
- Attachable frame 2.00 m.

	2 parallel frames		3 parallel frames	
	Vertex 60	Varimax	Vertex 60	Varimax
Centre-to-centre a [m]	1.00 m to 1.25 m	1.35 m	1.00 m	0.90 m
A Supporting frame 4.50 m				
B Vertical stacking with Attachable frame 1.50 m				
C Vertical stacking with Attachable frame 2.00 m				

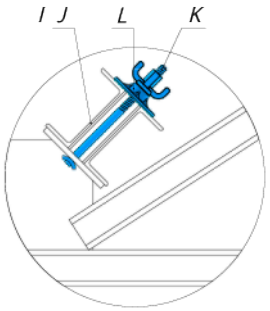
The examples illustrated here show the correct way of bracing the supporting construction frame units. The supporting frames and attachable frames come with ready-mounted screw-on couplers, making it possible to attach the bracing tubes very quickly on a construction site.

STANDARD UNITS

Items needed for a centre-to-centre distance «a» of 0.90 m to 1.35 m	Article №	Supporting module type					
		A 		B 		C 	
Number of parallel Supporting frames		**2**	**3**	**2**	**3**	**2**	**3**
(A) Supporting frame 4.50 m	4001	2	3	2	3	2	3
(B) Attachable frame 1.50 m	4002	-	-	2	3	2	3
(C) Attachable frame 2.00 m	4003	-	-	-	-	2	3
(D) Framed tube 48.3 mm 1.50 m	9413	4	-	6	-	8	-
(E) Framed tube 48.3 mm 2.00 m	9414	1	6	1	6	3	10
(F) Framed tube 48.3 mm 2.50 m	9415	2	4	4	10	4	12
(G) Framed tube 48.3 mm 3.00 m	9416	-	-	-	-	1	2
(H) Swivel coupler 48 mm	9417	5	10	8	16	12	24
(I) Anchor waling 1.95 m	4007	1	-	1	-	1	-
(J) Anchor waling 2.95 m	4012	-	1	-	1	-	1
(K) Anchor waling positioner	4006	2	3	2	3	2	3
(L) Superplate	2034	2	3	2	3	2	3

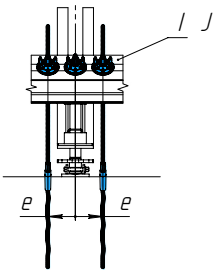
FIXING THE ANCHOR WALING

-Together with the Superplate, the Anchor waling positioner secures the Anchor waling so that it cannot tilt or slip out of position.

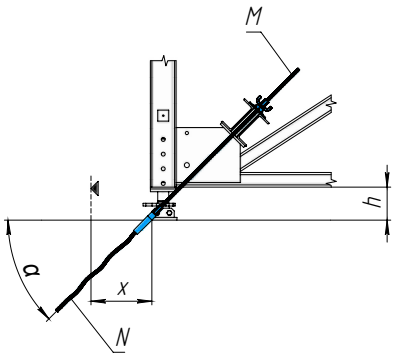


ANCHOR POSITIONING

- The loads from the diagonal anchors are transferred via anchor walings.
- For each supporting frame, an anchor is placed 15 cm either side of the vertical axis of the supporting frame (i.e. 2 in all).
- For more details on different anchoring variants, see «Anchoring solutions for the supporting frames».
- Exception: If the load-bearing capacity is sufficient for 1 anchor per supporting frame, the anchors on each unit must be placed symmetrically.



e ... 15.0 cm
α ... 45°



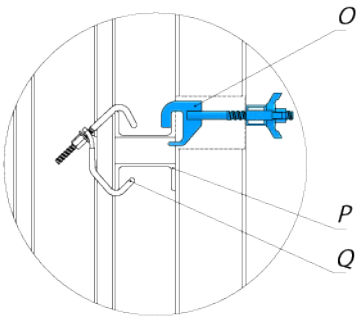
▲... Inside line of wall

M She-bold
N Pigtail anchor

COMBINING WITH LARGE-AREA FORMWORK VERTEX 60

FIXING THE FORMWORK

Large-area formwork elements are clamped directly onto the supporting module using the waling-to-bracket holder. The supporting frames and attachable frames are designed so that the walings of the elements can be fixed anywhere onto the frame.

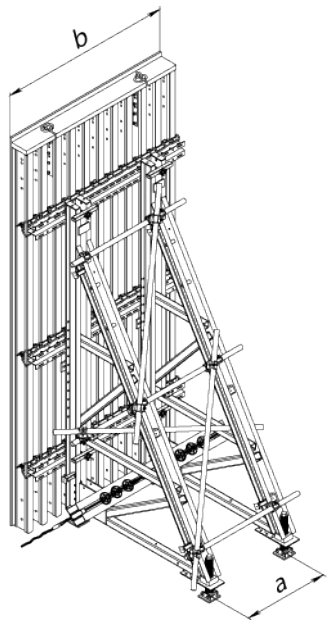


(O) Waling-to-bracket holder
(P) Waling 10 or 12
(Q) Flange clamp

Minimum q-ty of waling-to-bracket holder		
Formwork height	**2 parallel frames**	**3 parallel frames**
up to 4.50 m	4	6
up to 6.00 m	6	9
up to 8.00 m	8	12

Example: Formwork height 4.50 m

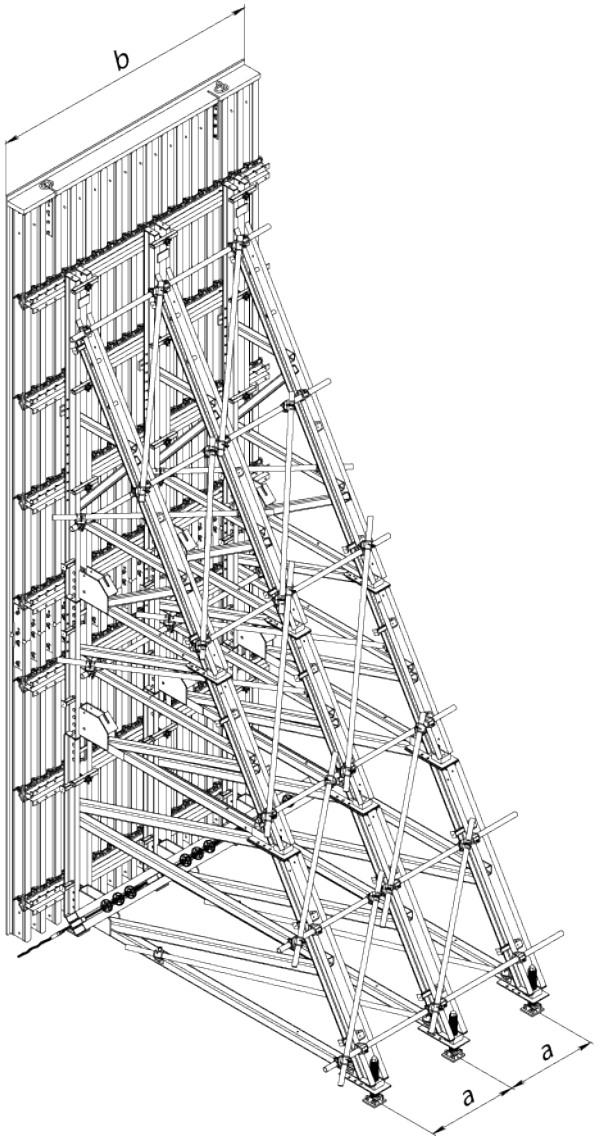
Centre-to-centre distance «a» = 1.00 m
Influence width = 1.00 m
Supporting module type **A**



a ... 1.0 m
b ... 2.0 m

Example: Formwork height 8.00 m

Centre-to-centre distance «a» = 1.00 m
Influence width = 1.00 m
Supporting module type **C**



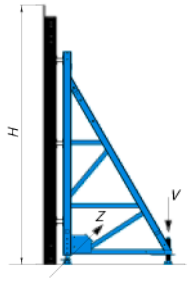
a ... 1.0 m
b ... 3.0 m

STRUCTURAL DESIGN – LARGE-AREA FORMWORK VERTEX 60

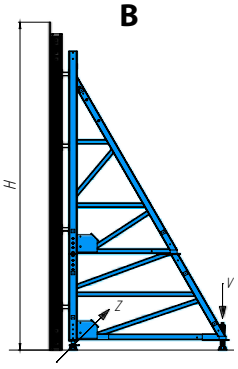
The values given in the table are only applicable to forming situations where there is no kicker. In cases with large kickers, the overall stability of the supporting frame must be reviewed.

The loading data is per parallel frame with an anchor inclination of 45°.

POUR HEIGHTS OF UP TO 4.50 M

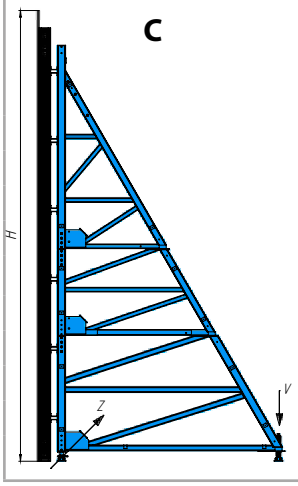
Supporting module type			Influence width 1.00 m			Influence width 1.25m		
A 	Permitted pressure of fresh concrete	Pour height H[m]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]
	40kN/m²	3.00	124	55	1	156	68	2
		3.50	153	81	2	191	101	2
		4.00	181	113	3	226	141	4
		4.50	209	150	10	262	188	12
	50kN/m²	3.00	141	59	1	177	73	2
		3.50	177	89	2	221	111	2
		4.00	212	126	4	265	158	4
		4.50	247	170	10	309	213	12

POUR HEIGHTS FROM 4.50 M TO 6.00 M

Supporting module type			Influence width 1.00 m			Influence width 1.25m		
B 	Permitted pressure of fresh concrete	Pour height H[m]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]
	40kN/m²	4.50	209	105	3	262	131	3
		5.00	238	135	5	297	168	7
		5.50	266	168	9	332	210	11
		6.00	294	206	16	368	257	20
	50kN/m²	4.50	247	119	3	309	148	4
		5.00	283	154	5	354	193	7
		5.50	318	194	9	398	243	12
		6.00	354	239	17	---	---	---

Fields containing no data (---) are not permissible – Supporting module would be overloaded.

