Deutsches Institut für Bautechnik
DIBt

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

European Technical Assessment

ETA-18/0391 of 3 July 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Pallet racking system "META Multipal S"
Product family to which the construction product belongs	Steel static storage systems - Adjustable pallet racking systems
Manufacturer	META-Regalbau GmbH & Co. KG Eichenkamp 59759 Arnsberg DEUTSCHLAND
Manufacturing plant	META-Regalbau GmbH & Co. KG Eichenkamp 59759 Arnsberg DEUTSCHLAND
This European Technical Assessment contains	30 pages including 7 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 200059-00-0302

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Specific part

1 Technical description of the product

The construction products are corrosion-protected steel components of the Pallet Racking System META Multipal S for the storage and retrieval of goods. The goods to be stored are generally on pallets or in box-containers. Annex 1 provides an overview of the racking systems.

The upright frames of the racking system are made up of two vertical upright profiles made of steel, which are screwed together via diagonals and, if necessary, horizontal bracing members. The uprights are thin-walled cold-formed Ω-shaped steel sections, which are produced by roll forming. They are perforated over their length continuously at a distance of 50mm. The uprights are fastened by means of a screw connection to the foot plate construction made of steel, which in turn is fixed by metal anchors in the substructure. The bracing members of the upright frames consist of thin-walled, cold-formed, non-perforated C-sections. The upright frames take over the vertical loads and ensure the stiffening in the transverse (cross aisle) direction of the pallet racking system.

The horizontal and down aisle placed pallet beams are designed as hollow cross-sections. They are either made of thin-walled and roll formed steel sheet elements and subsequently welded into a single hollow section or they are composed of two interlocking, cold-formed C-profiles.

For connecting the pallet beams to the frames uprights end plates (beam end connector = BEC) in the form of hook links (clasps) are welded transversely to the support direction at the end of the pallet beams. These hook links are designed as angle profiles. The outer leg extends beyond the pallet carrier and has hook-shaped spreaders, which are hooked into the perforation provided for this purpose within the uprights. By locking pins (connector lock), the hook link is secured against unintentional lifting.

The rotational stiffness of the floor connecting to the upright and the BEC connection to the upright ensures the stiffening of the pallet racking system in the longitudinal (down aisle) direction.

The components and the system setup of the product are given in the Annexes to this European Technical Assessment. They shall correspond to the information given in the Annexes 1 to 6.

The material properties, dimensions and tolerances not indicated in Annexes 1 to 6 shall correspond to the information laid down in the technical information[1] to this European Technical Assessment.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The construction products are intended to be used according to EAD 200059 00 0302, clause 1.2.

The performances given in Section 3 are only valid if the racking system components are used in compliance with the specifications and conditions given in the Annexes to this European Technical Assessment and if the assembly and setup is carried out according to the manufacturer's assembly instructions.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the racking system components of at least 10 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

[1] The technical documentation is deposited with Deutsches Institut für Bautechnik and as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure is handed over to the approved bodies.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	**Performance**
Upright characteristics	See Annex 7.1
BEC characteristics	See Annex 7.2
Floor connection characteristics	See Annex 7.3
Upright frame characteristics	See Annex 7.4
Beam characteristics	No Performance Assessed
Upright splices characteristics	No Performance Assessed

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 200059 00 0302, clause 3.1, the applicable European legal act is: 1998/214/EC

The system to be applied is: 2+

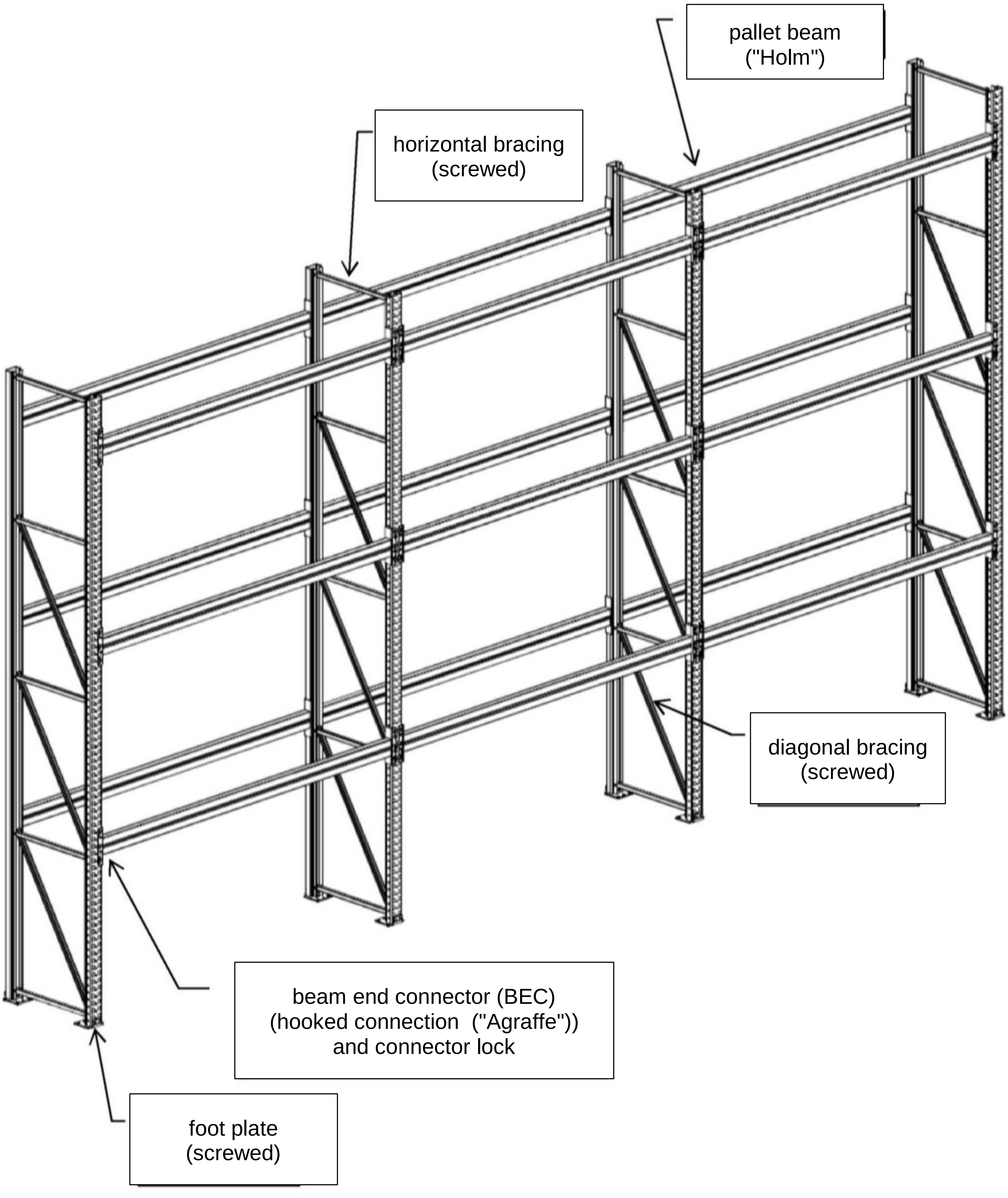
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 3 July 2018 by Deutsches Institut für Bautechnik

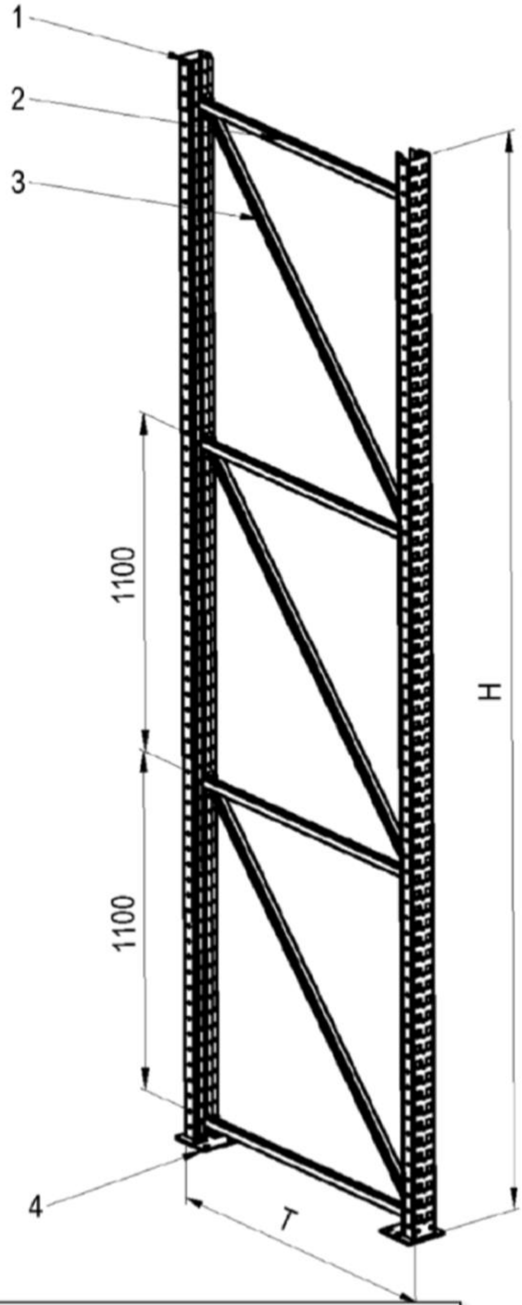
BD Dipl.-Ing. Andreas Kummerow
Head of Department

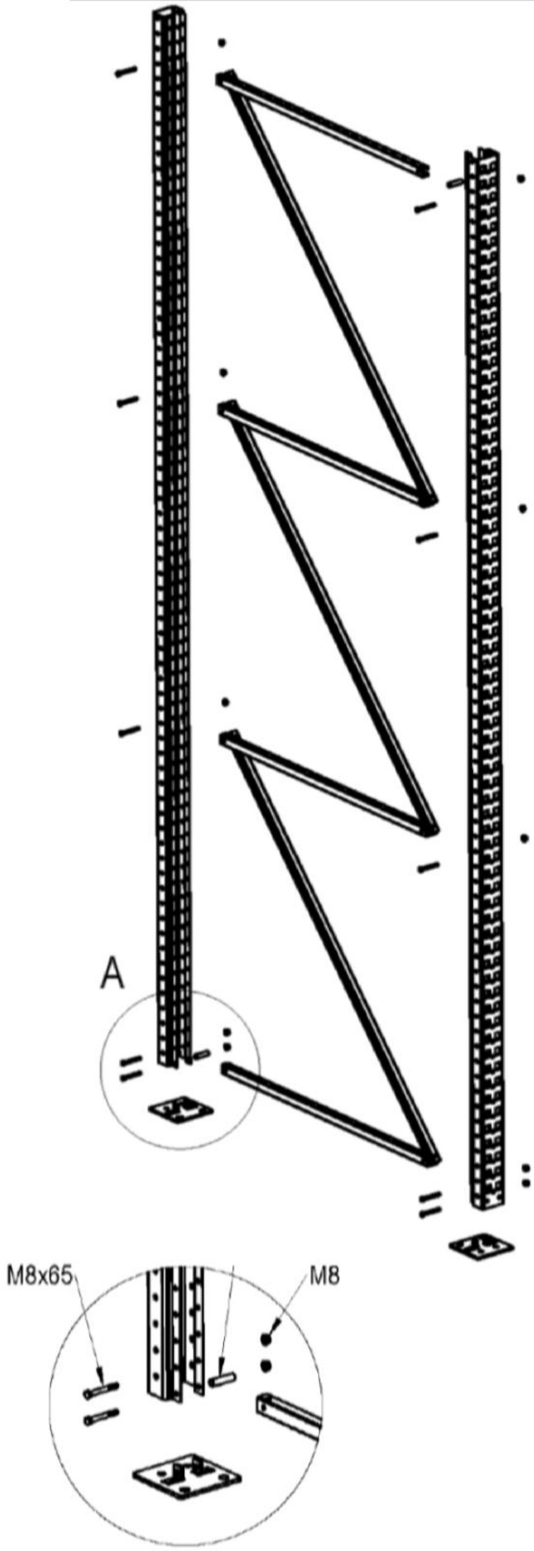
beglaubigt:
Reimuth



Pallet racking system "META Multipal S"	Annex 1
Isometric overview Upright frames with hooked beam levels	

detailed component information
deposited with DIBt





- 1 upright profile b=85/100
- 2 horizontal bracing C30/25/8/1.5
- 3 diagonal bracing C30/25/8/1.5
- 4 foot plate

- hexagon bolt M8x65/70 8.8
- hexagon nut M8 – 8 (self-locking)

Pallet racking system "META Multipal S"	Annex 2.1
Upright frame (Z-bracing) Frame structure overview for uprights: 85/17; 85/20; 100/20 and 100/21	

