

Declaration of Performance

No **5 - 006 - 230169 - 2023/01**



1.) Unique identification code of the product-type:

Three-dimensional nailing plates / EJOT Joist Hangers

2.) Intended use:

Joist Hangers for wood to wood connections and wood to concrete or steel connections

3.) Manufacturer:

EJOT Baubefestigungen GmbH, In der Stockwiese 35, 57334 Bad Laasphe - Germany

4.) System of AVCP:

System 2+

5.) European Assessment Document:

EAD 130186-00-0603

European Technical Assessment:

ETA-23/0169

Technical assessment body:

ETA-DANMARK A/S

Notified body:

1336 - Inspecta Estonia OÜ

6.) Declared Performance:

a) Mechanical resistance and stability (BWR 1) and safety and accessibility (BWR 4)

Essential characteristic	Performance
Characteristic load-carrying capacity	See Annex B
Stiffness	NPD
Ductility in cyclic testing	NPD
Resistance to seismic actions	NPD
Resistance to corrosion and deterioration	The joist hangers have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1, 2 and 3. The joist hangers can also be used in outdoor timber structures, service class 3, when a corrosion protection in accordance with Eurocode 5, table 4.1 (e.g., a Z350 corrosion protection) is applied, or when stainless steel with similar or better characteristic yield and ultimate strength is employed

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b) Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	The joist hangers are made from steel classified to have reaction to fire class A1 according to EN 13501-1.
Resistance to fire	NPD

c) Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance

d) Protection against noise (BWR 5)

Essential characteristic	Performance

e) Energy economy and heat retention (BWR 6)

Essential characteristic	Performance

f) Sustainable use of natural resources (BWR 7)

Essential characteristic	Performance

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by:

Dr. Jens Weber
(Name)

Bad Laasphe, 17/02/2023
(Place and date of issue)



(Signature)

Annex B

Characteristic load-carrying-capacities

Characteristic capacities of the joist hanger connections with nails

The downward and the upward directed forces are assumed to act in the middle of the joist. The lateral force is assumed to act at a distance $e_{J,90}$ above the centre of gravity of the nails in the joist.

Two nail patterns are specified. A full nailing pattern, where there are nails in all the holes, and a partial nailing pattern, where the number of nails in the joist and the header are at least half the numbers specified for full nailing. The nails in the joist may be staggered and there shall always be a nail in the upper and the lower holes. The other nails are distributed evenly over the height. The nails in the header shall be put in the holes closest to the bend line.

For joist hangers with overlapping nails in the joist (see figure 8.5 in EN 1995-1-1) the width of the joist shall be at least $l+4d$, where l is the length of the nails and d is the diameter of the nails in the joist. For joist hangers with staggered nails in the joist the width shall be at least the penetration length of the nails.

B.1 Joist hangers fastened with nails

Force downward toward the bottom plate:

$$F_{Z,Rk} = \min \left\{ (n_J + 2) \cdot F_{v,J,Rk} \right. \\ \left. \sqrt{\left(\frac{1}{n_H \cdot F_{v,H,Rk}} \right)^2 + \left(\frac{1}{k_{H,1} \cdot F_{ax,H,Rk}} \right)^2} \right\} \quad (B.1.1)$$

Force upward away from the bottom plate:

$$F_{Z,Rk} = \min \left\{ n_J \cdot F_{v,J,Rk} \right. \\ \left. \sqrt{\left(\frac{1}{n_{H1} \cdot F_{v,H,Rk}} \right)^2 + \left(\frac{1}{k_{H,2} \cdot F_{ax,H,Rk}} \right)^2} \right\} \quad (B.1.2)$$

Lateral force

$$F_{Y,Rk} = \min \left\{ \sqrt{\frac{n_J \cdot F_{v,J,Rk}}{2 \cdot \sqrt{e_{J,90}^2 + e_{J,90}^2}} + \left(\frac{F_{v,J,Rk}}{F_{ax,J,Rk}} \right)^2} \right. \\ \left. \sqrt{\frac{F_{v,H,Rk}}{\left(\frac{1}{n_{H1}} + \frac{e_H}{e_1} \right)^2 + \left(\frac{e_H}{e_2} \right)^2}} \right\} \quad (B.1.3)$$

n_J total number of nails in both sides of the joist

n_{H1} total number of nails in the side of the header

$F_{v,Rk}$ characteristic lateral load-carrying capacity of a nail in the joist or in the header indicated by the indices J or H in N, for 2,0 mm or 2,5 mm steel plates, the Eurocode 5 equations for thick steel plates may be applied

$F_{ax,Rk}$ characteristic axial load-carrying capacity of a nail in the joist or in the header indicated by the indices J or H in N

B width of the joist hanger in mm, see figure B1

$e_{J,90}$ distance of the lateral force above the centre of gravity of the nails in the joist in mm, see Tables B1 to B12. $e_{J,90}$ must not be taken less than 0.2 times the depth of the joist hanger

$e_{J,0}$ joist hanger dimension in mm, see Tables B1 to B12

e_{H1} distance of the lateral force above the centre of gravity of the nails in the header.

e_1 joist hanger dimension in mm, see Tables B1 to B12

e_2 joist hanger dimension in mm, see Tables B1 to B12

$k_{H1,1}$ form factor, see Tables B1 to B12

$k_{H1,2}$ form factor, see Tables B1 to B12

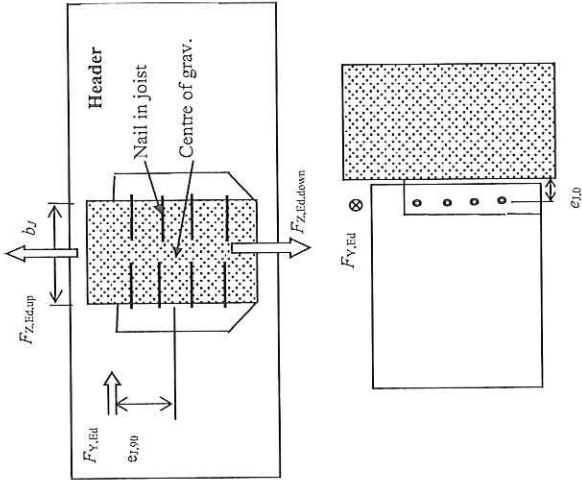


Figure B1: Definition of $e_{I,90}$ and $e_{I,0}$

Combined forces

In case of combined forces the relevant of the following inequalities shall be fulfilled:

Downward force:

$$\left(\frac{F_{Down,Ed}}{F_{Down,Rk}}\right)^2 + \left(\frac{F_{In,Ed}}{F_{In,Rk}}\right)^2 \leq 1,0 \tag{B.1.4}$$

Upward force:

$$\left(\frac{F_{Up,Ed}}{F_{Up,Rk}}\right)^2 + \left(\frac{F_{In,Ed}}{F_{In,Rk}}\right)^2 \leq 1,0 \tag{B.1.5}$$

Table B1: Joist hanger Blank 238 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1 and e_2 ; $e_{f,0} = 30$ mm

B [mm]	H [mm]	full nailing						partial nailing					
		n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]
40	99	6	4	13.1	1.60	908	178	4	2	8.72	1.33	388	132
42	98	6	4	12.9	1.60	953	183	4	2	8.59	1.33	412	135
44	97	6	4	12.7	1.60	999	188	4	2	8.46	1.33	437	139
45	97	6	4	12.6	1.60	1022	191	4	2	8.40	1.33	450	141
46	96	6	4	12.5	1.60	1046	194	4	2	8.33	1.33	463	142
48	95	6	4	12.3	1.60	1094	199	4	2	8.20	1.33	489	146
50	94	6	4	12.1	1.60	1143	204	4	2	8.08	1.33	516	150
51	94	6	4	12.0	1.60	1169	207	4	2	8.01	1.33	530	151
52	93	6	4	11.9	1.60	1194	209	4	2	7.95	1.33	544	153
54	92	6	4	11.8	1.60	1246	215	4	2	7.82	1.33	573	157
56	91	6	4	11.6	1.60	1299	220	4	2	7.69	1.33	603	161
58	90	6	4	11.4	1.60	1353	226	4	2	7.56	1.33	633	164
60	89	6	4	11.2	1.60	1408	231	4	2	7.43	1.33	664	168
62	88	6	4	11.0	1.60	1465	236	4	2	7.30	1.33	696	172
64	87	6	4	10.8	1.60	1523	242	4	2	7.18	1.33	729	176
66	86	6	4	10.6	1.60	1582	247	4	2	7.05	1.33	763	179
68	85	6	4	10.4	1.60	1642	253	4	2	6.92	1.33	797	183
70	84	6	4	10.2	1.60	1703	258	4	2	6.79	1.33	832	187
72	83	6	4	10.0	1.60	1766	264	4	2	6.66	1.33	868	191
73	83	6	4	9.92	1.60	1798	266	4	2	6.60	1.33	886	193
74	82	6	4	9.82	1.60	1830	269	4	2	6.54	1.33	905	195
76	81	6	4	9.63	1.60	1895	275	4	2	6.41	1.33	943	198
78	80	6	4	9.43	1.60	1961	280	4	2	6.28	1.33	981	202
80	79	6	4	9.24	1.60	2028	286	4	2	6.16	1.33	1020	206
82	78	6	4	9.05	1.60	2097	291	4	2	6.03	1.33	1060	210
84	77	6	4	8.86	1.60	2167	297	4	2	5.90	1.33	1101	214
86	76	6	4	8.67	1.60	2238	302	4	2	5.78	1.33	1143	218
88	75	6	4	8.48	1.60	2310	308	4	2	5.65	1.33	1185	221
90	74	6	4	8.29	1.60	2383	314	4	2	5.53	1.33	1228	225
92	73	6	4	8.10	1.60	2458	319	4	2	5.40	1.33	1272	229
94	72	6	4	7.91	1.60	2534	325	4	2	5.28	1.33	1317	233
96	71	6	4	7.72	1.60	2611	330	4	2	5.15	1.33	1363	237
98	70	6	4	7.53	1.60	2689	336	4	2	5.03	1.33	1409	241
100	69	6	4	7.34	1.60	2768	342	4	2	4.90	1.33	1456	245

Table B2: Joist hanger Blank 260 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1 and e_2 ; $e_{f,0} = 30$ mm

B [mm]	H [mm]	full nailing						partial nailing					
		n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]
40	110	8	4	17.9	3.19	963	293	4	2	8.72	1.33	388	132
42	109	8	4	17.6	3.19	1005	300	4	2	8.59	1.33	412	135
44	108	8	4	17.3	3.19	1048	307	4	2	8.46	1.33	437	139
45	108	8	4	17.2	3.19	1070	310	4	2	8.40	1.33	450	141
46	107	8	4	17.1	3.19	1092	314	4	2	8.33	1.33	463	142
48	106	8	4	16.8	3.19	1137	321	4	2	8.20	1.33	489	146
50	105	8	4	16.6	3.19	1184	328	4	2	8.08	1.33	516	150
51	105	8	4	16.4	3.19	1207	331	4	2	8.01	1.33	530	151
52	104	8	4	16.3	3.19	1231	335	4	2	7.95	1.33	544	153
54	103	8	4	16.1	3.19	1279	342	4	2	7.82	1.33	573	157
56	102	8	4	15.8	3.19	1328	349	4	2	7.69	1.33	603	161