POUR HEIGHTS FROM 6.00 m TO 8.00 m

Supporting module type			Influence width 1.00 m			Influence width 1.25m		
	Permitted pressure of fresh concrete	Pour height H[m]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]
	40kN/m²	6.00	294	145	5	368	182	6
		6.50	322	174	6	403	218	7
		7.00	351	206	7	438	258	9
		7.50	379	241	9	474	301	12
		8.00	407	278	15	---	---	---
	50kN/m²	6.00	354	169	6	442	211	7
		6.50	389	204	7	486	255	8
		7.00	424	242	8	---	---	---
		7.50	460	284	10	---	---	---
		8.00	495	329	16	---	---	---

Fields containing no data (---) are not permissible – Supporting module would be overloaded.

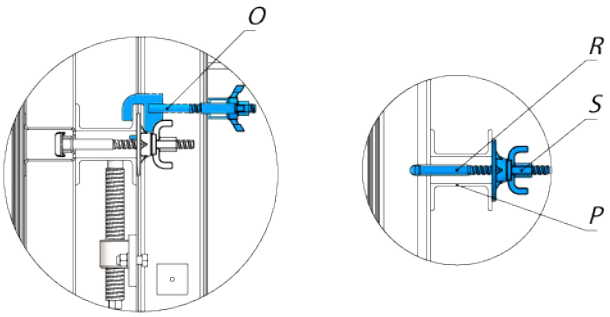
COMBINING WITH FRAMED FORMWORK VARIMAX

As well as the Variant-preferred solution with Large-area system Vertex 60, there are also the following possible way to use supporting framed with frame panels.

FIXING THE FORMWORK

Framed panels Varimax are clamped through waling onto the supporting module using the waling-to-bracket holder. The supporting module are designed so that the walings of the elements can be fixed anywhere onto the frame.

To be able to fix Varimax panels to the modular supporting frames, waling 10 or 12 are used, which are fiixed to the framed formwork by means of connection screw 10-16 and super plate. Then the panels is fixed to the modular supporting frames using the waling-to-bracket holder.

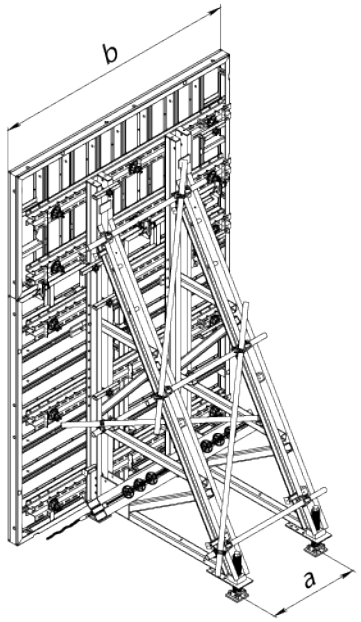


(O) Waling-to-bracket holder
(P) Waling 10 or 12
(R) Connection screw 10-16
(S) Superplate

Minimum q-ty of waling-to-bracket holder		
Formwork height	**2 parallel frames**	**3 parallel frames**
up to 4.50 m	4	6
up to 6.00 m	6	9
up to 8.00 m	8	12

Example: Formwork height 4.50 m

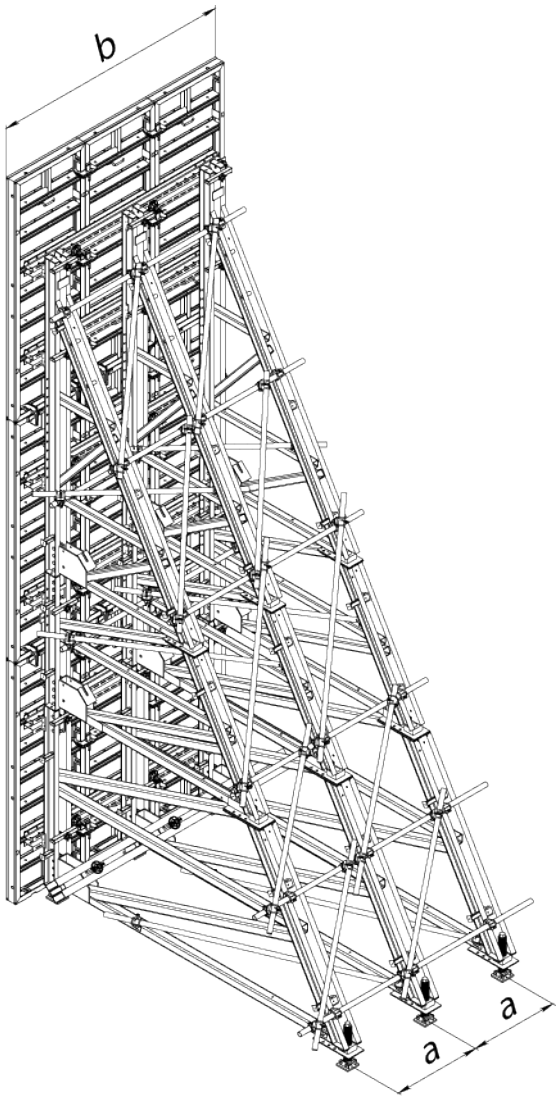
Centre-to-centre distance «a» = 1.35 m
Influence width = 1.35 m
Supporting module type **A**



a ... 1.35 m
b ... 2.70 m

Example: Formwork height 8.00 m

Centre-to-centre distance «a» = 0.90 m
Influence width = 0.90 m
Supporting module type **C**

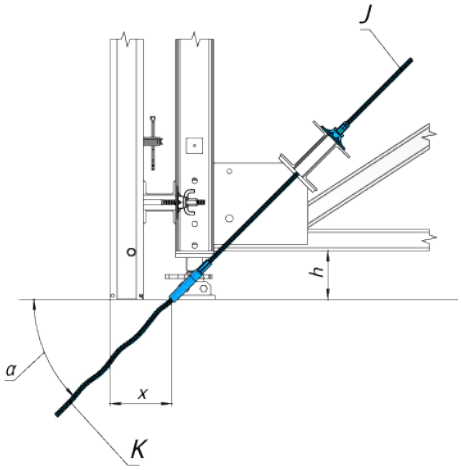


a ... 0.90 m
b ... 2.70 m

BASIC RULES:

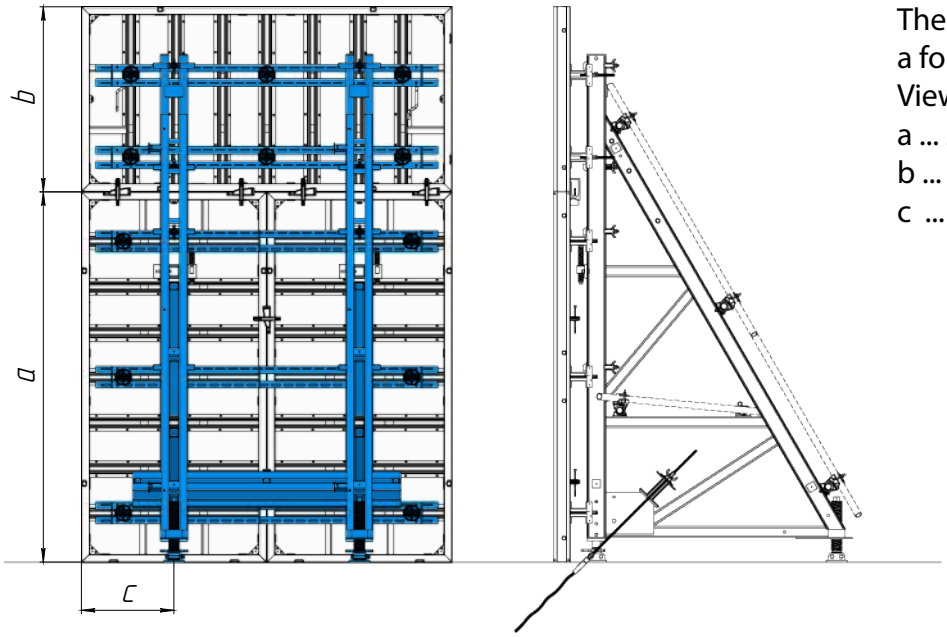
- Length of the walings:
- on upright panels: min. 2.00 m if assembled block consist of two 1.35 m width panels
- on horizontal panels: 2.50 m
- In cases where the following max. formwork heights are required (for the types of Supporting frame listed), the top panels can only be upright 1.35 m panels:
- 4.50 m: Supporting frame 4.5 m
- 6.00 m: Supporting frame 4.5 m + Attachable frame 1.50 m
- 8.10 m: Supporting frame 4.5 m + Attachable frame 1.50 m + Attachable frame F 2.00 m
- On each parallel Supporting frame, an adjusting spindle must be attached under a waling.

ANCHOR POSITIONING



(J) She-bolt
(K) Pigtail anchor

x ... 19.0 cm (where waling 10 & anchor is angled at 45^0 and h=18.0 cm)
α ... 45°



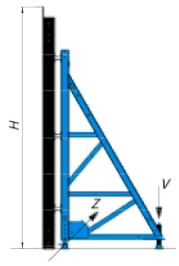
The examples shown are for a formwork height of 4.05 m. View shown without bracing.
a ... 2.70 m,
b ... 1.35 m,
c ... 0.68 cm

STRUCTURAL DESIGN – FRAMED FORMWORK VARIMAX

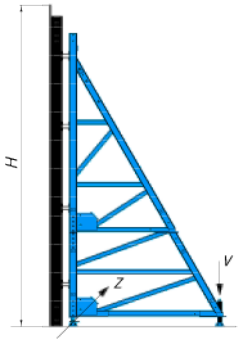
The values given in the table are only applicable to forming situations where there is no kicker. In cases with large kickers, the overall stability of the supporting frame must be reviewed.

The loading data is per parallel frame with an anchor inclination of 45°.

POUR HEIGHTS OF UP TO 4.50 m

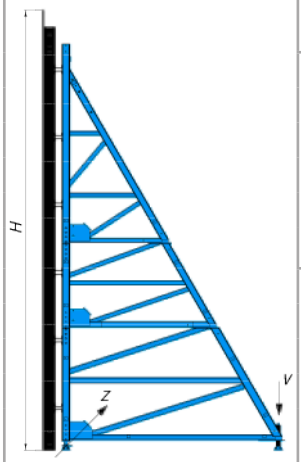
Supporting module type			Influence width 0.90 m			Influence width 1.35m		
A 	Permitted pressure of fresh concrete	Pour height H[m]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]
	40kN/m²	3.15	120	56	1	179	84	2
		3.60	143	78	2	214	118	3
		4.05	165	105	3	248	157	5
		4.50	188	135	9	283	203	13
	50kN/m²	3.15	137	60	1	205	90	2
		3.60	165	86	2	248	129	3
		4.05	194	117	3	291	176	5
		4.50	223	153	9	334	230	13

POUR HEIGHTS FROM 4.50 m TO 6.00 m

B 	Permitted pressure of fresh concrete	Pour height H[m]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]
	40kN/m²							
		5.10	219	127	5	328	191	8
		6.00	265	185	15	397	278	22
	50kN/m²							
		5.10	261	146	6	391	218	8
		6.00	318	215	15	---	---	---

Fields containing no data (---) are not permissible – Supporting module would be overloaded.