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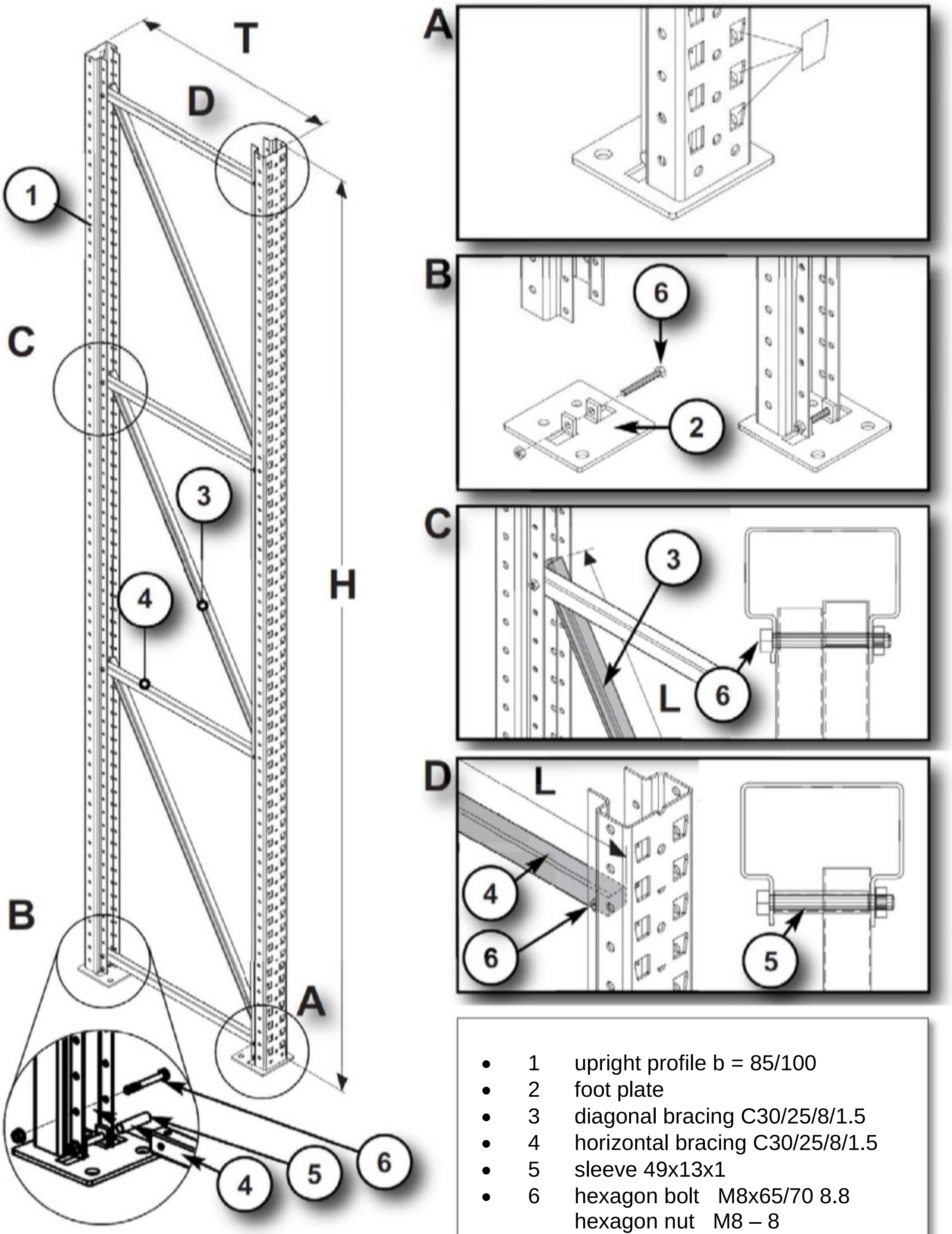

detailed component information deposited with DIBt

- 1 upright profile b = 85/100
- 2 foot plate
- 3 diagonal bracing C30/25/8/1.5
- 4 horizontal bracing C30/25/8/1.5
- 5 sleeve 49x13x1
- 6 hexagon bolt M8x65/70 8.8
  hexagon nut M8 – 8
  (self-locking)

Pallet racking system "META Multipal S"	Annex 2.1.1
Upright frame (Z-bracing) Frame structure overview for uprights: 85/17; 85/20; 100/20 and 100/21	

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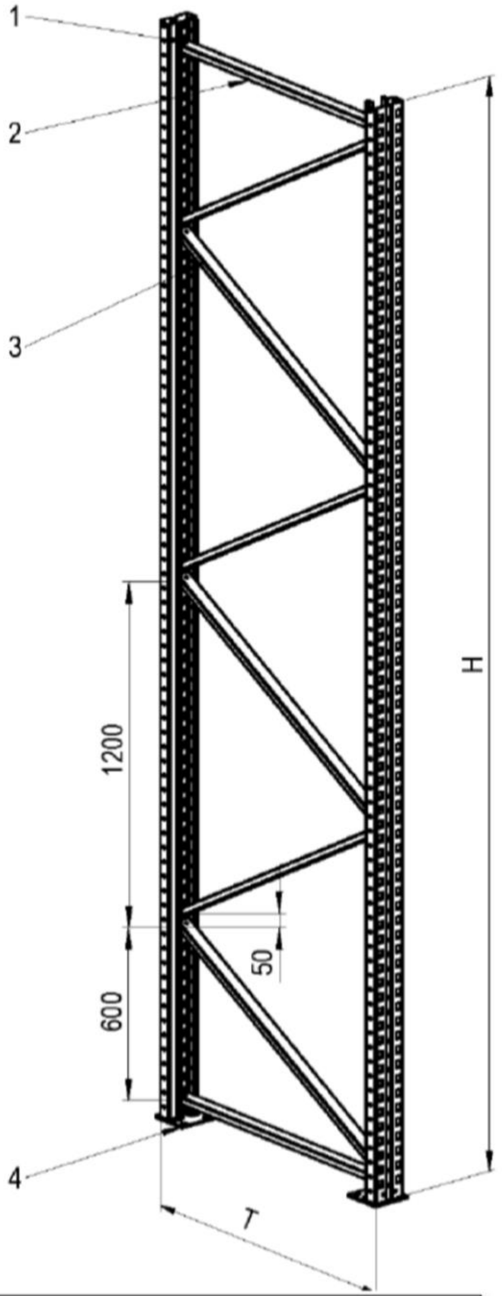
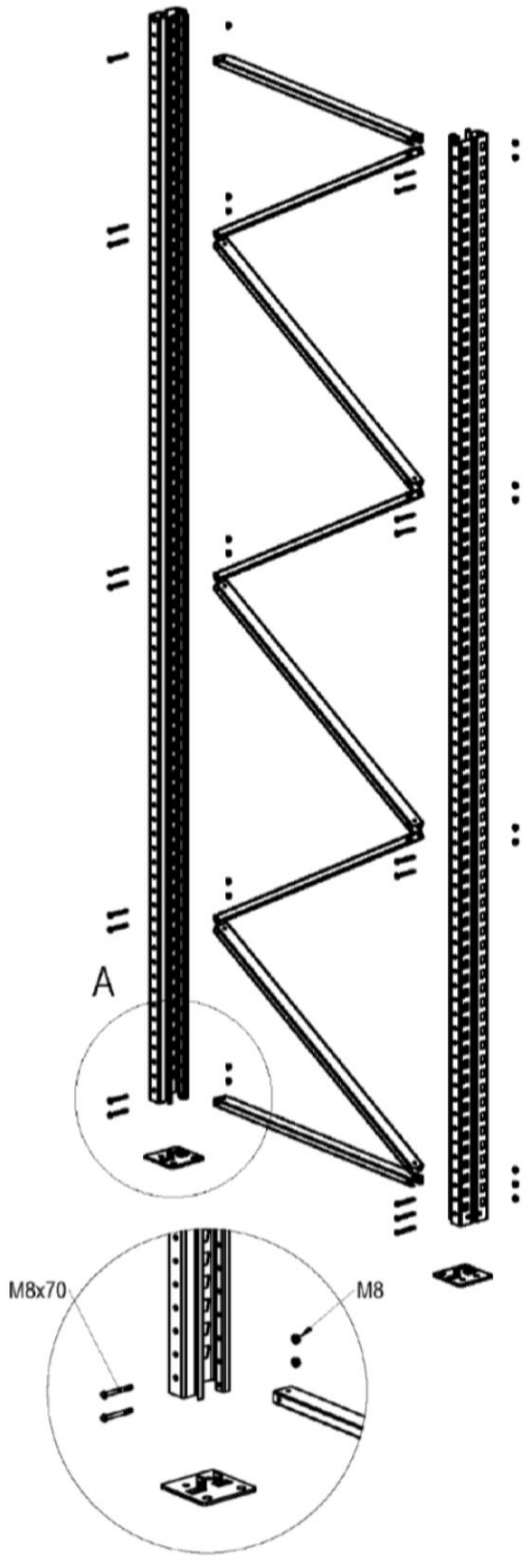
detailed component information deposited with DIBt

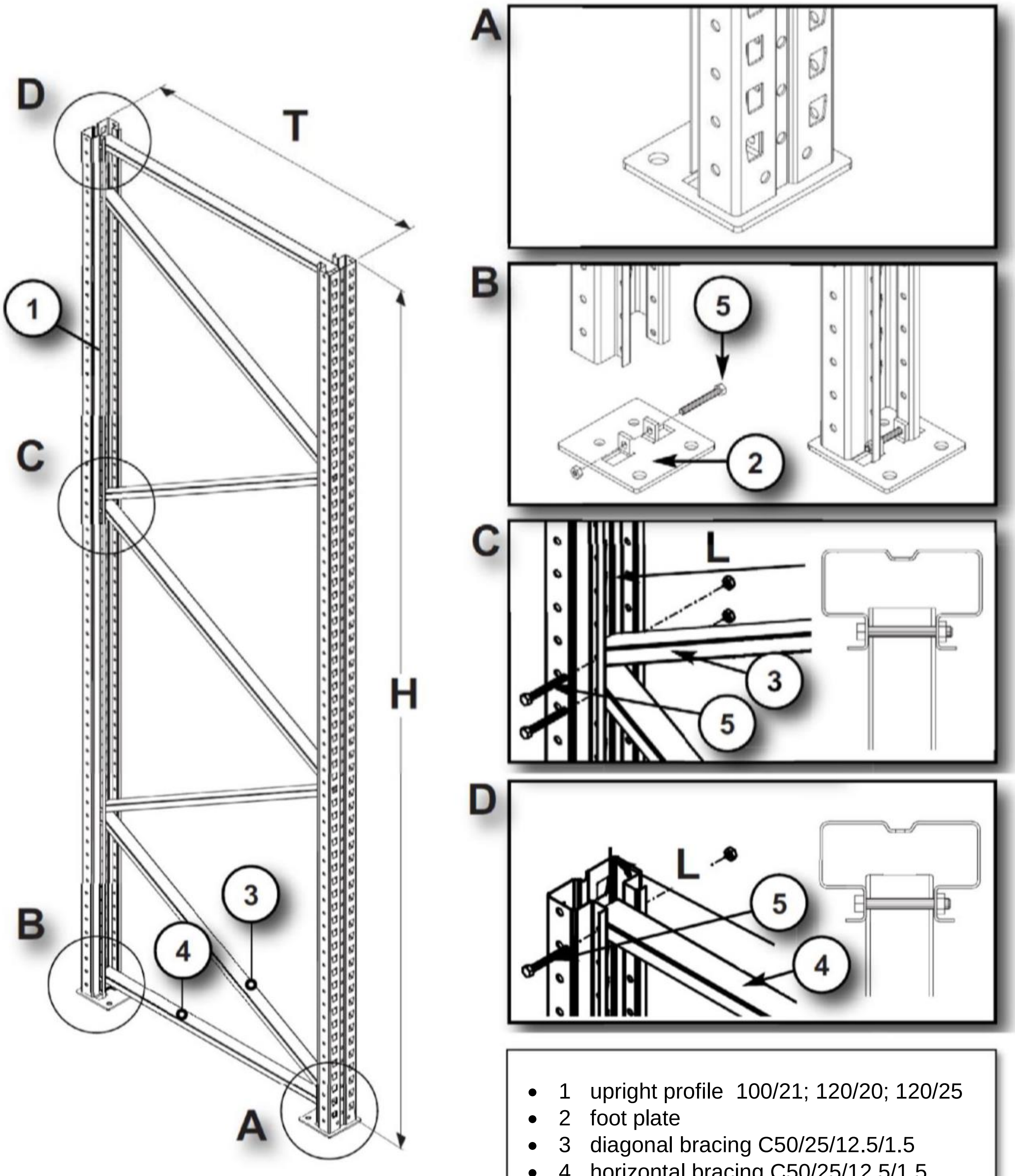




- 1 upright profile 100/21; 120/20; 120/25
- 2 horizontal bracing C50/25/12.5/1.5
- 3 diagonal bracing C50/25/12.5/1.5
- 4 foot plate

- hexagon bolt M8x65/70 8.8
- hexagon nut M8 – 8 (self-locking)

Pallet racking system "META Multipal S"	Annex 2.2
Upright frame (D-bracing) Frame structure overview for uprights: 100/21; 120/20 and 120/25	



