JKL FASTENING PLATES

TECHNICAL MANUAL
EUROCODE DESIGN

27.1.2021
REV A 19.3.2021

Contents:

1 FASTENING PLATE PRINCIPLE

JKL fastening plates are steel plates equipped with welded stud head anchors. The fastening plates are embedded into concrete before casting. JKL fastening plates are intended to be used as base plates to which steel profiles are welded. The fastening plates transfer loads from structures welded on it to concrete structures. The loads are transferred through rebar anchors.

JKL fastening plates consist of a steel on which stud head anchors are welded. Multiple sizes of plates are manufactured with different material options.

The resistances of JKL fastening plates are calculated for static loads.

Minimum reinforcement according to SFS-EN 1992-1-1 is always to be used in the location of the fastening plates to guarantee ductility of the structure in ultimate limit state. If in this manual the resistance is given without additional reinforcement, the minimum reinforcement is not contributing to the resistance given. When in this manual the resistance is presented with additional reinforcement, in addition to the minimum reinforcement, the structure has additional reinforcement according to section 4.10.

2 DIMENSIONS AND MATERIALS OF JKL FASTENING PLATES

2.1 MATERIALS AND STANDARDS

1	2	3	4
Type	Part	Material	Standard
JKL	Steel plate	S355J2+N	SFS-EN 10025
	Anchor plate	S355J2+N	SFS-EN 10025
	Anchor	B500B	SFS 1300
JKLR	Steel plate	1.4301	SFS-EN 10088
	Anchor plate	S355J2+N	SFS-EN 10025
	Anchor	B500B	SFS 1300
JKLH	Steel plate	1.4401	SFS-EN 10088
	Anchor plate	S355J2+N	SFS-EN 10025
	Anchor	B500B	SFS 1300

2.2 JKL DIMENSIONS

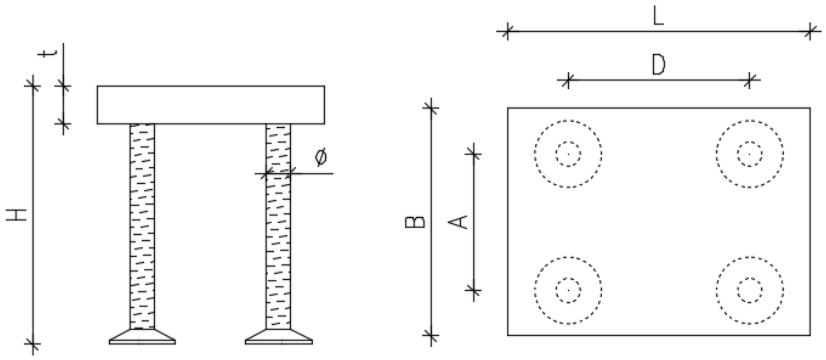

Figure 1. JKL fastening plate dimensions

Table 1. JKL fastening plate dimensions

1				2	3	4	5	6
JKL plate				H	A	D	t	Ø
	B	x	L	[mm]	[mm]	[mm]	[mm]	[mm]
JKL	150	x	150	220	90	90	25	16
	150	x	150	285	90	90	25	16
	150	x	200	220	100	120	25	20
	150	x	200	355	100	120	25	20
	150	x	250	220	100	190	25	20
	150	x	250	355	100	190	25	20
	200	x	200	220	120	120	25	20
	200	x	200	355	120	120	25	20
	200	x	250	220	120	190	25	20
	200	x	250	355	120	190	25	20
	200	x	300	280	120	200	25	25
	200	x	300	435	120	200	25	25
	250	x	250	220	190	190	25	20
	250	x	250	355	190	190	25	20
	300	x	300	280	200	200	25	25
	300	x	300	435	200	200	25	25
	300	x	500	280	200	133	30	25
	300	x	500	435	200	133	30	25
	400	x	400	280	300	300	30	25
	400	x	400	435	300	300	30	25
	500	x	500	280	400	400	30	25
	500	x	500	435	400	400	30	25
	600	x	600	280	500	500	30	25
	600	x	600	435	500	500	30	25

JKL 300 x 500 fastening plate has 8 anchors.