POUR HEIGHTS FROM 6.00 m TO 8.00 m

Supporting module type			Influence width 0.90 m			Influence width 1.35m		
C 	Permitted pressure of fresh concrete	Pour height H[m]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]	Anchor force Z [kN]	Spindle force V [kN]	Deformation at top [mm]
	40kN/m²	6.00	265	131	4	397	196	7
		6.45	288	154	5	431	231	8
		6.90	311	180	6	466	269	9
		7.20	326	198	7	489	296	11
		7.65	349	226	9	---	---	---
		8.10	372	257	15	---	---	---
	50kN/m²	6.00	318	152	5	477	228	8
		6.45	347	180	6	---	---	---
		6.90	375	211	7	---	---	---
		7.20	395	233	8	---	---	---
		7.65	423	267	10	---	---	---
		8.10	452	304	17	---	---	---

Fields containing no data (---) are not permissible – Supporting module would be overloaded.

INSIDE CORNER CONFIGURATIONS

Wherever possible, inside corners should be avoided on single-sided formwork. Plan to have the construction joint in the corner instead (to avoid time-consuming planning and modification work).

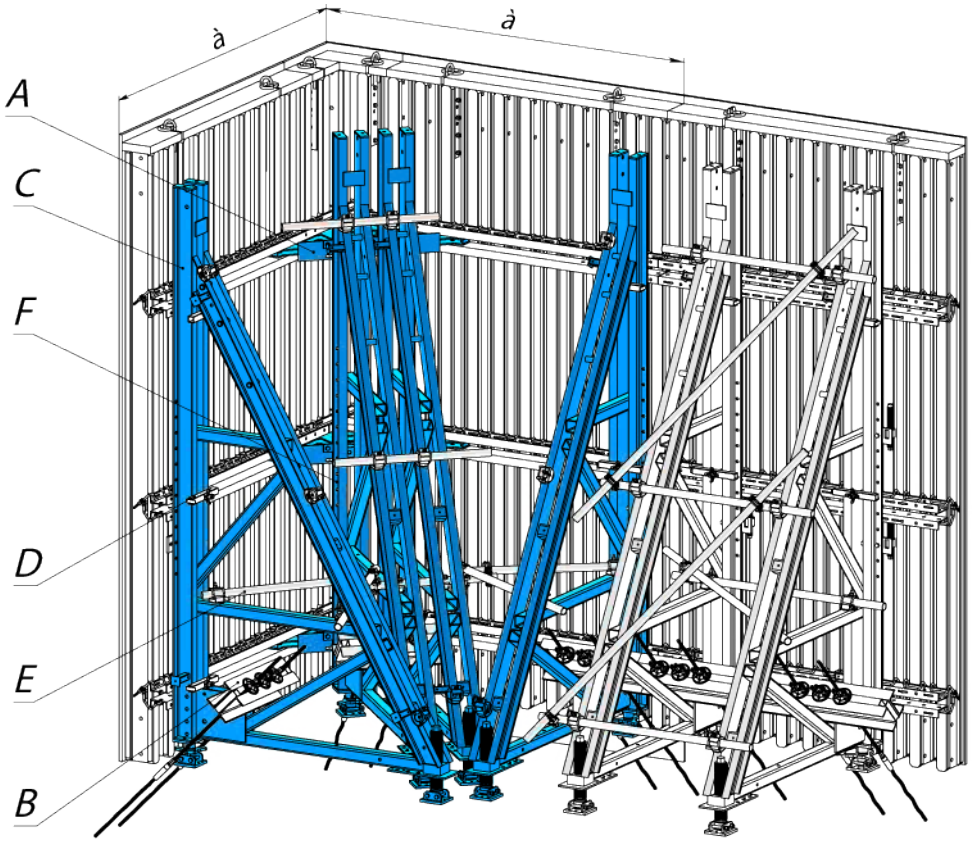
If corners still need to be constructed in a single pour, two standard components are available for this:

- Corner plate for supporting frame
- Anchor waling 0.70 m

EXAMPLE WITH LARGE-AREA FORMWORK VERTEX 60

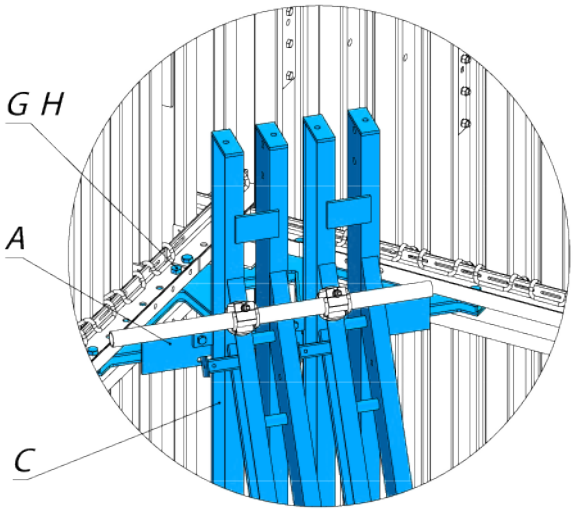
Max. pour height: 4.10 m
Permitted fresh-concrete pressure: 50 kN/m²

Plywod thickness	Corner zone - Dimension a	
	Walling 10	Walling 12
21mm	255.0cm	255.9cm
18mm	254.7cm	255.6cm



Up to a formwork height of 2.75 m, only 1 supporting frame 4.50 m is needed in the corner zone.

CLOSE-UP OF CORNER PLATE FOR SUPPORTING FRAME

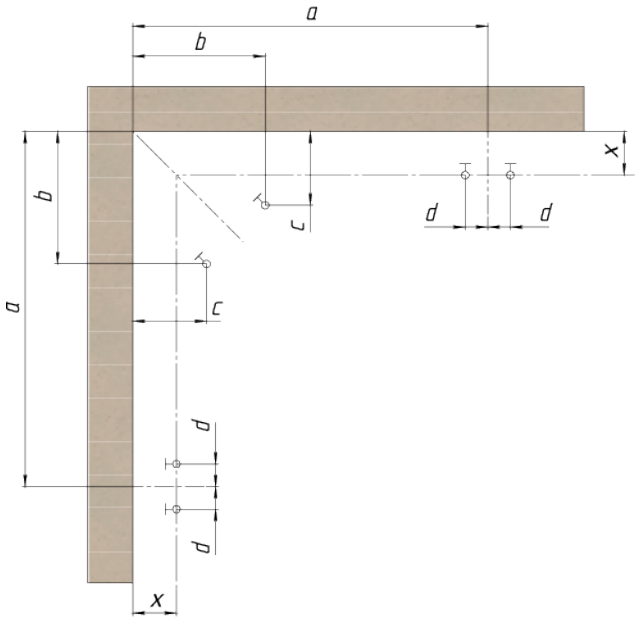


ITEMS NEEDED FOR CORNER ZONE "a"

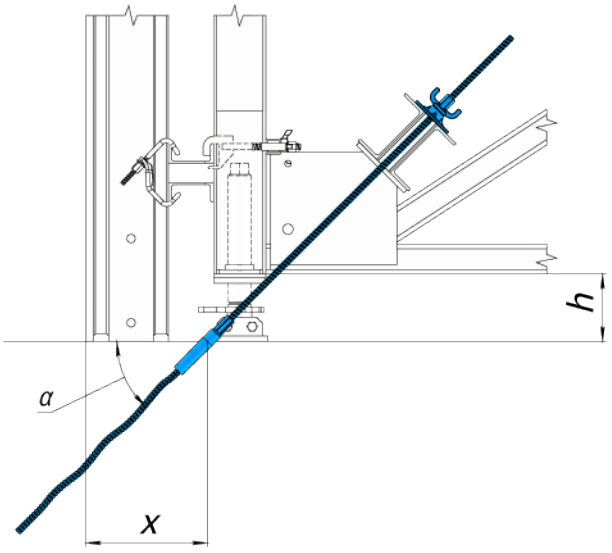
	Article	Concrete height	
		up to 2.75 m	up to 4.10 m
A Corner plate for supporting frame	4025	2	3
B Anchor waling 0.70 m		3	3
C Supporting frame 4.50 m	4001	3	4
D Waling-to-bracket holder	4005	4	6
E Framed tube 1.00 m	9412	5	7
F Swivel coupler	9417	4	4
G Connecting pin	3022	20	30
H Spring cotter	3023	12	18