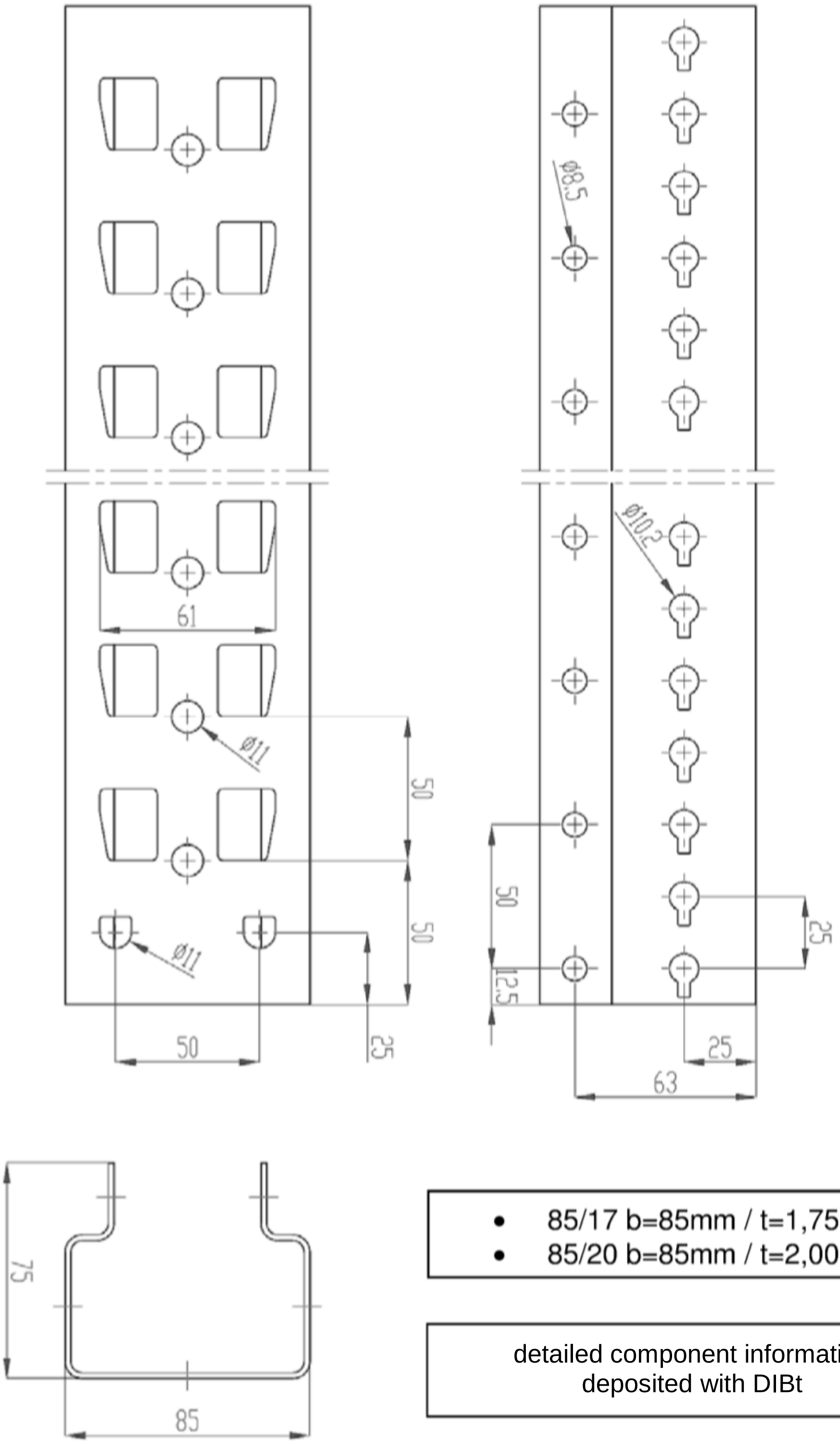
- 1 upright profile 100/21; 120/20; 120/25
- 2 foot plate
- 3 diagonal bracing C50/25/12.5/1.5
- 4 horizontal bracing C50/25/12.5/1.5
- 5 hexagon bolt M8x65/70 8.8
  hexagon nut M8 – 8
  (self-locking)

detailed component information deposited with DIBt

Pallet racking system "META Multipal S"

Upright frame (D-bracing)
Frame structure overview for uprights: 100/21; 120/20 and 120/25

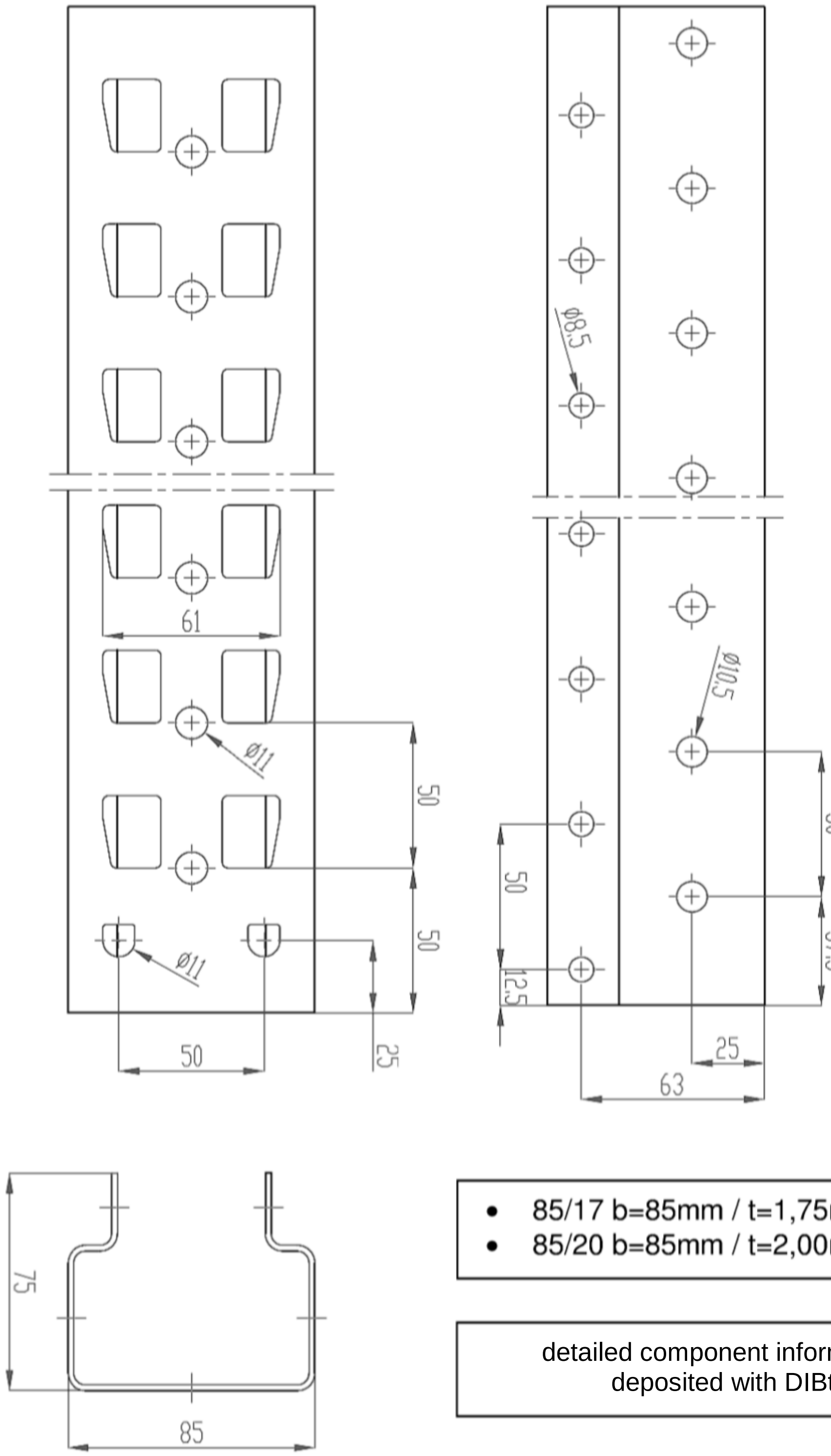
Annex 2.2.1



- 85/17 b=85mm / t=1,75mm
- 85/20 b=85mm / t=2,00mm

detailed component information
deposited with DIBt

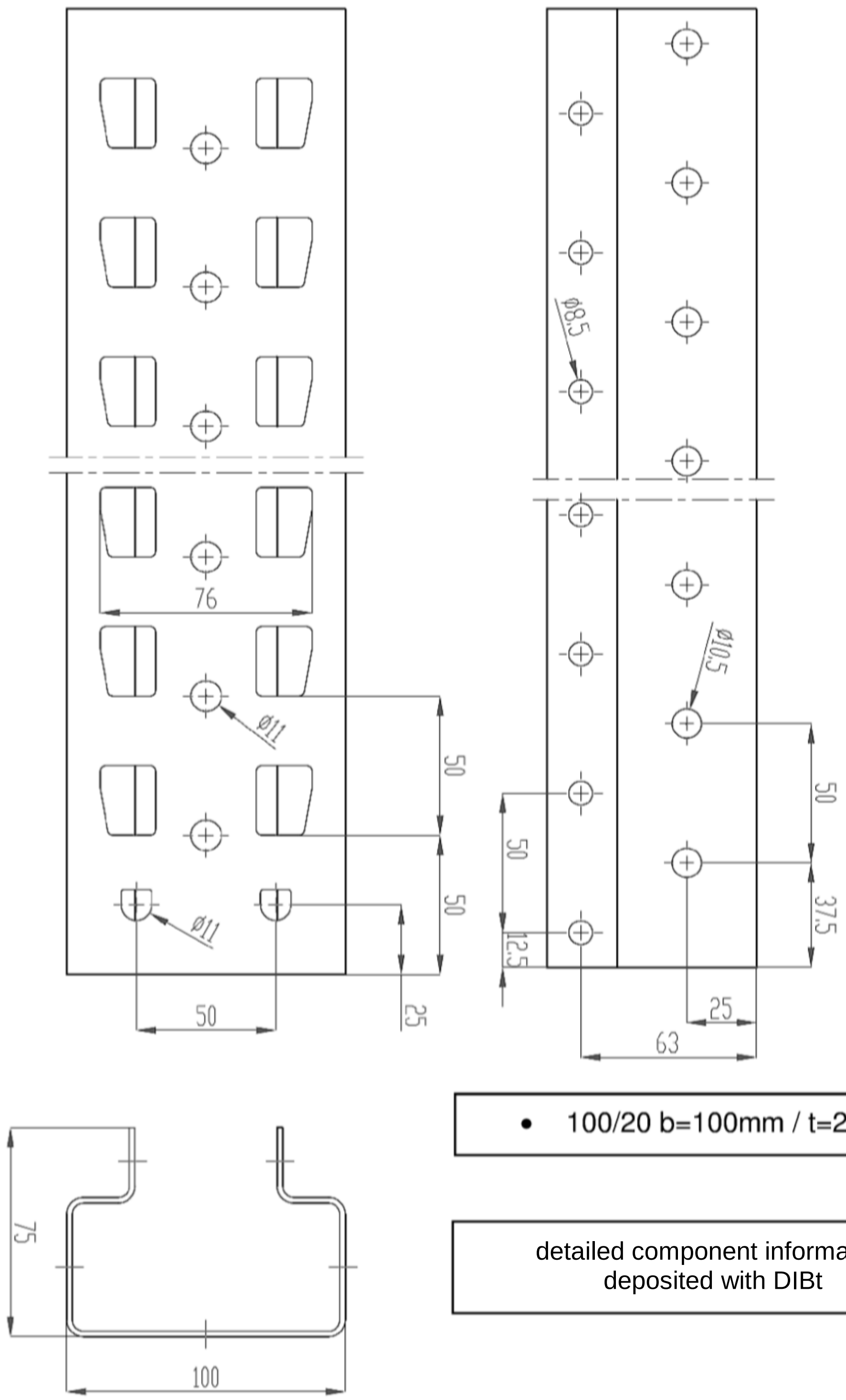
Pallet racking system "META Multipal S"	Annex 3.1
Uprights Upright 85/17 and 85/20, b = 85mm (side perforation type: keyhole)	



