WS

CE
EN 14592

Self-perforating dowel

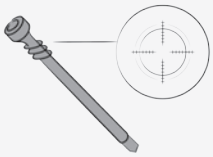
Carbon steel with white galvanic zinc coating

TECHNICAL ASSISTANCE

Complete documentation and personalised consultation

SPEED AND PRECISION

Quick fastening without pre-bored holes, with the possibility of simultaneous drilling of 1 to 3 steel plates

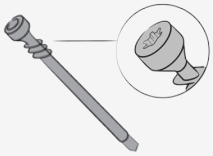


RIGIDITY AND DUCTILITY

Very rigid joint system, thanks to the lack of play between the hole and dowel

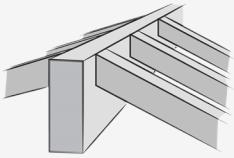
OPTIMISED GEOMETRY

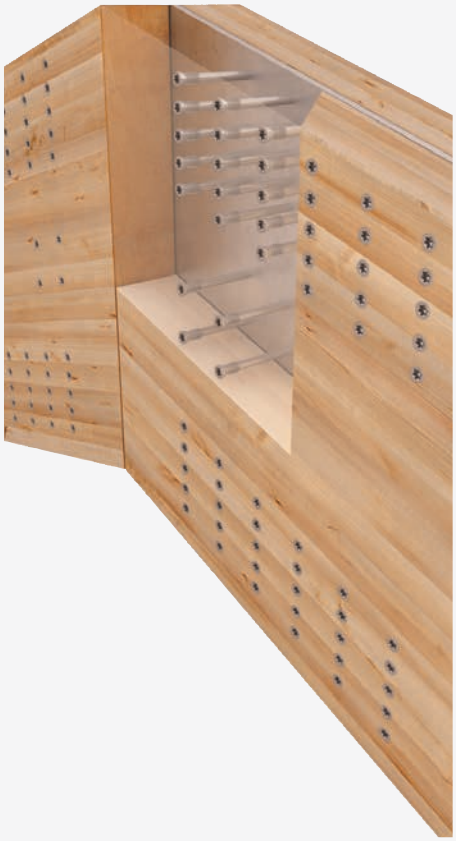
Self-perforating wood-steel tip, cylindrical hidden head, underhead thread to make insertion easier and impede slippage

