

H 20

Formwork for Walls and Columns
Instructions for assembly and use

February 2004



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Important notes

The following instructions for erection and use include detailed information on the handling and proper application of the products that are described and depicted. All instructions regarding technical operation and function have to be observed carefully.

Exceptional use requires a separate design calculation.

With regard to safe and technically correct use of our products abroad, all relevant safety rules, regulations and safety instructions of national institutes and/or local authorities have to be followed.

Generally, only flawless material must be used.

Damaged components have to

be sorted out. In case of repairs, only original spare parts of the Hünnebeck Company must be used.

Combined use of our formwork system with equipment from other suppliers may involve certain dangers and, therefore, requires an additional check up.

For reasons of further technical development we emphatically reserve the right to revise, change or modify any of the product's components at any time without prior notice.

1.0 Product features



The basis of the wall formwork is the H 20 timber beam. It is produced in an electronically-controlled production plant. Wood quality and splicing is continually checked, here.

The H 20 beam is sturdy, easy to handle and at a weight of only 5.0 kg/m offers a high load-bearing capacity at large distances of walers.

The advantage: **fewer ties.** Due to the project orientated arrangement of beams and tie positions, an optimum adaptation to ground

plans and to the demanded concrete surface will be achieved.

The steel walers (clamped onto the H 20 timber beam) allow the formwork elements to be assembled quickly and simply. The assembly is done as easily as the disassembly. The advantage: no problems with the restructuring of wall formwork units when a frequent change of ground plans takes place.

The H 20 beam is an economical alternative to the project-independent formwork systems. It is definitely the best when it comes to complicated ground plans and to numerous uniform-type applications with the same wall heights.

The H 20 timber beams are used for wall, column and slab formwork. They show high stability at low weight.

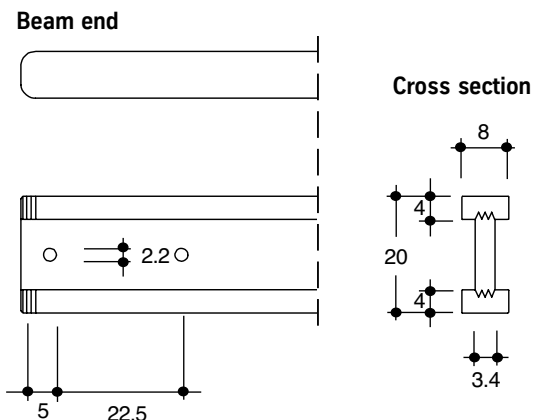
All safety regulations and safety rules of local authorities have to be considered for application.

Subject to change.

The H20 timber beam has a general approval of the building authorities under the registration number: No. Z-9.1-299 and is designed for the following static figures:

H 20 Timber beam

Beam dimensions [cm]

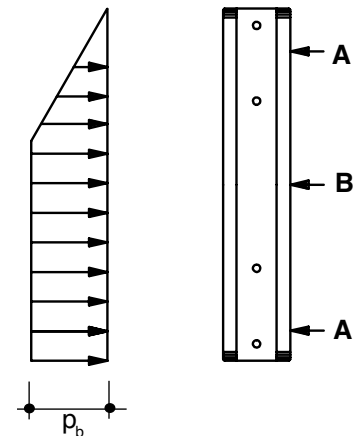


perm. **M** = 5 kNm (bending moment)

perm. **Q** = 11 kN (shear force)

max **B** = 22 kN (support reaction)

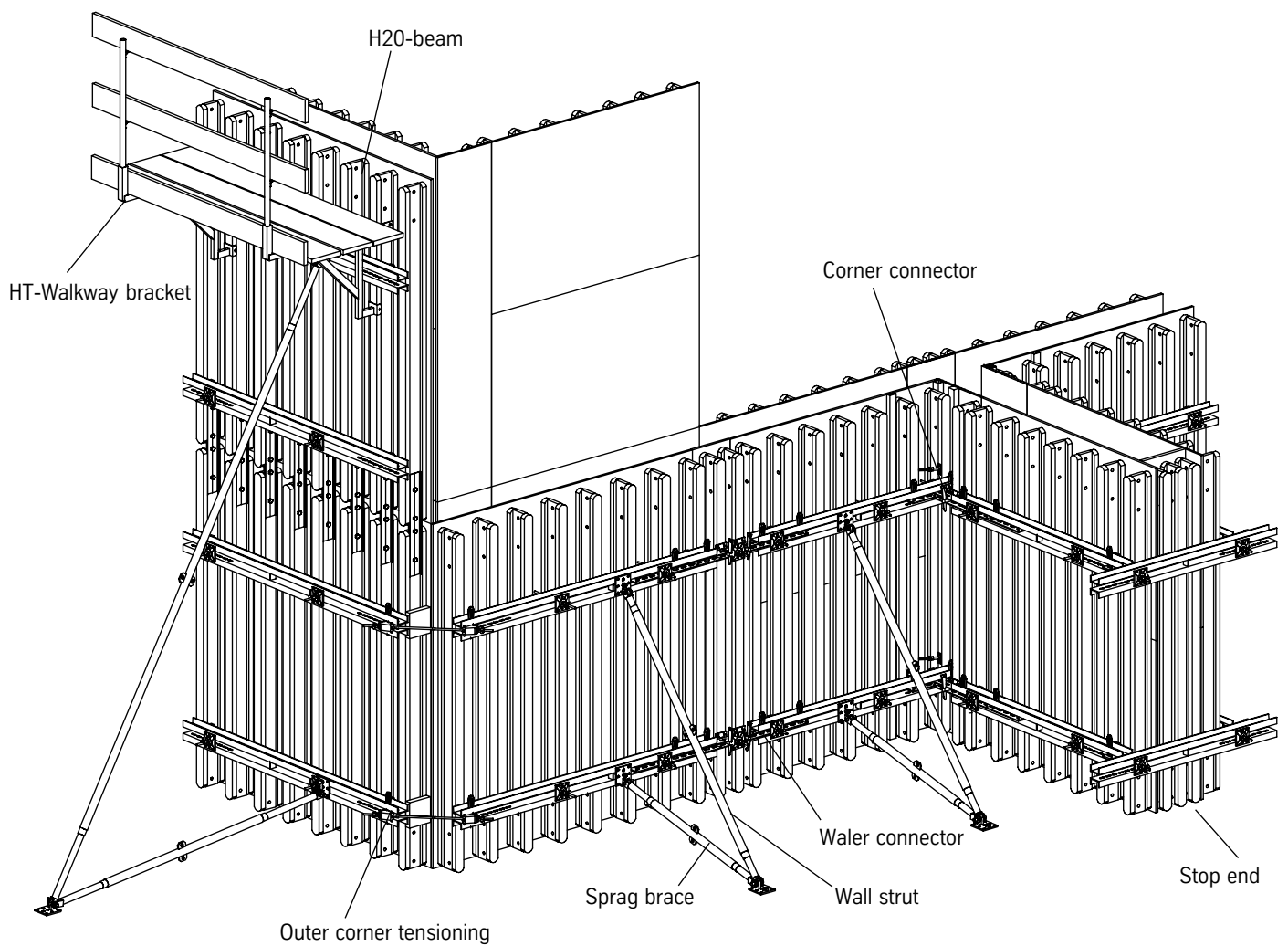
Flectural rigidity:
E • I = 500 kNm²



2.0 Overview

H20 Wall formwork

showing the typical arrangement of structural members.



3.0 Components

Description	Art. No.	Weight kg/item
	<p>H 20-beam 190 H 20-beam 245 H 20-beam 265 H 20-beam 290 H 20-beam 330 H 20-beam 360 H 20-beam 390 H 20-beam 450 H 20-beam 490 H 20-beam 590 H 20-beam 1190</p> <p>Special lengths per metre run up to max. length of 12.0 m (on request)</p> <p>The H 20 beam is used for supporting and fastening the shuttering skin. The spacing between the beams in the wall element depends on the concrete pressure and the selected shuttering skin.</p>	<p>581 760 9.5 581 770 12.3 581 781 13.2 581 792 14.5 581 807 16.5 581 818 18.0 581 829 19.5 581 830 22.5 581 840 24.5 581 851 29.5 582 319 59.5 581 862 5.0</p>
<p>Walers</p>	<p>Walers</p> <p>Waler 96 Waler 121 Waler 146 Waler 171 Waler 196 Waler 221 Waler 246 Waler 271 Waler 296</p> <p>Special lengths are available on request.</p> <p>Walers are joined with waler connectors to produce a pressure- and tension resistant element connection.</p> <p>The element connections are thus tight flush and in true alignment.</p>	<p>503 871 22.5 503 882 27.9 503 893 33.4 503 908 38.9 503 919 44.3 503 920 49.7 503 930 55.0 503 941 60.7 503 952 66.2</p>
	<p>H 20 Timber beam clamp</p> <p>It reliably connects the H 20 beam to the waler at any required position. The rigid round bar stirrup and the swivelling fingers grasp and tighten the waler flanges to the beam (see page 15).</p>	<p>568 048 0.8</p>

3.0 Components

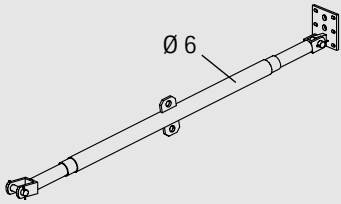
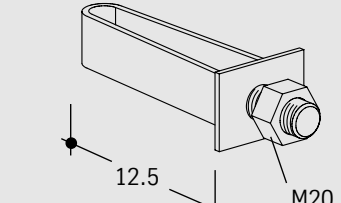
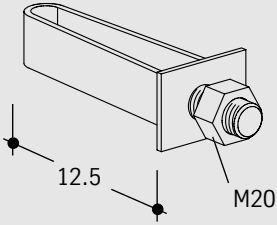
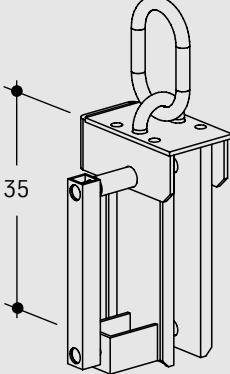
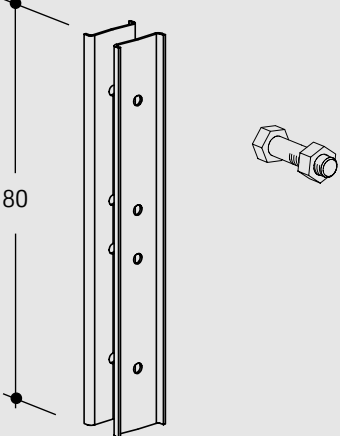


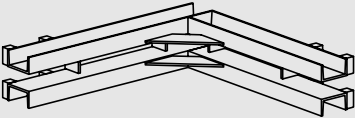
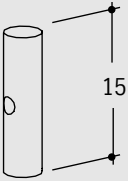
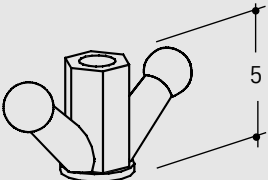
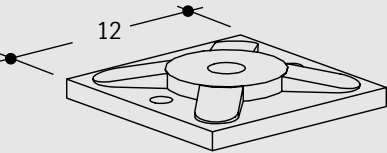
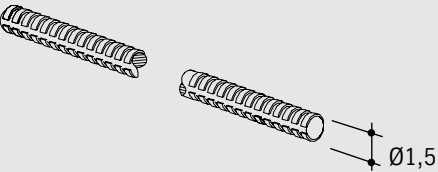
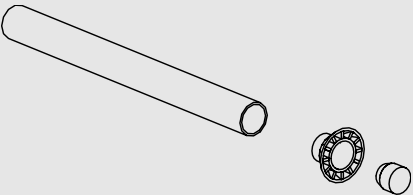
Description	Art. No.	Weight kg/item
	<p>Cam waler 96 505 907 22.5</p> <p>Cam waler 121 505 918 27.8</p> <p>Cam waler 146 505 930 33.3</p> <p>Cam waler 171 505 951 38.6</p> <p>Cam waler 196 505 962 43.9</p> <p>Cam waler 221 505 973 49.3</p> <p>Cam waler 246 505 984 54.7</p> <p>Cam waler 271 506 007 60.1</p> <p>Cam waler 296 506 018 65.4</p> <p>The cam walers provide support and tying locations in the elements.</p> <p>The H 20 beams are attached to them with the RU beam fastener.</p>	
	<p>RU beam fastener 568 703 1.1</p> <p>The beam fastener is required for circular formwork when the H 20 beam is attached to cam walers with intermediate arc templates (page page 27).</p>	
	<p>Three-hole plate 506 614 0.4</p> <p>To be used with circular formwork. For attaching the outer H 20 beam to the arc templates of the shuttering element (page page 27).</p>	
	<p>Waler connector 100 505 274 7.4</p> <p>Waler connector 165 505 296 13.0</p> <p>For connecting formwork elements. To be attached to the walers with the joining wedge (see page 16).</p>	
	<p>Corner connector 60 x 60 505 311 9.0</p> <p>For forming inner corners of shafts. To be used with joining wedge (see page 22).</p>	
	<p>Corner connector R 24 / H 20 505 436 11.0</p> <p>For forming inner corners with length adjustments. To be used with joining wedge (see page 17).</p>	

3.0 Components

Description	Art. No.	Weight kg/item
	<p>Hinged connector 70 x 70 Double hinged connector</p>	<p>505 355 504 328</p>
	<p>Outer corner bearing</p> <p>To be attached to the steel walers with the joining wedge. Holds diagonal brace of the outer corner (see page 18).</p>	<p>504 865 1.5</p>
	<p>Tension strap</p> <p>Component for stop-ends. To be secured in the steel waler with the joining wedge. Can be used with D+W tie rod (1.5 cm diam.) (see page 19).</p>	<p>505 388 1.5</p>
	<p>Joining wedge</p> <p>To be used with waler, corner and hinged connectors, as well as outer corner bearings and tension straps (see page 18).</p>	<p>505 241 0.9</p>
	<p>Beam fixing device</p> <p>Beam fixing device for circular formwork. To be used with infill panels and element extensions. Provided with nail holes for attaching to H 20 beams. To be attached to the connectors with wedge (Art. No. 504 497)* see page 16. *) Order separately.</p>	<p>504 512 504 887 1.0 0.8</p>
	<p>Wedge</p> <p>For locking the beam fixing devices in place and attaching wall struts or sprag braces. Also for attaching connection beam KK 230 (BKS struts). See page 16.</p>	<p>504 497 0.3</p>

	Description	Art. No.	Weight kg/item																								
	<p>Corner stiffener R 24 Used as a diagonal stiffening between two H 20 beams for inner corners. Connection angles have holes for nails measuring 5 mm in diameter (see page 17).</p>	504 291	0.7																								
<p>Brackets and aligning struts</p>	<p>TK-Railing post Used together with HT Walkway bracket.</p>	193 220	4.5																								
	<p>HT Walkway bracket Hot-dip galvanized bracket. Upper U-profile equipped with a wooden lath for nailing and with a squared tube for taking the separate railing post (*). (*) To be provided additionally (see page 24).</p>	568 390	14.1																								
	<p>Wall struts with 2 hinge plates lacquered</p> <table border="0"> <tr> <td>Wall strut, Size 1</td> <td>(170 - 240 cm)</td> <td>506 500</td> <td>19.5</td> </tr> <tr> <td>Wall strut, Size 2</td> <td>(220 - 290 cm)</td> <td>506 420</td> <td>21.0</td> </tr> <tr> <td>Wall strut, Size 3</td> <td>(270 - 340 cm)</td> <td>506 430</td> <td>22.0</td> </tr> <tr> <td>Wall strut, Size 4</td> <td>(320 - 390 cm)</td> <td>506 463</td> <td>24.0</td> </tr> <tr> <td>Wall strut, Size 5</td> <td>(420 - 490 cm)</td> <td>506 485</td> <td>27.0</td> </tr> <tr> <td>Wall strut, Size 6</td> <td>(530 - 590 cm)</td> <td>506 555</td> <td>40.0</td> </tr> </table> <p>For aligning and bracing formwork elements. To be attached to the waler with the hinge plate. Needed for this is the strut wedge strap (Art. No. 506 670) and wedge Art. No. 504 497) (see page 25).</p>	Wall strut, Size 1	(170 - 240 cm)	506 500	19.5	Wall strut, Size 2	(220 - 290 cm)	506 420	21.0	Wall strut, Size 3	(270 - 340 cm)	506 430	22.0	Wall strut, Size 4	(320 - 390 cm)	506 463	24.0	Wall strut, Size 5	(420 - 490 cm)	506 485	27.0	Wall strut, Size 6	(530 - 590 cm)	506 555	40.0		
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Wall strut, Size 6	(530 - 590 cm)	506 555	40.0																								