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
58	101	8	4	15.6	3.19	1379	356	4	2	7.56	1.33	633	164
60	100	8	4	15.3	3.19	1430	363	4	2	7.43	1.33	664	168
62	99	8	4	15.1	3.19	1483	371	4	2	7.30	1.33	696	172
64	98	8	4	14.8	3.19	1536	378	4	2	7.18	1.33	729	176
66	97	8	4	14.6	3.19	1590	385	4	2	7.05	1.33	763	179
68	96	8	4	14.3	3.19	1646	392	4	2	6.92	1.33	797	183
70	95	8	4	14.1	3.19	1702	400	4	2	6.79	1.33	832	187
72	94	8	4	13.8	3.19	1760	407	4	2	6.66	1.33	868	191
73	94	8	4	13.7	3.19	1789	411	4	2	6.60	1.33	886	193
74	93	8	4	13.5	3.19	1819	415	4	2	6.54	1.33	905	195
76	92	8	4	13.3	3.19	1878	422	4	2	6.41	1.33	943	198
78	91	8	4	13.1	3.19	1939	429	4	2	6.28	1.33	981	202
80	90	8	4	12.8	3.19	2000	437	4	2	6.16	1.33	1020	206
82	89	8	4	12.6	3.19	2063	444	4	2	6.03	1.33	1060	210
84	88	8	4	12.3	3.19	2127	452	4	2	5.90	1.33	1101	214
86	87	8	4	12.1	3.19	2192	459	4	2	5.78	1.33	1143	218
88	86	8	4	11.8	3.19	2257	467	4	2	5.65	1.33	1185	221
90	85	8	4	11.6	3.19	2324	474	4	2	5.53	1.33	1228	225
92	84	8	4	11.3	3.19	2392	482	4	2	5.40	1.33	1272	229
94	83	8	4	11.1	3.19	2461	489	4	2	5.28	1.33	1317	233
96	82	8	4	10.8	3.19	2531	497	4	2	5.15	1.33	1363	237
98	81	8	4	10.6	3.19	2602	504	4	2	5.03	1.33	1409	241
100	80	8	4	10.3	3.19	2674	512	4	2	4.90	1.33	1456	245

Table B3: Joist hanger Blank 320 with external flanges: Form factors k_{H,1} and k_{H,2} and dimensions e₁ and e₂; e₁; e_{1,0} = 30 mm

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
40	140	12	8	28.5	7.43	956	478	6	4	13.9	3.33	341	231
42	139	12	8	28.2	7.43	995	488	6	4	13.7	3.33	359	235
44	138	12	8	27.8	7.43	1034	498	6	4	13.5	3.33	378	240
45	138	12	8	27.6	7.43	1054	502	6	4	13.4	3.33	387	242
46	137	12	8	27.4	7.43	1074	507	6	4	13.3	3.33	397	244
48	136	12	8	27.0	7.43	1116	517	6	4	13.1	3.33	417	249
50	135	12	8	26.7	7.43	1158	527	6	4	13.0	3.33	437	253
51	135	12	8	26.5	7.43	1179	532	6	4	12.9	3.33	448	256
52	134	12	8	26.3	7.43	1201	537	6	4	12.8	3.33	458	258
54	133	12	8	25.9	7.43	1245	547	6	4	12.6	3.33	480	263
56	132	12	8	25.6	7.43	1290	557	6	4	12.4	3.33	502	268
58	131	12	8	25.2	7.43	1336	568	6	4	12.2	3.33	525	273
60	130	12	8	24.8	7.43	1382	578	6	4	12.0	3.33	548	278
62	129	12	8	24.5	7.43	1430	588	6	4	11.8	3.33	572	283
64	128	12	8	24.1	7.43	1479	599	6	4	11.7	3.33	597	288
66	127	12	8	23.8	7.43	1528	609	6	4	11.5	3.33	622	293
68	126	12	8	23.4	7.43	1579	619	6	4	11.3	3.33	648	298
70	125	12	8	23.0	7.43	1631	630	6	4	11.1	3.33	674	303
72	124	12	8	22.7	7.43	1683	641	6	4	10.9	3.33	701	308
73	124	12	8	22.5	7.43	1710	646	6	4	10.8	3.33	715	311
74	123	12	8	22.3	7.43	1736	651	6	4	10.8	3.33	729	313
76	122	12	8	21.9	7.43	1791	662	6	4	10.6	3.33	757	319
78	121	12	8	21.6	7.43	1846	673	6	4	10.4	3.33	786	324
80	120	12	8	21.2	7.43	1902	683	6	4	10.2	3.33	815	329
82	119	12	8	20.9	7.43	1960	694	6	4	10.0	3.33	845	335

B [mm]	H [mm]	full nailing					partial nailing						
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
84	118	12	8	20,5	7,43	2018	705	6	4	9,85	3,33	876	340
86	117	12	8	20,2	7,43	2077	716	6	4	9,67	3,33	907	345
88	116	12	8	19,8	7,43	2137	726	6	4	9,49	3,33	939	351
90	115	12	8	19,5	7,43	2198	737	6	4	9,31	3,33	971	356
92	114	12	8	19,1	7,43	2260	748	6	4	9,13	3,33	1004	362
94	113	12	8	18,8	7,43	2322	759	6	4	8,95	3,33	1038	367
96	112	12	8	18,4	7,43	2386	770	6	4	8,78	3,33	1072	373
98	111	12	8	18,1	7,43	2451	781	6	4	8,60	3,33	1107	378
100	110	12	8	17,7	7,43	2516	792	6	4	8,43	3,33	1142	384

Table B4: Joist hanger Blank 380 with external flanges: Form factors k_{H,1} and k_{H,2} and dimensions e₁ and e₂; e_{1,0} = 30 mm