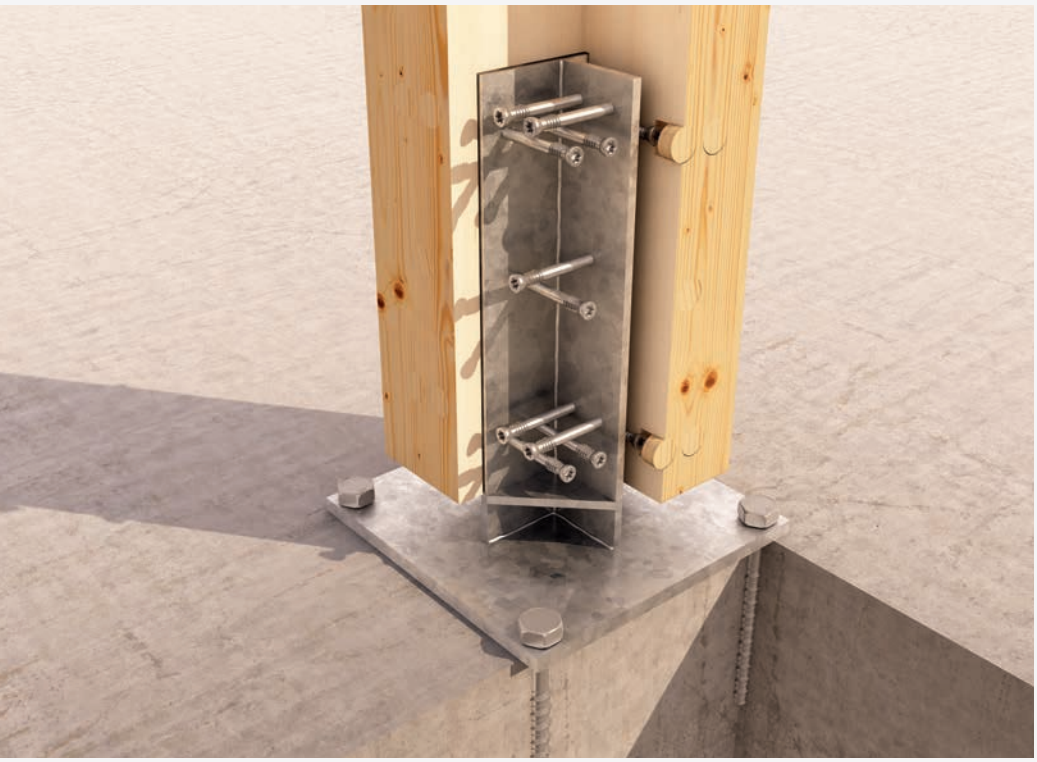


FIELDS OF USE

Self-perforating system for wood-steel retractable junctions. Can be used with S235/St37/Fe360 steel with a maximum thickness of 10 mm (1 plate) or 5 mm (2 and 3 plates). Can be used with screwdrivers with 1500 rpm minimum. Service classes 1 and 2







RIGID JOINTS

The connectors allow for the creation of rigid joints able to transfer bending moment stresses (moment-resisting joints). The reduced diameter also guarantees excellent ductility, ideal for anti-earthquake designs

PROTECTED RETRACTABLE JUNCTIONS

The connectors allow for the rapid and precise execution of retractable junctions on steel or aluminium alloy brackets (ALU brackets). The reduced dimensions allow for excellent fire protection

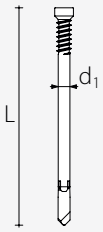
INTERLOCKING JOINTS

The reduced diameter of the connector (7mm) and the rapid installation without pre-bored holes makes this system excellent for the creation of interlocking joints on one or more steel plates (e.g. X10 pillar bases)

Applications

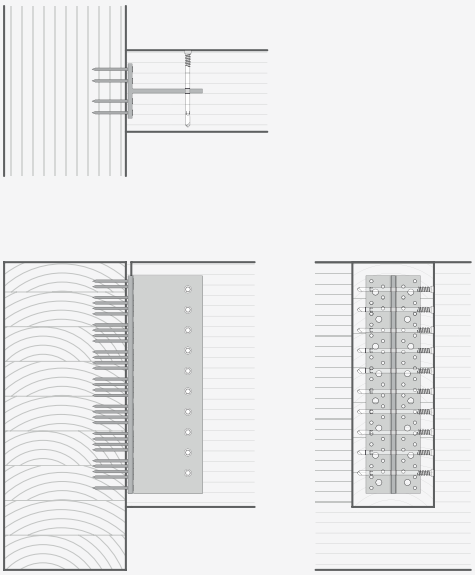
- Rigid "knee" joint with double internal plate
- ALU bracket fastening (without holes) for shear joint
- Fastening of pillar base with internal plate for shear joints

Codes and dimensions

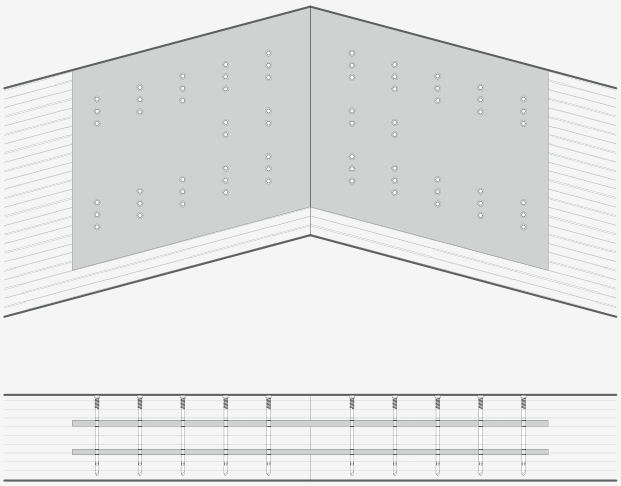


d_1 [mm]	code	L [mm]	pcs/pckg
7 *TX40*	**CS100165**	73	100
	CS100160	93	
	CS100240	113	
	CS100245	133	
	CS100215	153	
	CS100220	173	
	CS100225	193	
	CS100250	213	
	CS100255	233	