	Description	Art. No.	Weight kg/item
 <p>Technical drawing of a sprag brace, Size 1 lacquered. It is a long, thin metal rod with a diameter of 6 mm (Ø 6) and a hinge plate at one end.</p>	<p>Sprag brace, Size 1 lacquered 120 - 190 cm, for Sizes 1 + 2 wall struts (with 1 hinge plate and 1 hinge bolt) see page 25.</p>	506 511	16.0
 <p>Technical drawing of a sprag brace, Size 2 lacquered. It is a long, thin metal rod with a diameter of 6 mm (Ø 6) and a hinge plate at one end.</p>	<p>Sprag brace, Size 2 lacquered 170 - 240 cm, for Sizes 3 + 4 wall struts (with 1 hinge plate and 1 hinge bolt) see page 25.</p> <p>To be secured to the lower waler with the hinge plate. Attachment parts as for wall struts.</p>	506 533	18.0
 <p>Technical drawing of a strut wedge strap. It is a rectangular metal strap with a width of 12.5 mm and an M20 threaded end.</p>	<p>Strut wedge strap For securing the hinge plates of wall struts and sprag braces. Wedge (Art. No. 504 497) for fastening must be ordered separately (see page 25).</p>	506 670	0.9
 <p>Technical drawing of the H 20 Crane hook. It is a metal hook with a height of 35 mm.</p>	<p>H 20 Crane hook For setting upright, transporting and shifting formwork elements (see page 23). Max. allowable load per crane hook: 500 kg [5.0 kN] Note: separate Operation Instructions (April, 1999). Available (in German).</p>	582 320	8.7
 <p>Technical drawing of the H 20 Extension butt strap. It is a long metal strap with a height of 80 mm and an M20x80 bolt with nut.</p>	<p>H 20 Extension butt strap Bolt M20x80 with nut Used for connecting individual beams when wall elements are extended at height. (Extension butt strap to be ordered 2 times, bolts M20 4 times). Shown on page 21.</p>	582 352 489 801	4.5 0.3

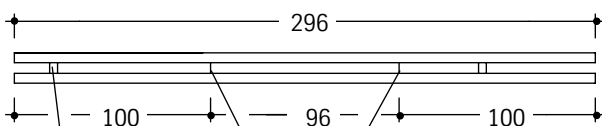
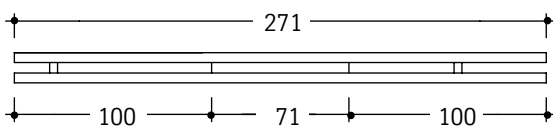
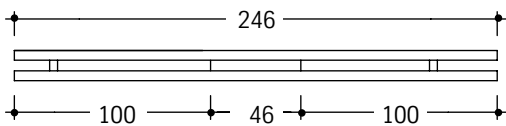
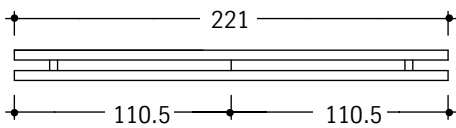
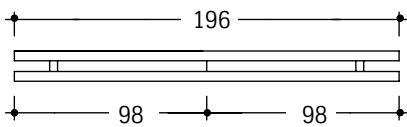
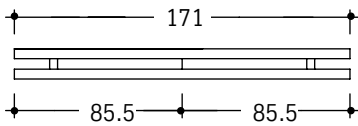
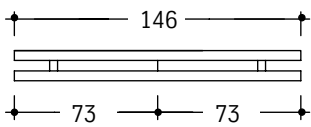
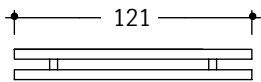
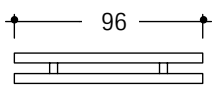
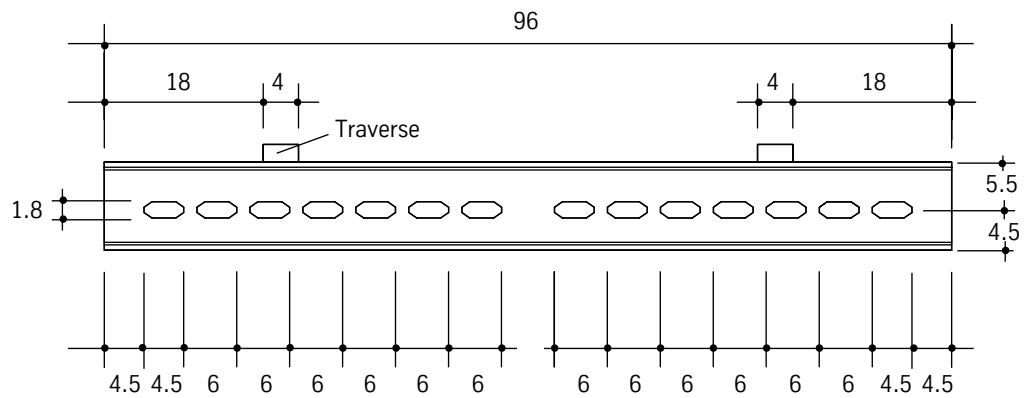
	Description	Art. No.	Weight kg/item
	<p>Walers for column formwork</p> <p>Column waler 72 x 72</p> <p>Column waler 89 x 89</p> <p>Column waler 106 x 106</p> <p>Column waler 123 x 123</p>	<p>505 182</p> <p>505 208</p> <p>505 219</p> <p>505 220</p>	<p>35.5</p> <p>44.3</p> <p>51.7</p> <p>60.7</p>
<p>For producing right-angled formwork halves with various dimensions for column shuttering. With welded-on squared bearing supports.</p> <p>Order bracing separately. See page 28.</p>			
	<p>Bearing bar for column waler</p> <p>To be placed in the steel column waler and to hold the 1.5 cm tie rod (see page 28).</p>	<p>505 230</p>	<p>1.9</p>
	<p>Wing nut (forged)</p> <p>To be used for wall ties and for bracing corners in steel column walers.</p> <p>Max. permitted load: 90 kN</p> <p>See page 28.</p>	<p>509 618</p>	<p>0.3</p>
	<p>Counter plate 12/12</p> <p>In connection with the wing nut. (Art.No. 509 618) see page 19.</p>	<p>509 559</p>	<p>1.0</p>
	<p>Tie rod 75 (DW 15)</p> <p>Tie rod 100</p> <p>Tie rod 130</p> <p>Tie rod 175</p> <p>Max. permitted load: 90 kN</p> <p>Not weldable.</p>	<p>437 660</p> <p>024 387</p> <p>020 481</p> <p>020 470</p>	<p>1.1</p> <p>1.4</p> <p>1.9</p> <p>2.5</p>
	<p>1 bundle of tubular sleeves, 25 pcs. (each 200 cm long)</p> <p>1 package of cones, 200 pcs.</p> <p>1 package of plugs for sleeves, 500 pcs.</p> <p>Sleeves with cones secure the distance between two opposite shuttering elements.</p>	<p>048 220</p> <p>048 311</p> <p>048 332</p>	<p>15.4</p> <p>1.5</p> <p>1.6</p>

3.0 Components

Description	Art. No.	Weight kg/item
<p>Tie nut 85 (DW 15) With large base plate and spherical nut. Up to 10° incline is possible. Max. permitted load: 90 kN.</p>	020 492	1.2
<p>TK Tension nut (DW 15) For use in stopends. Max. permitted load: 40 kN.</p>	197332	0.7
<p>Manto tie nut Even when under a full tie load, can be easily loosened with the ratchet, due to the special sliding discs. Max. permitted load: 90 kN.</p>	464 600	1.3
<p>Tie nut 230 With extremely large base plate and spherical nut. Up to 10° incline is possible Max. permitted load: 90 kN.</p>	048 344	2.4
<p>Manto ratchet With the Manto ratchet (w.a.f. 36), tie nuts can be tightened or loosened quickly, while saving strength and materials. Do not extend the ratchet arm!</p>	408 780	1.0

	Description	Art. No.	Weight kg/item
	<p>Inclined strut for extreme shuttering heights</p> <p>Hinged end section</p> <p>Hingeless end section</p> <p>Intermediate section short 240 cm</p> <p>Intermediate section long 370 cm</p> <p>Bolt M16 x 60 with nut 4 pcs. per joint</p> <p>Fit bolt M20 x 80 with nut 1 pc.</p>	<p>489 102</p> <p>489 775</p> <p>489 113</p> <p>489 124</p> <p>489 786</p> <p>489 801</p>	<p>36.2</p> <p>29.0</p> <p>44.0</p> <p>63.0</p> <p>0.2</p> <p>0.4</p>
	<p>KK 230 Connection beam</p> <p>For connecting BKS inclined struts to the H 20 wall formwork. The vertical profile is connected to the steel waler by means of the wedge strap, which is welded on at the top, and the wedge (Art. No. 504 497).</p> <p>The lower waler transverse profile must be fixed to the H 20 beam with 2 times H 20 timber beam clamp (Art. No. 568 048).</p> <p>These connection items must be ordered separately. (see page 26).</p>	<p>529 540</p>	<p>27,8</p>
	<p>Shaft corner 125</p> <p>Shaft corner 300</p> <p>Shaft corner 400</p> <p>Clamping mechanism permits connection to the wall element shuttering skin and eases stripping by loosening the clamping joint following concreting. (see page 22).</p>	<p>504 659</p> <p>504 660</p> <p>504 670</p>	<p>31.5</p> <p>75.0</p> <p>100.0</p>

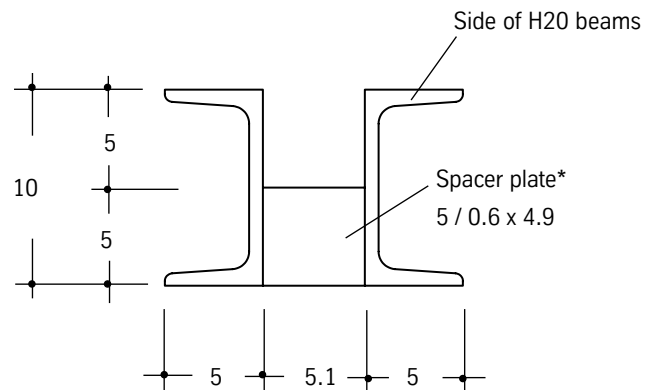
4.0 List of walers



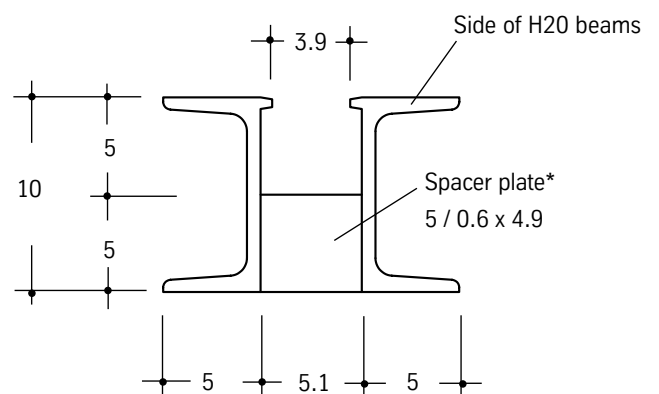
Traverse

Spacer plates

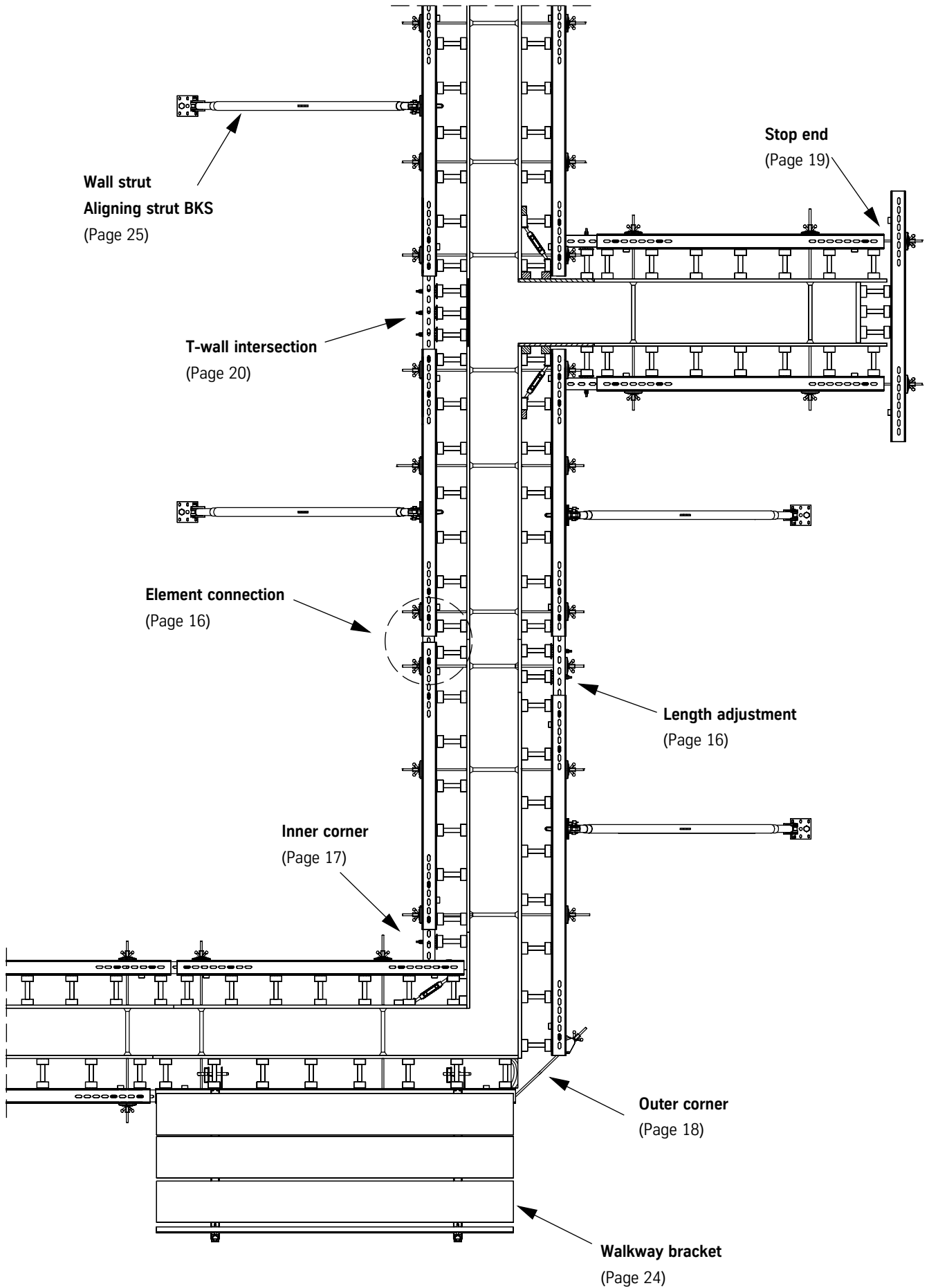
Cross section F-steel waler



Cross section cam steel waler



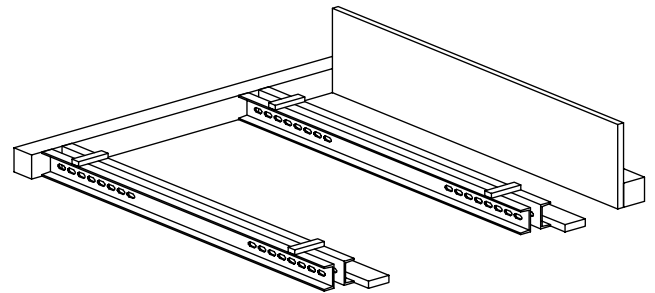
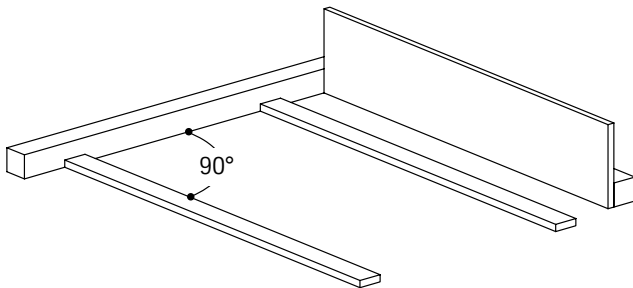
*Spacer plate from waler length 146 cm upwards



6.0 Assembly of elements



Preparation for assembly is the same for F-steel walers and for cam walers.