B [mm]	H [mm]	full nailing					partial nailing						
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
40	170	18	10	45,6	33,2	1507	1345	8	5	19,5	9,67	349	473
42	169	18	10	45,2	33,0	1532	1340	8	5	19,3	9,67	361	474
44	168	18	10	44,7	32,8	1557	1337	8	5	19,1	9,67	373	474
45	168	18	10	44,5	32,7	1570	1335	8	5	19,0	9,67	380	475
46	167	18	10	44,2	32,6	1584	1334	8	5	18,9	9,67	386	475
48	166	18	10	43,8	32,3	1611	1332	8	5	18,6	9,67	399	477
50	165	18	10	43,3	32,1	1639	1331	8	5	18,4	9,67	413	479
51	165	18	10	43,1	32,0	1653	1331	8	5	18,3	9,67	420	480
52	164	18	10	42,8	31,9	1668	1331	8	5	18,2	9,67	427	481
54	163	18	10	42,3	31,7	1697	1332	8	5	18,0	9,67	441	484
56	162	18	10	41,9	31,5	1728	1333	8	5	17,7	9,67	456	487
58	161	18	10	41,4	31,3	1760	1334	8	5	17,5	9,67	471	490
60	160	18	10	41,0	31,0	1792	1337	8	5	17,3	9,67	487	493
62	159	18	10	40,5	30,8	1825	1339	8	5	17,1	9,67	503	497
64	158	18	10	40,0	30,6	1859	1343	8	5	16,8	9,67	519	501
66	157	18	10	39,6	30,4	1894	1347	8	5	16,6	9,67	536	505
68	156	18	10	39,1	30,2	1930	1351	8	5	16,4	9,67	553	509
70	155	18	10	38,6	30,0	1967	1356	8	5	16,2	9,67	571	513
72	154	18	10	38,2	29,8	2004	1361	8	5	16,0	9,67	589	518
73	154	18	10	38,0	29,7	2024	1364	8	5	15,8	9,67	598	520
74	153	18	10	37,7	29,6	2043	1367	8	5	15,7	9,67	607	523
76	152	18	10	37,3	29,4	2082	1373	8	5	15,5	9,67	626	527
78	151	18	10	36,8	29,2	2122	1380	8	5	15,3	9,67	645	532
80	150	18	10	36,4	29,0	2163	1386	8	5	15,1	9,67	665	537
82	149	18	10	35,9	28,8	2205	1394	8	5	14,9	9,67	685	543
84	148	18	10	35,5	28,6	2248	1401	8	5	14,7	9,67	705	548
86	147	18	10	35,0	28,4	2292	1409	8	5	14,4	9,67	726	553
88	146	18	10	34,6	28,2	2336	1417	8	5	14,2	9,67	747	559
90	145	18	10	34,1	28,0	2382	1426	8	5	14,0	9,67	769	564
92	144	18	10	33,7	27,9	2428	1435	8	5	13,8	9,67	791	570
94	143	18	10	33,2	27,7	2475	1444	8	5	13,6	9,67	813	576
96	142	18	10	32,8	27,5	2523	1453	8	5	13,4	9,67	836	582
98	141	18	10	32,3	27,3	2572	1463	8	5	13,2	9,67	859	588
100	140	18	10	31,9	27,1	2622	1473	8	5	13,0	9,67	883	594

Table B5: Joist hanger Blank 440 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1 and e_2 ; $e_{1,0} = 30$ mm

B [mm]	H [mm]	full nailing					partial nailing				
		n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	e_1 [mm]
40	200	24	14	71.3	45.7	1713	2015	12	8	37.1	18.2
42	199	24	14	70.7	45.5	1737	2005	12	8	36.8	18.2
44	198	24	14	70.0	45.3	1763	1996	12	8	36.5	18.2
45	198	24	14	69.7	45.2	1776	1992	12	8	36.3	18.2
46	197	24	14	69.4	45.1	1790	1988	12	8	36.1	18.2
48	196	24	14	68.8	44.9	1817	1982	12	8	35.8	18.2
50	195	24	14	68.1	44.7	1845	1977	12	8	35.5	18.2
51	195	24	14	67.8	44.6	1860	1975	12	8	35.3	18.2
52	194	24	14	67.5	44.5	1874	1973	12	8	35.2	18.2
54	193	24	14	66.9	44.3	1904	1970	12	8	34.8	18.2
56	192	24	14	66.3	44.1	1935	1968	12	8	34.5	18.2
58	191	24	14	65.6	43.9	1967	1967	12	8	34.2	18.2
60	190	24	14	65.0	43.7	1999	1967	12	8	33.8	18.2
62	189	24	14	64.4	43.5	2033	1969	12	8	33.2	18.2
64	188	24	14	63.8	43.4	2067	1969	12	8	32.9	18.2
66	187	24	14	63.1	43.2	2102	1971	12	8	32.5	18.2
68	186	24	14	62.5	43.0	2138	1974	12	8	32.2	18.2
70	185	24	14	61.9	42.8	2175	1977	12	8	31.9	18.2
72	184	24	14	61.3	42.6	2213	1982	12	8	31.7	18.2
73	184	24	14	61.0	42.5	2232	1984	12	8	31.6	18.2
74	183	24	14	60.7	42.4	2251	1987	12	8	31.3	18.2
76	182	24	14	60.1	42.2	2291	1992	12	8	30.9	18.2
78	181	24	14	59.4	42.1	2331	1998	12	8	30.6	18.2
80	180	24	14	58.8	41.9	2372	2005	12	8	30.3	18.2
82	179	24	14	58.2	41.7	2414	2012	12	8	30.0	18.2
84	178	24	14	57.6	41.5	2457	2020	12	8	29.7	18.2
86	177	24	14	57.0	41.3	2501	2028	12	8	29.4	18.2
88	176	24	14	56.4	41.2	2546	2036	12	8	29.0	18.2
90	175	24	14	55.8	41.0	2591	2046	12	8	28.7	18.2
92	174	24	14	55.2	40.8	2637	2055	12	8	28.4	18.2
94	173	24	14	54.6	40.6	2685	2065	12	8	28.1	18.2
96	172	24	14	54.0	40.5	2733	2075	12	8	27.8	18.2
98	171	24	14	53.4	40.3	2782	2086	12	8	27.5	18.2
100	170	24	14	52.8	40.1	2831	2097	12	8	27.2	18.2

Table B6: Joist hanger Blank 500 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1 and e_2 ; $e_{1,0} = 30$ mm