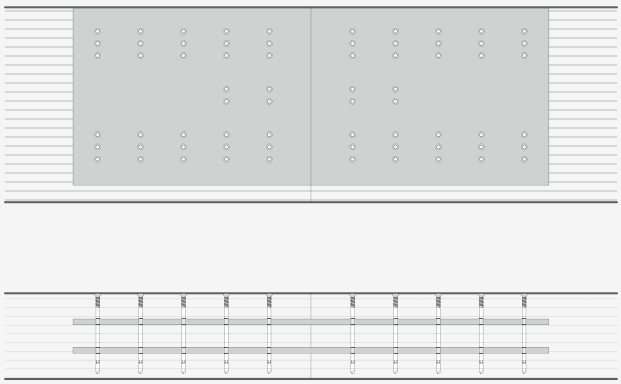
Application examples



Main-secondary joint with AluMIDI bracket.



Interlocking joint "knee" beam.



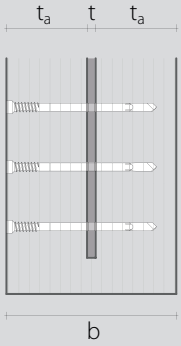
Interlocking joint straight beam.

Interlocking joint at the base with X10 pillar base.

Carpenter statics

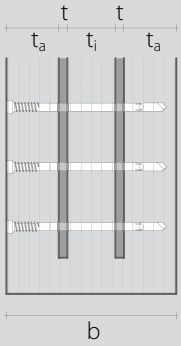
ALLOWABLE VALUES
DIN 1052:1988

SHEAR WOOD-STEEL-WOOD V_{adm}



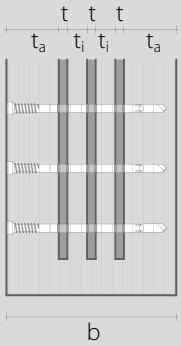
1 INTERNAL PLATE (2 shear planes)

Fastening	WS	[mm]	7x73	7x93	7x113	7x133	7x153	7x173	7x193	7x213	7x233
Beam width	b	[mm]	80	100	120	140	160	180	200	220	240
Exterior wood	t_a	[mm]	37	47	57	67	77	87	97	107	117
Plate thickness	t	[mm]	5	5	5	5	5	5	5	5	5
V_{adm} [kN]	Angle Force - Grain	0°	2,65	3,37	3,85	4,04	4,04	4,04	4,04	4,04	4,04
		30°	2,43	3,09	3,53	3,71	3,71	3,71	3,71	3,71	3,71
		45°	2,32	2,95	3,37	3,54	3,54	3,54	3,54	3,54	3,54
		60°	2,21	2,81	3,21	3,37	3,37	3,37	3,37	3,37	3,37
		90°	1,99	2,53	2,89	3,03	3,03	3,03	3,03	3,03	3,03



2 INTERNAL PLATES (4 shear planes)

Fastening	WS	[mm]	7x73	7x93	7x113	7x133	7x153	7x173	7x193	7x213	7x233
Beam width	b	[mm]	80	100	120	140	160	180	200	220	240
Exterior wood	t_a	[mm]	-	-	-	43	53	61	61	61	61
Interior wood	t_i	[mm]	-	-	-	42	42	46	66	86	106
Plate thickness	t	[mm]	-	-	-	5	5	5	5	5	5
V_{adm} [kN]	Angle Force - Grain	0°	-	-	-	6,30	6,78	7,17	7,17	7,17	7,17
		30°	-	-	-	5,78	6,22	6,57	6,57	6,57	6,57
		45°	-	-	-	5,51	5,93	6,27	6,27	6,27	6,27
		60°	-	-	-	5,25	5,65	5,97	5,97	5,97	5,97
		90°	-	-	-	4,73	5,09	5,37	5,37	5,37	5,37



3 INTERNAL PLATES (6 shear planes)

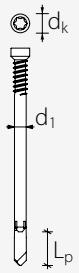
Fastening	WS	[mm]	7x73	7x93	7x113	7x133	7x153	7x173	7x193	7x213	7x233
Beam width	b	[mm]	80	100	120	140	160	180	200	220	240
Exterior wood	t_a	[mm]	-	-	-	-	-	39	49	59	61
Interior wood	t_i	[mm]	-	-	-	-	-	42	42	42	50
Plate thickness	t	[mm]	-	-	-	-	-	5	5	5	5
V_{adm} [kN]	Angle Force - Grain	0°	-	-	-	-	-	9,09	9,71	10,19	10,29
		30°	-	-	-	-	-	8,33	8,90	9,34	9,43
		45°	-	-	-	-	-	7,95	8,50	8,92	9,00
		60°	-	-	-	-	-	7,58	8,09	8,49	8,58
		90°	-	-	-	-	-	6,82	7,28	7,64	7,72