3 MANUFACTURING AND TOLERANCES

3.1 MANUFACTURING METHOD AND EXECUTION CLASS

Steel plates: Thermal or mechanical cutting
Steel bars: Mechanical cutting, heading (cold/hot)
Welding: MAG welding, manual or robotic, resistance welding or arc stud welding
Welding class: C (SFS-EN ISO 5817), EXC2 (SFS-EN 1090-2 section 7.6)

Execution class: EXC2 (SFS-EN 1090-2) [more demanding classes according to a separate guideline]

3.2 MANUFACTURING TOLERANCES

Plate side lengths:	± 4 mm	150 mm < L ≤ 600 mm
Plate straightness:	L/150	
Plate cut edge surface roughness:	SFS-EN 1090-2	
Squareness of cut edges:	SFS-EN 1090-2	
Steel part height:	± 5 mm	
Anchor location:	± 5 mm	
Anchor spacing:	± 5 mm	
Anchor inclination:	± 5°	

3.3 SURFACE TREATMENT

Protective painting shall be applied to the visible surfaces of the fastening plates. The fastening plates are delivered with an approximately 40 µm shop priming. Upon request the fastening plates are delivered with a 60 µm epoxy painting or hot dip galvanized according to galvanizing standard. Stainless and acid-proof fastening plates are delivered without protective painting.

3.4 QUALITY CONTROL

Demands of product standards are to be applied in quality control. The manufacturer of the fastening plates has a valid quality control agreement for the quality control of steel part manufacturing.

4 RESISTANCES

4.1 BASIS OF STRUCTURAL DESIGN

The resistances of JKL fastening plates have been calculated according to the following norms, rules, and regulations:

SFS-EN 1992 Eurocode 2 Design of concrete structures
SFS-EN 1993 Eurocode 3 Design of steel structures

The resistances have been calculated with respect to static loads. For dynamic and fatigue loads the resistances need to be separately checked on a case-by-case basis.

4.2 RESISTANCES WITHOUT EFFECTS OF ADDITIONAL REINFORCEMENT AND EDGE DISTANCE

Table 2 presents the resistances of JKL fastening plates when only one loading acts at a time. The resistance of JKL fastening plates with respect to combinations of load effects shall be checked according to 4.7.

The resistances given in table 2 have been calculated using the following assumptions:

- Concrete strength C25/30
- Cracking can occur in the location of the fastening plate.
- No additional reinforcement at the location of the fastening plate. Structure only reinforced with minimum reinforcement and splitting reinforcement in section 4.6. The resistances of fastening plate with additional reinforcement are presented in section 4.10.
- Concrete structure has been designed to withstand all applied loads.
- The fastening plate is located so far from the edge that the breakage of the edge of concrete structure is not a governing failure mechanism (the required edge distances are given in section 4.4). If the edge distance is smaller than what given in 4.4, the resistances need to be reduced or additional reinforcement according to section 4.10 needs to be used at the location of the fastening plate.
- The thickness of the member on which the fastening plate is mounted is according to section 4.5.
- The tolerance for the location of a load is smaller of 10 % plate side dimension or 15 mm (In addition the manufacturing tolerance ± 5 mm has been considered in the calculations).
- The fastening surface of the steel component to be mounted on the fastening plate shall have minimum area according to section 4.3.
- Shear force V_{Ed} can act in both directions of the plate but in one direction at a time. Shear force acting in both directions need to be considered according to section 4.7.
- Bending moment M_{Ed} can act in both plate directions but only in one direction at a time. Bending moment acting in both directions simultaneously shall be considered according to section 4.7.