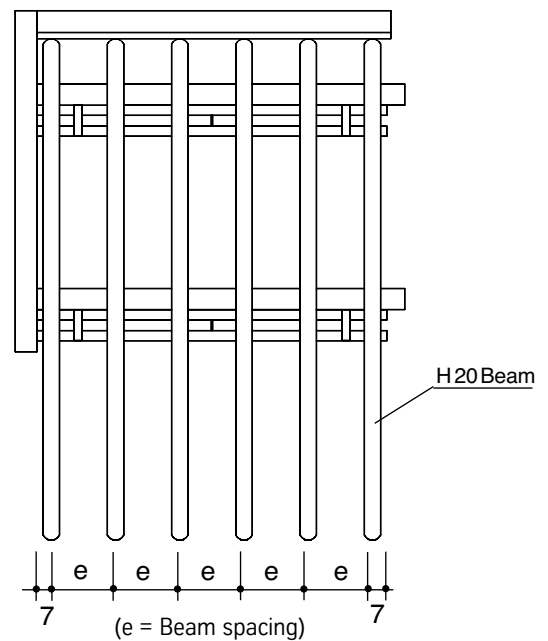
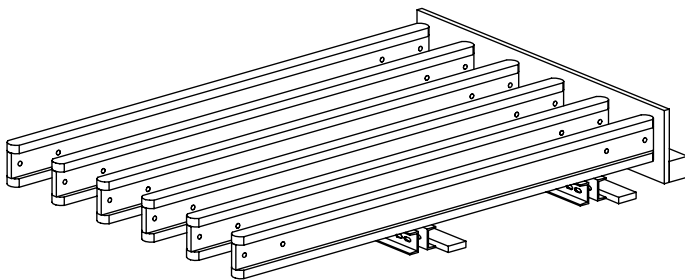


1 For basic assembly

of the H 20 elements, an assembly floor which is large enough for the largest element must be provided. To assure the precise positioning of the walers and beams, stop bars are nailed on. The stop bars are to correspond to the waler spacing.

2 Positioning the steel walers

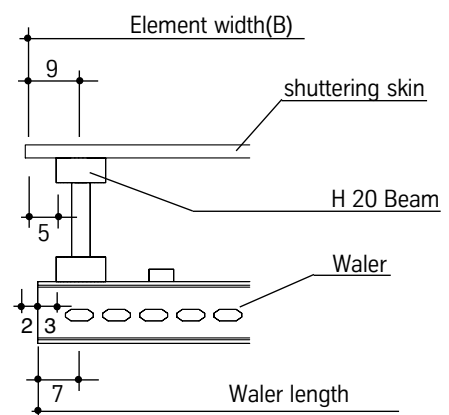
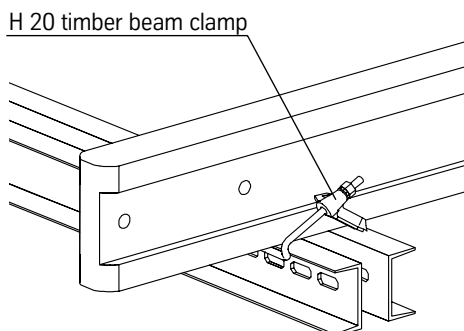
on the assembly floor. Cams for cam walers or traverses for steel walers are on the top.



3 Positioning the H 20 beam

in the statically required spacing.

Attaching of the beams with H 20 timber beam clamps (see also note below).



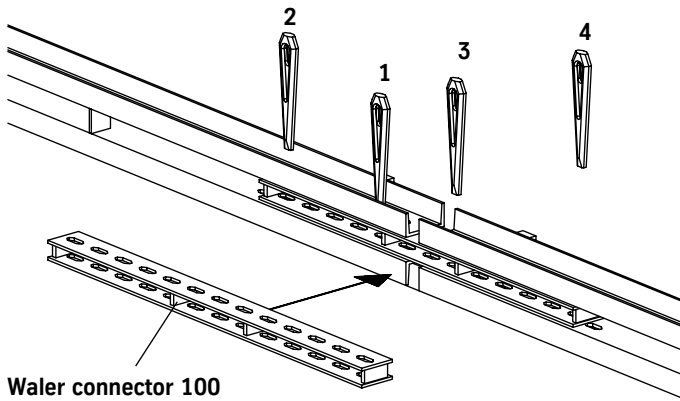
4 Attaching the shuttering skin

The shuttering skin is attached with nails, screw nails, or screws (preferably Spax screws). With its width of 8 cm, the H 20 beam offers a firm base for nailing or screwing.

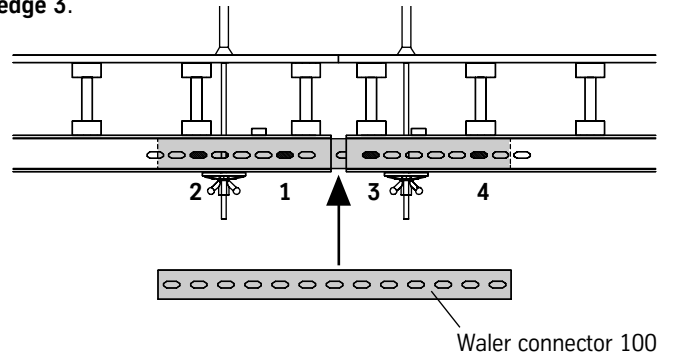
Attaching the H 20 beam to the steel waler with the H 20 timber beam clamp.

Element connection

The connection of elements using waler connector 100 and four joining wedges produces an aligned, compression- and tension-resistant tightening of the wall elements.

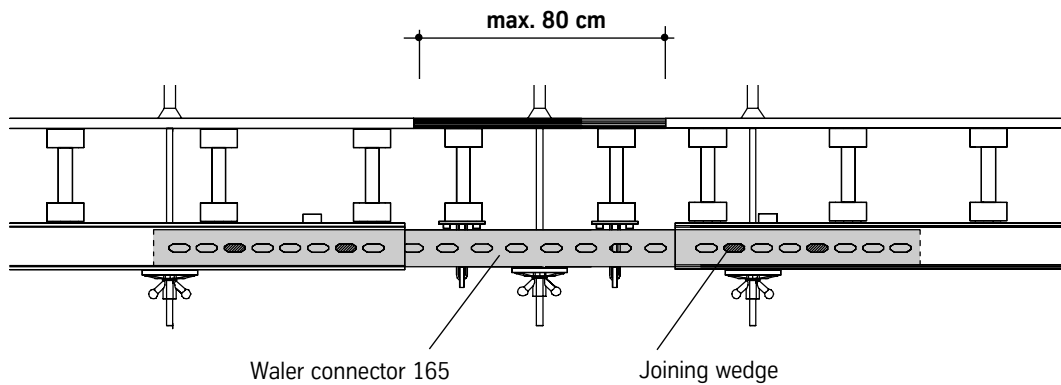


Place waler connector 100 with equal distances in the two adjacent walers and secure it with **Wedge 1** (first step). Then position **Wedge 2** at a far distance (maximum possible spacing) and fasten it slightly. Now insert **Wedge 3** and tighten element joint. Fix **Wedge 1** and **Wedge 3**.



After this operation **Wedge 4** and **Wedge 2** must be tightly driven in.

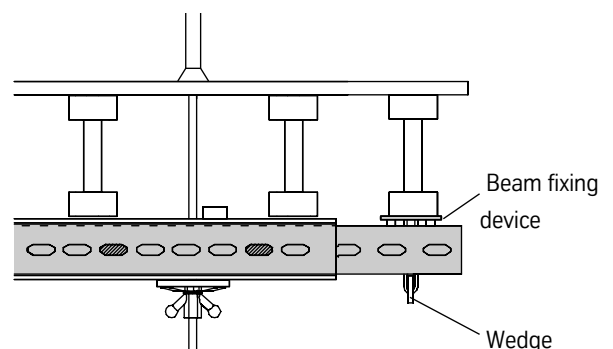
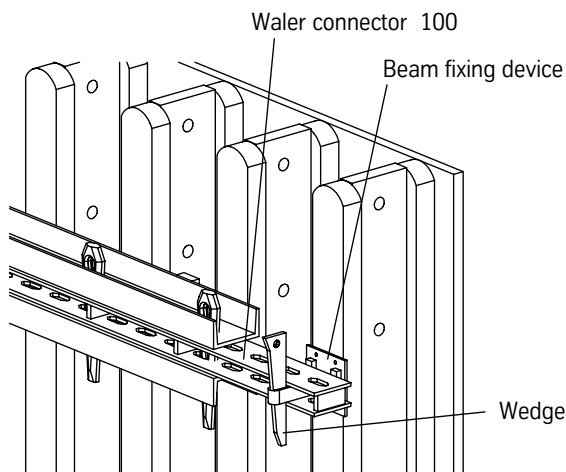
Waler connector 165 is used to produce adjustment panels (**max. 80 cm**) or to extend shuttering elements. As of **20 cm**, additional tying is necessary.



Length adjustment

Using the beam fixing device and the wedge, the H 20 beam is attached to the waler connector.

The beam fixing device has 0.6 cm diam. nail holes.

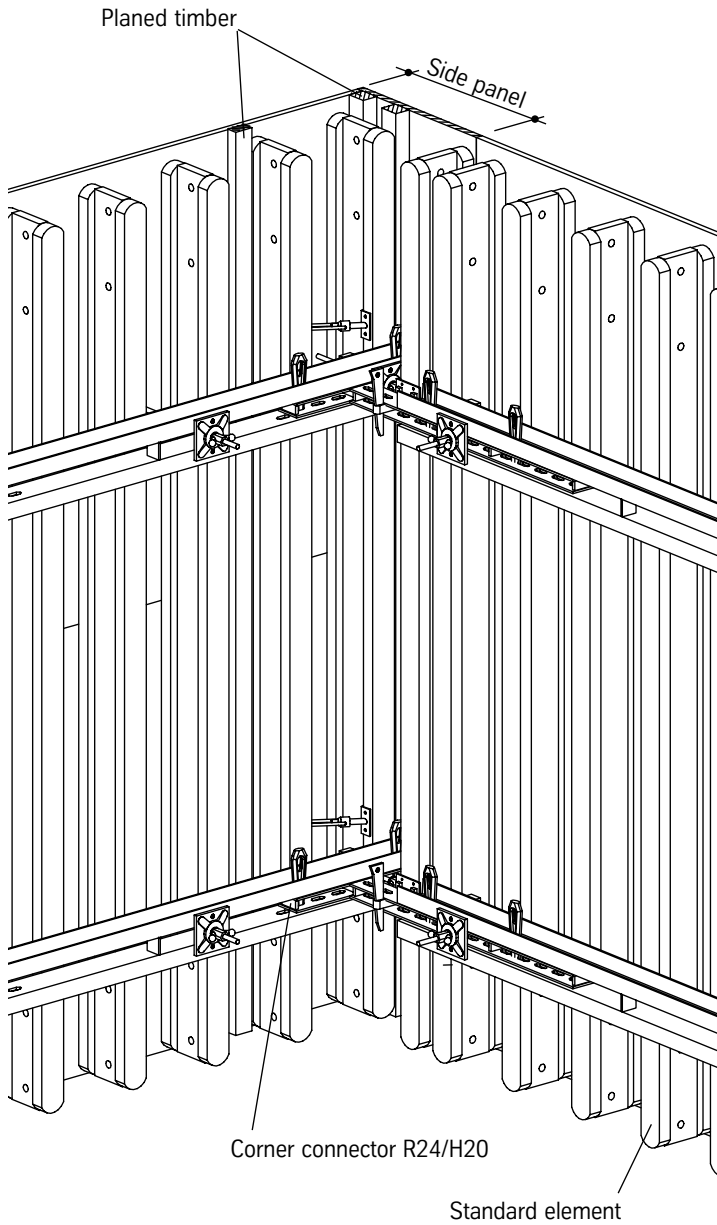


Inner corner

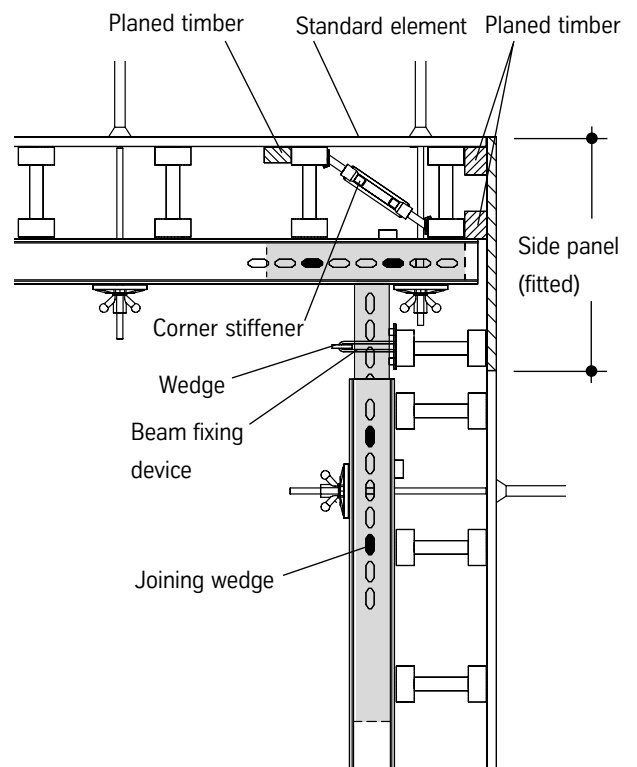
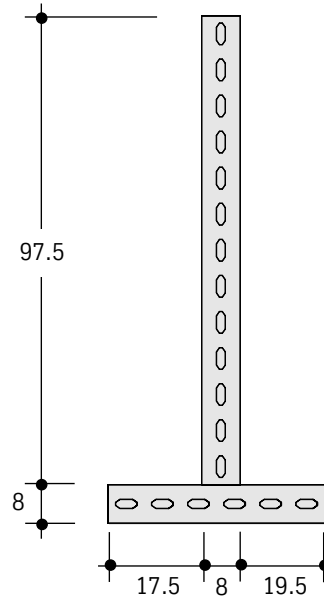
The corner connector R 24 / H 20 makes it possible to construct an inner corner by using standard elements.
Fastened to the waler with joining wedges.

Note:

The shorter H 20 leg (17.5 cm) must point towards the inner corner of the H 20 formwork.