B [mm]	H [mm]	full nailing					partial nailing				
		n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	e_1 [mm]
40	230	28	16	87.0	63.2	1845	2732	12	8	37.1	18.2
42	229	28	16	86.2	63.0	1870	2715	12	8	36.8	18.2
44	228	28	16	85.5	62.8	1895	2699	12	8	36.5	18.2
45	228	28	16	85.2	62.7	1908	2692	12	8	36.3	18.2
46	227	28	16	84.8	62.6	1921	2686	12	8	36.1	18.2
48	226	28	16	84.1	62.4	1948	2674	12	8	35.8	18.2
50	225	28	16	83.4	62.2	1976	2664	12	8	35.5	18.2
51	225	28	16	83.0	62.1	1990	2659	12	8	35.3	18.2
52	224	28	16	82.6	62.1	2004	2655	12	8	35.2	18.2
54	223	28	16	81.9	61.9	2033	2647	12	8	34.8	18.2
56	222	28	16	81.2	61.7	2063	2640	12	8	34.5	18.2
58	221	28	16	80.5	61.5	2094	2635	12	8	34.2	18.2

B [mm]	H [mm]	full nailing				partial nailing			
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J
60	220	28	16	79.8	61.3	2126	2631	12	8
62	219	28	16	79.1	61.1	2158	2628	12	8
64	218	28	16	78.4	61.0	2192	2626	12	8
66	217	28	16	77.7	60.8	2226	2625	12	8
68	216	28	16	77.0	60.6	2260	2625	12	8
70	215	28	16	76.3	60.4	2296	2626	12	8
72	214	28	16	75.6	60.3	2332	2628	12	8
73	214	28	16	75.2	60.2	2351	2629	12	8
74	213	28	16	74.9	60.1	2369	2631	12	8
76	212	28	16	74.2	59.9	2407	2634	12	8
78	211	28	16	73.5	59.7	2446	2638	12	8
80	210	28	16	72.8	59.6	2486	2643	12	8
82	209	28	16	72.1	59.4	2526	2649	12	8
84	208	28	16	71.4	59.2	2567	2655	12	8
86	207	28	16	70.7	59.1	2609	2662	12	8
88	206	28	16	70.0	58.9	2652	2670	12	8
90	205	28	16	69.3	58.7	2695	2678	12	8
92	204	28	16	68.6	58.6	2740	2686	12	8
94	203	28	16	67.9	58.4	2785	2695	12	8
96	202	28	16	67.3	58.2	2831	2705	12	8
98	201	28	16	66.6	58.1	2877	2715	12	8
100	200	28	16	65.9	57.9	2925	2726	12	8

Table B7: Joist hanger Blank 238 with internal flanges: Form factors k_{H,1} and k_{H,2} and dimensions e₁ and e₂ : e_{1,0} = 30 mm

B [mm]	H [mm]	full nailing				partial nailing			
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J
40	99	4	4	8.72	1.33	388	132	4	2
42	98	4	4	8.59	1.33	412	135	4	2
44	97	4	4	8.46	1.33	437	139	4	2
45	97	4	4	8.40	1.33	450	141	4	2
46	96	4	4	8.33	1.33	463	142	4	2
48	95	4	4	8.20	1.33	489	146	4	2
50	94	4	4	8.08	1.33	516	150	4	2
51	94	4	4	8.01	1.33	530	151	4	2
52	93	4	4	7.95	1.33	544	153	4	2
54	92	4	4	7.82	1.33	573	157	4	2
56	91	4	4	7.69	1.33	603	161	4	2
58	90	4	4	7.56	1.33	633	164	4	2
60	89	4	4	7.43	1.33	664	168	4	2
62	88	4	4	7.30	1.33	696	172	4	2
64	87	4	4	7.18	1.33	729	176	4	2
66	86	4	4	7.05	1.33	763	179	4	2
68	85	4	4	6.92	1.33	797	183	4	2
70	84	4	4	6.79	1.33	832	187	4	2
72	83	4	4	6.66	1.33	868	191	4	2
73	83	4	4	6.60	1.33	886	193	4	2
74	82	4	4	6.54	1.33	905	195	4	2
76	81	4	4	6.41	1.33	943	198	4	2
78	80	4	4	6.28	1.33	981	202	4	2
80	79	4	4	6.16	1.33	1020	206	4	2
82	78	4	4	6.03	1.33	1060	210	4	2
84	77	4	4	5.90	1.33	1101	214	4	2

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
86	76	4	4	5.78	1.33	1143	218	4	2	5.78	1.33	1143	218
88	75	4	4	5.65	1.33	1185	221	4	2	5.65	1.33	1185	221
90	74	4	4	5.53	1.33	1228	225	4	2	5.53	1.33	1228	225
92	73	4	4	5.40	1.33	1272	229	4	2	5.40	1.33	1272	229
94	72	4	4	5.28	1.33	1317	233	4	2	5.28	1.33	1317	233
96	71	4	4	5.15	1.33	1363	237	4	2	5.15	1.33	1363	237
98	70	4	4	5.03	1.33	1409	241	4	2	5.03	1.33	1409	241
100	69	4	4	4.90	1.33	1456	245	4	2	4.90	1.33	1456	245

Table B8: Joist hanger Blank 260 with internal flanges: Form factors k_{H,1} and k_{H,2} and dimensions e₁ and e₂; e_{1,0} = 30 mm