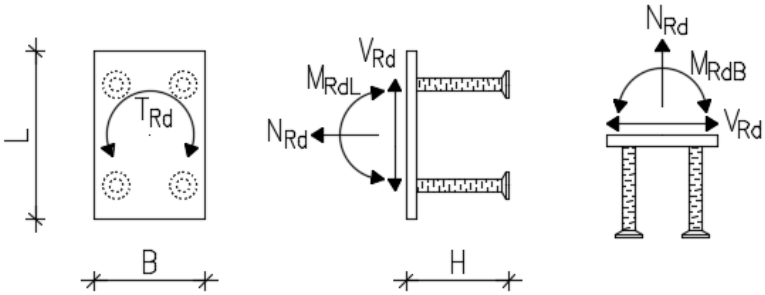

Figure 2. Notation for force directions in JKL fastening plates

Table 2. Resistances of JKL fastening plates for single load effects for cracked C25/30 concrete without additional reinforcement and without considering the effect of edge distances.

1				2	3	4	5	6	7
Fastening plate				H	N_{Rd}	V_{Rd}	M_{RdL}	M_{RdB}	T_{Rd}
	B	x	L	[mm]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
JKL JKLR JKLH	150	x	150	220	115	143	11,4	11,4	11,3
	150	x	150	285	164	143	15,6	15,6	11,3
	150	x	200	220	120	232	15,2	12,5	19,7
	150	x	200	355	228	232	28,4	22,7	21,6
	150	x	250	220	131	243	21,6	13,8	29,6
	150	x	250	355	242	243	41,0	24,7	29,7
	200	x	200	220	123	234	14,7	14,7	22,0
	200	x	200	355	232	234	30,2	30,2	23,5
	200	x	250	220	135	243	21,8	16,7	31,1
	200	x	250	355	245	243	43,0	32,7	31,1
	200	x	300	280	182	363	34,2	23,1	43,9
	200	x	300	435	321	382	64,0	42,8	50,4
	250	x	250	220	147	248	23,2	23,2	37,1
	250	x	250	355	261	248	46,3	46,3	37,1
	300	x	300	280	195	391	36,3	36,3	57,9
	300	x	300	435	340	391	69,9	69,9	61,1
	300	x	500	280	236	472	61,0	46,4	81,1
	300	x	500	435	386	755	113,7	77,1	120,2
	400	x	400	280	238	403	53,9	53,9	91,6
	400	x	400	435	387	403	104,7	104,7	91,6
	500	x	500	280	276	410	74,9	74,9	122,2
	500	x	500	435	438	410	141,3	141,3	122,2
	600	x	600	280	332	414	104,2	104,2	152,7
	600	x	600	435	486	414	187,5	187,5	152,7

The values in table 2 are maximum resistances of JKL fastening plates for individual load effects. The maximum resistances given are values for concrete structures with minimum reinforcement and fastening plate locations according to tables 5 and 6 without additional reinforcement.

4.3 FASTENING AREA

When using resistances given in section 4.2 the fastening areas of the steel components to be attached on the JKL fastening plates shall have minimum values according to table 3. If the steel component is welded all around, the welds can be taken as part of the fastening area. If necessary, stiffeners can be used in the connection between the fastening plate and the steel component to achieve the required fastening area.