Corner connector R24/H20



Inner corner

Corner connector R24/H20	Art. No. 505 436 (1x)*
Joining wedge	Art. No. 505 241 (4x)*
Corner stiffener	Art. No. 504 291 (1x)*

*per each waler level

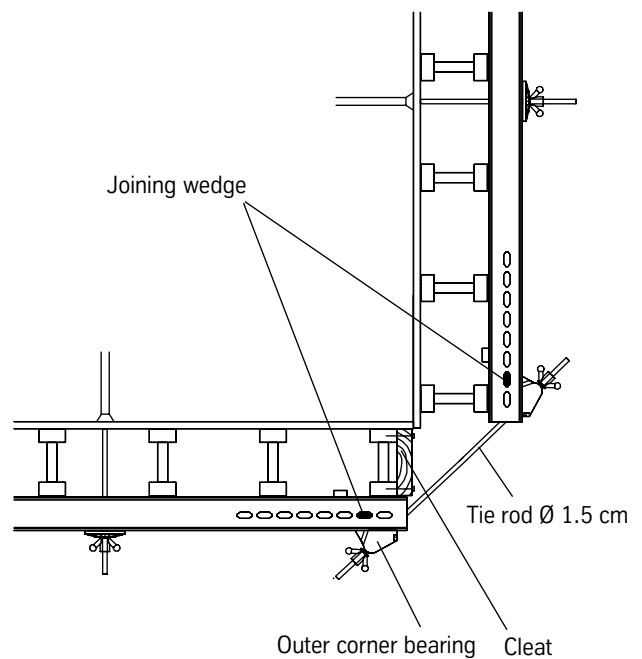
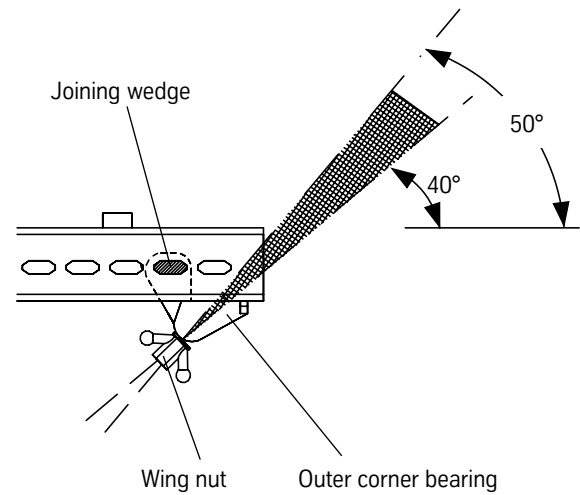
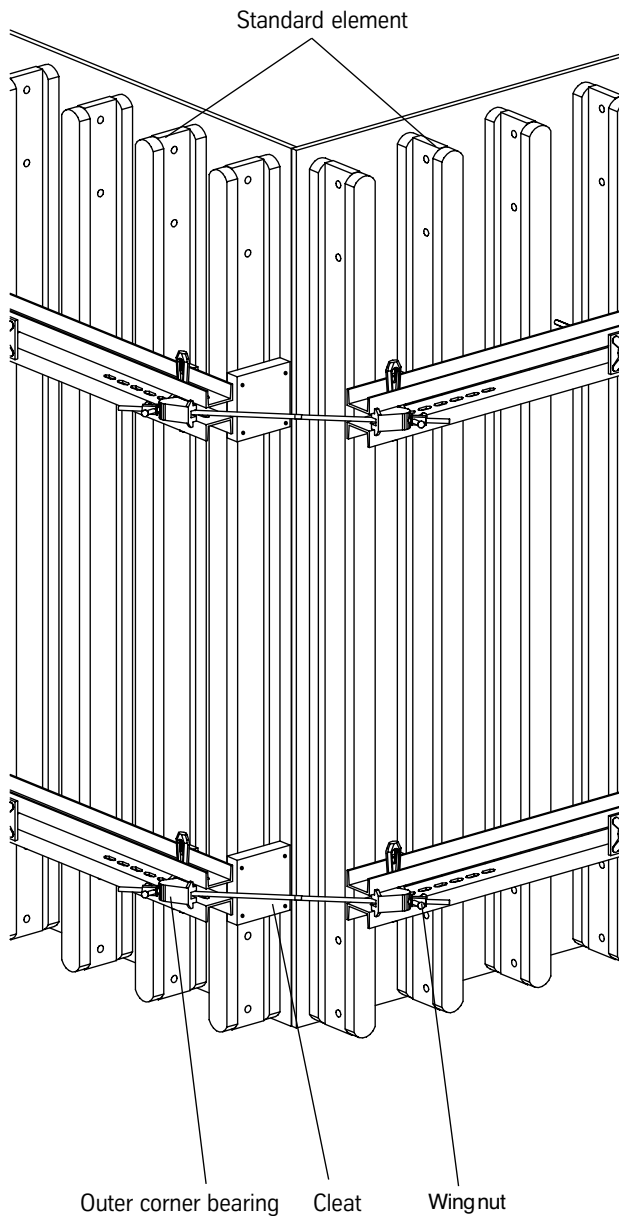
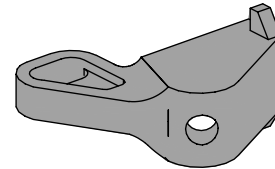
Outer corner

The standard outer corner is made from 2 standard elements.
 The timber cleat prevents an offset of the elements during tightening.
 The outer corner bearing can be fastened to the steel waler with the joining wedge (Art. No 505 241).
 Tightening the corner should be performed at an angle of 45° to the waler.

Note:

Outer corner bearing application: **min 40° to max. 50°.**

Outer corner bearing



Outer corner:

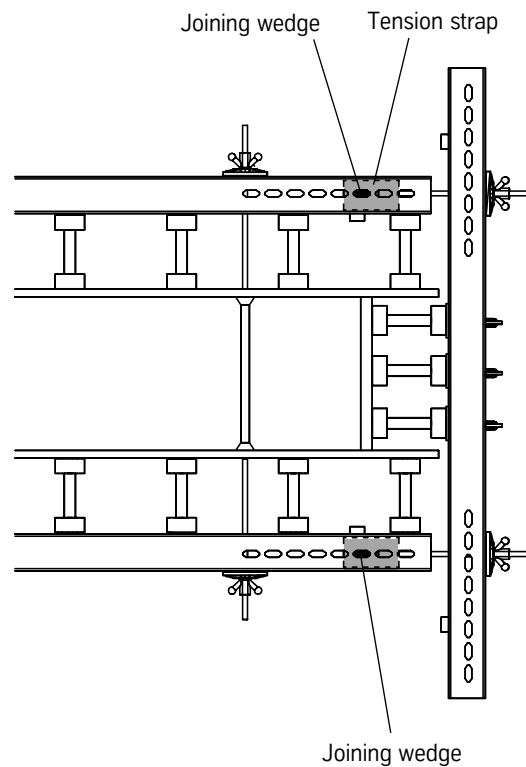
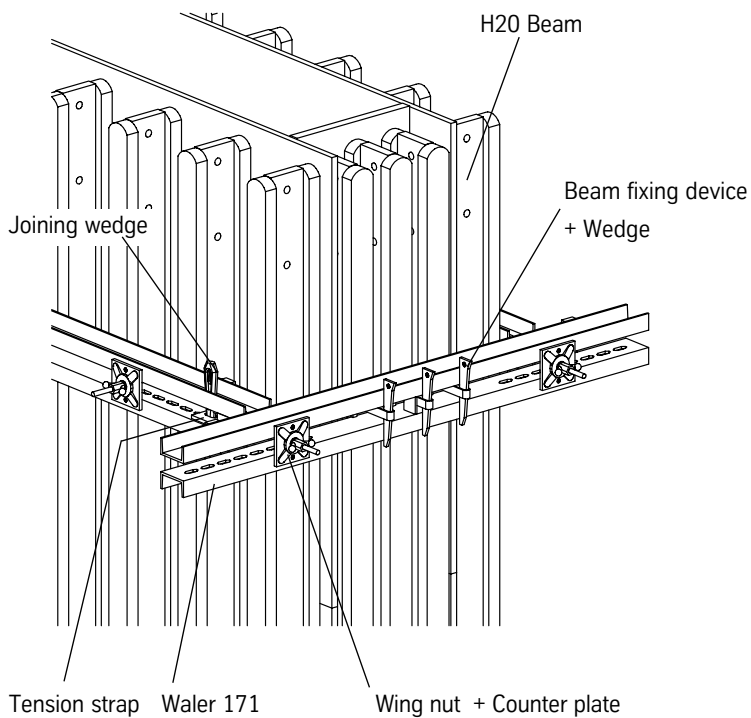
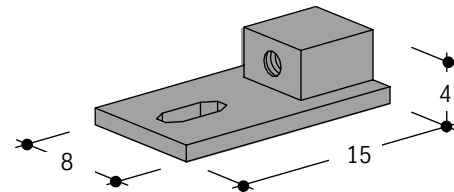
- Outer corner bearing Art. No: 504 865 (2x)*
- Joining wedge Art. No: 505 241 (2x)*
- Tie rod 100, Ø 1.5 cm Art. No: 024 387 (1x)*
- Wing nut Art. No: 509 618 (2x)*

*per each waler level

9.0 Stopend

The tension strap fits between the waler profiles of the standard elements and is fixed in place with the joining wedge.
The compression loads from fresh concrete are absorbed by the tie rods. Wing nut and counter plate allow for exact adjustment.
At least 2 additional H20 beams must be used for the stopend.

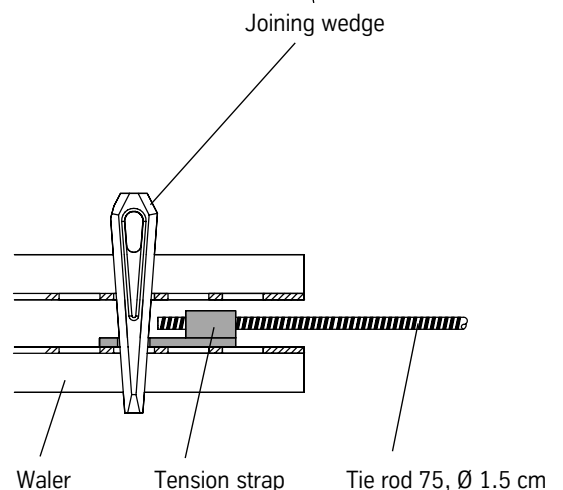
Tension strap



Stopend:

Tension strap	Art. No. 505 388 (2x)*
Joining wedge	Art. No. 505 241 (2x)*
Tie rod 75, Ø 1.5 cm	Art. No. 437 660 (2x)*
Wing nut	Art. No. 509 618 (2x)*
Counter plate 12/12	Art. No. 509 559 (2x)*
Beam fixing device	Art. No. 504 512 (3x)*
Wedge	Art. No. 504 497 (3x)*
Waler 171	Art. No. 503 908 (1x)*

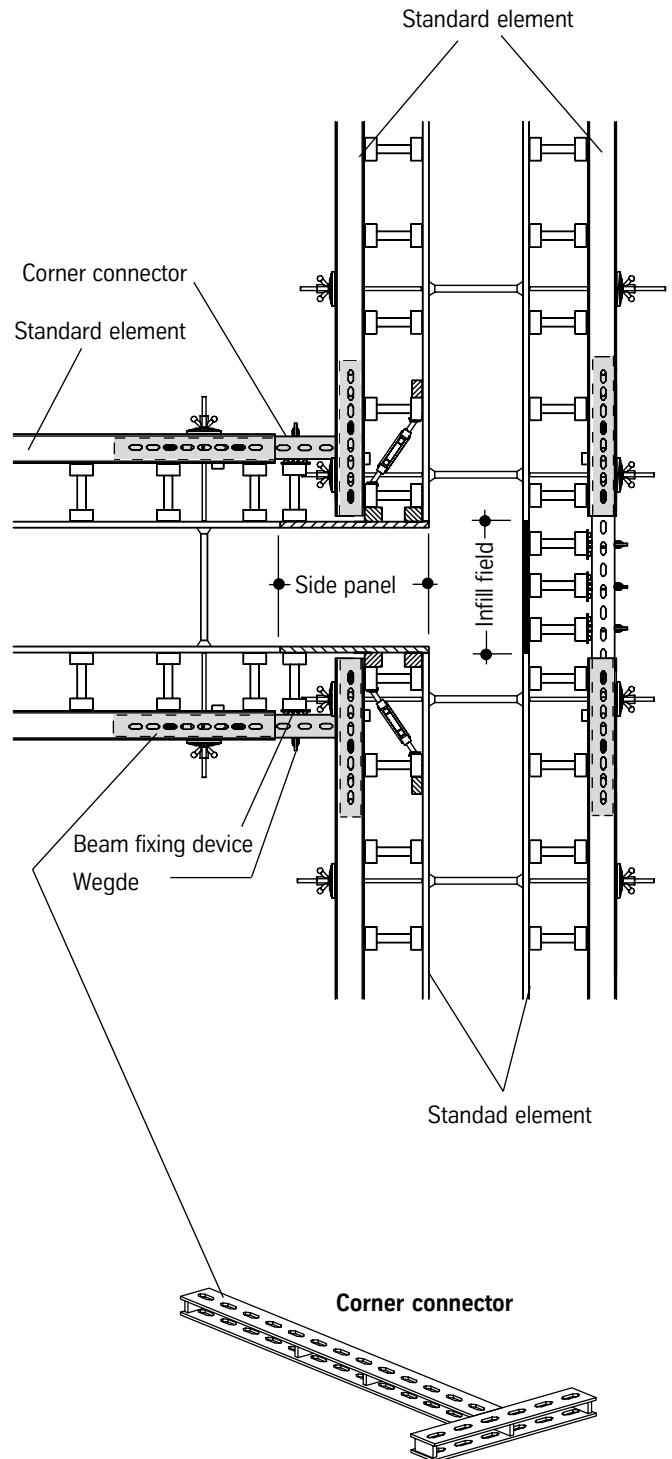
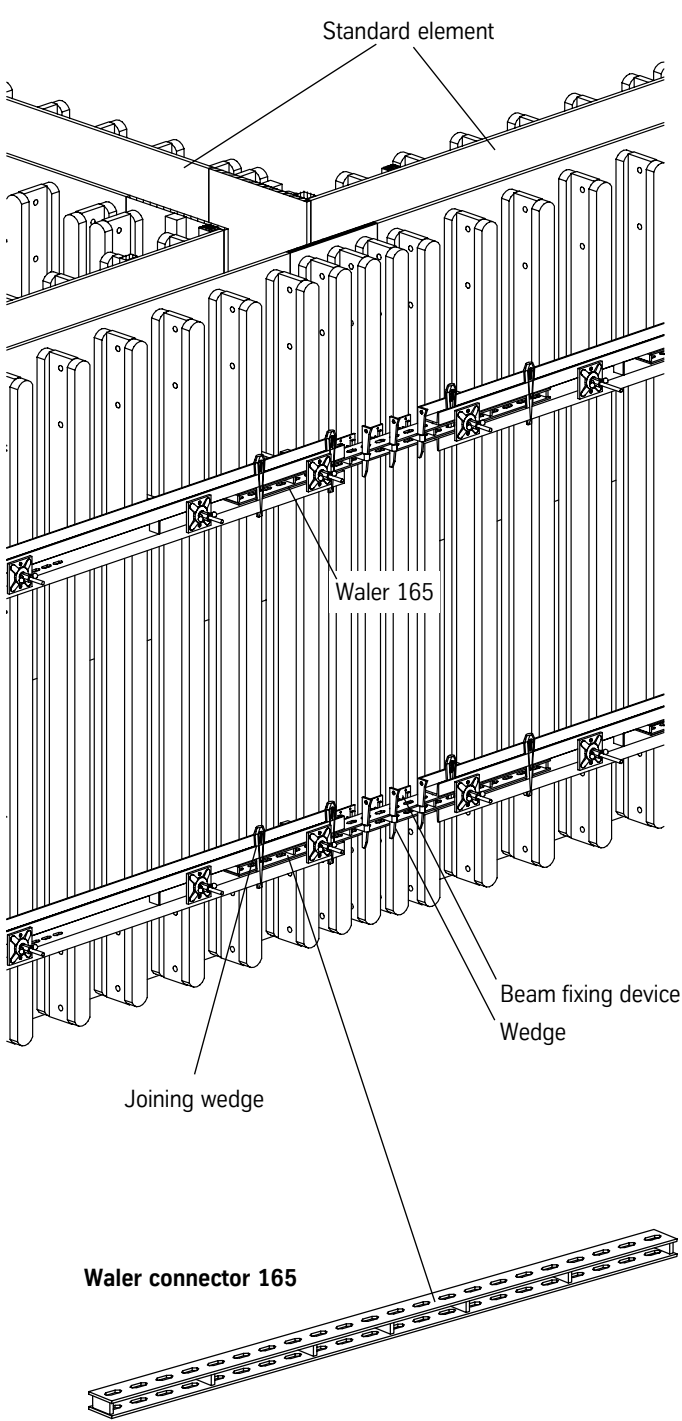
*per each waler level



10.0 T-Wall intersection

Constructing a T-wall intersection with standard elements and infill field. For the infill field, use waler connector 165 (Art. No. 505 296) (see page 16).

The inner corners are constructed in standard design (standard element with side panel) see page 17.