- 85/17 b=85mm / t=1,75mm
- 85/20 b=85mm / t=2,00mm

detailed component information deposited with DIBt

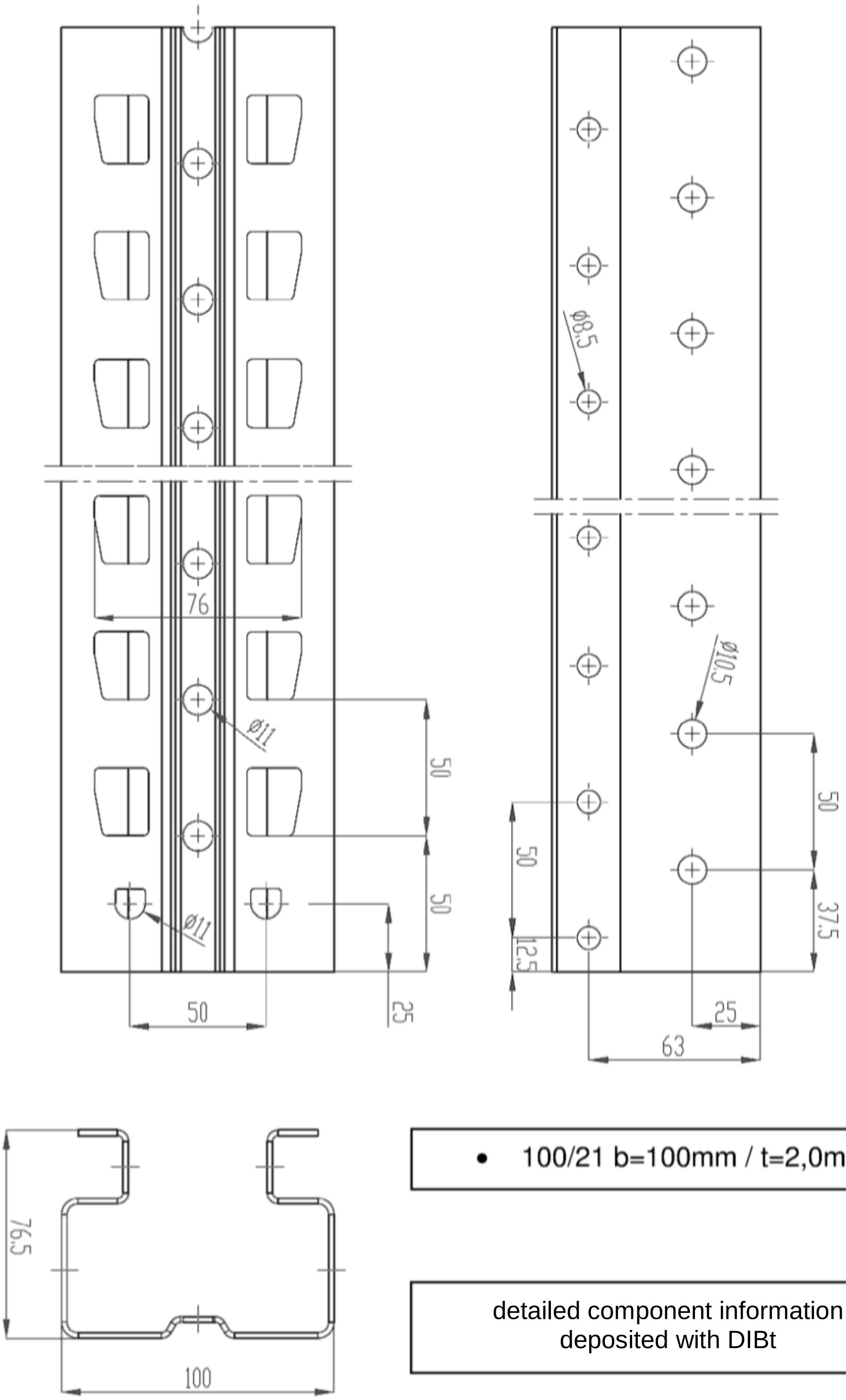
Pallet racking system "META Multipal S"	Annex 3.2
Uprights Upright 85/17 and 85/20, b = 85mm (side perforation type: round hole)	



- 100/20 b=100mm / t=2,0mm

detailed component information deposited with DIBt

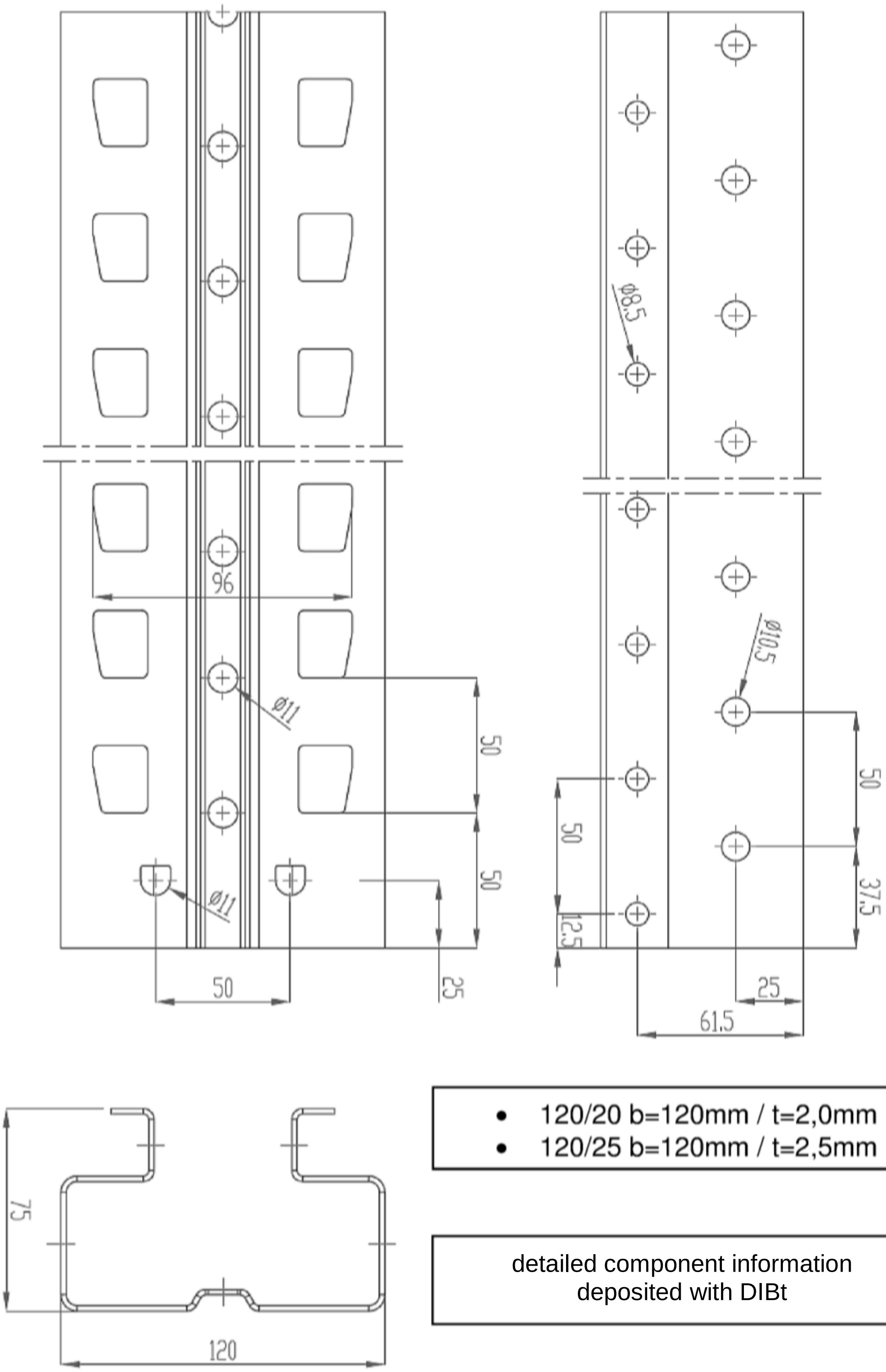
Pallet racking system "META Multipal S"	Annex 3.3
Uprights Upright 100/20, b = 100mm (side perforation type: round hole)	



- 100/21 b=100mm / t=2,0mm

detailed component information deposited with DIBt

Pallet racking system "META Multipal S"	Annex 3.4
Uprights Upright 100/21, b = 100mm (side perforation type: round hole)	



- 120/20 b=120mm / t=2,0mm
- 120/25 b=120mm / t=2,5mm

detailed component information deposited with DIBt

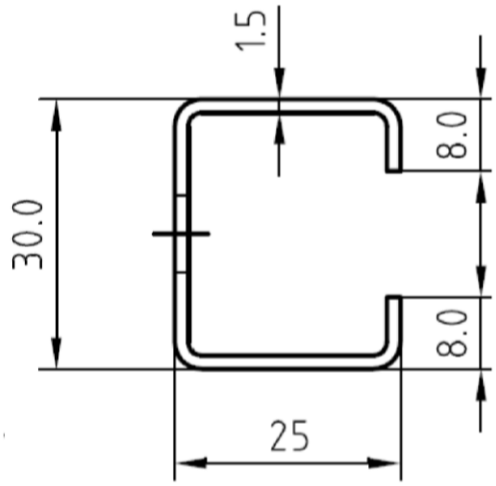
Pallet racking system "META Multipal S"

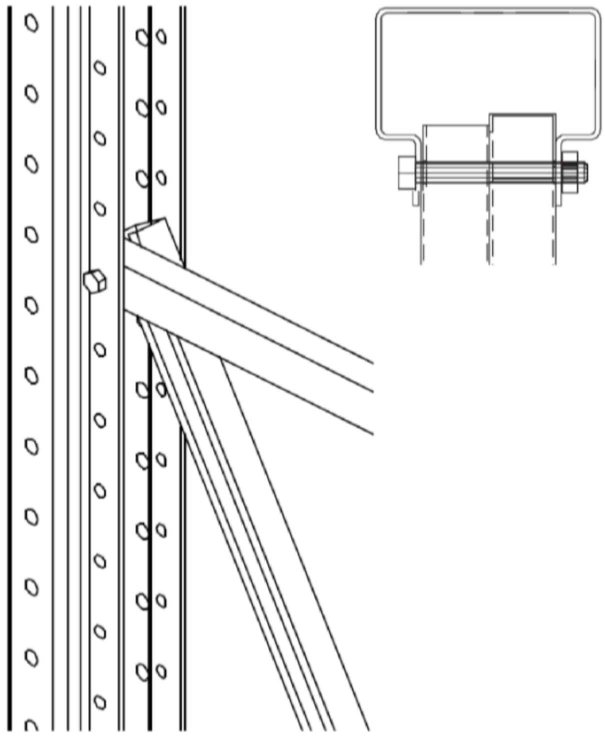
Uprights
Upright 120/20 und 120/25, b = 120mm (side perforation type: round hole)

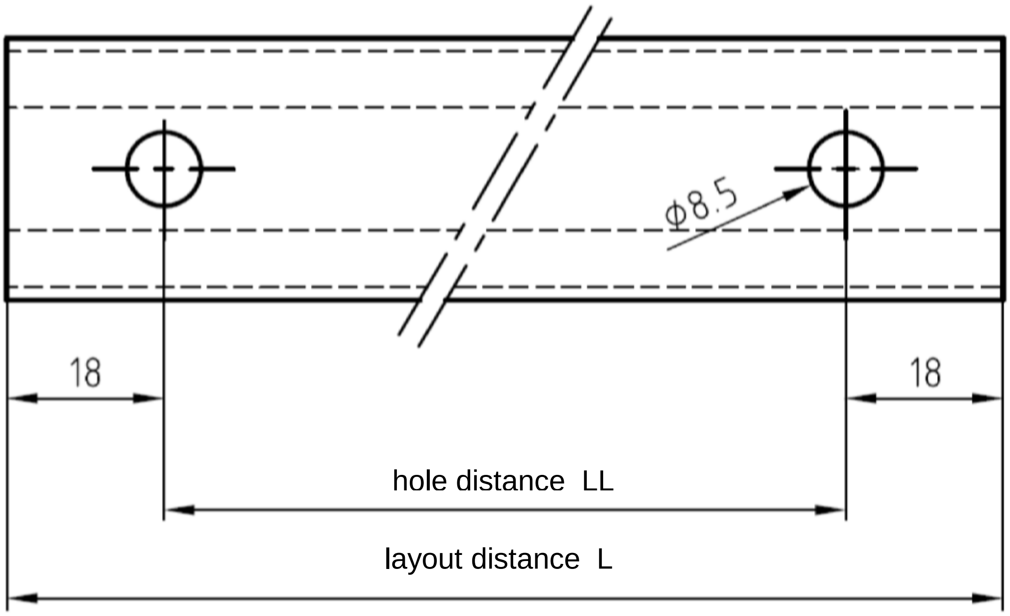
Annex 3.5

detailed component information deposited with DIBt

- uprights:
  85/17; 85/20; 100/20 and 100/21
- horizontal bracing C30/25/8/1.5
- diagonal bracing C30/25/8/1.5
- hexagon bolt M8x65/70 8.8
  hexagon nut M8 – 8
  (self-locking)