Table 3. JKL fastening plate minimum fastening areas

1					2	3				4			
Fastening plate					H	Minimum fastening area							
						JKL				JKLR, JKLH			
	B	x	L		[mm]	[mm]	x	[mm]		[mm]	x	[mm]	
JKL JKLR JKLH	150	x	150		220	50	x	50		75	x	75	
	150	x	150		285	80	x	80		80	x	80	
	150	x	200		220	90	x	50		70	x	115	
	150	x	200		355	95	x	140		95	x	140	
	150	x	250		220	85	x	140		90	x	165	
	150	x	250		355	85	x	190		85	x	190	
	200	x	200		220	60	x	60		85	x	85	
	200	x	200		355	130	x	130		130	x	130	
	200	x	250		220	50	x	110		90	x	150	
	200	x	250		355	120	x	180		130	x	190	
	200	x	300		280	80	x	180		105	x	205	
	200	x	300		435	130	x	225		130	x	225	
	250	x	250		220	90	x	90		120	x	120	
	250	x	250		355	165	x	165		180	x	180	
	300	x	300		280	145	x	145		165	x	165	
	300	x	300		435	210	x	210		225	x	225	
	300	x	500		280	150	x	340		170	x	370	
	300	x	500		435	190	x	395		190	x	395	
	400	x	400		280	140	x	140		200	x	200	
	400	x	400		435	245	x	245		280	x	280	
	500	x	500		280	200	x	200		300	x	300	
	500	x	500		435	315	x	315		370	x	370	
	600	x	600		280	310	x	310		430	x	430	
	600	x	600		435	395	x	395		470	x	470	

If the fastening area of the component to be mounted on the fastening plate is smaller than value given in table 3, the resistances of JKL fastening plate need to be reduced according to appendix 2.

For shear force and torsional moment, it is not necessary to reduce the resistances due to fastening area.

4.4 MINIMUM EDGE AND CENTER DISTANCES

When using resistance values given in section 4.2, the center and edge distances of JKL fastening plates need to equal to at least the values given in table 5. The values given in table 4 are such that the concrete edge breakout is not decisive mode of failure. With smaller edge or center distances, the resistances of JKL fastening plates shall be reduced according to appendix 1 or resistance needs to be calculated according to EN 1992-4.

The edge distances in table 4 are distances between the center of an anchor in JKL fastening plate to the edge of the concrete structure, according to Figure 3. Similarly, the center distances are distances between the centers of adjacent anchors in JKL fastening plates.

The center distance k_t has the minimum value of 2 x the edge distance if the full resistances according to table 2 are used. With smaller center distances, the resistance of the fastening plates shall be reduced according to appendix 1 as with single fastening plates

In special cases and for further information please contact Semko technical support.

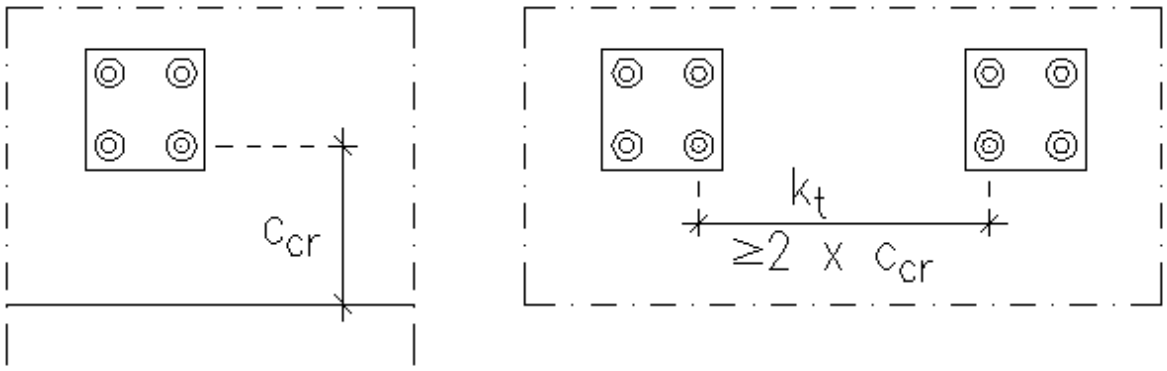

Figure 3. The edge distance c_{cr} of JKL fastening plate from the center of the anchor to the edge of the concrete structure and the center distance between adjacent fastening plates.

Table 4. Minimum edge distances of JKL fastening plates for resistances according to section 4.2.