LOCATION OF ANCHORING POINTS

Plan view



View



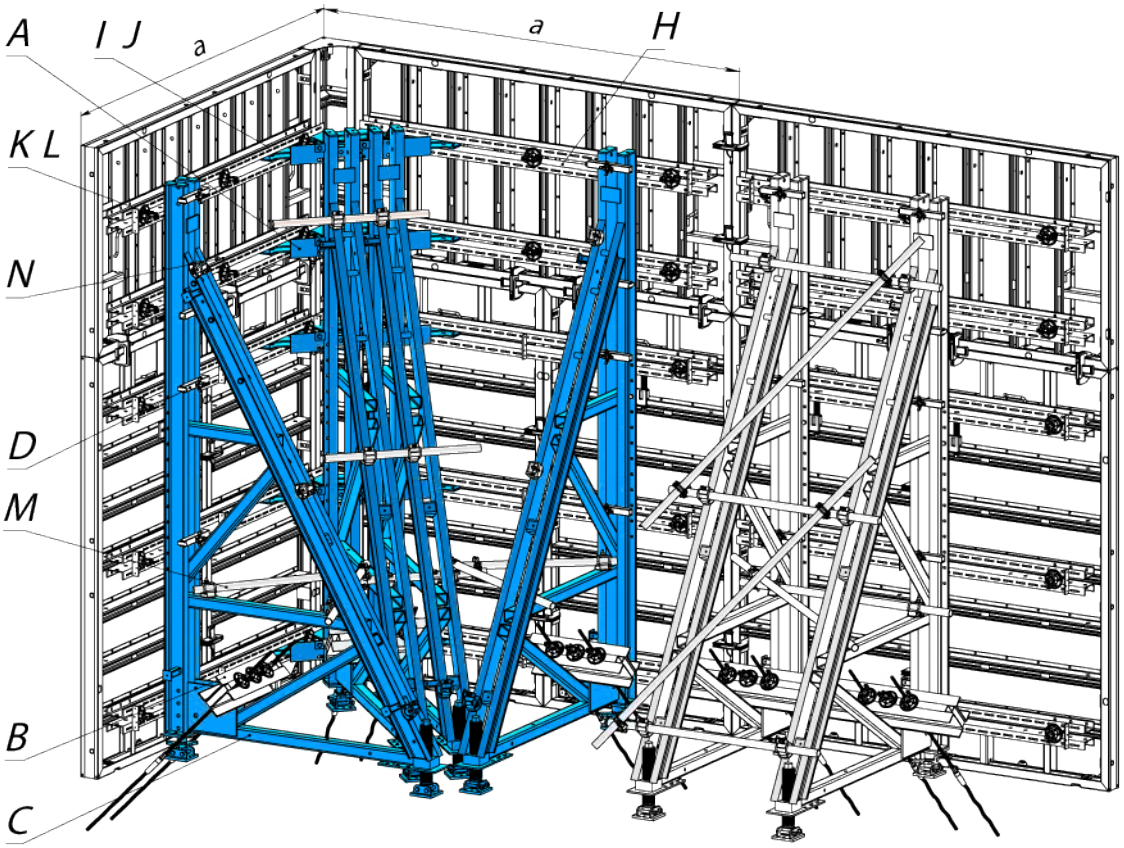
The dimensions given here apply to H20 timber-beam formwork with a 21 mm or 18 mm thick form-ply where:
- h = 18.0 cm
- anchor inclination α= 45°

a ... 236.0 cm
b ... 88.0 cm
c ... 49.0 cm
d ... 15.0 cm
X ... 29.0 cm (with waling 10)

EXAMPLE WITH FRAMED FORMWORK VARIMAX

Max. formwork height: 4.05 m

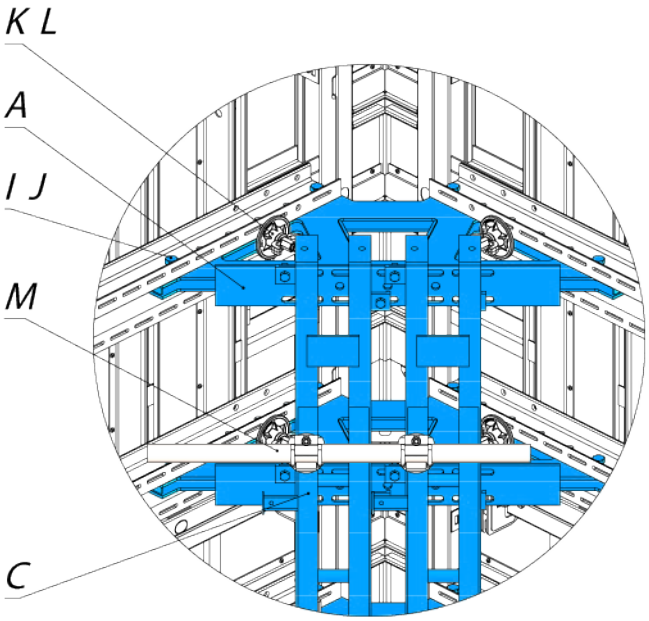
Permitted pressure of fresh concrete: 50 kN/m^2



a = 3.00 m

Up to a formwork height of 2.70 m, only 1 Supporting frame 4.50 m is needed in the corner zone.

CLOSE-UP OF CORNER PLATE FOR SUPPORTING FRAME

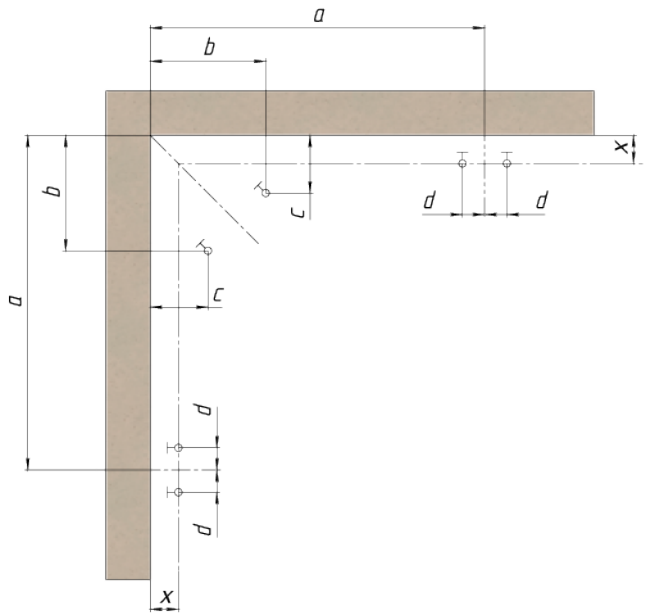


ITEMS NEEDED FOR CORNER ZONE "a"

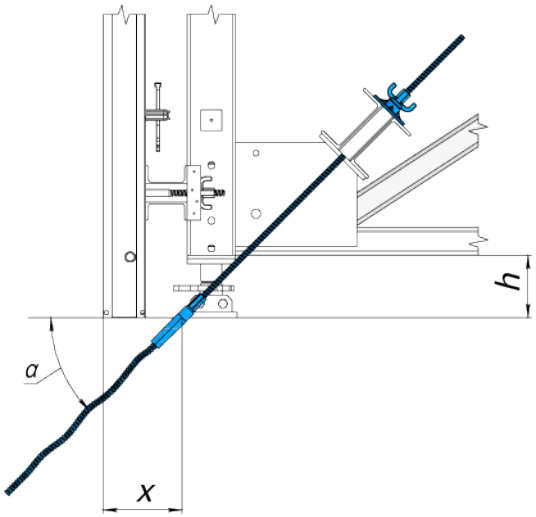
	Article	Concrete height	
		up to 2.75 m	up to 4.05 m
A Corner plate for supporting frame	4025	3	5
B Anchor waling 0.70 m		3	3
C Supporting frame 4.50 m	4001	3	4
D Waling-to-bracket holder	4005	4	6
H Waling 10 2.50 m	3060	6	10
I Connecting pin	3022	12	20
J Spring cotter	3023	12	20
K Connection screw 10-16	2033	12	20
L Superplate	2034	12	20
M Framed tube 1.00 m	9412	5	7
N Swivel coupler	9417	4	4

LOCATION OF ANCHORING POINTS

Plan view



View



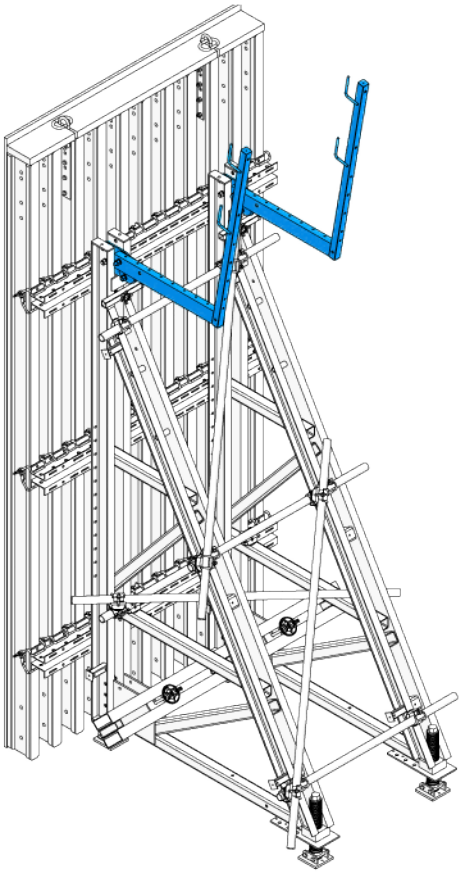
The dimensions given here apply to framed formwork Varimaxwhere:
- h = 18.0 cm
- anchor inclination α= 45°

a ... 226.0 cm
b ... 78.0 cm
c ... 39.0 cm
d ... 15.0 cm
X ... 19.0 cm (with waling 10)

POURING PLATFORMS

SCREW-ON ACCESS BRACKET

- A universal working bracket
- Platform width 75 cm
- Is fastened directly to the vertical profile of the Supporting frame
- Is independent of which type of formwork system is being used
- Permitted live load: 1.5 kN/m^2 (150 kg/m^2)
- Max. influence width: 2.00 m



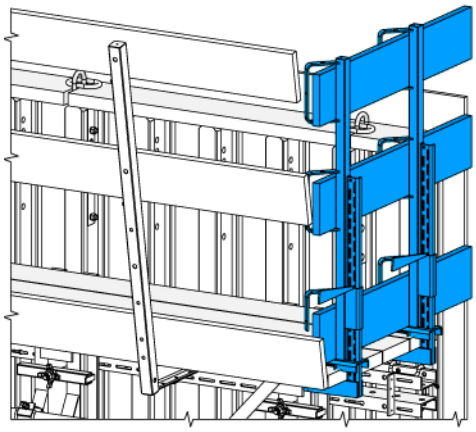
FLOOR DECKING FOR SUPPORT CENTRES OF UP TO 2.50 M:

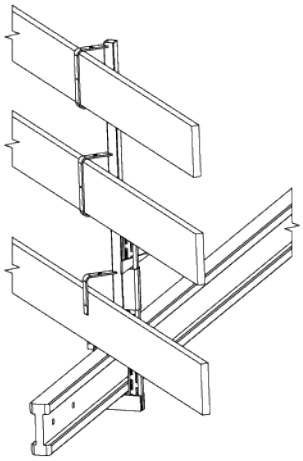
- Deck-boards min. 20x5 cm
- Guard-rail boards min. 20x3 cm
- Deck-boards fix with 4 square bolts M10x70 and 1 square bolt M 10x120 per bracket (not included in supportingope of supply)

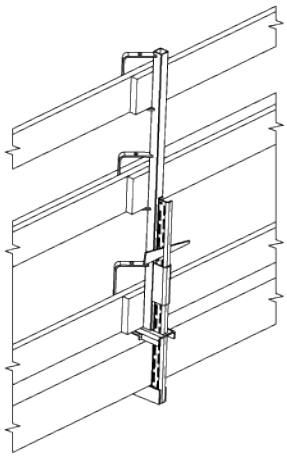
GUIDE RAIL CLAMP

- Attached with integral clamp:
  - on the timber beam
  - on the floor slab
- Guard-rail boards or scaffold tubes can be used as the safety barrier

Suitable for side guards on exposed platform-ends

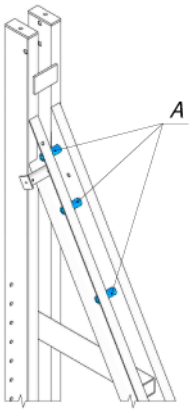






SHIFTING BY CRANE

The Supporting frame is equipped with 3 crane-hoisting points. In this way, it is always possible to find an optimum centre-of-gravity position for the whole unit, despite the many different possible configurations of the formwork and the Supporting frames (e.g. vertically stacked configurations using attachable frames).