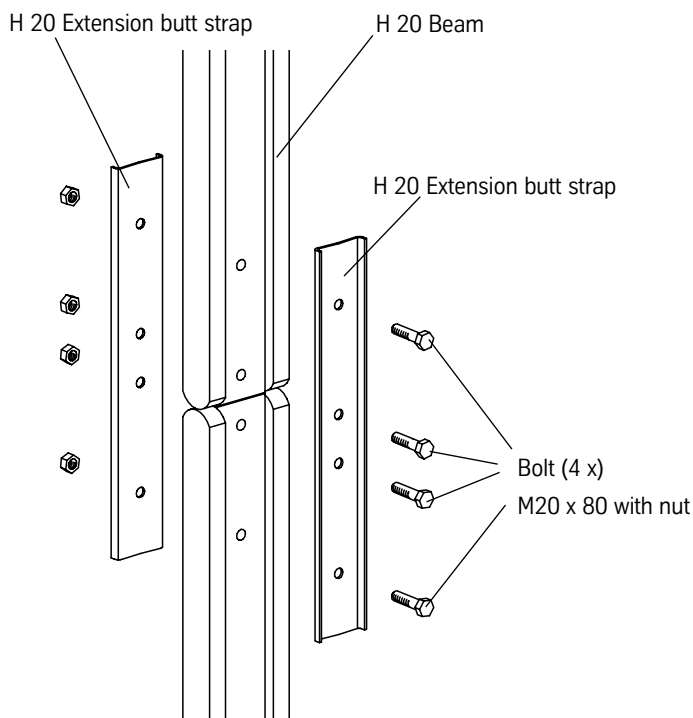
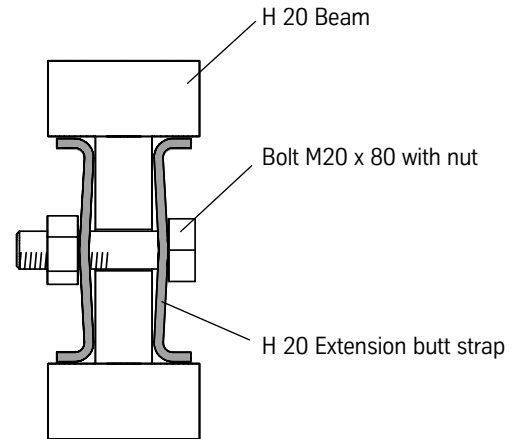
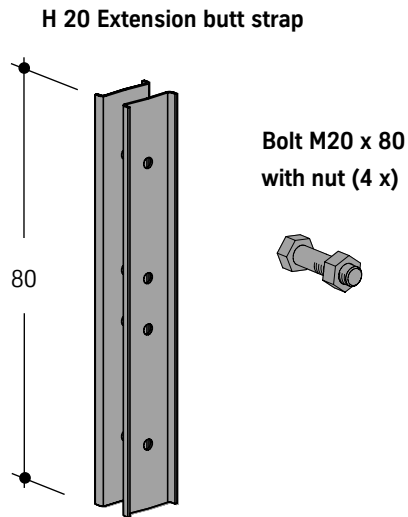
11.0 Height extension

The H 20 extension butt strap is used for extending elements. It forms a connection between individual beams and produces a tension- and compression resistant, rigid, aligned and offset-free joint between beams or elements.

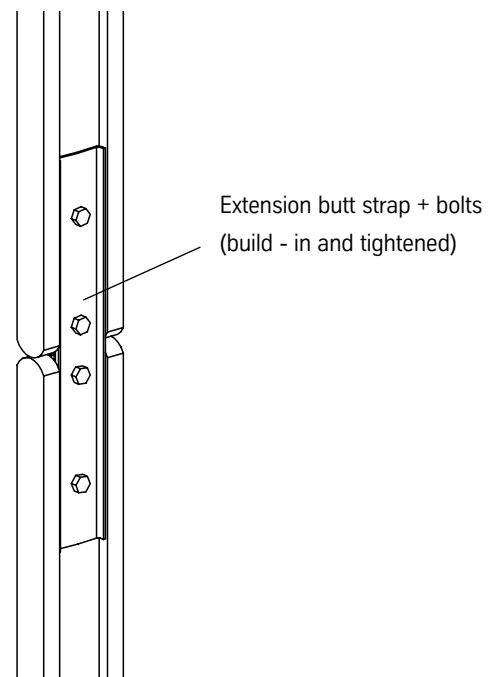
The extension butt strap has to be installed on each H 20 beam joint (exceptions are possible in individual cases, which must be carefully examined and precisely described).

Both members must be ordered in the following number:

- 2 x H 20 Extension butt straps
- 4 x Bolts M20 x 80 with nuts



Beam butt joint ready for use

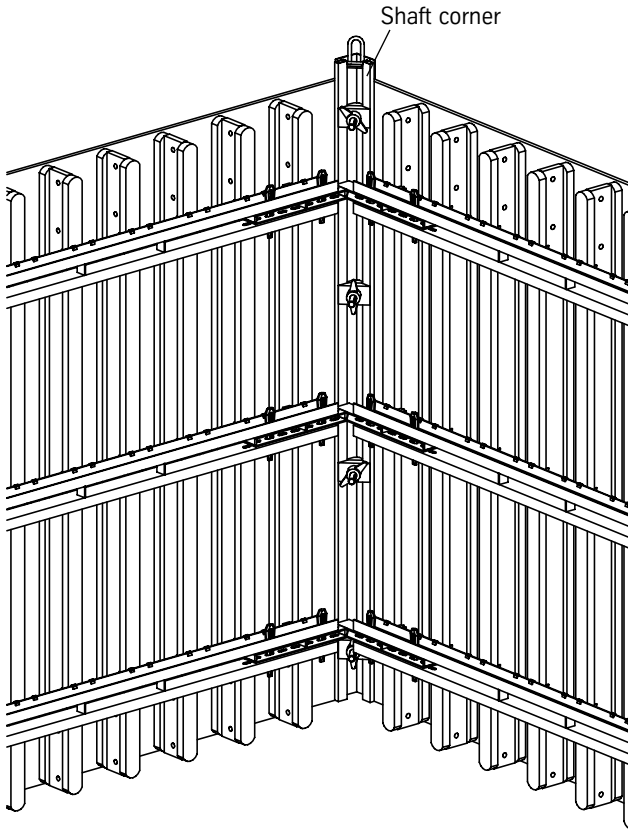


12.0 Shaft formwork

Shaft corner enable the inner corner of the formwork to be easily stripped.

The wall elements are provided with a protruding cantilever of the plywood supported by the shaft corner (see also detail below).

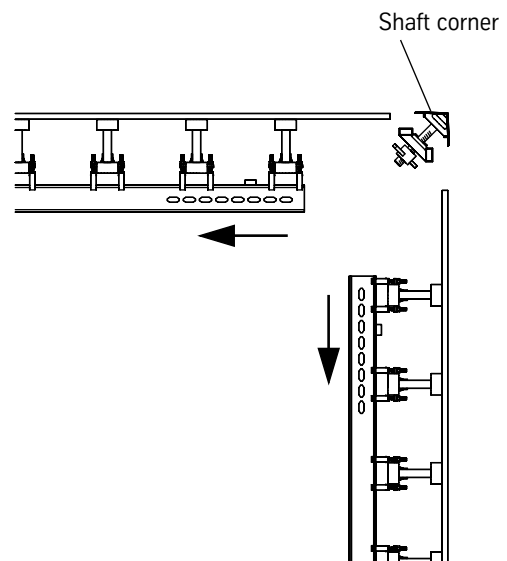
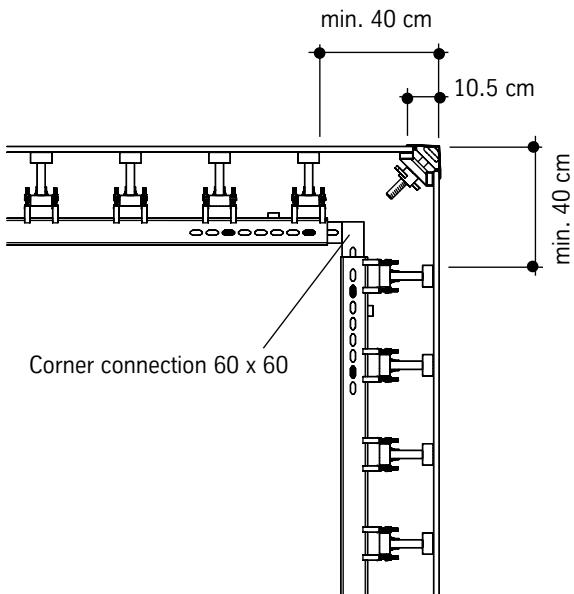
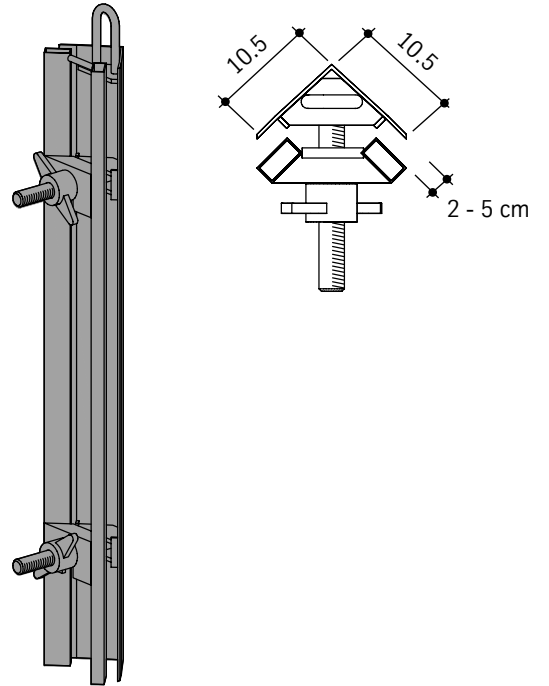
The rectangular connection of the walers is executed by means of the corner connector 60 x 60 plus 4 joining wedges.



Shaft corner 125

Shaft corner 300

Shaft corner 400



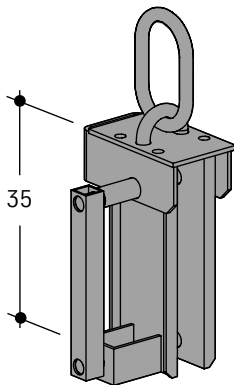
13.0 Crane hook

The H 20 crane hook is put onto the H 20 beam end and then secured by means of the integrated safety catch.

The lower pin of the safety catch must completely be inserted until it stops. The permissible loading capacity per H 20 Crane hook is:

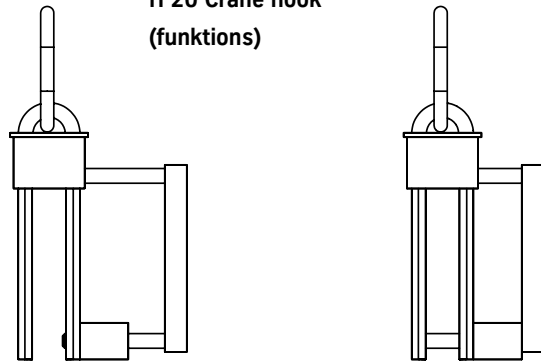
perm. F = 500 kg (5 kN)

H 20 Crane hook



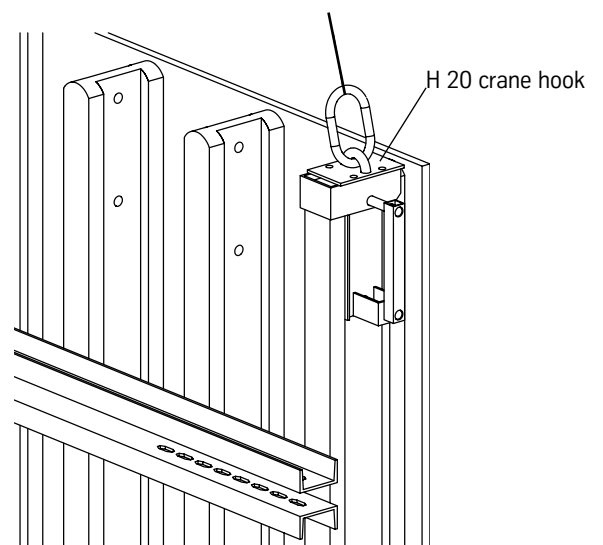
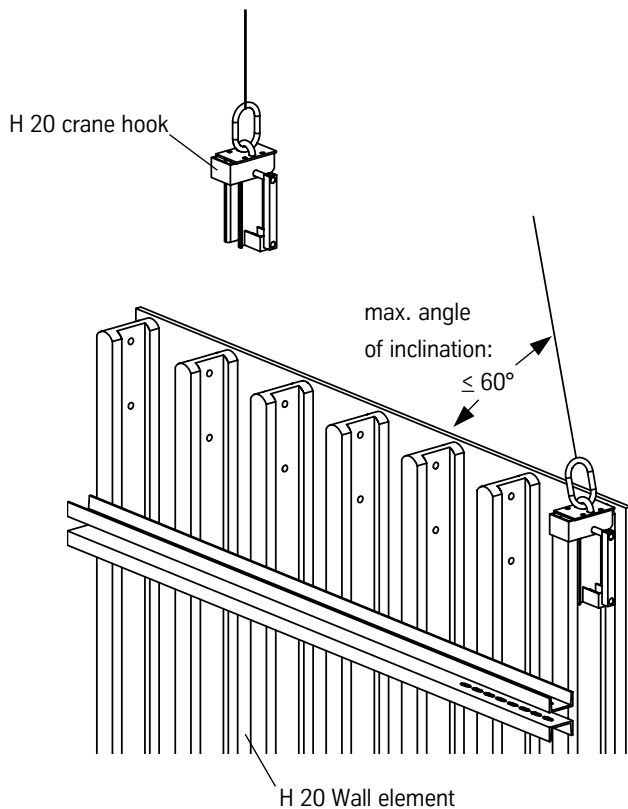
Operation instructions of the crane hook have to be followed!

H 20 Crane hook (funktionen)



Safety catch (pulled out)

Safety catch (tightly inserted)



14.0 HT-Walkway bracket

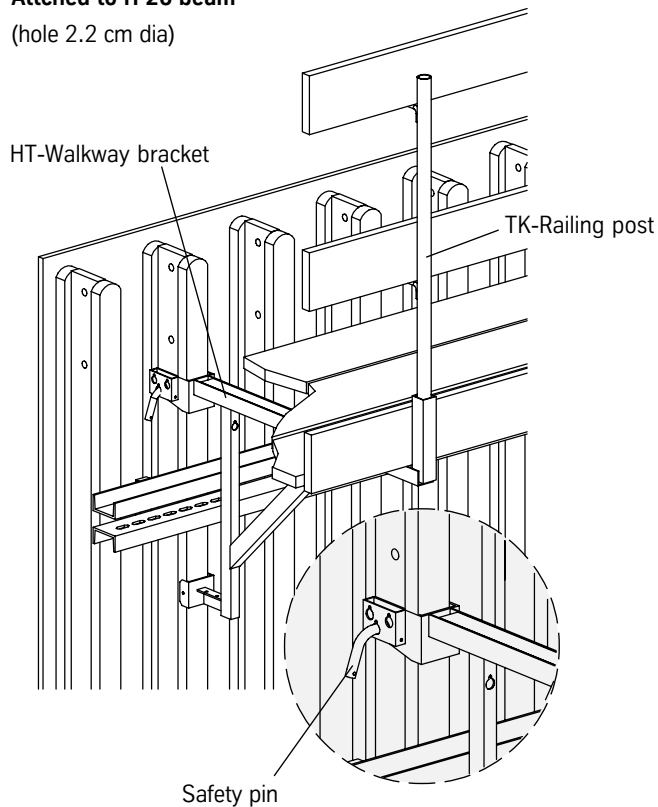
The HT walkway bracket offers a working width of about 90 cm and is produced as a ready-to-use scaffold bracket with a loose railing post (TK railing post, Art. No. 193 220, has to be ordered additionally).

The HT walkway bracket is provided with a wooden lath for fastening planks and with a safety pin for fixing the suspension head.