1				2	3	4
Fastening plate				H	Minimum edge distance for resistances N_{Rd}, M_{RdL} and M_{RdB}	Minimum edge distance for resistances V_{Rd} and T_{Rd}
	B	x	L	[mm]	$c_{cr.N}$ [mm]	$c_{cr.V}$ [mm]
JKL JKLR JKLH	150	x	150	220	321	960
	150	x	150	285	419	960
	150	x	200	220	318	1200
	150	x	200	355	521	1200
	150	x	250	220	318	1200
	150	x	250	355	521	1200
	200	x	200	220	318	1200
	200	x	200	355	521	1200
	200	x	250	220	318	1200
	200	x	250	355	521	1200
	200	x	300	280	405	1500
	200	x	300	435	638	1500
	250	x	250	220	318	1200
	250	x	250	355	521	1200
	300	x	300	280	405	1500
	300	x	300	435	638	1500
	300	x	500	280	405	1500
	300	x	500	435	638	1500
	400	x	400	280	405	1500
	400	x	400	435	638	1500
	500	x	500	280	405	1500
	500	x	500	435	638	1500
	600	x	600	280	405	1500
	600	x	600	435	638	1500

4.5 CONCRETE MINIMUM THICKNESS

When using the resistances given in section 4.2 thickness of the concrete base must have the minimum value given in table 5.

Table 5. Minimum concrete thickness for JKL fastening plate

1				2	3
Fastening plate				H	Minimum thickness h_{min} of the base (concrete structure)
	B	x	L	[mm]	[mm]
JKL JKLR JKLH	150	x	150	220	240
	150	x	150	285	305
	150	x	200	220	240
	150	x	200	355	375
	150	x	250	220	240
	150	x	250	355	375
	200	x	200	220	240
	200	x	200	355	375
	200	x	250	220	240
	200	x	250	355	375
	200	x	300	280	300
	200	x	300	435	455
	250	x	250	220	240
	250	x	250	355	375
	300	x	300	280	300
	300	x	300	435	455
	300	x	500	280	300
	300	x	500	435	455
	400	x	400	280	300
	400	x	400	435	455
	500	x	500	280	300
	500	x	500	435	455
	600	x	600	280	300
	600	x	600	435	455

4.6 SPLITTING REINFORCEMENT

For resistances in section 4.2 splitting reinforcement must be installed on the fastening plate area.

Required splitting reinforcement may be determined by EN 1992-4 section 7.2.1.7 equation

$$A_{s,re} = 0{,}5\frac{N_{Ed}}{f_{yk,re}/\gamma_{Ms,re}}$$

where

N_{Ed} = applied tension load on fastening plate
$f_{yk,re}$ = yield strength of reinforcement (≤ 600 MPa)
$\gamma_{Ms,re}$ = partial safety factor of reinforcement = 1,15

Reinforcement areas for resistances in section 4.2 are given in table 6. Splitting reinforcement needs to be placed on top and side of concrete structure (see figure 4). Other reinforcement in concrete may be used for splitting, provided it is not fully utilized for other requirements.

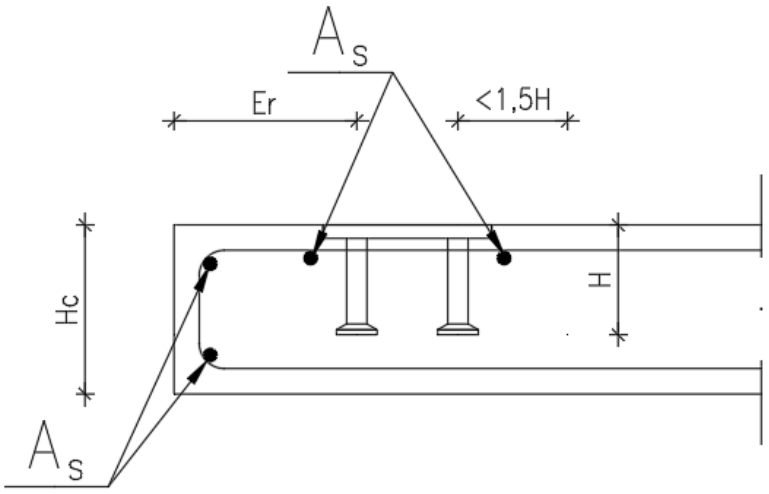

Figure 4. Positioning of splitting reinforcement in structure

Splitting reinforcement area in figure 4 is given in table 6 column 3.