(A) Crane-hoisting points

IMPORTANT NOTE:

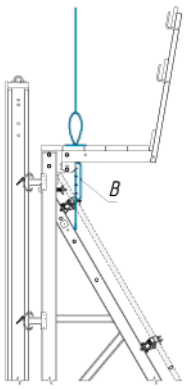
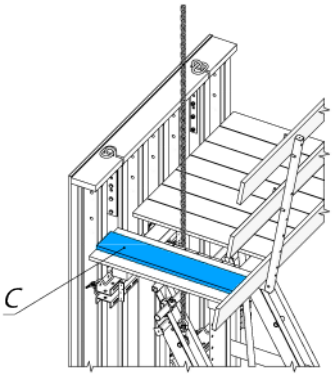
- When lifting and resetting supporting modules, do not attach the crane to the formwork element or to other components such as walings.
- Lifting the supporting module with the formwork attached is only permitted at near-ground level.
- Make sure that the crane suspension tackle is sufficiently long (oblique pull).
- Never use the crane to break concrete cohesion!

Max. load: 2500 kg per crane-hoisting point

In all phases of the work, ensure sufficient stability when setting down the Supporting module units! (Where necessary, provide ballast, back-stays or extra shoring).

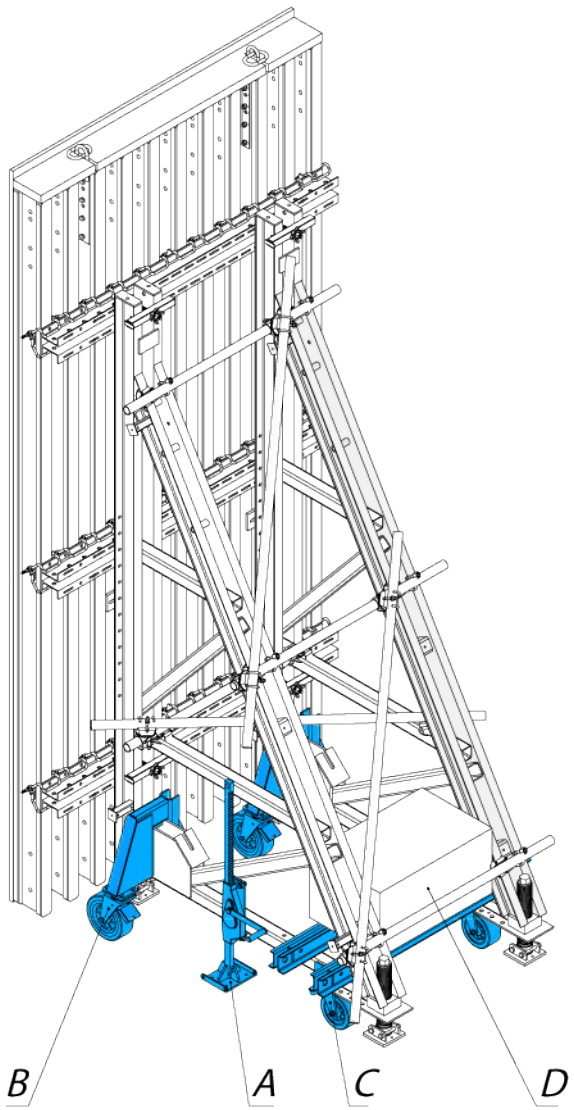
ATTACHING THE HOISTING TACKLE WHEN A POURING PLATFORM IS BEING USED

If it is not possible to attach the crane suspension tackle directly, e.g. because there are platforms in the way, there are 2 possible solutions:

Solution 1	Solution 2
Use a Crane sling 3.50 m as a variable «extension».	Leave access openings (e.g. tilt-back boards) in the platform decking.
	
B Crane sling 3.50 m	C Tilt-back board

SHIFTING BY WHEEL UNITS

For Supporting modules of up to 6.00 m in height



POSIBILITIES OF USING:

- For quick repositioning of the supporting frame units in situations where no crane assistance is available
(e.g. in tunnels)
- Wherever crane time is in short supply

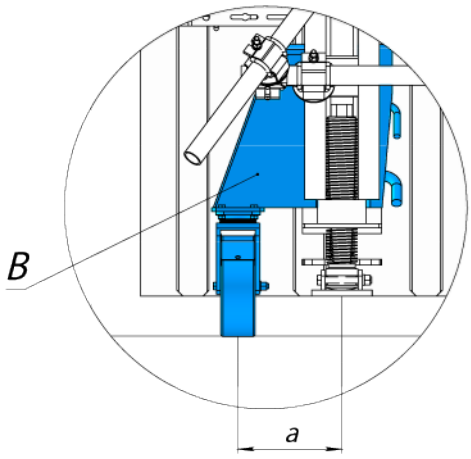
CAN BE MOUNTED ON:

- Supporting frame 4.50 m
- Attachable frame 1.50 m

MAX. LOAD:

- Attachable roller 250: 1400 kg
- Attachable roller 200: 1000 kg

Cross-section



a ... 27 cm

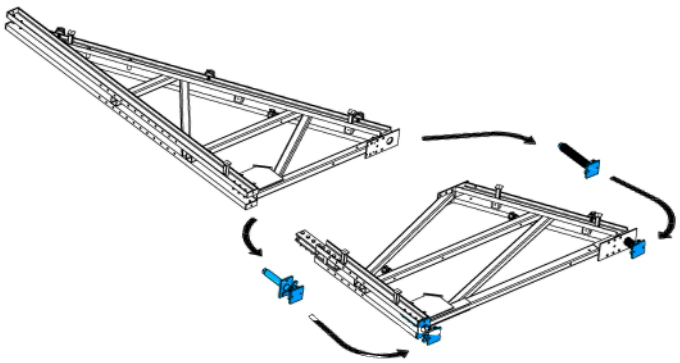
A Winch with transport device
B Attachable roller 250
C Attachable roller 200
D Ballast

ASSEMBLY

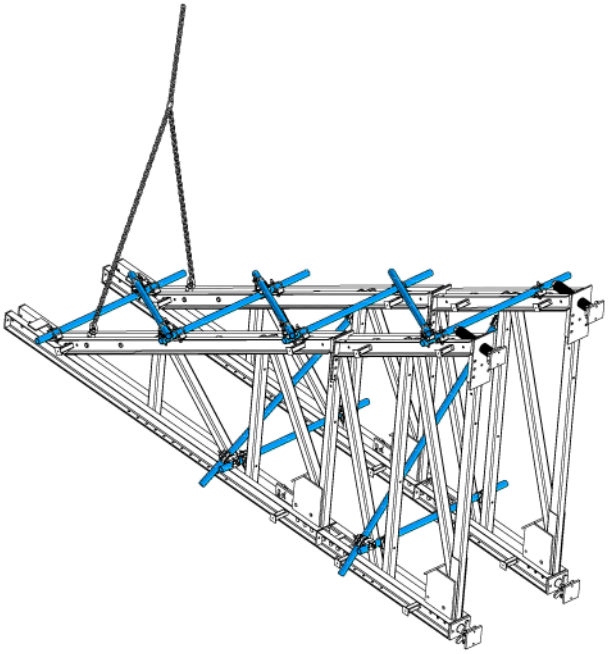
Example of a vertically stacked configuration:

PRE-ASSEMBLY

- Place a Supporting frame 4.50 m and an Attachable frame 1.50 m (plus an Attachable frame 2.00 m if needed) flat on the ground.
- Dismount the front spindle, including the nut-plate, from the supporting construction frame 4.50 m. Mount this spindle in the appropriate Attachable frame (spanner width-across 24 mm).
- Unscrew the rear spindle from the Supporting frame 4.50 m and Unscrew it into the appropriate Attachable frame (width-across 46 mm).



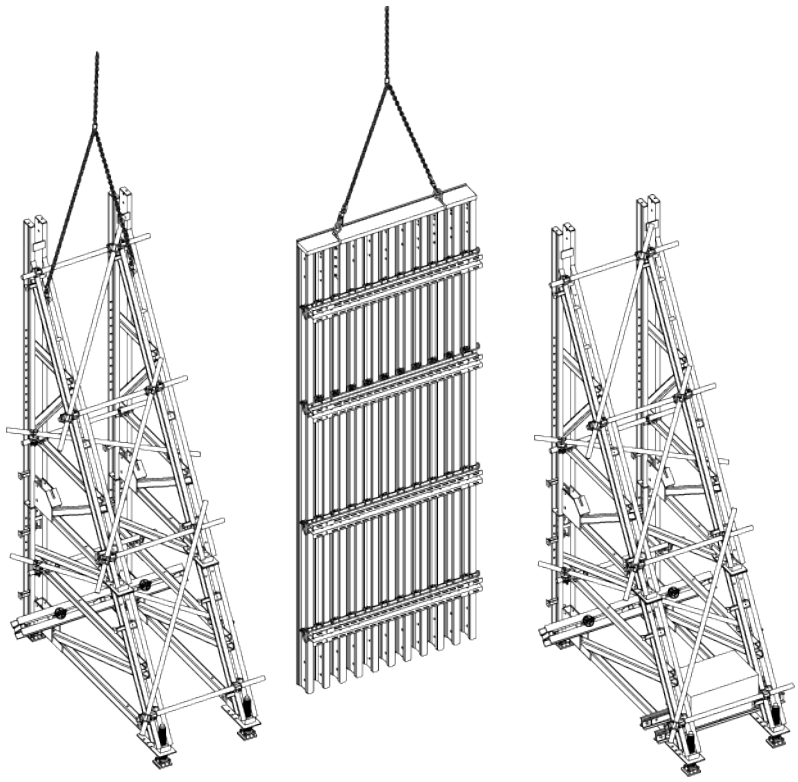
- Bolt the Supporting frame 4.50 m onto the Attachable frame (width-across 30 mm).
- Once the Supporting frame is bolted together, stand it on its back and stabilize it so that it cannot fall over.
- Stand the next Supporting frame on its back, in the same way. Space the two frames the required centre-to-centre distance apart and brace them with framed tubes (spanner width-across 22 mm).
- See «Standard modular frame units» for details of how to arrange framed tube-bracing.