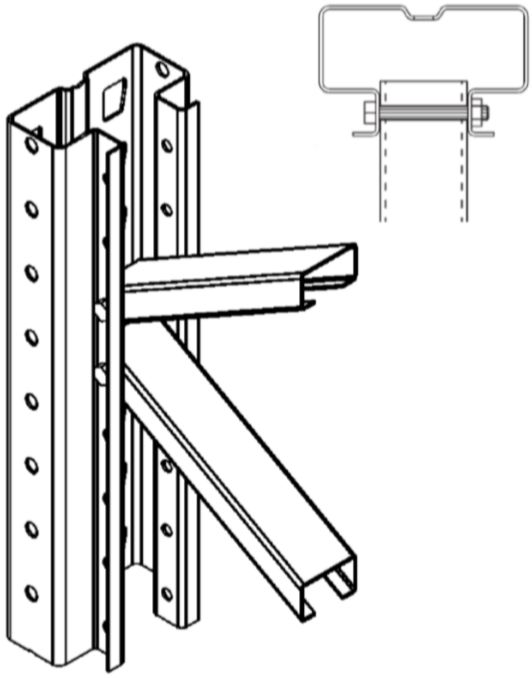


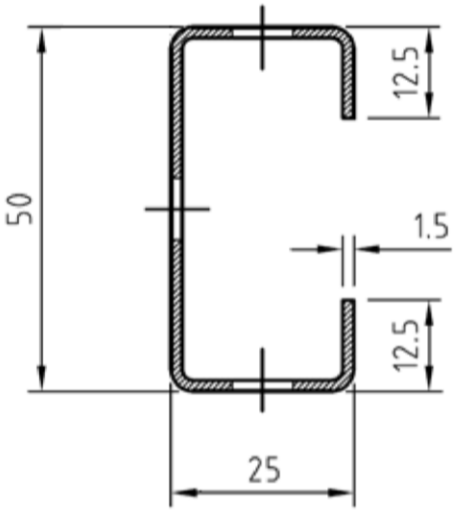




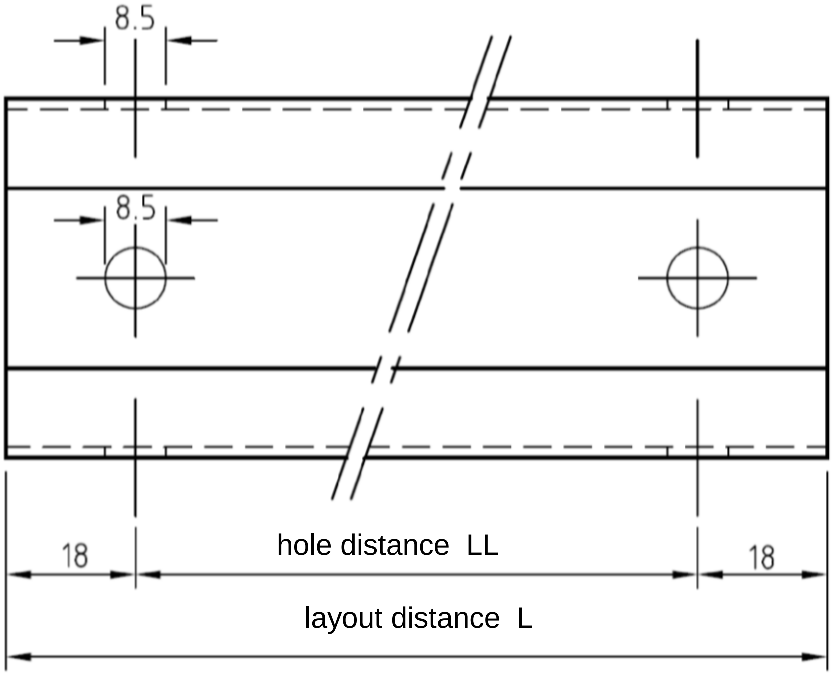
Pallet racking system "META Multipal S"	Annex 4.1
Bracing member C30-25-8-1.5	

- uprights: 100/21; 120/20 and 120/25
- horizontal bracing C50/25/12.5/1.5
- diagonal bracing C50/25/12.5/1.5
- hexagon bolt M8x65/70 8.8
  hexagon nut M8 – 8
  (self-locking)

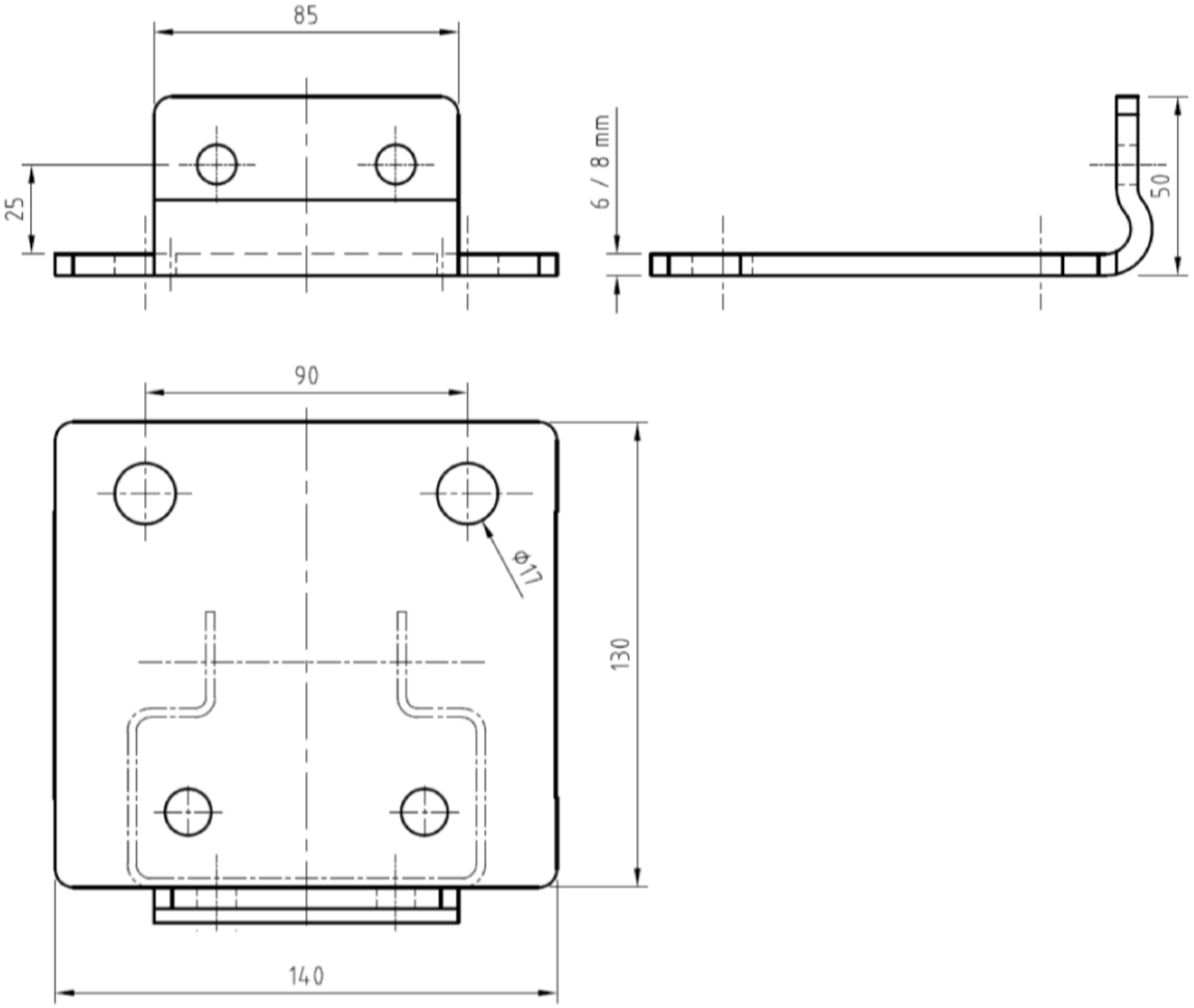




detailed component information
deposited with DIBt



Pallet racking system "META Multipal S"	Annex 4.2
Bracing member C50-25-12.5-1.5	

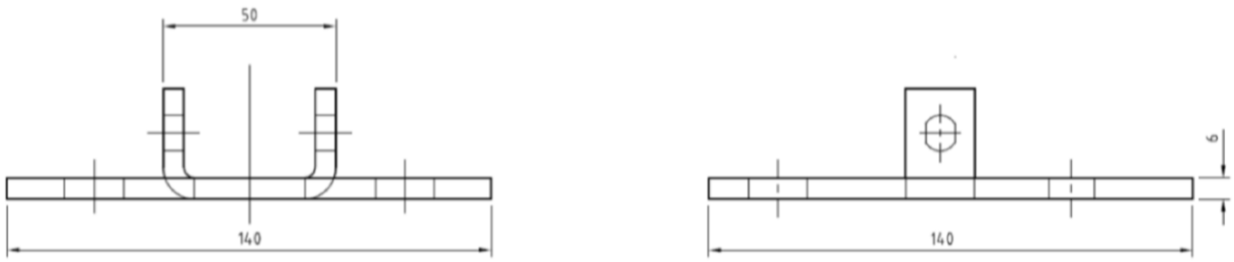


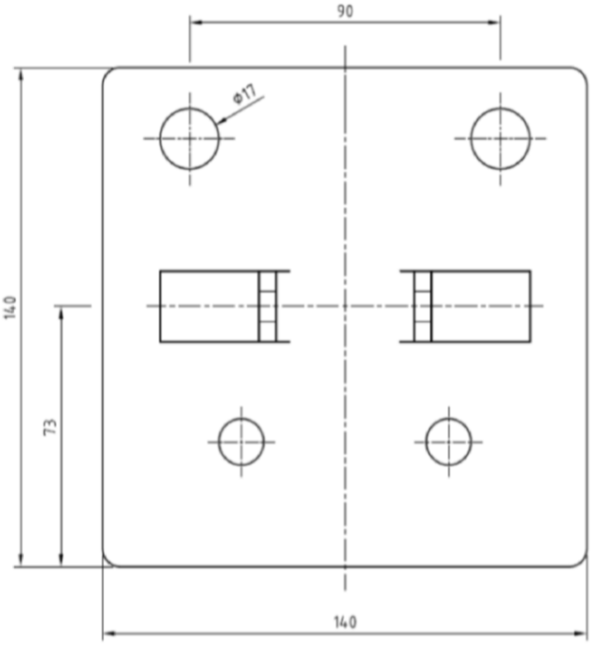
connection to the upright

- foot plate
- hexagon bolt M10x25 8.8
  hexagon nut M10 – 8
  (self-locking)

detailed component information deposited with DIBt

Pallet racking system "META Multipal S"	Annex 5.1
Foot plate 130x140x6 and 130x140x8	



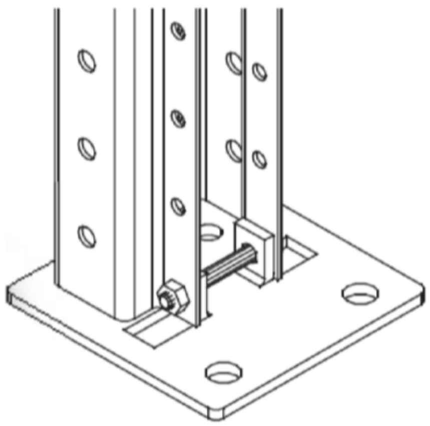


connection to the upright

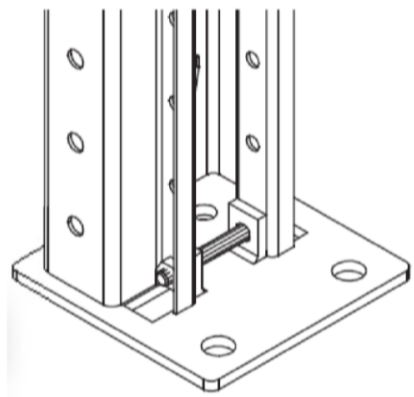
- foot plate
- hexagon bolt M8x65/70 8.8
  hexagon nut M8 – 8
  (self-locking)