Splitting reinforcement is placed next to fastening plate anchors (max. distance 1,5 H) on top and side of concrete as in figure 4.

Table 6. JKL fastening plate splitting reinforcement

1				2	3	4	5
Fastening plate				H	Splitting reinforcement A_s	Diameter d_s	Number of rebars n_s
	B	x	L	[mm]	[mm^2]	[mm]	[kpl]
JKL JKLR JKLH	150	x	150	220	132	8	3
	150	x	150	285	189	8	4
	150	x	200	220	138	8	3
	150	x	200	355	262	10	4
	150	x	250	220	151	8	3
	150	x	250	355	278	10	4
	200	x	200	220	141	8	3
	200	x	200	355	267	10	4
	200	x	250	220	155	10	3
	200	x	250	355	282	10	4
	200	x	300	280	209	10	3
	200	x	300	435	369	12	4
	250	x	250	220	169	10	3
	250	x	250	355	300	10	4
	300	x	300	280	224	10	3
	300	x	300	435	391	12	4
	300	x	500	280	271	12	3
	300	x	500	435	444	12	4
	400	x	400	280	274	12	3
	400	x	400	435	445	12	4
	500	x	500	280	317	12	3
	500	x	500	435	504	12	5
	600	x	600	280	382	12	4
	600	x	600	435	559	12	5

4.7 RESISTANCES FOR COMBINATIONS OF LOAD EFFECTS

If multiple load effects act simultaneously on JKL fastening plate the resistance of the fastening plate shall be checked according to the following equations.

$$\beta_N = \frac{N_{Ed}}{N_{Rd}} + \frac{M_{EdL}}{M_{RdL}} + \frac{M_{EdB}}{M_{RdB}} \leq 1{,}0 \qquad (1)$$

$$\beta_V = \frac{V_{EdB}+V_{EdL}}{V_{Rd}} + \frac{T_{Ed}}{T_{Rd}} \leq 1{,}0 \qquad (2)$$

Where subscript Ed means the ultimate limit state value for the dimensioning value of the load effect and Rd the corresponding resistance of the fastening plate and subscript corresponds to the direction of the load or resistance.

In addition to equations (1) and (2) following equations need to be verified:

With no reinforcement in concrete area or additional reinforcement for all loads, equations 3, 4 and 5.

$$(\beta_N)^2 + (\beta_V)^2 \leq 1{,}0 \qquad (3)$$

$$(\beta_N)^{1{,}5} + (\beta_V)^{1{,}5} \leq 1{,}0 \qquad (4)$$

$$\beta_N + \beta_V \leq 1{,}2 \qquad (5)$$

If concrete base is not reinforced for all loads (i.e. reinforcement only for some load and for other load concrete resistance is used) equation 6 needs to be verified.

$$(\beta_N)^{\frac{2}{3}} + (\beta_V)^{\frac{2}{3}} \leq 1{,}0 \qquad (6)$$

See also EN 1992-4.

4.8 EFFECT OF EDGE AND CENTER DISTANCES ON RESISTANCES

If JKL fastening plate edge or center distances are smaller than given in table 4, resistances in section 4.2 need to be reduced. Resistances may be determined with appendix 1 or calculated according to EN 1992-4.

Minimum values of edge distances which may not be fallen below without additional reinforcement are given in table 7.