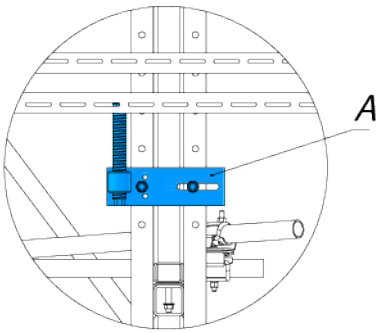


In all phases of the work, ensure sufficient stability when setting down the Supporting frame units! (Where necessary, provide ballast, back-stays or extra shoring).

ERECTING THE FORMWORK

- Raise the entire supporting frame unit by crane and stand it in the upright (see «Shifting»).
- Mount the anchor walings.
- Lift the pre-assembled formwork element by crane and position it against the Supporting module unit.
- Fix the formwork element to the supporting module unit (the connectors used will depend on which formwork system is being used).
- Detach the formwork element from the crane.
- Lift the entire formwork unit by crane to its usage location (see «Shifting»).
- Adjust the unit with the spindles.
- Anchor the unit.





A Adjusting spindle

The Adjusting spindle fixes the formwork elements at the desired height and also permits fine adjustment.

TOOLS NEEDED FOR ASSEMBLY:

For:	Width-across [mm]	Tool
Vertical stacking	30	Reversible ratchet 1/2» with Box nut 30 1/2» (or) Fork spanner 30/32
Bracing-tube couplers	22	Fork spanner 22/24
Relocating the Adjusting spindle	24	Reversible ratchet 1/2» with Box nut 24 (or) Fork spanner 22/24
Removing and refitting the front spindle incl. nut-plate	24	Reversible ratchet 1/2» with Box nut 24 (or) Fork spanner 22/24
Supporting distancer 20 cm	30/24	Fork spanner 30/32 Reversible ratchet 1/2» with Box nut 24 (or) Fork spanner 22/24
Holding the Supporting frame bolt		Spanner for tie-rod 15.0/20.0

TOOLS NEEDED FOR OPERATION:

For:	Width-across [mm]	Tool
Adjusting spindle	19	Reversible ratchet 1/2" with Nut for box spanner 19 and Extension piece 11 cm
Spindles (front and rear)	46	Reversible ratchet 3/4" with Hexagon spanner head 46 3/4" and Extension piece 20 cm 3/4"
Attachable roller 200 (rear)	22	Fork spanner 22/24

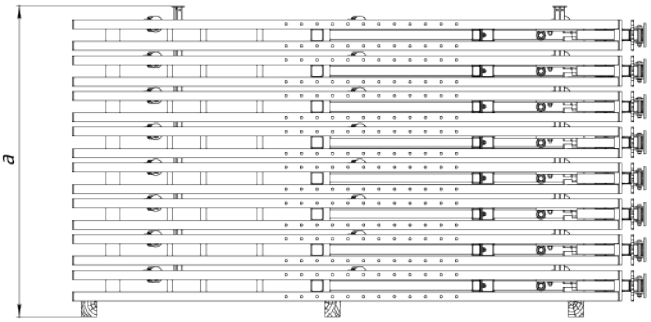
TRANSPORTING, STACKING AND STORING

The welded-on spacers prevent the supporting frames sliding over one another, and ensure that the stacked «layers» are safe against overturning.

The fact that the supporting frames can be separated not only provides a high degree of adaptability to different heights of formwork, but also means that they are transported by truck easily and (thanks to the integral spacers) safely.

SUPPORTING FRAME 4.50 m

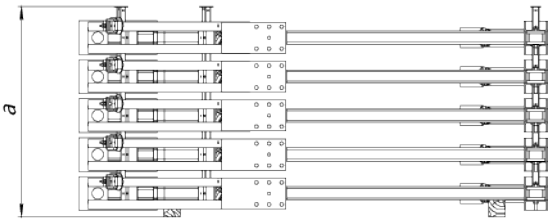
- Stack of 8 (weight approx. 2500 kg)



a ... 188 cm

ATTACHABLE FRAME 1.50 m

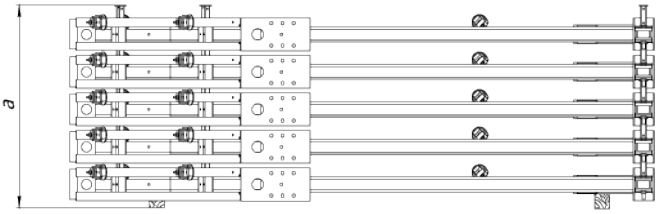
- Stack of 5 (weight approx. 1200 kg)



a ... 116 cm

ATTACHABLE FRAME 2.00 m

- Stack of 5 (weight approx. 2300 kg)



a ... 126 cm

ANCHORING SOLUTIONS FOR THE SUPPORTING FRAMES

The decisive criterion for the choice of anchoring system is the tensile forces that will occur.

PERMITTED ANCHOR FORCE

Anchoring system	Permitted load to DIN 18216	Max. load, allowing a 1.6:1 factor of safety against failure
15.0	90 kN	120 kN
20.0	150 kN	220 kN
26.5	250 kN	350 kN

Standard situation: 2 anchors per supporting frame
Example:
Tensile force Zk shown in Table = 266 kN
Anchoring system to choose:
266 ÷ 2 = 133 kN, i.e. choose Anchoring system 20.0

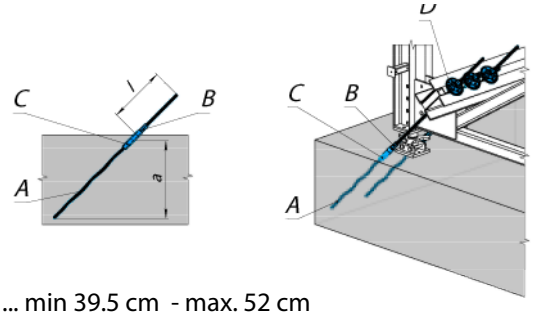
Only use approved anchoring components.
Never weld or heat tie-rods - risk of fracture.
It is forbidden to mix suspension components that have different depths of concrete cover.
Always sscrew in components until they fully engage. When correctly fitted, there will still be 1cm of thread visible between the part and the depth mark on the stop anchor or pigtail anchor.

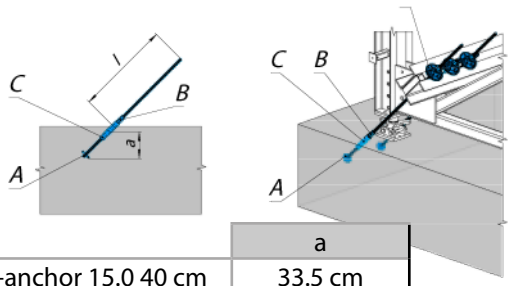
PERMITTED LOADS FOR ANCHOR WALINGS

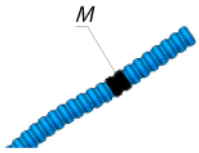
Anchor waling	Permitted anchor force: Z
Waling 12	175 kN
Anchor waling 14 1.95 m and 2.95 m	430 kN
Special anchor waling 0.55 m	700 kN

The tensile forces that can be sustained only apply where the anchor is positioned exactly as required, i.e. 15 cm either side of the vertical axis of the supporting module.

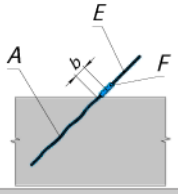
OPTION OF USING ANCHORING SYSTEM 15.0

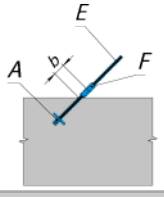
<table>
<tr><th>With pigtail anchor</th><th>With stop-anchor</th></tr>
<tr><td>This is the anchorage method that can best transfer the high tensile forces from Supporting modules into the foundation slabs.
 

a ... min 39.5 cm - max. 52 cm</td><td>Only use these with appropriate extra reinforcement steel (as dictated by the placement depth).
 

<table><tr><th></th><th>a</th></tr><tr><td>Stop-anchor 15.0 40 cm</td><td>33.5 cm</td></tr><tr><td>Stop-anchor 15.0 16 cm</td><td>16.5 cm</td></tr></table></td></tr>
<tr><td>(A) Pigtail anchor 15.0[1]</td><td>(A) Stop-anchor 15.0 16 cm[1] or Stop-anchor 15.0 40 cm[1]</td></tr>
<tr><td>(B) She-bolt 15.0 5 cm[2] (length 65 cm) incl. (C) or She-bolt 15.0 5 cm 1.20 m (length 120 cm) incl. (C)</td><td>(B) She-bolt 15.0 5 cm[2] (length 65cm) incl. (C) or She-bolt 15.0 5 cm 1.20 m (length 120cm) incl. (C)</td></tr>
<tr><td>(C) Sealing sleeve 15.0 5cm[1]</td><td>(C) Sealing sleeve 15.0 5 cm[1]</td></tr>
<tr><td>(D) Superplate
[1] Expendable anchoring component
[2] Only suitable for Adjustable supporting frames
 

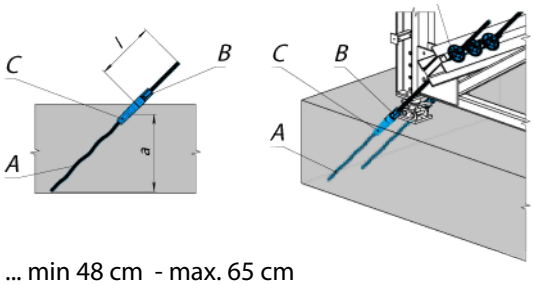
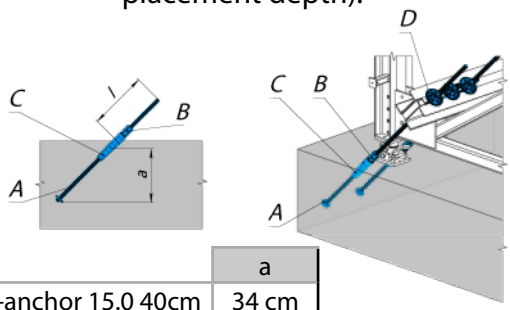
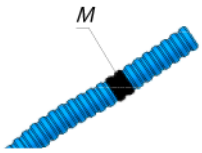
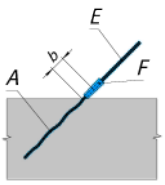
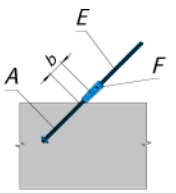
(M) The depth mark must always be at the end fitted into the she-bolt</td><td>(D) Superplate
[1] Expendable anchoring component
[2] Only suitable for Adjustable supporting frames

Tools for removing she-bolts:
- Spanner for tie-rod 15.0/20.0 or
- Fork spanner 24</td></tr>
<tr><th>Alternative solution:</th><th>Alternative solution:</th></tr>
<tr><td>Pigtail anchor protrudes from concrete: Instead of the she-bolt, fasten a Tie-rod 15.0 mm to the pigtail anchor using a Rod connector 15.0.
 