detailed component information
deposited with DIBt

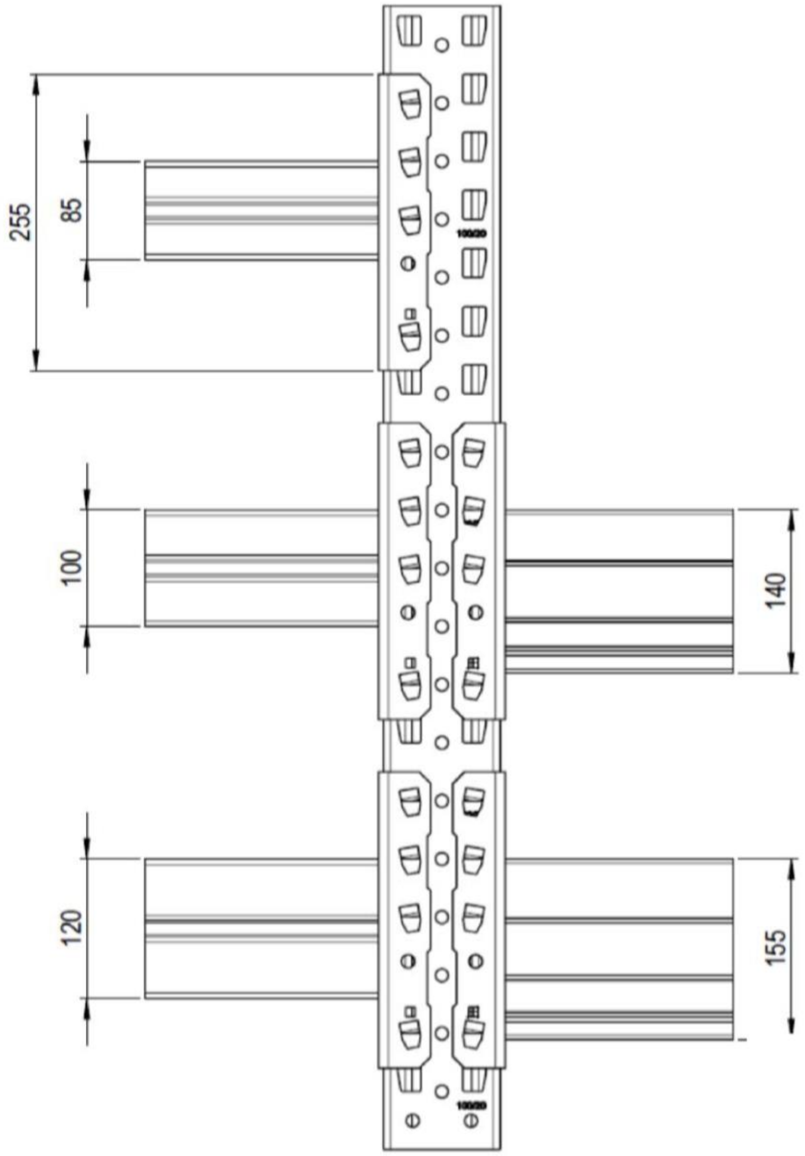
in combination with
upright 85 / 100mm

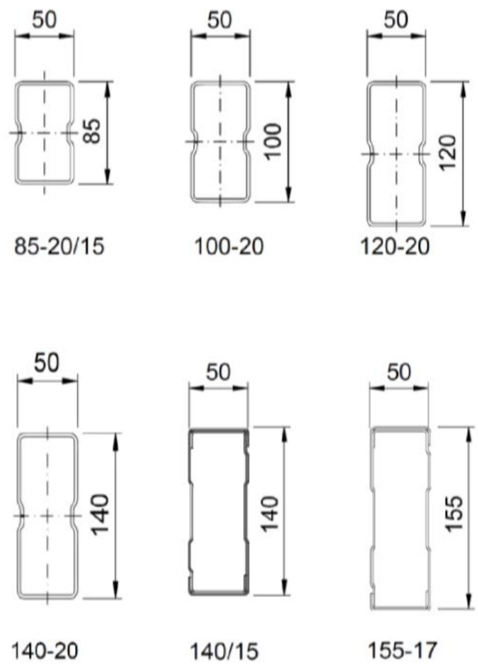


in combination with
upright 100/21 and 120mm



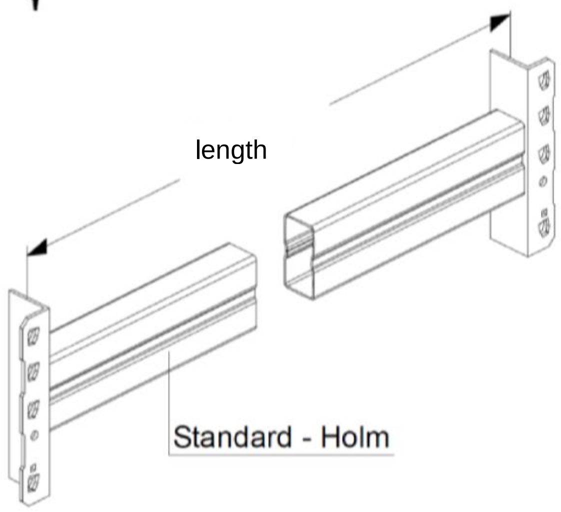
Pallet racking system "META Multipal S"	Annex 5.2
Foot plate 140x140x6	





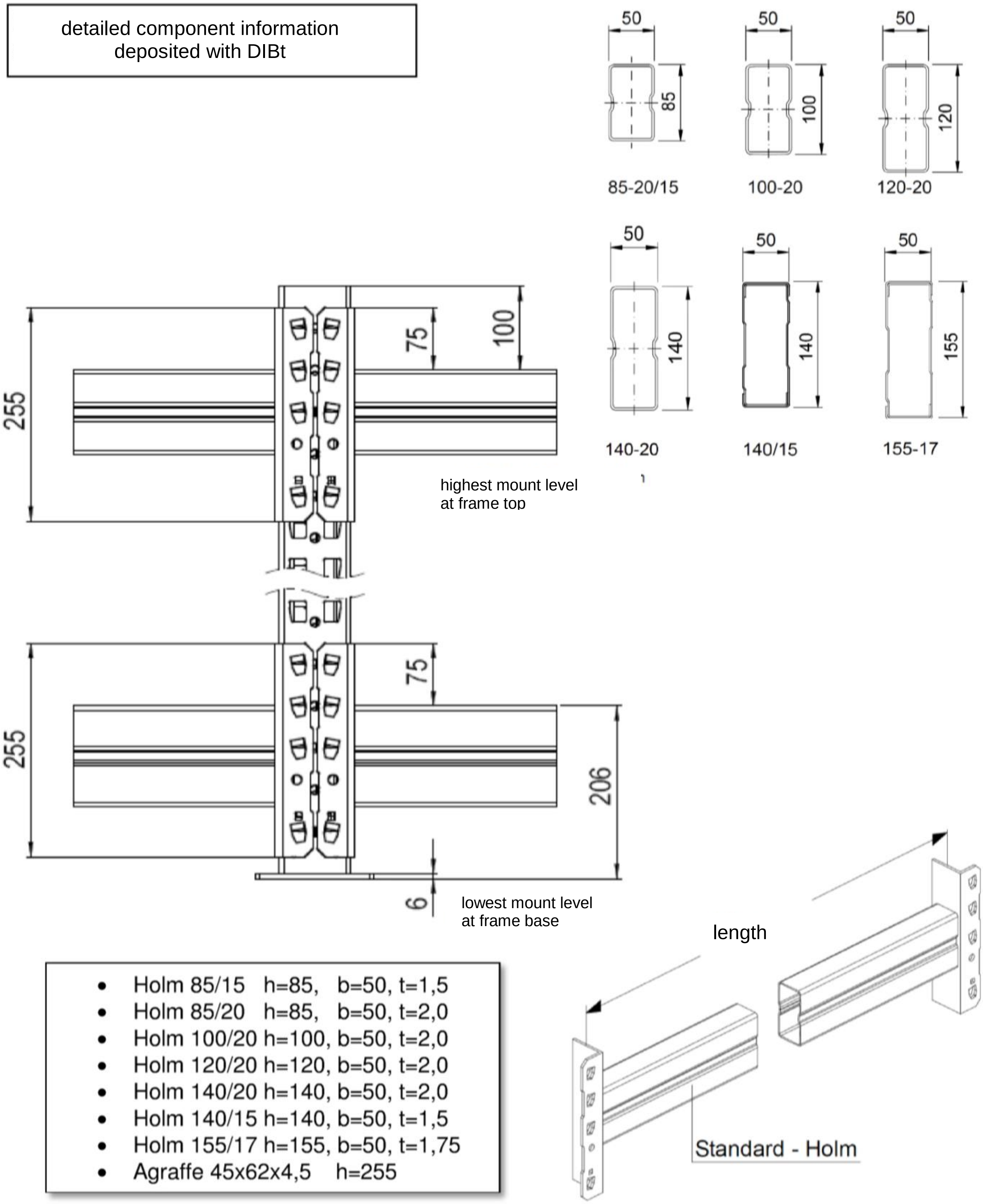
detailed component information
deposited with DIBt

- Holm 85/15 h=85, b=50, t=1,5
- Holm 85/20 h=85, b=50, t=2,0
- Holm 100/20 h=100, b=50, t=2,0
- Holm 120/20 h=120, b=50, t=2,0
- Holm 140/20 h=140, b=50, t=2,0
- Holm 140/15 h=140, b=50, t=1,5
- Holm 155/17 h=155, b=50, t=1,75
- Agraffe 45x62x4,5 h=255
- L up to 4500mm



Pallet racking system "META Multipal S"	Annex 6.1
Beam Types ("Holm" overview) 85/15, 85/20, 100/20, 120/20, 140/20, 140/15, 155/17	

detailed component information
deposited with DIBt

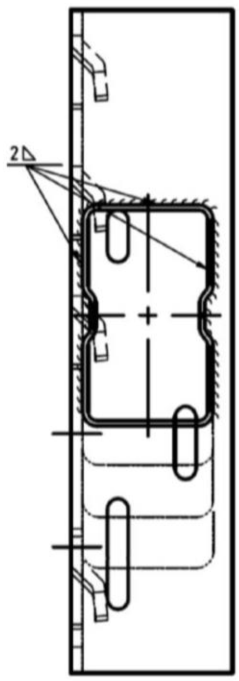


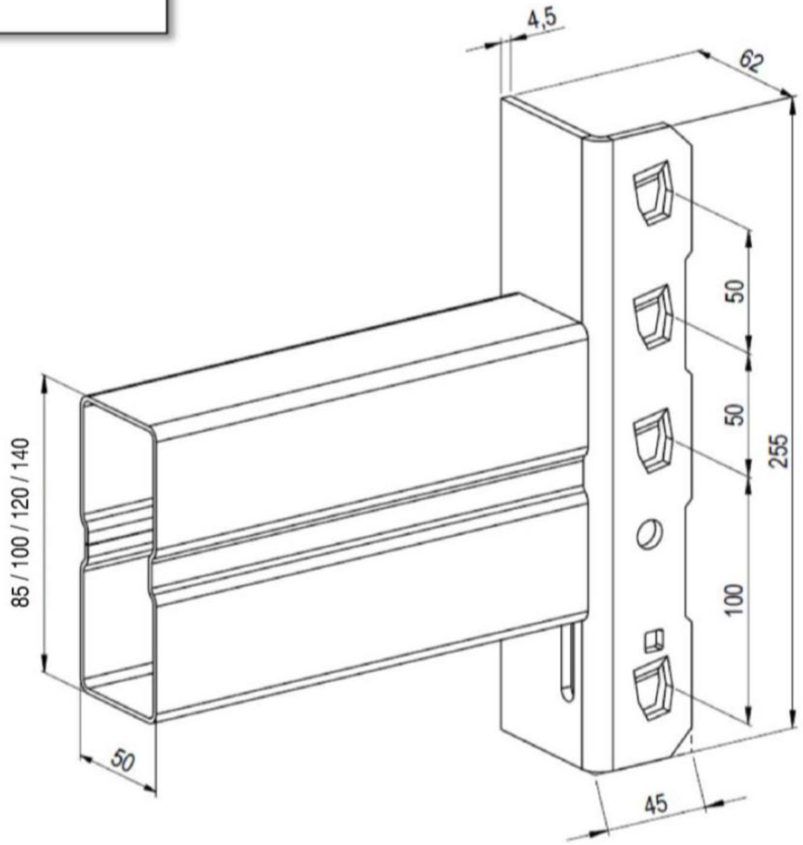
- Holm 85/15 h=85, b=50, t=1,5
- Holm 85/20 h=85, b=50, t=2,0
- Holm 100/20 h=100, b=50, t=2,0
- Holm 120/20 h=120, b=50, t=2,0
- Holm 140/20 h=140, b=50, t=2,0
- Holm 140/15 h=140, b=50, t=1,5
- Holm 155/17 h=155, b=50, t=1,75
- Agraffe 45x62x4,5 h=255

Pallet racking system "META Multipal S"	Annex 6.2
Min/max installation levels of the pallet beams 85/15, 85/20, 100/20, 120/20, 140/20, 140/15, 155/17	

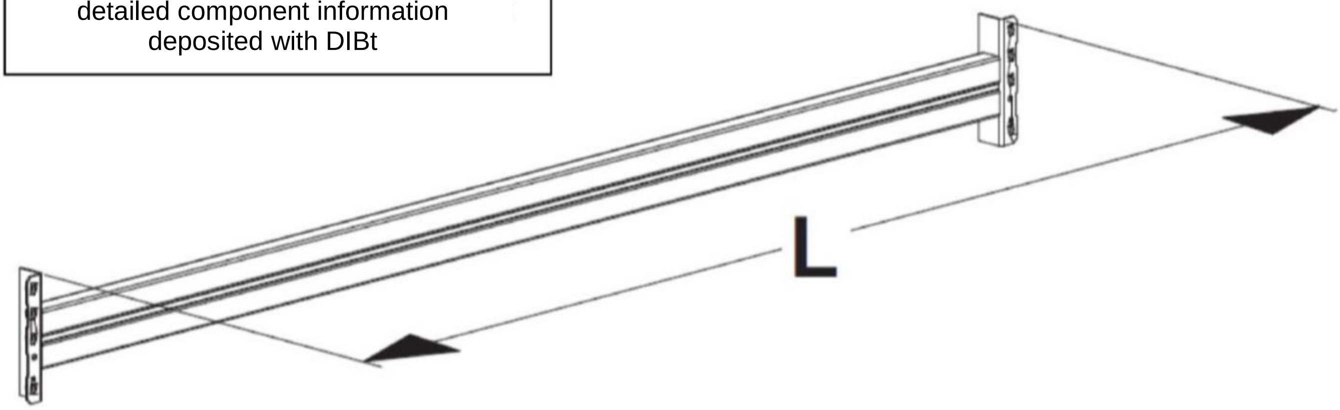
- Holm 85/15 h=85, b=50, t=1,5
- Holm 85/20 h=85, b=50, t=2,0
- Holm 100/20 h=100, b=50, t=2,0
- Holm 120/20 h=120, b=50, t=2,0
- Holm 140/20 h=140, b=50, t=2,0
- Agraffe 45x62x4,5 h=255
- L up to 4500mm

one-sided presentation
other side mirror image





detailed component information
deposited with DIBt



Pallet racking system "META Multipal S"	Annex 6.3.1
Box section beams 85/15, 85/20, 100/20, 120/20, 140/20	