There are 3 different possibilities of attaching the HT bracket to the formwork:

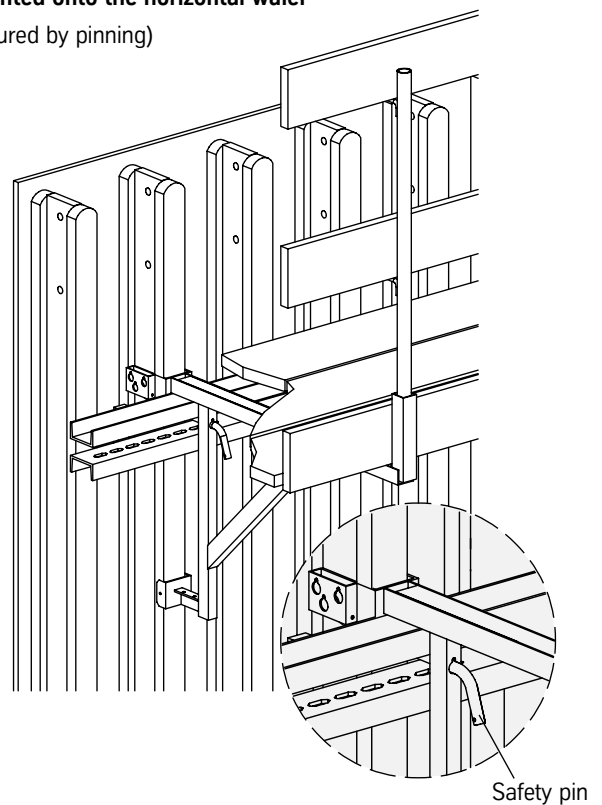
1. Attached to H 20 beam

(hole 2.2 cm dia)



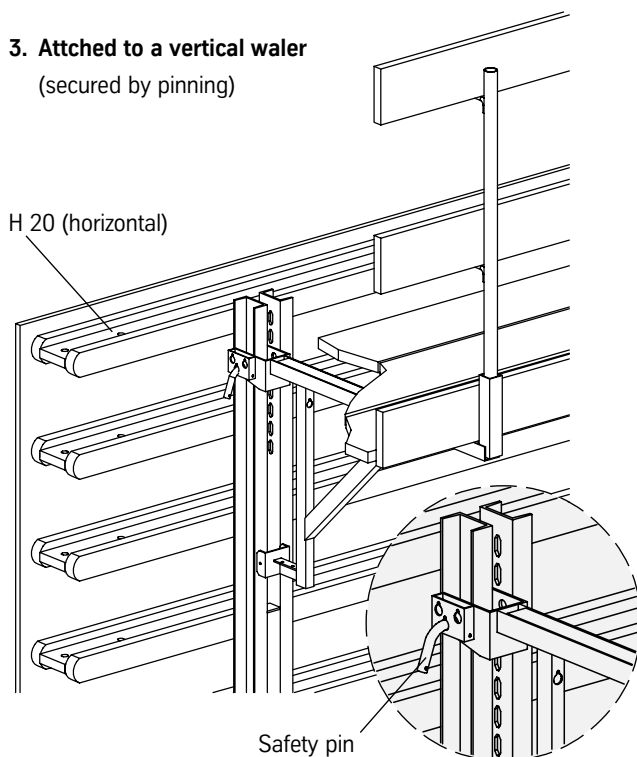
2. Mounted onto the horizontal waler

(secured by pinning)



3. Attached to a vertical waler

(secured by pinning)



Plank dimensions and board thicknesses for guard rail should meet the needs of the specific construction site situation.

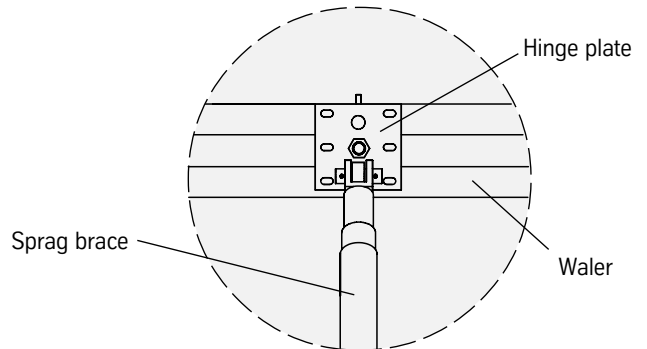
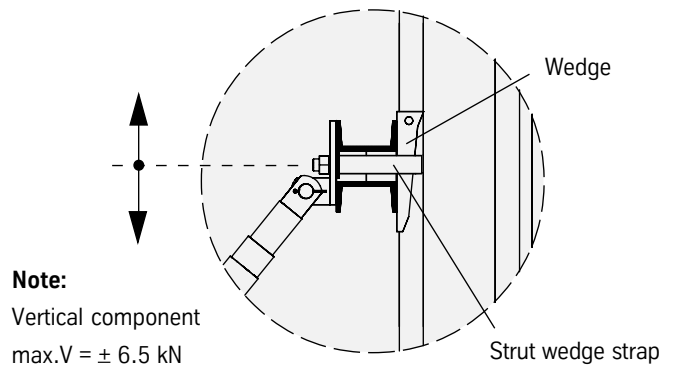
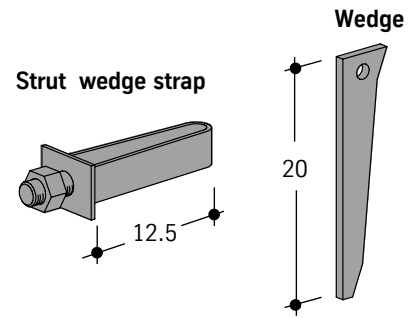
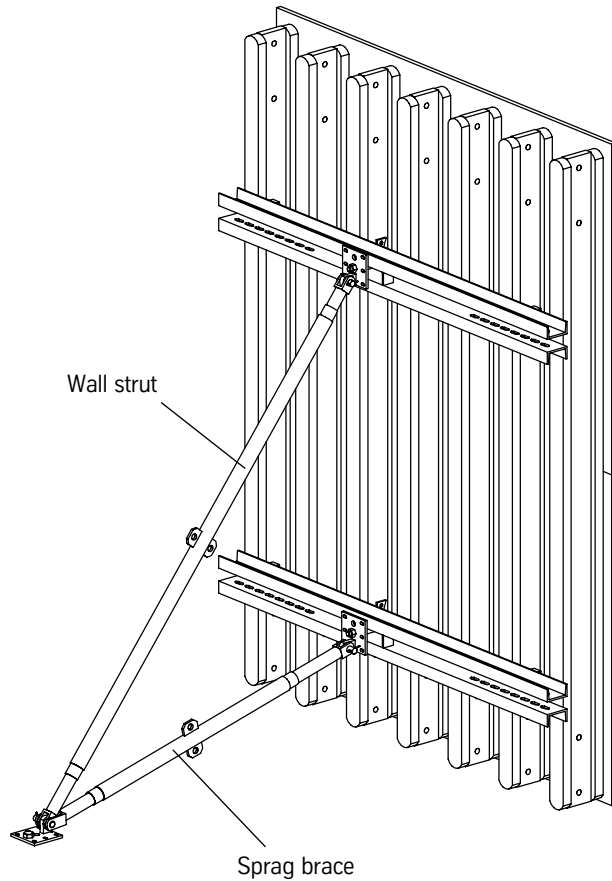
Max. distance between walkway brackets: **1.50 m**.

The walkway bracket is designed for Scaffolding Group 2, in line with DIN 4420, Part 1, Edition 12/90.

15.0 Strutting the formwork

Wall struts with sprag braces

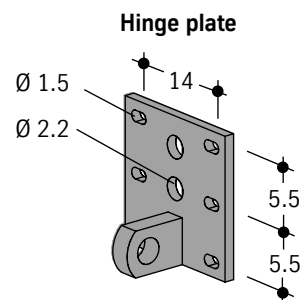
Used for aligning and supporting the formwork. They are tension- and compression-resistant in picking up and diverting wind load. Wall strut and sprag brace are supplied separately. The strut wedge strap and wedge are used for fastening them to the waler.



Wall strut

with double spindle and two hinge plate

Size	Art. No.	min. L (m)	perm. F (kN)	max. L (m)	perm. F (kN)
1	506 500	1.76	40	2.40	26
2	506 420	2.20	31	2.90	17
3	506 430	2.70	20	3.40	13
4	506 463	3.20	14	3.90	9
5	506 485	4.20	10	4.90	7
6	506 555	5.30	13	5.90	10



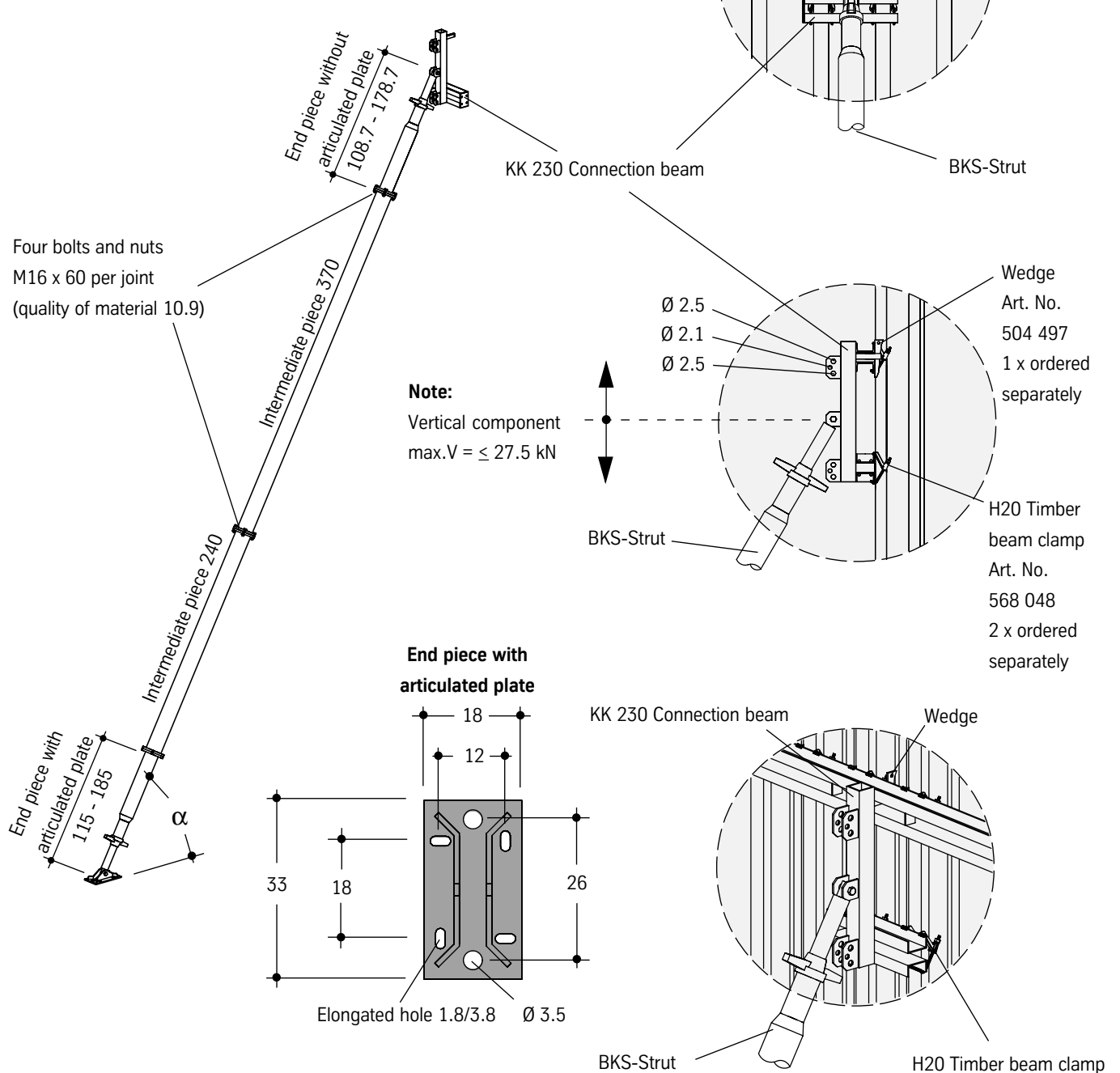
Sprag brace

with double spindle and one hinge plate

Size	Art. No.	min. L (m)	perm. F (kN)	max. L (m)	perm. F (kN)
1	506 511	1.15	47	1.65	36
2	506 433	1.70	40	2.40	26

Aligning strut BKS

The BKS aligning struts are suitable for tension- and compression-resistant alignment of high or height- extended wall elements. The BKS struts consist of individual components which can be joined to make up the combinations shown below (Types 1 to 7). Permitted loads are also shown in the table.



Technical data of the BKS aligning struts

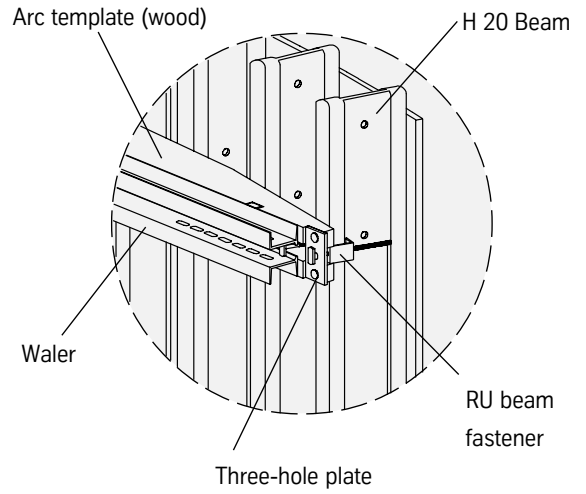
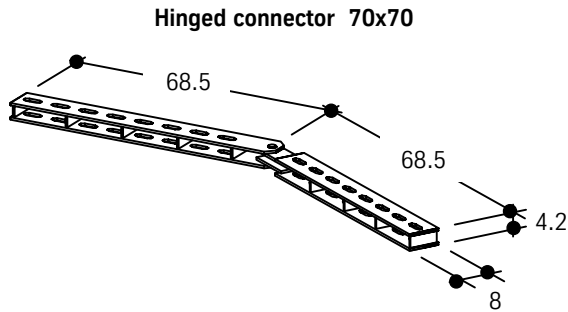
Type	Length [cm]		perm. Load [kN] fully extended	number of end pieces		number of intern. piece	
	min.	max.		with art. 489 102	without art. 489 775	short (240 cm) 489 113	long (370 cm) 489 124
BKS 4	703.7	843.7	25			2	-
BKS 5	833.7	973.7	22	per 1	per 1	1	1
BKS 6	963.7	1103.7	17.5			-	2
BKS 7	1073.7	1213.7	15			2	1

Attention:
Vertical component
 $\max.V = \leq 27.5 \text{ kN}$

16.0 Circular formwork

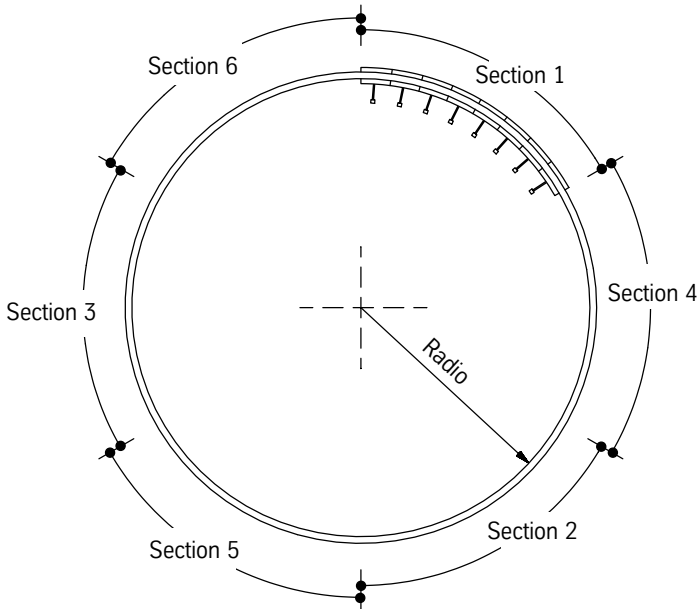
H 20 elements which are in a polygonal arrangement (e.g. circular shuttering) can be connected with one another using the hinged connectors.

They are secured by inserting the joining wedges into the cam walers.



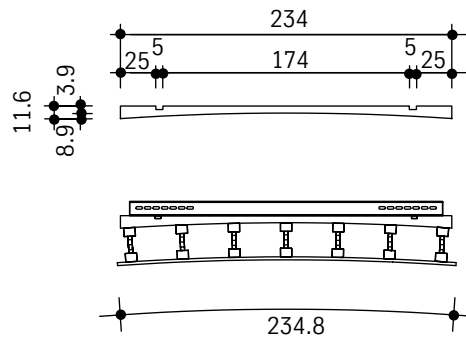
Example:

Sequence of construction for circular structure.