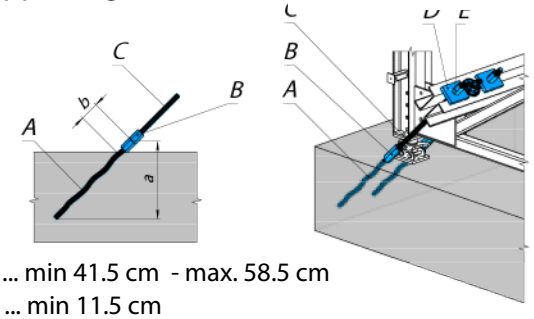
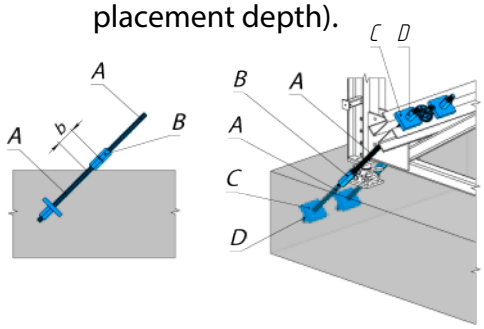
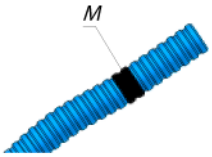
b ... min. 8 cm</td><td>Stop-anchor protrudes from concrete: Instead of the she-bolt, fasten a Tie-rod 15.0 mm to the stop-anchor using a Rod connector 15.0.
 

b ... min. 8 cm</td></tr>
<tr><td>(A) Pigtail anchor 15.0</td><td>(A) Stop-anchor 15.0 40 cm</td></tr>
<tr><td>(E) Tie-rod 15.0 mm</td><td>(E) Tie-rod 20.0 mm</td></tr>
<tr><td>(F) Rod connector 15.0</td><td>(F) Rod connector 15.0</td></tr>
</table>

OPTION OF USING ANCHORING SYSTEM 20.0

With pigtail anchor	With stop-anchor
This is the anchorage method that can best transfer the high tensile forces from Supporting modules into the foundation sla  a ... min 48 cm - max. 65 cm	Only use these with appropriate extra reinforcement steel (as dictated by the placement depth).  a Stop-anchor 15.0 40cm: 34 cm Stop-anchor 15.0 16cm: 18 cm
(A) Pigtail anchor 20.0[1]	(A) Stop-anchor 20.0 22 cm[1] or Stop-anchor 20.0 45 cm[1]
(B) She-bolt 20.0 (length 125 cm) incl. (C)	((B) She-bolt 20.0 (length 125 cm) incl. (C)
(C) Sealing sleeve 20.0 cm[1]	(C) Sealing sleeve 20.0[1]
(D) Superplate 20.0 [1] Expendable anchoring component [2] Only suitable for Adjustable supporting frames  (M) The depth mark must always be at the end fitted into the she-bolt	(D) Superplate 20.0 [1] Expendable anchoring component [2] Only suitable for Adjustable supporting frames **Tools for removing she-bolts:** - Spanner for tie-rod 15.0/20.0 or 20.0/26.5 or - Fork spanner 36/41
Alternative solution:	**Alternative solution:**
Pigtail anchor protrudes from concrete: Instead of the she-bolt, fasten a Tie-rod 20.0 mm to the pigtail anchor using an Anchoring cone 20.0.  b ... min. 10 cm	Stop-anchor protrudes from concrete: Instead of the she-bolt, fasten a Tie-rod 20.0 mm to the Stop-anchor 20.0 45cm using an Anchoring cone 20.0.  b ... min. 10 cm
(A) Pigtail anchor 20.0	(A) Stop-anchor 20.0 45 cm
(E) Tie-rod 20.0 mm	(E) Tie-rod 20.0 mm
(F) Rod connector 20.0	(F) Rod connector 20.0

OPTION OF USING ANCHORING SYSTEM 26.5

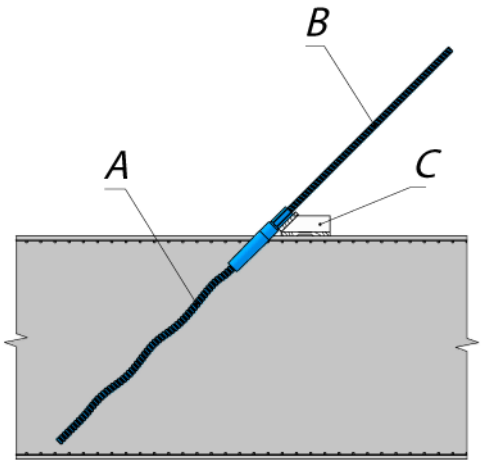
With pigtail anchor	With stop-anchor
This is the anchorage method that can best transfer the high tensile forces from Supporting module into the foundation slabs.  a ... min 41.5 cm - max. 58.5 cm b ... min 11.5 cm	Only use these with appropriate extra reinforcement steel (as dictated by the placement depth).  b ... min 11.5 cm
(A) Pigtail anchor 26.5[1]	(A) Tie-rod 26.5 mm[1]
(B) Rod connector 26.5	(B) Rod connector 26.5
(C) Tie-rod 26.5 mm	(C) Anchor plate 26.5[1]
(D) Anchor plate 26.5	(D) Hexagon nut 26.5[1]
(E) Hexagon nut 26.5	
[1] Expendable anchoring component  (M) The depth mark must always be at the end fitted into the she-bolt	[1] The combination of - Tie-rod 26.5 mm - Anchor plate 26.5 - Hexagon nut 26.5 together serves as a substitute for a stop-anchor. For this reason it counts as an «expendable anchoring component».

FITTING DIAGONAL ANCHORS

In everyday site practice, there are various different ways of preparing positioning points for diagonal anchors at a precise angle (usually 45°), depending on the site situation.
The following examples show several possible and effective options. These apply equally to the use of either pigtail anchors or stop-anchors.

FIT THE ANCHORS AT A 45° ANGLE.

- Fitting a diagonal anchor at a steeper angle than this increases the load.
- If the angle is increased by 10° (i.e. to 55°), this increases the load on the tie-rod by over 20% and may thus lead to serious overloading.



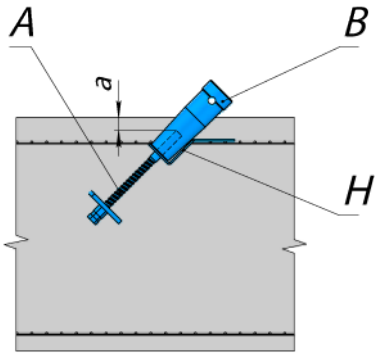
(A) Pigtail anchor or stop-anchor
(B) She-bolt with sealing sleeve
(C) Wooden template

WOODEN TEMPLATE

- This method permits variable distribution of the positioning points, and can therefore be reused in any situation.
- Alternatively, a clear, fixed arrangement of the positioning points can be made with naildown wedges of square-sawn timber.
- Many variations are possible on this theme, meaning that this example can be optimized for the case in hand.

ANCHOR HOLDERS AND CLEARANCE CONES

- For precise location and directionally stable fitting of anchoring components at a 45° angle.
- Mount an anchor holder on the tie-rod, and fasten it to the top reinforcement.
- Screw in the clearance cone.
- After pouring, replace the clearance cone with a she-bolt.



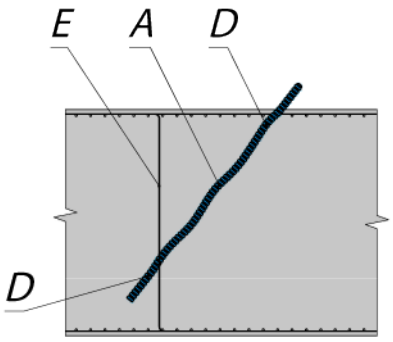
a ... 30 mm

(A) Pigtail anchor or stop-anchor
(B) Clearance cone
(H) Anchor holder

FIXING TO REINFORCEMENTS

- Option 1

● By using two extra longitudinally-placed reinforcement rods, the anchor can be firmly fixed so that it safely withstands pouring.

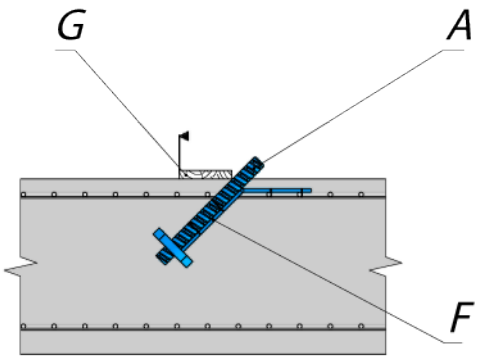


(A) Pigtail anchor or stop-anchor
(D) Extra reinforcement rod
(E) Extra hoop

- Option 2

● The stop-anchor or pigtail anchor can be fixed to the longitudinal reinforcements with the aid of an extra hoop.

● A suitably wide spacer board makes it easier to achieve exact positioning.