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
40	110	4	4	8.72	1.33	103	82	4	2	8.72	1.33	103	82
42	109	4	4	8.59	1.33	113	84	4	2	8.59	1.33	113	84
44	108	4	4	8.46	1.33	124	86	4	2	8.46	1.33	124	86
45	108	4	4	8.40	1.33	130	87	4	2	8.40	1.33	130	87
46	107	4	4	8.33	1.33	136	88	4	2	8.33	1.33	136	88
48	106	4	4	8.20	1.33	149	90	4	2	8.20	1.33	149	90
50	105	4	4	8.08	1.33	163	93	4	2	8.08	1.33	163	93
51	105	4	4	8.01	1.33	170	94	4	2	8.01	1.33	170	94
52	104	4	4	7.95	1.33	177	96	4	2	7.95	1.33	177	96
54	103	4	4	7.82	1.33	192	99	4	2	7.82	1.33	192	99
56	102	4	4	7.69	1.33	208	102	4	2	7.69	1.33	208	102
58	101	4	4	7.56	1.33	225	105	4	2	7.56	1.33	225	105
60	100	4	4	7.43	1.33	243	108	4	2	7.43	1.33	243	108
62	99	4	4	7.30	1.33	261	111	4	2	7.30	1.33	261	111
64	98	4	4	7.18	1.33	280	114	4	2	7.18	1.33	280	114
66	97	4	4	7.05	1.33	300	118	4	2	7.05	1.33	300	118
68	96	4	4	6.92	1.33	321	121	4	2	6.92	1.33	321	121
70	95	4	4	6.79	1.33	343	125	4	2	6.79	1.33	343	125
72	94	4	4	6.66	1.33	365	128	4	2	6.66	1.33	365	128
73	94	4	4	6.60	1.33	376	130	4	2	6.60	1.33	376	130
74	93	4	4	6.54	1.33	388	132	4	2	6.54	1.33	388	132
76	92	4	4	6.41	1.33	412	135	4	2	6.41	1.33	412	135
78	91	4	4	6.28	1.33	437	139	4	2	6.28	1.33	437	139
80	90	4	4	6.16	1.33	463	142	4	2	6.16	1.33	463	142
82	89	4	4	6.03	1.33	489	146	4	2	6.03	1.33	489	146
84	88	4	4	5.90	1.33	516	150	4	2	5.90	1.33	516	150
86	87	4	4	5.78	1.33	544	153	4	2	5.78	1.33	544	153
88	86	4	4	5.65	1.33	573	157	4	2	5.65	1.33	573	157
90	85	4	4	5.53	1.33	603	161	4	2	5.53	1.33	603	161
92	84	4	4	5.40	1.33	633	164	4	2	5.40	1.33	633	164
94	83	4	4	5.28	1.33	664	168	4	2	5.28	1.33	664	168
96	82	4	4	5.15	1.33	696	172	4	2	5.15	1.33	696	172
98	81	4	4	5.03	1.33	729	176	4	2	5.03	1.33	729	176
100	80	4	4	4.90	1.33	763	179	4	2	4.90	1.33	763	179

Table B10: Joist hanger Blank 320 with internal flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1 and e_2 ; $e_{1,0} = 30$ mm

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
40	140	6	8	13.9	3.33	127	203	6	4	13.9	3.33	127	203
42	139	6	8	13.7	3.33	135	200	6	4	13.7	3.33	135	200
44	138	6	8	13.5	3.33	143	197	6	4	13.5	3.33	143	197
45	138	6	8	13.4	3.33	148	197	6	4	13.4	3.33	148	197
46	137	6	8	13.3	3.33	152	196	6	4	13.3	3.33	152	196
48	136	6	8	13.1	3.33	162	196	6	4	13.1	3.33	162	196
50	135	6	8	13.0	3.33	172	196	6	4	13.0	3.33	172	196
51	135	6	8	12.9	3.33	177	197	6	4	12.9	3.33	177	197
52	134	6	8	12.8	3.33	183	197	6	4	12.8	3.33	183	197
54	133	6	8	12.6	3.33	194	199	6	4	12.6	3.33	194	199
56	132	6	8	12.4	3.33	206	201	6	4	12.4	3.33	206	201
58	131	6	8	12.2	3.33	219	203	6	4	12.2	3.33	219	203
60	130	6	8	12.0	3.33	232	206	6	4	12.0	3.33	232	206
62	129	6	8	11.8	3.33	246	209	6	4	11.8	3.33	246	209
64	128	6	8	11.7	3.33	260	212	6	4	11.7	3.33	260	212
66	127	6	8	11.5	3.33	275	216	6	4	11.5	3.33	275	216
68	126	6	8	11.3	3.33	291	219	6	4	11.3	3.33	291	219
70	125	6	8	11.1	3.33	307	223	6	4	11.1	3.33	307	223
72	124	12	8	22.7	7.43	342	306	6	4	13.0	3.33	324	227
73	124	12	8	22.5	7.43	351	309	6	4	12.9	3.33	332	229
74	123	12	8	22.3	7.43	360	311	6	4	12.8	3.33	341	231
76	122	12	8	21.9	7.43	378	316	6	4	12.6	3.33	359	235
78	121	12	8	21.6	7.43	397	321	6	4	12.4	3.33	378	240
80	120	12	8	21.2	7.43	417	327	6	4	12.2	3.33	397	244
82	119	12	8	20.9	7.43	438	333	6	4	12.0	3.33	417	249
84	118	12	8	20.5	7.43	460	340	6	4	11.8	3.33	437	253
86	117	12	8	20.2	7.43	482	346	6	4	11.7	3.33	458	258
88	116	12	8	19.8	7.43	506	354	6	4	11.5	3.33	480	263
90	115	12	8	19.5	7.43	531	361	6	4	11.3	3.33	502	268
92	114	12	8	19.1	7.43	556	369	6	4	11.1	3.33	525	273
94	113	12	8	18.8	7.43	583	376	6	4	10.9	3.33	548	278
96	112	12	8	18.4	7.43	611	384	6	4	10.8	3.33	572	283
98	111	12	8	18.1	7.43	639	393	6	4	10.6	3.33	597	288
100	110	12	8	17.7	7.43	668	401	6	4	10.4	3.33	622	293

Table B11: Joist hanger Blank 380 with internal flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1 and e_2 ; $e_{1,0} = 30$ mm

B [mm]	H [mm]	full nailing					partial nailing						
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	e ₁ [mm]	e ₂ [mm]	
40	170	8	10	17.7	28.5	767	1842	8	5	17.7	28.5	767	1842
42	169	8	10	17.5	28.2	763	1697	8	5	17.5	28.2	763	1697
44	168	8	10	17.3	27.9	760	1573	8	5	17.3	27.9	760	1573
45	168	8	10	17.2	27.7	759	1517	8	5	17.2	27.7	759	1517
46	167	8	10	17.1	27.6	757	1466	8	5	17.1	27.6	757	1466
48	166	8	10	17.0	27.2	755	1373	8	5	17.0	27.2	755	1373
50	165	8	10	16.8	26.9	754	1292	8	5	16.8	26.9	754	1292
51	165	8	10	16.7	26.8	753	1256	8	5	16.7	26.8	753	1256
52	164	8	10	16.6	26.6	753	1221	8	5	16.6	26.6	753	1221
54	163	8	10	16.4	26.3	753	1158	8	5	16.4	26.3	753	1158
56	162	8	10	16.2	26.0	753	1102	8	5	16.2	26.0	753	1102
58	161	8	10	16.1	25.7	754	1053	8	5	16.1	25.7	754	1053