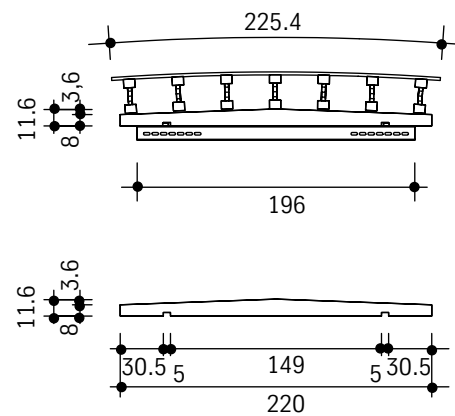


Arc templates:

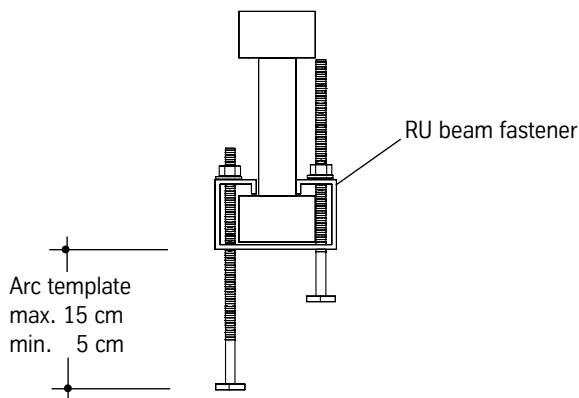
Outer element

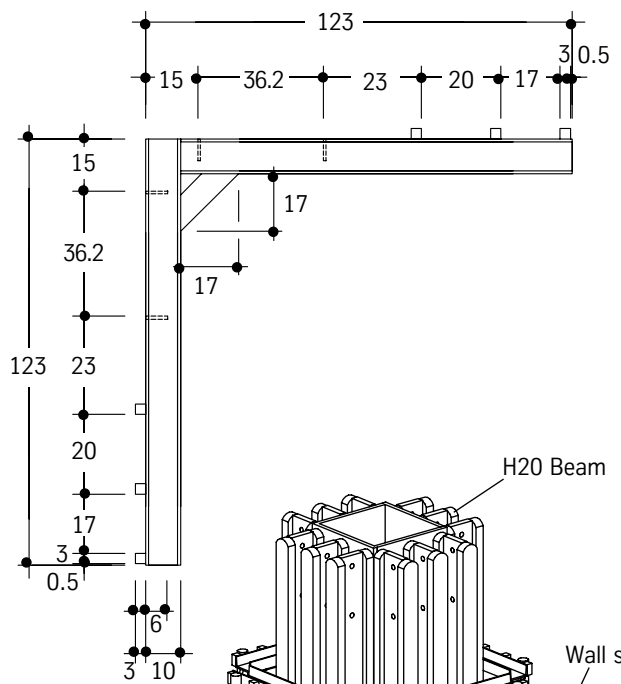
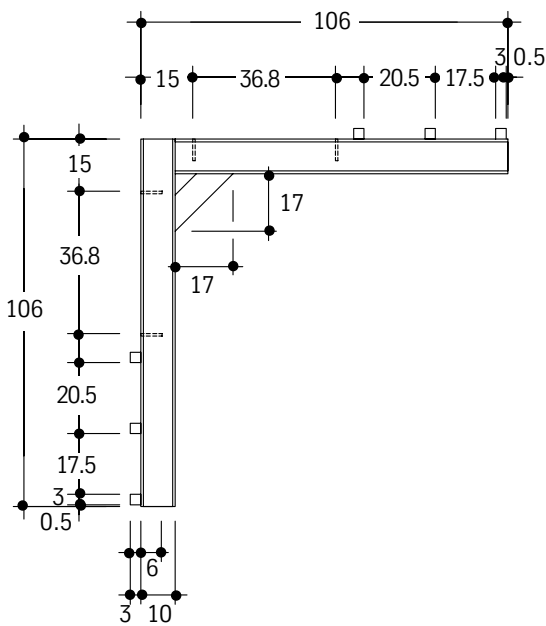
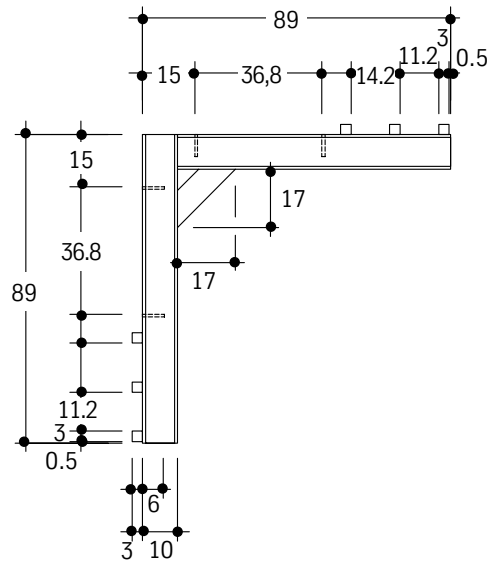
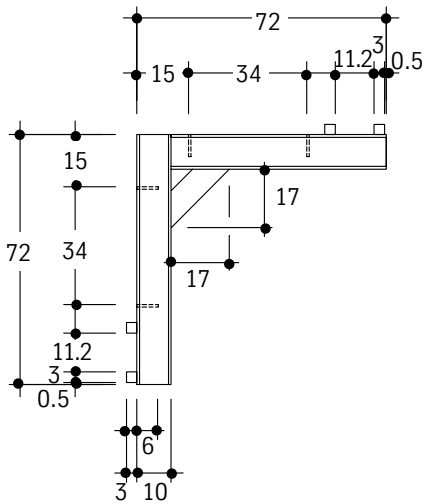


Inner element

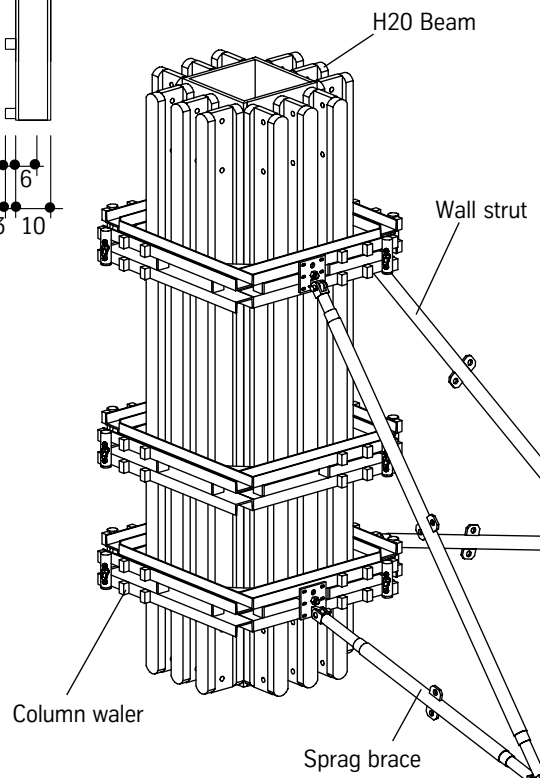
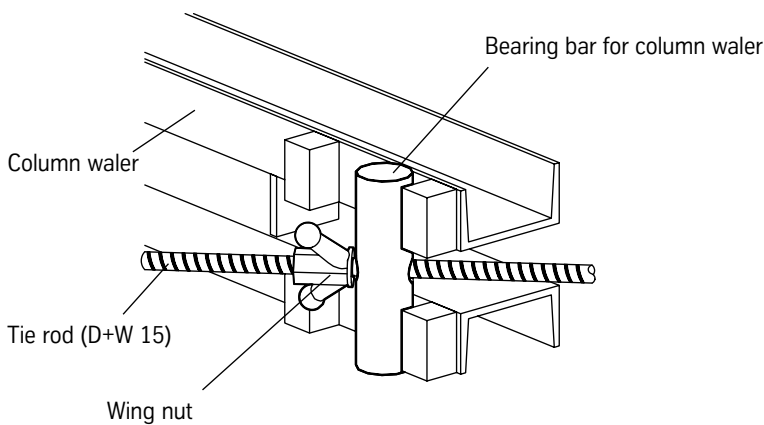


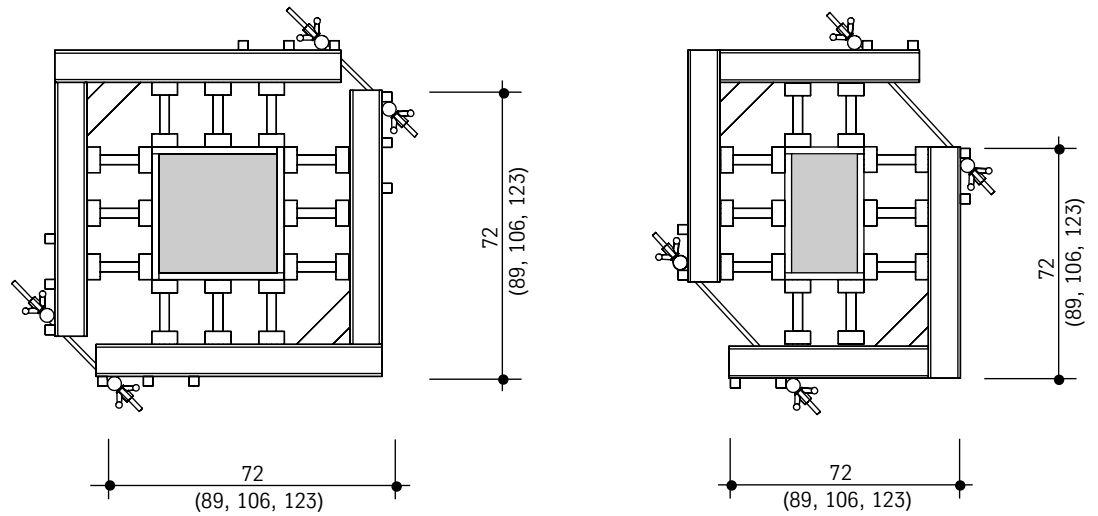
Outer radius
Inner radius





Corner tensioning

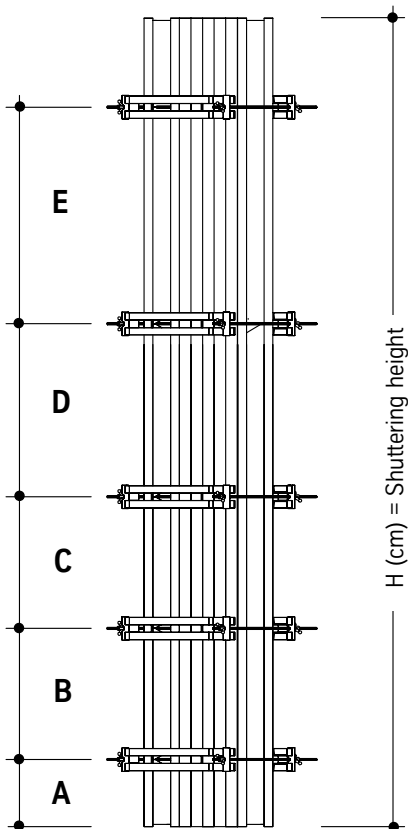




with column waler [cm]	square cross-sections		rectangular cross-sections	
	from	to	from	to
72 / 72	20 / 20	36 / 36	20 / 20	20 / 36
89 / 89	37 / 37	53 / 53	20 / 37	20 / 53
106 / 106	54 / 54	70 / 70	20 / 54	20 / 70
123 / 123	71 / 71	87 / 87	20 / 71	20 / 87

The column walers and H20 beams are connected with H20 timber beam clamps.

Table for column formwork
with a maximum concrete pressure of 80 kN/m²



h	A	B	C	D	E
245	45	130			
265	45	130			
290	30	100	100		
330	30	100	100		
360	30	100	130		
390	30	100	130		
450	30	90	100	130	
490	30	90	100	130	
590	30	90	90	130	130

Number of H 20 beams

Column width (cm)	20	30	40	50	60	70	87
Number of beams per side	2	2	3	3	4	4	5

(max. spacing of H 20 beams: e = 23 cm)

Note:

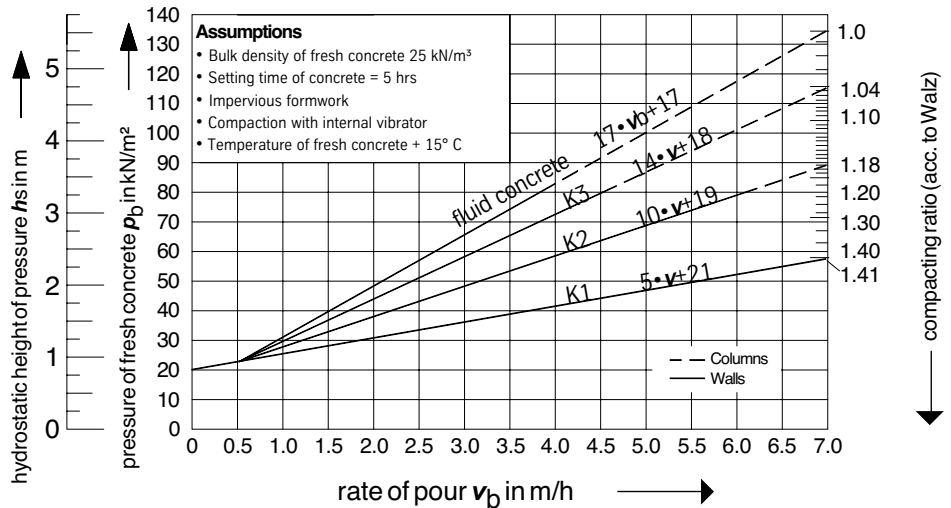
21.0 mm plywood is subject to this column formwork.

Fresh concrete pressure diagram

Diagram for determining the fresh concrete pressure (p_b) on formwork in relation to the rate of pour (v_b) and consistency "K" of fresh concrete (acc. to DIN 18218).

Legend

- K3 = KR = smooth concrete
- K2 = KP = plastic concrete
- K1 = KS = stiff concrete



General notes and explanations regarding the use of load tables on page 31 and 32.

1. There are always three different figures of concrete pressure (40, 50 and 60 kN/m²) for the execution of H 20 wall elements.
2. The wall heights of the elements are shown as static beam systems with fixed arrangements of the walers (A, B, C, D, E,). All dimensions given in the load tables are actual distances between the walers.
The initial height at the bottom is always 40 cm.
3. The execution of the H 20 wall elements defined with element numbers between 1 and 41 is based on shuttering skin (plywood) with 18 mm thickness (Modulus of elasticity is assumed with appr. 700 kN/cm²).
4. There are 2 different figures to be found for the spacing of H 20 beams, namely
 - a. determined by plywood 18 mm
 - b. determined by statical values of H 20
 For the execution of elements, the smaller figures have been taken into consideration.
5. The loading on the walers (A, B, C, etc.) are stated as linear load [kN/m].
6. At the bottom of each load table, the relevant element numbers (from 1 to 41) are shown. The element number depends on the concrete pressure to be allowed and on the 9 different element widths (**B**) which are based on the nine different F-waler lengths (see page 31).

Notes and explanations with regard to the execution of elements on page 33 and 34.

1. On page 33, all constructional details which are important for the element design can be found (length of walers, element widths, nos. of H 20 beams, exact spacing of beams, etc.)
The fourth vertical column on page 24 contains the element numbers between 1 and 41 which are also given in the load tables. The arrangement of H 20 beams is based on the details shown at the bottom on **page 15** (item 4: attaching the shuttering skin).
2. From page 34 the typical arrangements of wall ties can be taken (A, C, C/2, C1, C2, D, E,) for each element number. The tying schemes 1, 3 and 4 are fully symmetrical. When using tying scheme 2, pay attention to wall elements of the same **length B** facing each other because this tying is not symmetrical.
3. Tie rods D+W 15 mm dia. have to be applied for all elements (perm. load **F = 90 kN** per wall tie).