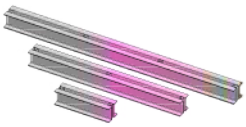
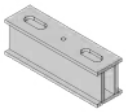
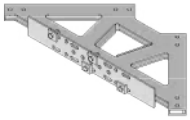


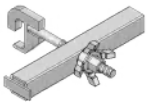
(A) Stop-anchor 15.0 40 cm or 20.0 45 cm
(F) Hoop with stop-anchor, fastened to reinforcement
(G) Spacer board

▲... Inside line of wall

COMPONENT OVERVIEW

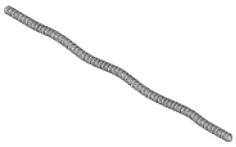
Item		[kg]	Article nº
Supporting frame 4.50 m 		350,87	31 001 200
Attachable frame 1.50 m 		263,67	31 002 200
Attachable frame 2.00 m 		497,04	31 003 200
Waling 12 	1.00m 2.00m 3.00m	21,00 42,32 63,53	21 100 000 21 200 000 21 300 000

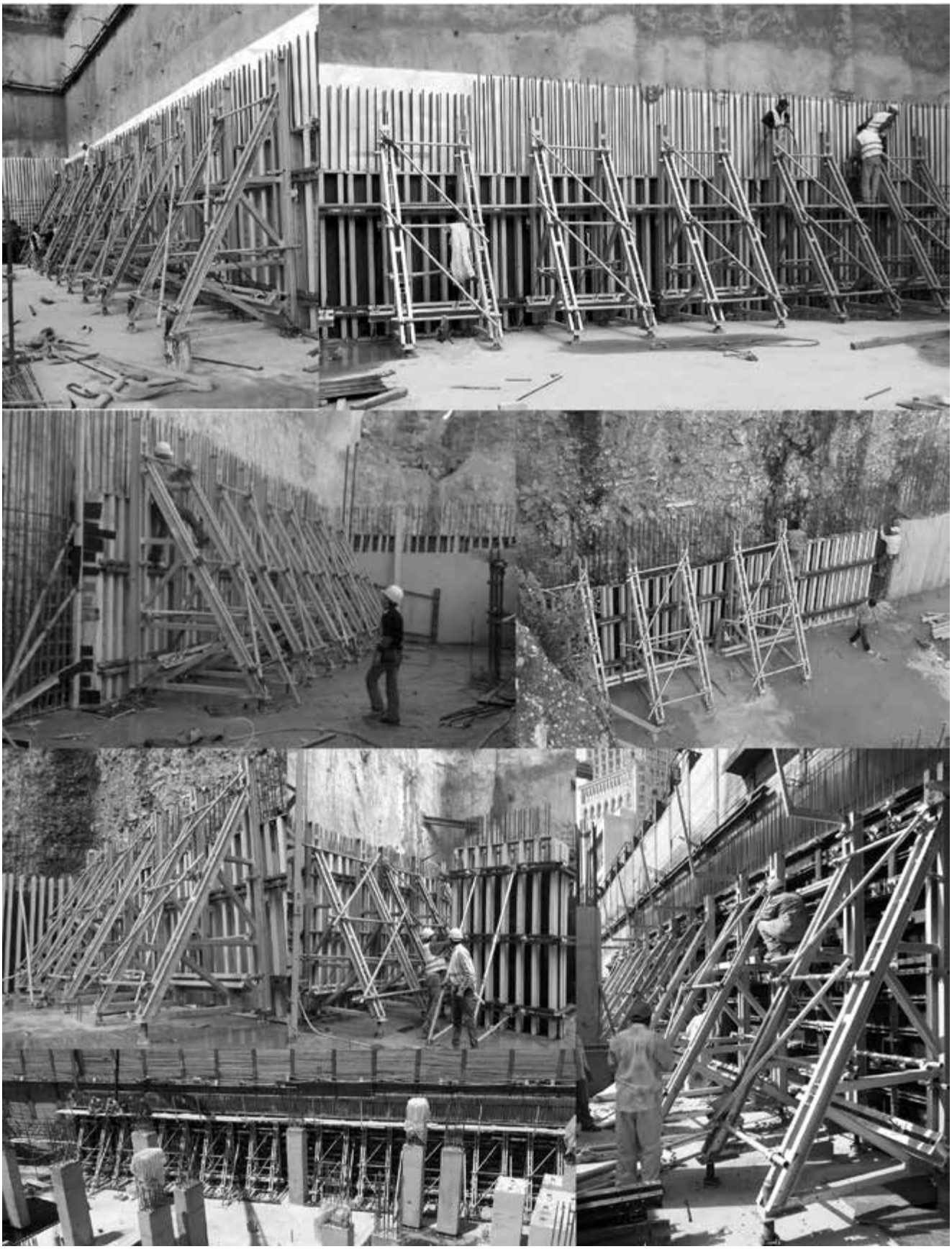
Item		[kg]	Article nº
Anchor waling 18 	0.70m 1.95m 2.95m	26,45 72,40 108,93	33 070 200 33 195 200 33 295 200
Special anchor waling 	0.55m	47,39	33 055 200
Anchor waling positioner 		0,63	32 108 100
Corner plate MSF 		47,25	32 100 100
Front spindle MSF 		19,43	32106100
Rear spindle MSF 		19,18	32104100
Adjusting spindle 		6,62	32102100

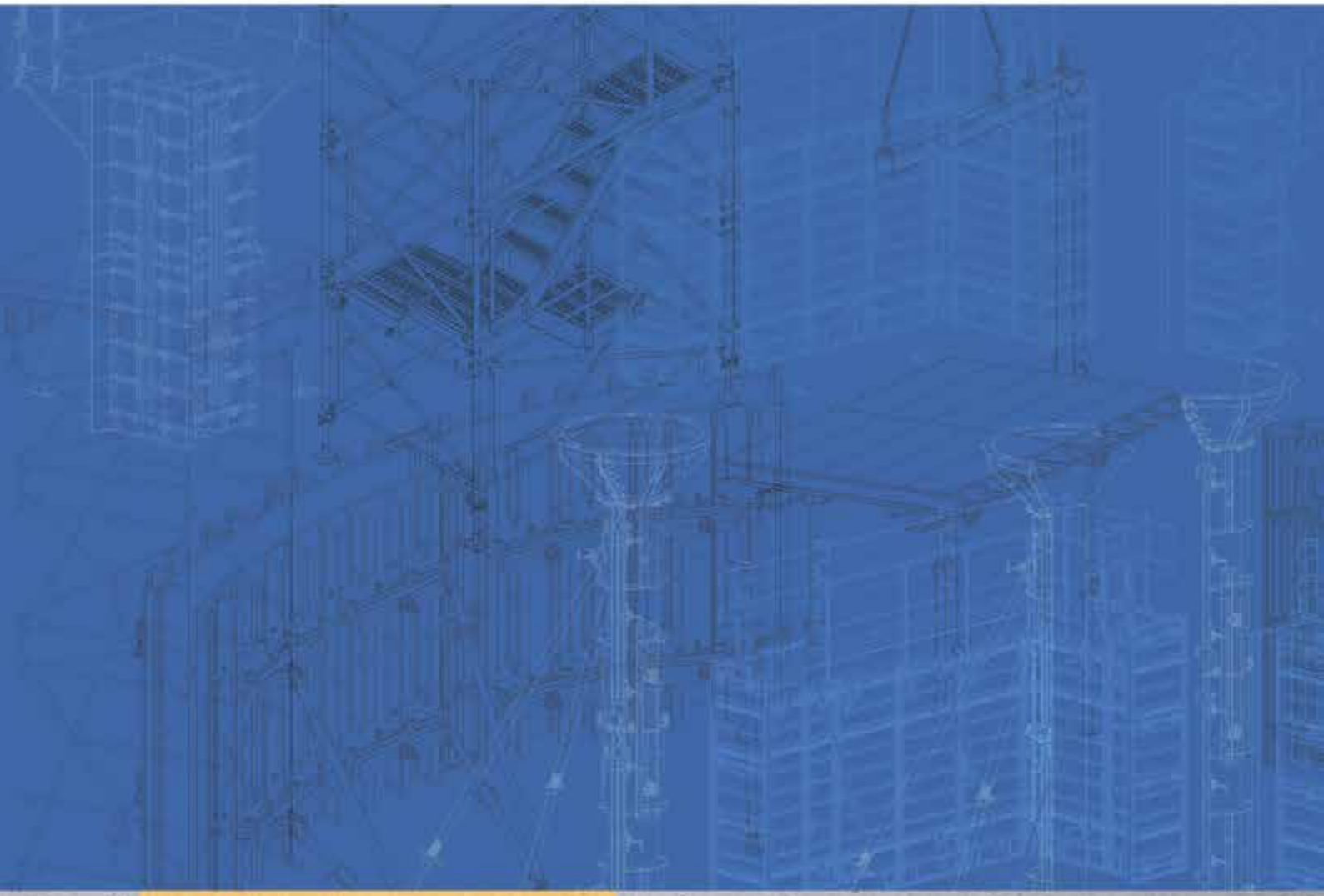
Item		[kg]	Article nº
Connecting pin 		0,39	23 400 100
Spring cotter 		0,05	23 402 100
Connection screw 	10-16	0,63	11 908 100
Wailing-to bracket holder 		2,61	75 200 100
Screw-on access bracket 		17,32	75 116 100
Swivel plate 		4,10	75 118 100

Item		[kg]	Article nº
Attachable roller A for supporting frame 4.50 m 		9,78	34 100 000
Attachable roller B for supporting frame 4.50 m 		41,06	34 102 000
Adjustable jack 		30,45	34 104 000
Framed tube 48 mm 	1.00m 1.50m 2.00m 2.50m 3.00m	4,60 6,91 9,21 11,51 13,81	94 100 200 94 150 200 94 200 200 94 250 200 94 300 200
Swivel coupler 	48x48mm	1,22	95 106 100
Screw-on coupler 48 mm 	30 70 100	1,21 1,26 1,33	95 100 100 95 102 100 95 104 100

Item		[kg]	Article nº
She-bolt 	15.0mm 0.65m 15.0mm 1.20m 20.0mm 1.25m	1,83 2,72 5,94	95 304 100 95 306 100 95 308 100
Tie rod 	15.0mm 1.50m 20.0mm 1.50m 26.5mm 1.50m	2,40 3,60 6,83	92 150 300 93 150 300 95 310 300
Rod connector 	15	0,50	95 214 100
Clearance cone 	15 20	0,38 0,38	95 300 100 95 302 100
Anchoring cone 	20	1,05	95 312 100
Superplate 	15 20	1,22 2,10	95 200 100 95 202 100
Hexagon nut 	15 26.5	0,37 0,80	95 208 100 95 218 100
Rod connector 	26.5	1,51	95 216 100

Item		[kg]	Article nº
Anchor plate 	26.5	3,47	95 220 100
Pigtail anchor 	15 20 26.5	0,92 1,90 3,60	99 208 300 99 210 300 99 212 300
Stop anchor 	15.0mm 0.16m 15.0mm 0.40m 20.0mm 0.22m 20.0mm 0.45m	0,43 1,07 0,64 1,30	99 200 100 99 202 100 99 204 100 99 206 100
Sealing sleeve 	15 20	0,008 0,03	99 104 400 99 106 400
Anchor holder 	15 20	0,34 0,42	99 214 300 99 216 300





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