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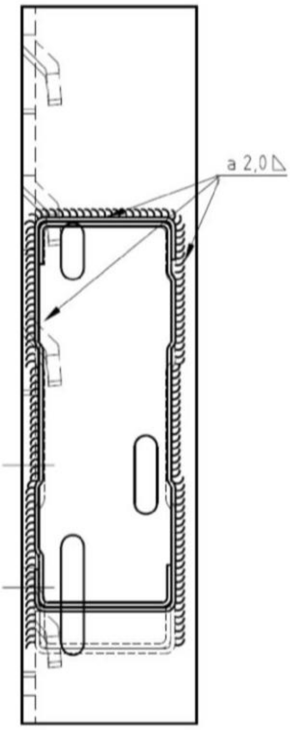
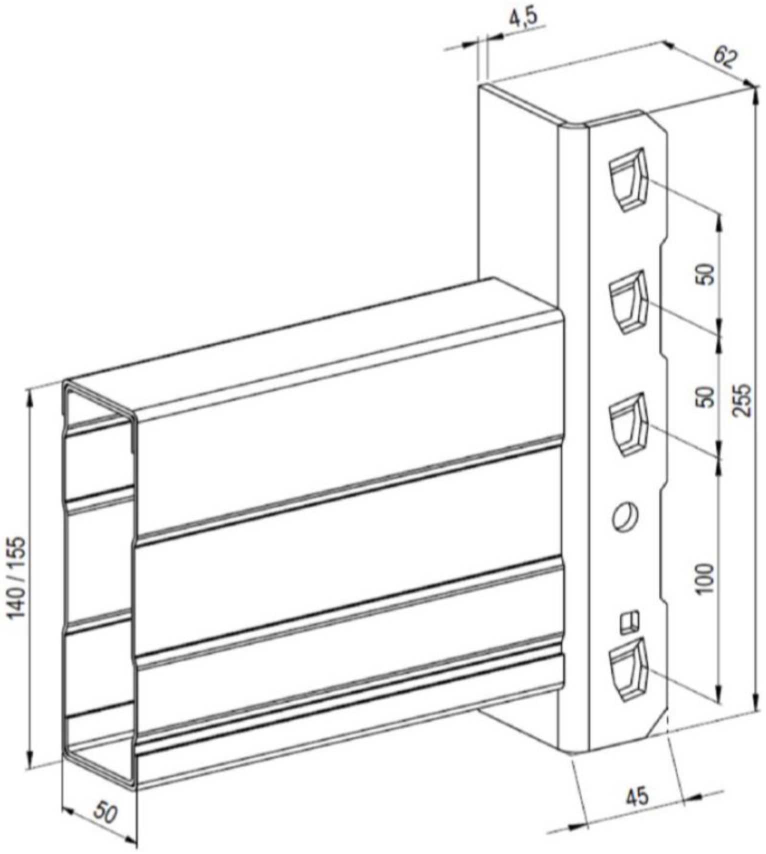
- Holm 140/15 h=140, b=50, t=1,5
- Holm 155/17 h=155, b=50, t=1,75
- Agraffe 45x62x4,5 h=255
- L up to 4500mm

one-sided presentation
other side mirror image





detailed component information
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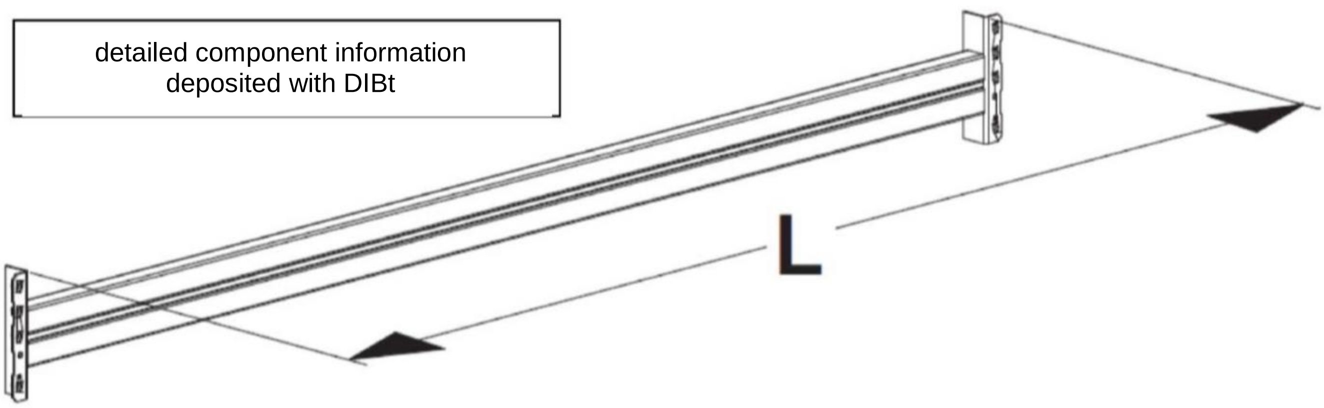
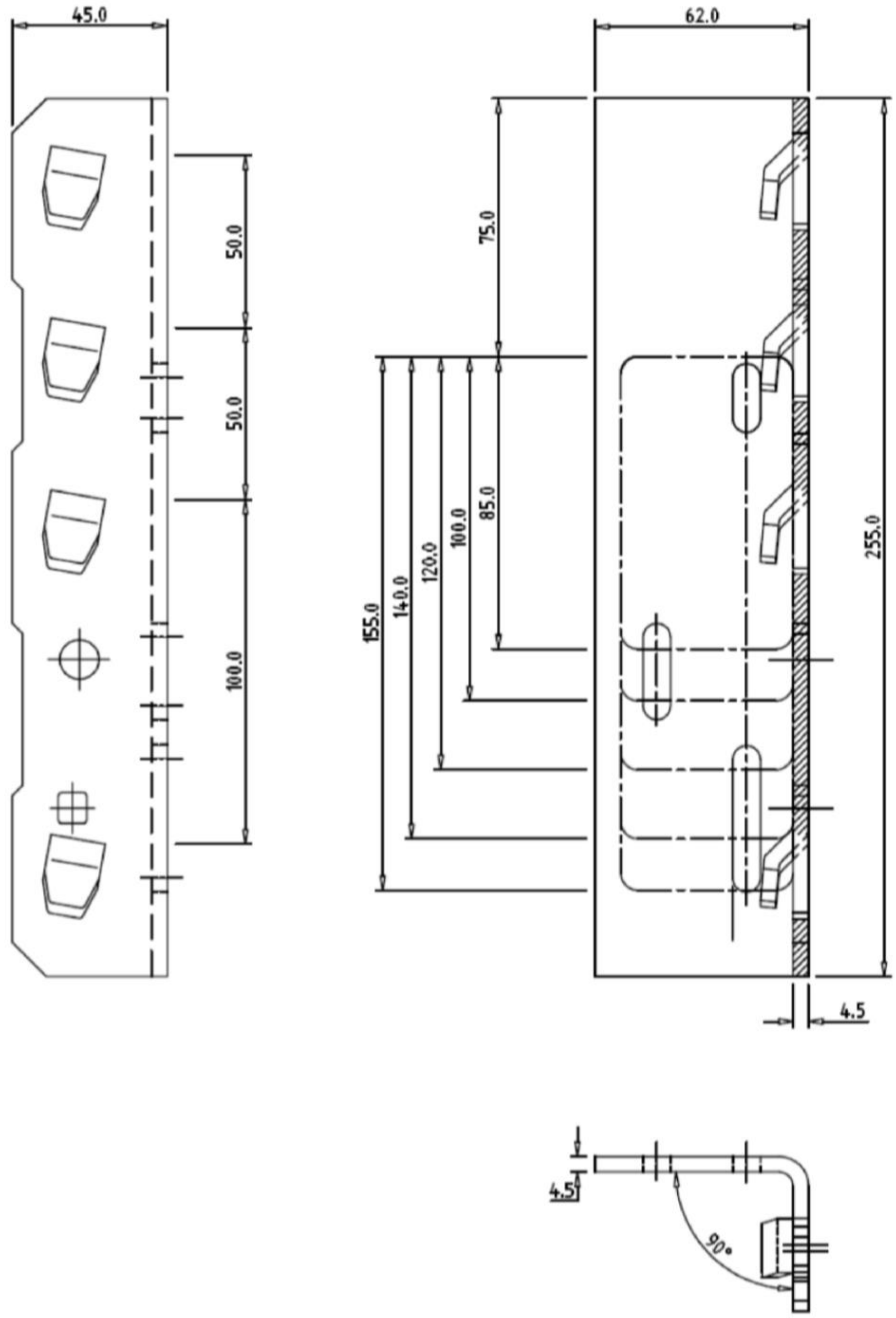


Pallet racking system "META Multipal S"	Annex 6.3.2
Boxed C-section beams 140/15, 155/17	

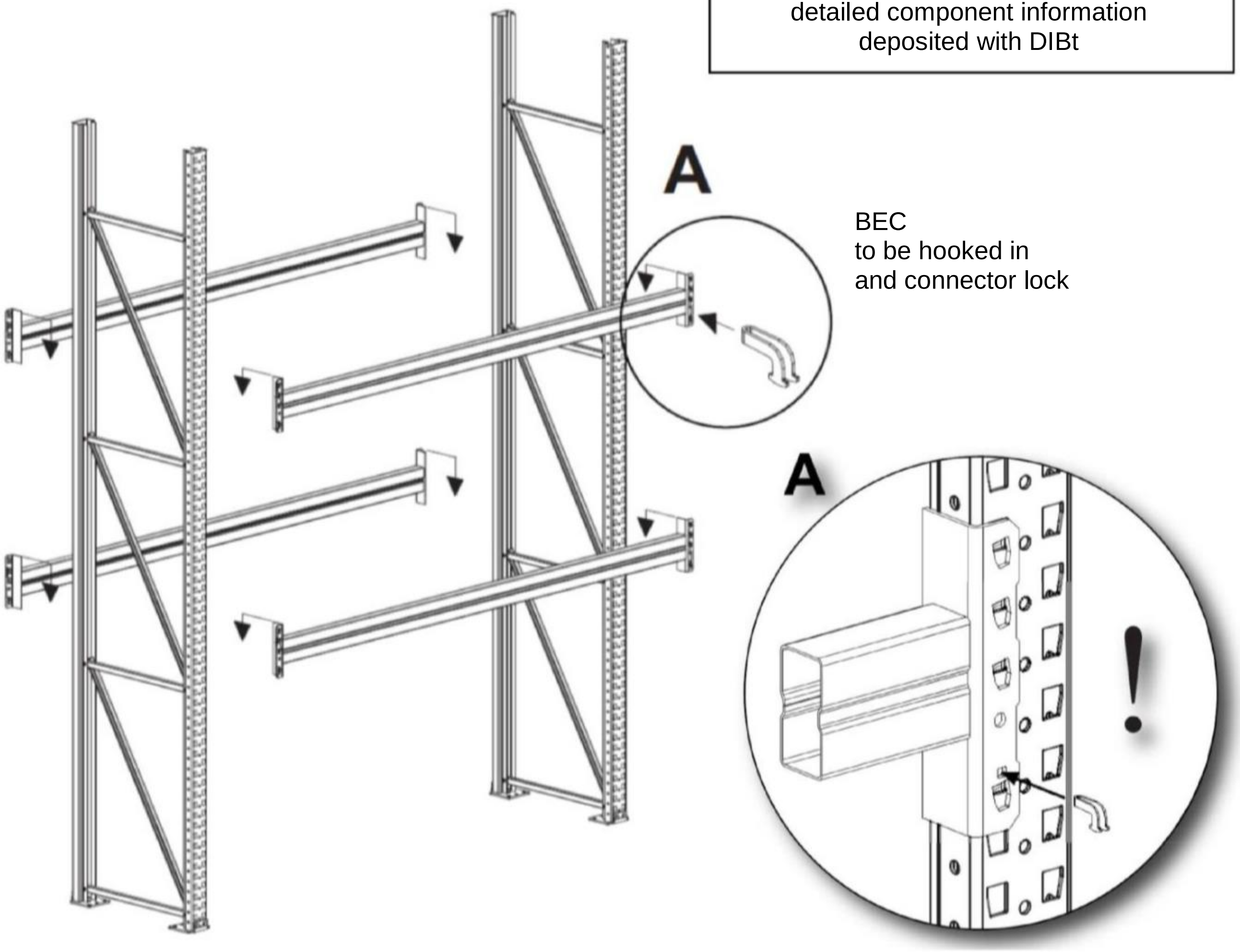
one-sided presentation
other side mirror image

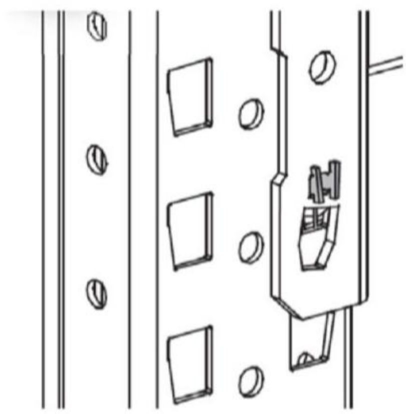


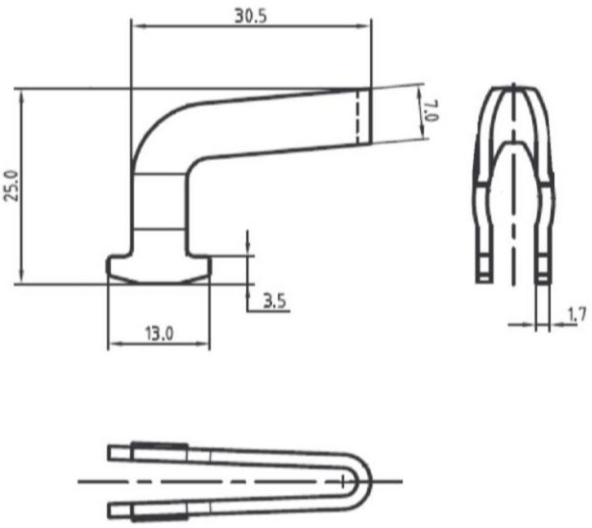
detailed component information deposited with DIBt

Pallet racking system "META Multipal S"	Annex 6.4
Beam end connector (BEC, "Agraffe") left side 45x62x4.5, h=255mm	

detailed component information
deposited with DIBt







Pallet racking system "META Multipal S"	Annex 6.5
Connector lock Installation at the beam end connector ("Agraffe")	

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Use conditions

Within the scope of the inspection intervals specified in EN 15635:2008, the racking constructions shall be checked. Any damage detected shall be eliminated in accordance with EN 15635:2008, clause 9.7.3.