19.0 Load tables



fresh concrete pressure pb [kN/m ²]		40	50	60	40	50	60	40	50	60	40	50	60		
wall element system		①			②			③			④.1				
The heights of the wall elements shown in the statical systems are based on standard H20 beam lengths between 2.45 m and 5.90 m. Element widths "B" from 1.0 m to 3.0 m can be used in steps of 25 cm (see also below).															
height of wall element [cm]:		245			265			290			330				
perm. beam spacing acc. to plywood 18 mm [cm]		44	35	30	37	35	30	37	35	30	32	28	24		
perm. beam spacing acc. to H 20 values [cm]		59	53	49	49	48	45	40	38	35	32	28	24		
linear load on waler [kN/m] at		A	33.7	40.6	43.7	34.8	43	48.2	38.7	48.4	55.6	47.5	59.4	69.4	
		B	32.3	31.9	31.3	39.2	39.5	38.8	45.3	46.6	46.4	52.5	55.6	56.6	
		C	-	-	-	-	-	-	-	-	-	-	-	-	-
		D	-	-	-	-	-	-	-	-	-	-	-	-	-
		E	-	-	-	-	-	-	-	-	-	-	-	-	-
relevant Element-No. for the execution of wall elements depending on waler length (element width B) and concrete pressure. (see also page 30 and 31)	element width B [cm]	100	2	2	2	2	2	2	2	2	2	2	2	3	
		125	4	5	5	4	5	5	4	5	5	5	5	6	
		150	8	8	9	8	8	9	8	8	9	9	9	10	
		175	12	12	13	12	12	13	12	12	13	12	13	14	
		200	16	17	18	16	17	18	16	17	18	17	18	19	
		225	21	21	22	21	21	22	21	21	22	22	23	24	
		250	26	26	27	26	26	27	26	26	27	27	28	29	
		275	31	32	33	31	31	33	31	32	33	33	34	35	
		300	37	38	39	37	37	39	37	38	39	38	40	41	

fresh concrete pressure pb [kN/m ²]		40	50	60	40	50	60	40	50	60	40	50	60	
wall element system		④.2			⑤.1			⑤.2			⑥			
The heights of the wall elements shown in the statical systems are based on standard H20 beam lengths between 2.45 m and 5.90 m. Element widths "B" from 1.0 m to 3.0 m can be used in steps of 25 cm (see also below).														
height of wall element [cm]:		330			360			360			390			
perm. beam spacing acc. to plywood 18 mm [cm]		37	35	30	28	25	21	37	35	35	37	35	30	
perm. beam spacing acc. to H 20 values [cm]		52	49	41	22	20	18	48	42	35	44	39	33	
linear load on waler [kN/m] at		A	33.7	42.3	51	50.8	64	75.8	36.9	46	55.3	37.3	46.6	56.2
		B	30	36.3	38.8	61.2	66	68.2	34	42.7	47.8	43.7	54.8	62.5
		C	36.3	36.4	36.3	-	-	-	41.1	41.3	40.9	42.9	43.6	43.3
		D	-	-	-	-	-	-	-	-	-	-	-	-
		E	-	-	-	-	-	-	-	-	-	-	-	-
relevant Element-No. for the execution of wall elements depending on waler length (element width B) and concrete pressure. (see also page 30 and 31)	element width B [cm]	100	2	2	2	2	3	3	2	2	2	2	2	2
		125	4	5	5	5	6	-	4	5	5	4	5	5
		150	8	8	9	9	10	-	8	8	9	8	8	9
		175	12	12	13	13	14	-	12	12	13	12	12	13
		200	16	17	18	18	19	-	16	17	18	16	17	18
		225	21	21	22	23	24	-	21	21	22	21	21	22
		250	26	26	27	28	29	-	26	26	27	26	26	27
		275	31	32	33	34	35	-	31	32	33	31	32	33
		300	37	38	39	40	41	-	37	38	39	37	38	39

19.0 Load tables

fresh concrete pressure p_b [kN/m ²]		40	50	60	40	50	60	40	50	60	40	50	60	
wall element system		(7.1)			(7.2)			(8.1)			(8.2)			
The heights of the wall elements shown in the statical systems are based on standard H 20 beam lengths between 2.45 m and 5.90 m. Element widths "B" from 1.0 m to 3.0 m can be used in steps of 25 cm (see also below).														
height of wall element [cm]:		450			450			490			490			
perm. beam spacing acc. to plywood 18 mm [cm]		33	27	22	37	35	30	31	25	21	37	35	30	
perm. beam spacing acc. to H 20 values [cm]		33	27	22	51	42	35	31	25	21	40	39	36	
linear load on waler [kN/m] at		A	42.9	53.5	64.5	34.9	43.5	52.1	42.4	52.9	63.8	35.9	44.9	53.8
		B	61.5	76.9	89.4	39.7	50.1	60.6	70.8	89	104.7	39.9	49.6	60.1
		C	43.7	44.6	44.1	42.1	50.2	54.5	50.8	53.1	53.6	41.4	52.5	60.2
		D	-	-	-	31.2	31.1	30.8	-	-	-	46.8	48	48
		E	-	-	-	-	-	-	-	-	-	-	-	-
relevant Element-No. for the execution of wall elements depending on waler length (element width B) and concrete pressure. (see also page 30 and 31)	element width B [cm]	100	2	3	3	2	2	2	2	3	3	2	2	2
		125	5	5	6	4	5	5	5	6	-	4	5	5
		150	8	9	10	8	8	9	9	10	-	8	8	9
		175	12	13	-	12	12	13	13	14	-	12	12	13
		200	17	18	-	16	17	18	17	19	-	16	17	18
		225	22	23	-	21	21	22	22	24	-	21	21	22
		250	27	28	-	26	26	27	27	29	-	26	26	27
		275	32	34	-	31	32	33	33	35	-	31	32	33
		300	38	40	-	37	38	39	39	41	-	37	38	39

fresh concrete pressure p_b [kN/m ²]		40	50	60	40	50	60	40	50	60	40	50	60
wall element system		(9.1)			(9.2)								
The heights of the wall elements shown in the statical systems are based on standard H 20 beam lengths between 2.45 m and 5.90 m. Element widths "B" from 1.0 m to 3.0 m can be used in steps of 25 cm (see also below).													
height of wall element [cm]:		590			590								
perm. beam spacing acc. to plywood 18 mm [cm]		37	30	25	44	39	32						
perm. beam spacing acc. to H 20 values [cm]		37	30	25	47	39	32						
linear load on waler [kN/m] at		A	39	48.8	58.5	35.5	44.4	53.3					
		B	58.4	72.7	87.6	42	52.5	62.8					
		C	55.6	70.6	82.9	45.1	56.4	68.2					
		D	51	52.8	53	41.7	51.6	57.9					
		E	-	-	-	39.7	40.1	39.8					
relevant Element-No. for the execution of wall elements depending on waler length (element width B) and concrete pressure. (see also page 30 and 31)	element width B [cm]	100	2	2	3	1	2	2					
		125	4	5	6	4	5	5					
		150	8	9	10	8	8	9					
		175	12	13	14	12	12	13					
		200	16	18	19	16	17	18					
		225	21	22	24	21	21	22					
		250	26	27	29	26	26	27					
		275	31	33	35	31	32	33					
		300	37	39	41	37	38	39					

(Part 1)

Arrangement and spacing of H20 beams

*spacing allowed only with plywood 21 mm thick

designation and design of elements		ele- ment no.	nos. of H20 pcs./ element	H20 spacing due to element width			
waler [cm]	B [cm]			(B=element width) element system	F [cm]	$B = F + M + F$ $M = n \times e$ [cm] (M = division measure, e = beam spacing)	F [cm]
96	100		1*	3	9	2 x 41	9
			2	4	9	3 x 27.3	9
			3	5	9	4 x 20.5	9
121	125		4	4	9	3 x 35.7	9
			5	5	9	4 x 26.8	9
			6	6	9	5 x 21.4	9
146	150		7*	4	9	3 x 44	9
			8	5	9	4 x 33	9
			9	6	9	5 x 26.4	9
			10	7	9	6 x 22	9
171	175	<p>F = 9 cm e = beam spacing (centre to centre H20)</p>	11*	5	9	4 x 39.3	9
			12	6	9	5 x 31.4	9
			13	7	9	6 x 26.2	9
			14	8	9	7 x 22.4	9
196	200		15*	5	9	4 x 45.5	(9)
			16	6	9	5 x 36.4	9
			17	7	9	6 x 30.3	9
			18	8	9	7 x 26	9
			19	9	9	8 x 22.8	9
221	225		20*	6	9	5 x 41.4	9
			21	7	9	6 x 34.5	9
			22	8	9	7 x 29.6	9
			23	9	9	8 x 25.9	9
			24	10	9	9 x 23	9
246	250		25*	7	9	6 x 38.7	9
			26	8	9	7 x 33.1	9
			27	9	9	8 x 29	9
			28	10	9	9 x 25.8	9
			29	11	9	10 x 23.2	9
271	275		30*	7	9	6 x 42.8	9
			31	8	9	7 x 36.7	9
			32	9	9	8 x 32.1	9
			33	10	9	9 x 28.6	9
			34	11	9	10 x 25.7	9
			35	12	9	11 x 23.4	9
			36*	8	9	7 x 40.3	9
296	300		37	9	9	8 x 35.3	9
			38	10	9	9 x 31.3	9
			39	11	9	10 x 28.2	9
			40	12	9	11 x 25.6	9
			41	13	9	12 x 23.5	9

F = fixed measure (at beginning and end)

(Part 2)

Dimensional division and arrangement of wall ties

element no.	relevant tying scheme (shown right)	distance of wall ties (depending on element width an nos.)								Examples of the different tying schemes ○ = type of scheme
		A [cm]	C [cm]	C/2 [cm]	C ₁ [cm]	C ₂ [cm]	D [cm]	E [cm]	A [cm]	
1	①	25	50	---	---	---	---	---	25	①
2	①	25	50	---	---	---	---	---	25	
3	①	19	62	---	---	---	---	---	19	
4	①	25	75	---	---	---	---	---	25	
5	①	25	75	---	---	---	---	---	25	
6	①	19	87	---	---	---	---	---	19	
7	①	33	84	---	---	---	---	---	33	
8	①	33	84	---	---	---	---	---	33	
9	①	28	94	---	---	---	---	---	28	
10	①	40	70	---	---	---	---	---	40	
11	①	40	95	---	---	---	---	---	40	
12	①	33	109	---	---	---	---	---	33	
13	①	44	87	---	---	---	---	---	44	
14	②	19	---	---	67	70	---	---	19	
15	①	45	110	---	---	---	---	---	45	
16	①	38	124	---	---	---	---	---	38	
17	①	48	104	---	---	---	---	---	48	
18	②	27	---	---	71	75	---	---	27	
19	②	40	---	---	52	68	---	---	40	
20	①	43	138	---	---	---	---	---	43	
21	①	52	128	---	---	---	---	---	52	
22	②	32	---	---	79	82	---	---	32	
23	②	43	---	---	61	78	---	---	43	
24	②	40	---	---	71	74	---	---	40	
25	①	56	138	---	---	---	---	---	56	
26	①	56	138	---	---	---	---	---	56	
27	②	46	---	---	71	87	---	---	46	
28	③	43	---	82	---	---	---	---	43	
29	②	41	---	---	76	92	---	---	41	
30	②	44	---	---	85	102	---	---	44	
31	③	39	---	98.5	---	---	---	---	37,5	
32	②	50	---	---	79	96	---	---	50	
33	③	46	---	91.5	---	---	---	---	46	
34	②	45	---	---	84	101	---	---	45	
35	④	42	---	---	---	---	69	53	42	
36	③	42	---	108	---	---	---	---	42	
37	②	37	---	---	105	121	---	---	37	
38	③	50	---	100	---	---	---	---	50	
39	②	46	---	---	96	112	---	---	46	
40	④	45	---	---	---	---	75	60	45	
41	④	41	---	---	---	---	74	70	41	

At tie loads $F > 90$ kN use only tie rods D+W 20. (perm. $F = 150$ kN)

Important features of the H 20 large-area formwork

1. Basic assembly

The steel walers are fastened to the H 20 timber beams by means of H 20 timber beam clamps. Fastening is possible at any section of the steel walers.

Advantage: Quick and inevitable assembly and disassembly. Safe connection.

2. Element connection

Adjacent elements are joined with waler connectors and joining wedges.

Advantage: Connections are proof against tension and compression, aligned and resistant against bending.

3. Adaptability

The variable adaptation of H 20 beams and steel walers makes the flexible arrangement to any shape of ground plan possible. The 165 cm long waler connector allows length adjustments of up to 80 cm.

Advantage: Adequate adaptation to concrete pressure, disturbing sections and adjustments.

4. Tying

Wall ties can be positioned accord. to static requirements or as required by the concrete structure itself. Page 34 shows recommended tying schemes for standard elements.

Advantage: Disturbing sections can simply be solved.

5. Height extension

Wall elements can be extended at height by means of the H 20 extension butt straps. They are needed in pairs for individual beams. Non-positive beam connections are assured in this way.

Advantage: Use of elements for varying wall heights.

6. Versatility

The H 20 large-area formwork can also be used in conjunction with climbing brackets and rigid support frames (single-sided formwork) as well as for columns, tunnels and other types of special formwork.

Advantage: Many-sided applications.

7. Additional components

All steel parts of the H 20 large-area formwork are hot-dip galvanized.

Advantage: Clean components without rust. Long life-expectancy of all steel parts.

8. Approval of H 20 beam

The H 20 timber beam has a general approval of the Building Supervisory Board. It is registered under the No. Z-9.1-299.

Production of H 20 beams is continuously controlled.

Advantage: High safety due to constant quality of the product.

Defined factors for calculations

A. Statical figures

H 20 timber beam

perm. Q = 11kN

perm. M = 5 kNm

E • I = 500 kNm²

accord. to general approval by the Building Supervisory Board

Steel waler 2 x U-100

92.2 kN

11.5 kNm

865 cm⁴

Spacing of ties

(e) < 1.25 m

B. Dimensions

H 20 timber beam

H x W: 20 x 8 cm

Lengths: 1.90 m; 2.45 m; 2.65 m; 2.90 m; 3.30 m; 3.60 m; 3.90 m; 4.50 m; 4.90 m; 5.90 m; 11.90 m.

Special lengths up to 12.0 m on request.

Steel waler 2 x U-100

10 x 15 cm

0.96 m up to 2.96 m in steps of 25 cm.

Special lengths only on request

C. Weights

H 20 timber beam: approx. 5.0 kg/m

Steel waler: approx. 21.2 kg/m

Element: approx. 48.0 kg/m² without Ply
approx. 60.0 kg/m² with Ply

D. Time figures for erection / striking

Basic assembly: approx. 0.25 h/m²

Disassembly: approx. 0.15 h/m²

Erection and striking: approx. 0.30 - 0.50 h/m²

E. Transport volume of components

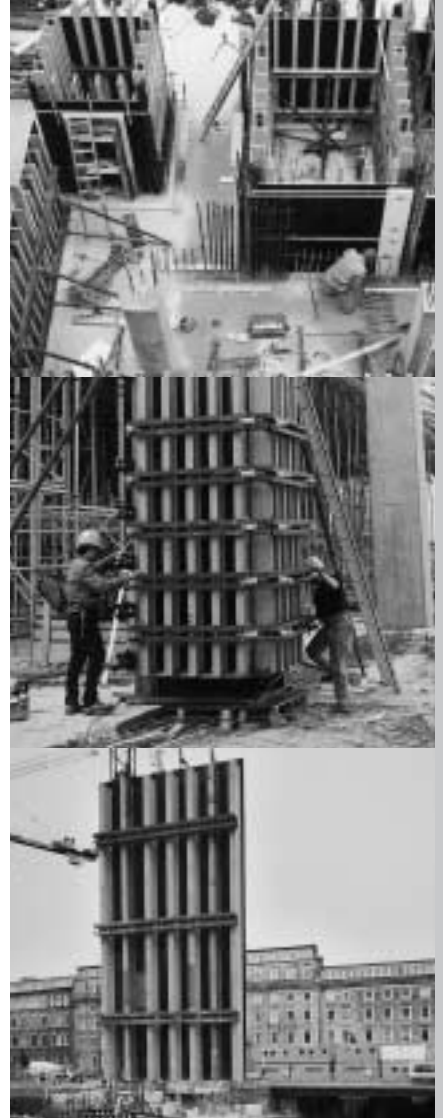
H 20 timber beams: approx. 0.022 m³/m

Steel walers: approx. 0.018 m³/m

Element without Ply: 0.24 - 0.31 m³/m² (*)

Element with Ply: 0.33 - 0.38 m³/m² (*)

*) dependent on method of loading



Hünnebeck GmbH

P. O. Box 104461, D-40853 Ratingen, Germany
Phone +49 (0) 2102/937-1, Fax +49 (0) 2102/37651
info@huennebeck.com, www.huennebeck.com