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
60	160	8	10	15.9	25.4	756	1008	8	5	15.9	25.4	756	1008
62	159	8	10	15.7	25.1	758	968	8	5	15.7	25.1	758	968
64	158	8	10	15.5	24.8	761	932	8	5	15.5	24.8	761	932
66	157	8	10	15.3	24.6	765	900	8	5	15.3	24.6	765	900
68	156	8	10	15.2	24.3	769	871	8	5	15.2	24.3	769	871
70	155	8	10	15.0	24.0	774	845	8	5	15.0	24.0	774	845
72	154	18	10	37.6	32.8	852	1196	8	5	18.4	9.67	337	474
73	154	18	10	37.3	32.7	856	1180	8	5	18.3	9.67	343	473
74	153	18	10	37.1	32.6	859	1165	8	5	18.2	9.67	349	473
76	152	18	10	36.6	32.4	867	1137	8	5	18.0	9.67	361	474
78	151	18	10	36.2	32.1	876	1113	8	5	17.7	9.67	373	474
80	150	18	10	35.7	31.9	886	1091	8	5	17.5	9.67	386	475
82	149	18	10	35.3	31.7	897	1071	8	5	17.3	9.67	399	477
84	148	18	10	34.8	31.5	909	1054	8	5	17.1	9.67	413	479
86	147	18	10	34.3	31.2	922	1039	8	5	16.8	9.67	427	481
88	146	18	10	33.9	31.0	936	1025	8	5	16.6	9.67	441	484
90	145	18	10	33.4	30.8	951	1014	8	5	16.4	9.67	456	487
92	144	18	10	33.0	30.6	966	1004	8	5	16.2	9.67	471	490
94	143	18	10	32.5	30.4	983	996	8	5	16.0	9.67	487	493
96	142	18	10	32.1	30.2	1001	989	8	5	15.7	9.67	503	497
98	141	18	10	31.6	30.0	1020	983	8	5	15.5	9.67	519	501
100	140	18	10	31.2	29.8	1040	979	8	5	15.3	9.67	536	505

Table B12: Joist hanger Blank 440 with internal flanges: Form factors k_{H,1} and k_{H,2} and dimensions e₁ and e₂; e_{1,0} = 30 mm

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
40	200	12	14	35.7	34.6	920	3681	12	8	35.7	34.6	920	3681
42	199	12	14	35.4	34.3	917	3398	12	8	35.4	34.3	917	3398
44	198	12	14	35.1	34.1	915	3156	12	8	35.1	34.1	915	3156
45	198	12	14	35.0	34.0	914	3048	12	8	35.0	34.0	914	3048
46	197	12	14	34.8	33.9	914	2947	12	8	34.8	33.9	914	2947
48	196	12	14	34.5	33.6	913	2765	12	8	34.5	33.6	913	2765
50	195	12	14	34.2	33.4	912	2606	12	8	34.2	33.4	912	2606
51	195	12	14	34.1	33.3	912	2533	12	8	34.1	33.3	912	2533
52	194	12	14	33.9	33.2	912	2465	12	8	33.9	33.2	912	2465
54	193	12	14	33.6	32.9	913	2340	12	8	33.6	32.9	913	2340
56	192	12	14	33.3	32.7	914	2229	12	8	33.3	32.7	914	2229
58	191	12	14	33.0	32.5	915	2129	12	8	33.0	32.5	915	2129
60	190	12	14	32.8	32.2	918	2039	12	8	32.8	32.2	918	2039
62	189	12	14	32.5	32.0	920	1958	12	8	32.5	32.0	920	1958
64	188	12	14	32.2	31.8	924	1885	12	8	32.2	31.8	924	1885
66	187	12	14	31.9	31.5	927	1818	12	8	31.9	31.5	927	1818
68	186	12	14	31.6	31.3	932	1758	12	8	31.6	31.3	932	1758
70	185	12	14	31.3	31.1	937	1703	12	8	31.3	31.1	937	1703
72	184	22	12	55.8	37.8	1010	2127	12	6	30.6	18.2	536	1128
73	184	22	12	55.5	37.7	1014	2097	12	6	30.5	18.2	542	1120
74	183	22	12	55.2	37.6	1018	2070	12	6	30.3	18.2	547	1113
76	182	22	12	54.7	37.5	1026	2018	12	6	30.0	18.2	559	1100
78	181	22	12	54.1	37.3	1035	1971	12	6	29.7	18.2	572	1089
80	180	22	12	53.5	37.1	1045	1929	12	6	29.4	18.2	585	1079
82	179	22	12	53.0	36.9	1055	1890	12	6	29.0	18.2	598	1071
84	178	22	12	52.4	36.8	1067	1855	12	6	28.7	18.2	611	1063

B [mm]	H [mm]	full nailing						partial nailing					
		n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]	n _H	n _J	k _{H,1}	k _{H,2}	e ₁ [mm]	e ₂ [mm]
86	177	22	12	51.9	36.6	1079	1823	12	6	28.4	18.2	625	1057
88	176	22	12	51.3	36.4	1092	1795	12	6	28.1	18.2	640	1052
90	175	22	12	50.8	36.2	1106	1769	12	6	27.8	18.2	655	1047
92	174	22	12	50.2	36.1	1120	1746	12	6	27.5	18.2	670	1044
94	173	22	12	49.7	35.9	1136	1725	12	6	27.2	18.2	685	1041
96	172	22	12	49.1	35.7	1152	1706	12	6	26.9	18.2	701	1039
98	171	22	12	48.6	35.6	1169	1690	12	6	26.6	18.2	718	1038
100	170	22	12	48.0	35.4	1186	1675	12	6	26.3	18.2	735	1037

B.2 Characteristic load-carrying-capacities of the joist hanger connections with bolts

For joist hangers connected to a wall of concrete, lightweight concrete or to a steel member the assumptions for the calculation of the load-carrying capacity of the connection are:

- The force transfer from the joist to the joist hanger is as for a wood-wood connection, see clause B.1.
- The bolts shall always be positioned symmetrically about the vertical axis of the joist hanger.
- Washers according to EN ISO 7094 shall be installed under the bolt heads or nuts.