Preferably, damaged components should be replaced by original components.

If this is not possible in individual cases, a new stability check and verification of the racking construction is compulsory taking into account the repair measure of the damaged components.

Design

For the planning and design of pallet racking systems, EN 15512:2009 may be used, if other national regulations are missing. Verification of the structural safety of the pallet racking system is to be provided in each individual case or by structural calculations for types of racking systems.

For the verification of structural safety according to EN 15512:2009, the characteristics compiled in the following sections of Annex 7 may be used.

Ultimate limit state

Checks on the ultimate limit state may be carried out in accordance with EN 15512:2009, sections 9 and 10.

The redistribution of bending moments in accordance with EN 5512:2009, clause 9.4.3.2, is not allowed.

Serviceability limit state

Checks on the serviceability limit state may be carried out in accordance with EN 15512:2009, section 11.

Actions

The actions in accordance with EN 15512:2009, section 6, may be used.

Load combination rules

The load combination rules in accordance with EN 15512:2009, sections 6 and 7, may be used.

Partial factors

The partial factors in accordance with EN 15512:2009, section 7, may be used, taking into account Annex I.2.

Pallet racking system "META Multipal S"	Annex 7
Characteristics Use conditions and design	

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Effective areas of cross sections $\mathbf{A_{eff}}$ und section moduli $\mathbf{W_{eff}}$

Upright	A_{eff} [cm^2]	$W_{eff,y}$ *1,3) [cm^3]	$W_{eff,z}$ *2,3) [cm^3]
SR 85/17	2,54	7,97	4,64
SR 85/20 *4)	2,88 *5)	8,61	5,54
	2,99 *6)		
SR 100/20	3,88	11,9	7,58
SR 100/21	5,00	12,8 *3a)	9,56 *3a)
SR 120/20	5,44	17,0	10,6
SR 120/25	6,76	20,8	14,4

*1) Strong-axis bending of the upright profile – Axis y-y

*2) Week-axis bending of the upright profile – Axis z-z

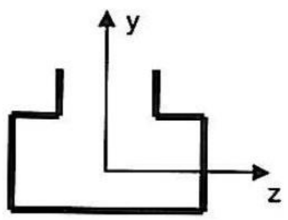
*3) The values apply to the node distances of the frame bracing shown in the annexes (1100mm with Z-bracing and 1200mm with D-bracing).
The values apply to "Holm"-distances ≤ 3,0m (*3a) ≤ 3,8m)
$W_{eff,y}$ already includes the effects of lateral torsional buckling.
For the verification of stability in accordance with EN 15512:2009, 9.7.6.4 χ_{LT} may be set 1.

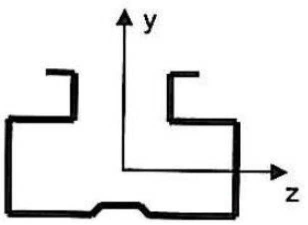
*4) For the verifications of stability in accordance with EN 15512:2009, clause 9.7, all values to be used are either respecting *5) or respecting *6) .

*5) I_y = 52,8cm^4, I_z = 29,6cm^4 (for gross cross sections in accordance with EN 15512:2009, clause 9.7)

*6) I_y = 47,6cm^4, I_z = 25,5cm^4 (for average net cross sections due to perforations)

Cross section-axes conventions of the profiles





Pallet racking system "META Multipal S"	Annex 7.1
Upright characteristics A_{eff}, W_{eff}, χ_{LT}, ($\chi(\bar{\lambda})$ no performance assessed)	

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Bending strength **M_{Rk}** and rotational stiffness of BECs
for downward bending moments in accordance with EN 15512:2009, A.2.4

Upright	"Holm"	M_{Rk} [kNcm]	$k_d(\eta=1)$ *2) [kNcm/rad]	M_{Rd} *1) [kNcm]
SR 85/17	85/15	190	8.170	173
	85/20	237	7.410	215
	100/20	240	10.100	218
	120/20	244	10.900	222
	140/20	244	10.900	222
SR 85/20	85/15	190	8.170	173
	85/20	263	7.400	239
	100/20	295	10.100	268
	120/20	331	11.000	301
	140/20	333	13.200	303
	140/15	333	13.200	303
	155/17	334	14.600	304
SR 100/20	85/15	202	9.540	184
	85/20	292	7.400	265
	100/20	328	10.100	298
	120/20	351	11.000	319
	140/20	353	13.200	321
	140/15	359	13.200	326
	155/17	362	14.600	329
SR 100/21	85/15	198	9.540	180
	85/20	282	9.180	256
	100/20	320	9.640	291
	120/20	350	11.900	318
	140/20	353	14.400	321
	140/15	350	13.200	318
	155/17	351	15.500	319
SR 120/20	85/15	202	10.300	184
	85/20	292	8.600	265
	100/20	328	9.640	298
	120/20	351	11.900	319
	140/20	353	14.400	321
	140/15	359	14.500	326
	155/17	362	15.100	329
SR 120/25	85/15	202	11.300	184
	85/20	323	8.080	294
	100/20	374	11.600	340
	120/20	439	14.000	399
	140/20	468	14.400	425
	140/15	495	14.700	450
	155/17	508	16.600	462

*1) For the calculation of the design moment M_{Rd} in accordance with EN 15512:2009 (A.10) a partial factor of $\gamma_M = 1{,}1$ *3) was used.

*2) For the calculation of the design value of the rotational stiffness k_d the procedure in accordance with EN 15512:2009 (Figure A.6) using a partial factor of $\gamma_M = 1{,}1$ *3) was executed.

*3) In case of absence of other national regulations.

For verifications in accordance with EN 15512:2009, clause 9.5.4, a distance a = 40cm may be used.

Pallet racking system "META Multipal S"	Annex 7.2.1
BEC characteristics M_{Rk}, ($k(\eta)$, $k(\theta)$ no performance assessed)	

Deutsches Institut für Bautechnik DIBt

Bending strength $\mathbf{M_{Rk}}$ and rotational stiffness of BECs
for upward bending moments and looseness φ_ℓ

Upright	"Holm"	$k_d(\eta=1)$ [*2] [kNcm/rad]	M_{Rk}, M_{Rd} [*1] [kNcm]	φ_ℓ [rad]
SR 85/17+85/20	all	80% [*]	60% [*]	0,00005
SR 100/20+/21+120/20 SR 120/25	all	80% [*]	60% [*]	0

*) …of the values of annex 7.2.1

*1,2) …as in annex 7.2.1

Shear strength $\mathbf{V_{Rk}}$ for downward shear loads

Upright	"Holm"	V_{Rk} [kN]	V_{Rd} [*1] [kN]
SR 85/17+85/20 SR 100/20+/21+120/20	all	36,0	32,7
SR 120/25	all	62,2	56,5

*1) For the calculation of the design value of the shear strength V_{Rd} a partial factor of $\gamma_M = 1{,}1$[*2] was used.

*2) In case of absence of other national regulations.

The design value of the shear strength V_{Rd} represents the maximum downward shear load of the BEC bearable for the upright. For "Holm 155/17" this shear strength V_{Rd} also verifies sufficient load capacity of the welded joint between the "Holm 155/17" and the BEC. Separate verifications are required for other "Holm" profiles.

The connector lock shown within annex 6.5 fulfills the requirements of EN 15512:2009, clause 6.4.2. The precondition for this is that the connector lock always remains fixed in its position and slipping out of the BEC is permanently prevented. This shall be ensured by appropriate means of control during all racking operations.

Pallet racking system "META Multipal S"	Annex 7.2.2
BEC characteristics M_{Rk}, (k(η), k(θ) no performance assessed), φ_ℓ, V_{Rk}	

Ultimate moment of resistance $\mathbf{M_{y,Rk}}$ and stiffness
for a range of axial loads N

(Information concerning the orientation of the axes can be found with the upright characteristics)

Upright	Foot plate	N [kN]	$M_{y,Rk}(N)$ [kNcm]	$k_{y,d}(N)$ *2) [kNcm/rad]	$M_{y,Rd}(N)$ *1) [kNcm]
SR 85/17	140x130x6 140x140x6	0	0	0	0
		14	54,1	4.810	49,2
		28	103,0	8.760	94,0
		42	138,0	11.900	125,0
		56	145,0	14.100	132,0
		81	0	14.100	0
SR 85/20	140x130x6 140x140x6	0	0	0	0
		17	58,5	5.190	53,2
		33	112,0	9.460	102,0
		50	149,0	12.500	135,0
		66	156,0	15.200	142,0
		92	0	15.200	0
SR 100/20 SR 100/21	140x130x6 140x140x6	0	0	0	0
		20	91,6	6.140	83,3
		40	171,0	11.600	155,0
		60	230,0	16.300	209,0
		80	266,0	20.200	242,0
		123	0	20.200	0
SR 120/20 SR 120/25	140x130x8 140x140x6	0	0	0	0
		31	165,0	11.700	150,0
		62	277,0	21.400	252,0
		93	275,0	29.000	250,0
		124	187,0	34.500	170,0
		215	0	34.500	0

*1) For the calculation of the design moment M_{Rd} in accordance with EN 15512:2009 (A.10) a partial factor of $\gamma_M = 1{,}1$ *3) was used.

*2) For the calculation of the design value of the rotational stiffness k_d the procedure in accordance with EN 15512:2009 (Figure A.6) using a partial factor of $\gamma_M = 1{,}1$ *3) was executed.

*3) In case of absence of other national regulations.

The design values apply to installations on concrete floors with sufficient strength to be able to bear the contact pressure. Sufficient strength of the substructure should be verified in accordance with EN 15512:2009. Precondition for the applicability of the design values is a sufficient planarity of the floor, so that a full-surface contact of the foot plates can be ensured. Anchoring of the foot plates in the concrete floor is not necessary for the application of the design values.

Transverse shear stiffness **S**
and range of transverse shear stiffness validity $\mathbf{V_{max}}$ of the upright frame

<table>
<tr><th>Upright frame</th><th></th><th>S
[kN/rad]</th><th>VV_{max}
[kN]</th></tr>
<tr><td>Uprights SR 85/17
Z-bracing</td><td>- Bracing C30/25/8/1.5</td><td>377</td><td>4,5</td></tr>
<tr><td>Uprights SR 85/20
Z-bracing</td><td>- Bracing C30/25/8/1.5</td><td>399</td><td>4,5</td></tr>
<tr><td>Uprights SR 100/20
Z-bracing</td><td>- Bracing C30/25/8/1.5</td><td>452</td><td>4,8</td></tr>
<tr><td rowspan="2">Uprights SR 100/21
Z-bracing</td><td rowspan="2">- Bracing C30/25/8/1.5</td><td>448</td><td rowspan="2">5,0</td></tr>
<tr><td>489 *)</td></tr>
<tr><td rowspan="2">Uprights SR 100/21
D-bracing</td><td rowspan="2">- Bracing C50/25/12.5/1.5</td><td>1100</td><td>12,0</td></tr>
<tr><td>1150 *)</td><td>10,8 *)</td></tr>
<tr><td>Uprights SR 120/20+25
D-bracing</td><td>- Bracing C50/25/12.5/1.5</td><td>1190</td><td>11,0</td></tr>
<tr><td colspan="4">Values valid for frame depths 750mm ≤ T ≤ 1100mm
*) for T = 1300mm
V_{max} is the maximum permissible design value of the lateral force in the frame,
it limits the validity of S (see EN 15512:2009, Figure A.13)</td></tr>
</table>

For the design and structural analysis of the upright frame, S determined from tests, may be used to derive either a reduced bracing cross section area A_{red} or alternatively a spring characteristic k_{fd} for the bracing connection. A_{red} or k_{fd} will depend on the bracing-type (Z- or D-bracing) and the geometry (connection angle and dimensions of the bracings).

Pallet racking system "META Multipal S"	Annex 7.4
Upright frame characteristics S, V_{max}	