NOTE

- Allowable values in accordance with DIN 1052:1988.
- The values provided are calculated using 5 mm thick plates and a 6 mm thick milled cut in the wood.
- Maximum drill capacity for steel S235/St37/Fe360:
  - 3 plates, 5 mm thick
  - 1 plate, 10 mm thick

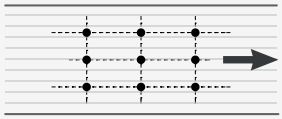
Geometry and minimum distances

GEOMETRY AND MECHANICAL CHARACTERISTICS

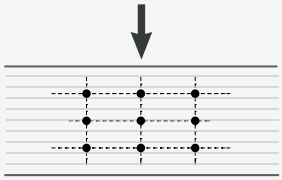


WS CONNECTOR		
Nominal diameter	**d_1 [mm]**	**7**
Head diameter	d_K [mm]	11,00
Tip length	L_p [mm]	12,00
Characteristic yield moment	$M_{y,k}$ [Nmm]	31930

MINIMUM DISTANCES FOR CONNECTORS SUBJECTED TO SHEAR STRESS [1]

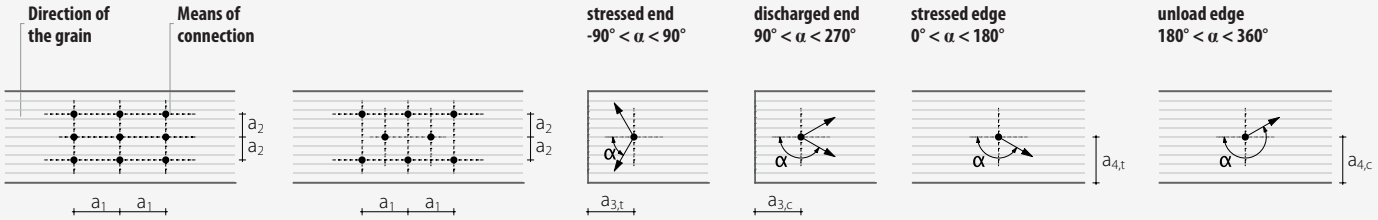


Angle between strength and grain α = 0°



Angle between strength and grain α = 90°

		7	7
a_1	[mm]	35	21
a_2	[mm]	21	21
$a_{3,t}$	[mm]	80	80
$a_{3,c}$	[mm]	21	21
$a_{4,t}$	[mm]	21	28
$a_{4,c}$	[mm]	21	21

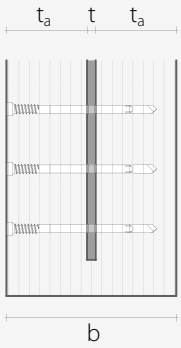


NOTE

[1] Minimum distances in accordance with EN 1995:2008.

Designer statics

SHEAR WOOD - STEEL -WOOD $R_{v,k}$



INTERNAL PLATE (2 shear planes)

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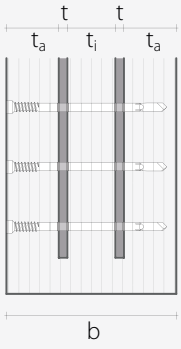
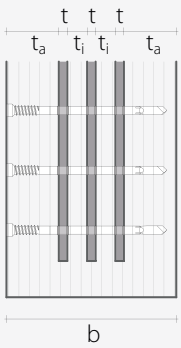
Beam width	b	[mm]	80	100	120	140	160	180	200	220	240
Exterior wood	t_a	[mm]	37	47	57	67	77	87	97	107	117
Plate thickness	t	[mm]	5	5	5	5	5	5	5	5	5
		0°	7,87	8,71	9,89	10,80	11,49	11,71	11,71	11,71	11,71
		30°	7,22	8,05	9,06	10,08	10,68	11,09	11,09	11,09	11,09
$R_{v,k}$ [kN]	Angle Force - Grain	45°	6,65	7,51	8,39	9,44	10,01	10,57	10,57	10,57	10,57
		60°	6,18	7,06	7,83	8,76	9,44	9,96	10,11	10,11	10,11
		90°	5,78	6,67	7,36	8,20	8,96	9,43	9,71	9,71	9,71