Description of the static model

For a downward directed force toward the bottom plate the static behaviour is basically the same as for a wood-wood connection with nails.

The fasteners in the joist are subjected to a lateral force, which is equally distributed over the nails in the joist.

Since the concrete and steel have a larger compressive strength than timber subjected perpendicular to the grain the rotation point may be assumed positioned at the top of the bottom plate.

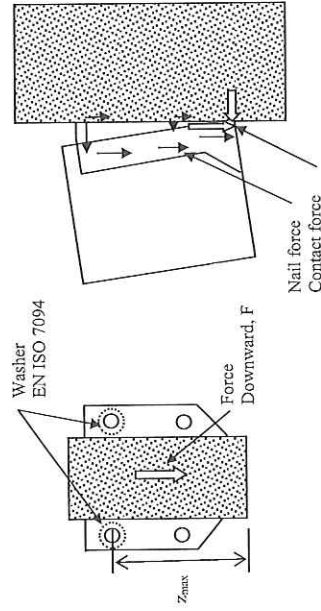


Figure B2 Left: Cross section in joist. Right: The joist will deflect and rotate, at the bottom a contact force will occur at the bottom plate, and the withdrawal forces in the bolts in the wall will vary linearly as assumed for a nailed connection in the header.

The forces in the bolts will be partly lateral forces, partly withdrawal forces. The lateral forces are distributed evenly over all bolts. The withdrawal forces are on the safe side assumed to be taken by the 2 upper bolts with washers. The maximum withdrawal force in a upper bolt can be calculated from

$$F_{ax,bolt} = \frac{F \cdot e}{2 \cdot Z_{max}} \quad (B.2.1)$$

Where

F downward directed force toward the bottom plate

e eccentricity = distance from the nail column in the joist to the surface of the header.

Z_{max} max distance from upper bolt to the bottom plate (rotation point)

The upper 2 bolts are critical. They are subjected to a lateral force and a withdrawal force. The lateral force is determined assuming an even distribution of the downward force F.

$$F_{\text{in,bolt}} = F_{Z,\text{Ed}} / n_{\text{bolt}} \quad (\text{B.2.2})$$

Characteristic capacities of a bolted joist hanger connection

The characteristic capacity of the nail connection between the joist and the joist hanger can be calculated from the same assumptions and formulas as for joist hangers nailed to a wooden header.

$$F_{Z,\text{LRK}} = (n_j + 2) \cdot F_{v,\text{LRK}} \quad (\text{B.2.3})$$

The upper 2 bolts are critical. They are subjected to a lateral force calculated from formula (B.2.2).

The withdrawal force in an upper bolt is calculated from (B.2.1).

Where

$F_{Z,\text{Ed}}$ downward directed force toward the bottom plate

n_{bolt} total number of bolts in the joist hanger

e eccentricity = distance from the nail column in the joist to the surface of the header

z_{max} max distance from the upper bolt to the bottom plate (rotation point)

It shall be verified by the design of the bolted connection that the upper bolts have sufficient load-carrying design capacity to carry the combined lateral and axial forces.

From the characteristic capacity of the bearing resistance between the bolt and the plate of the joist hanger the following maximum characteristic capacity of the joist hanger connection can be determined.

$$F_{\text{bear,RK}} = n_{\text{bolt}} \cdot f_{u,k} \cdot d \cdot t \quad (\text{B.2.4})$$

Where

n_{bolt} total number of bolts in the 2 flaps

$f_{u,k}$ characteristic ultimate tensile strength of the steel, 360 MPa

d diameter of the bolt

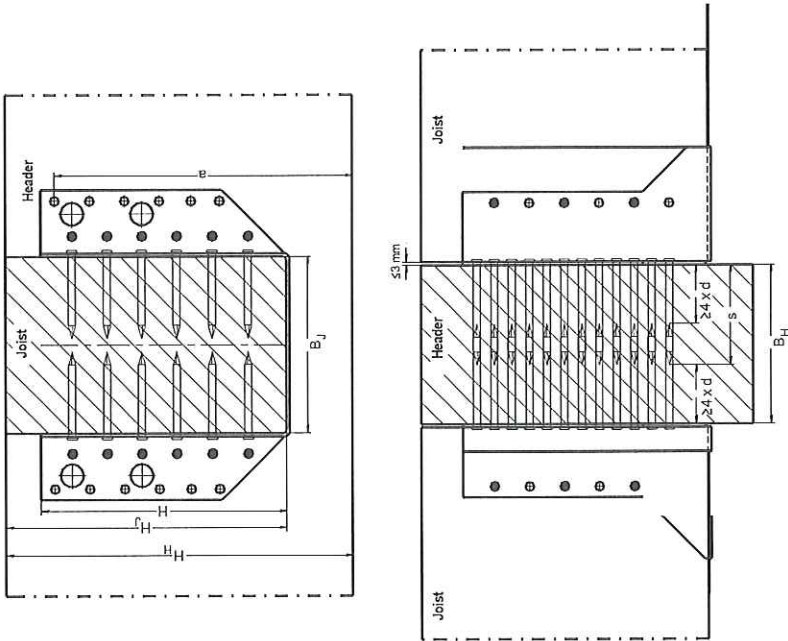
t thickness of the steel plate of the joist hanger

The characteristic load-carrying capacity of the joist hanger connection is the minimum of:

- The capacity determined from (B.2.3) from the nails in the joist
- The capacity determined from (B.2.4) from the embedding strength of the steel plate against the bolt
- The capacity controlled by the bolt forces given by (B.2.1) and (B.2.2).

Annex C
Installation of joist hangers

Joist hanger in wood/wood connection



Joist hanger connected to concrete, lightweight concrete or a steel member by bolts