2 INTERNAL PLATES (4 shear planes)

Fastening	WS	[mm]	7x73	7x93	7x113	7x133	7x153	7x173	7x193	7x213	7x233
Beam width	b	[mm]	80	100	120	140	160	180	200	220	240
Exterior wood	t_a	[mm]	-	-	-	40	40	55	65	65	75
Interior wood	t_i	[mm]	-	-	-	48	68	58	58	78	78
Plate thickness	t	[mm]	-	-	-	5	5	5	5	5	5
		0°	-	-	-	17,80	19,77	21,34	22,37	22,37	23,05
		30°	-	-	-	16,26	18,61	19,41	20,52	21,05	21,65
$R_{v,k}$ [kN]	Angle Force - Grain	45°	-	-	-	14,99	17,62	17,78	18,80	19,78	20,47
		60°	-	-	-	13,94	16,79	16,43	17,34	18,68	19,45
		90°	-	-	-	12,99	15,78	15,29	16,11	17,73	18,57



3 INTERNAL PLATES (6 shear planes)

Fastening	WS	[mm]	7x73	7x93	7x113	7x133	7x153	7x173	7x193	7x213	7x233
Beam width	b	[mm]	80	100	120	140	160	180	200	220	240
Exterior wood	t_a	[mm]	-	-	-	-	-	39	39	43	53
Interior wood	t_i	[mm]	-	-	-	-	-	42	52	58	58
Plate thickness	t	[mm]	-	-	-	-	-	5	5	5	5
		0°	-	-	-	-	-	25,00	29,10	31,70	32,80
		30°	-	-	-	-	-	22,80	26,40	28,80	29,80
$R_{v,k}$ [kN]	Angle Force - Grain	45°	-	-	-	-	-	20,90	24,20	26,40	27,20
		60°	-	-	-	-	-	19,30	22,30	24,40	25,00
		90°	-	-	-	-	-	17,80	20,60	22,60	23,20

Corrective coefficient k_F for different densities ρ_k

ρ_k [kg/m³]	350	380	410	430	450
k_F	0,93	1,00	1,04	1,06	1,09

For different densities ρ_k the wood-side design resistance is calculated as: $R'_{V,d} = R_{V,d} \cdot k_F$

Effective number of n_{ef} for $a_1 = 35$ mm

	n	1	2	3	4	5
Angle Force - Grain	0°	1,00	1,47	2,12	2,74	3,35
	30°	1,00	1,65	2,41	3,16	3,90
	45°	1,00	1,73	2,56	3,37	4,18
	60°	1,00	1,82	2,71	3,58	4,45
	90°	1,00	2,00	3,00	4,00	5,00

Effective number of n_{ef} for $a_1 = 50$ mm

	n	1	2	3	4	5
Angle Force - Grain	0°	1,00	1,61	2,31	3,00	3,66
	30°	1,00	1,74	2,54	3,33	4,11
	45°	1,00	1,80	2,66	3,50	4,33
	60°	1,00	1,87	2,77	3,67	4,55
	90°	1,00	2,00	3,00	4,00	5,00

In the case of multiple dowels placed parallel to the fibres, the effective number must be taken into account: $R'_{V,d} = R_{V,d} \cdot n_{ef}$

NOTE

- Characteristic values comply with EN 1995:2008.
- Design values are obtained from the following characteristic values:

$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_m}$$

  The coefficients γ_m and k_{mod} should be taken according to the current regulations used for the calculation.
- The values provided are calculated with 5 mm thick plates and a 6 mm thick milled cut in the wood.
- Maximum drill capacity for steel S235/St37/Fe360:
- - 3 plates, 5 mm thick
- - 1 plate, 10 mm thick
- In the calculations, the density of the wood elements was considered equal to $\rho_k = 380$ kg/m³.
- Sizing and verification of the wooden elements and metal plates must be done separately.