Table 7. JKL fastening plate minimum edge distances without additional reinforcement

1				2	3	4
Fastening plate				H	Minimum edge distance for resistances N_{Rd}, M_{RdL} and M_{RdB}	Minimum edge distance for resistances V_{Rd} and T_{Rd}
	B	x	L	[mm]	$c_{cr.N.min}$ [mm]	$c_{cr.V.min}$ [mm]
JKL JKLR JKLH	150	x	150	220	50	150
	150	x	150	285	50	150
	150	x	200	220	50	150
	150	x	200	355	50	150
	150	x	250	220	50	150
	150	x	250	355	50	150
	200	x	200	220	50	150
	200	x	200	355	50	150
	200	x	250	220	50	150
	200	x	250	355	50	150
	200	x	300	280	50	150
	200	x	300	435	50	150
	250	x	250	220	50	150
	250	x	250	355	50	150
	300	x	300	280	50	150
	300	x	300	435	50	150
	300	x	500	280	50	150
	300	x	500	435	50	150
	400	x	400	280	50	150
	400	x	400	435	50	150
	500	x	500	280	50	150
	500	x	500	435	50	150
	600	x	600	280	50	150
	600	x	600	435	50	150

4.9 EFFECT OF REINFORCEMENT ON EDGE DISTANCES

Concrete cover required by exposure class and fire class must be accounted for with additionally reinforced JKL fastening plates. Section 4.10 gives the reinforcement effect on resistances and figures 5 and 6 principles on reinforcing.

4.10EFFECT OF REINFORCEMENT ON RESISTANCES

Reinforcement improves JKL fastening plate resistances when resistances should otherwise need to be reduced due to edge distances. Maximum resistances are still those in table 2. In tables 8 and 9 resistance of one rebar placed as in figures 5 and 6 is presented. Total resistance of JKL fastening plate with additional reinforcement depends on the number of correctly placed rebars in concrete.

4.10.1REINFORCEMENT FOR TENSION AND BENDING

Additional reinforcement for tension and bending loads is to be placed to concrete as in figure 5. Additional reinforcement is placed as close to JKL anchors as possible. Maximum distance between JKL anchor and reinforcement bar is 0,5H from the center of anchor. Additional reinforcement is to be anchored to the concrete structure outside JKL fastening plate concrete cone for full yield force.

Straight rebar is to be placed inside the bend of the additional reinforcement, diameter at least the same as additional rebar.

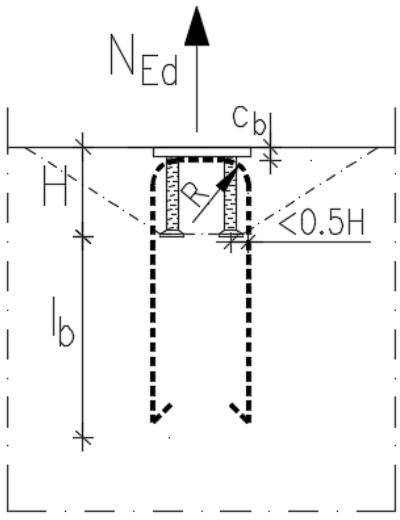

Figure 5. JKL fastening plate reinforcement for tension and bending

c_b = concrete cover (20mm)
l_b = anchoring length in EN 1992-1-1
R = bending radius of reinforcement according to EN 1992-1-1

Table 8 gives tension resistances (anchoring resistance in concrete cone) for JKL fastening plates when positioned as in figure 5. Values in table are for ”poor” bond conditions. Total tension resistance for additionally reinforced JKL fastening plate is obtained by multiplying the number of reinforcing bars with the resistance of one rebar in table 8. Additional reinforcement must be placed as close as possible to JKL fastening plate anchors.

Values in table 8 are calculated for steel grade B500B or similar rebar.

Table 8. Tension resistances for JKL fastening plate additional reinforcement (one reinforcement loop positioned as in figure 5)

1	2	3	4	5	6
Fastening plate		Tension resistance of reinforcement $N_{Rd.s}$ [kN]			
		Rebar diameter Φs [mm]			
	H [mm]	T8	T10	T12	T16
JKL JKLR JKLH	220	8,6	10,7	12,9	17,1
	280	11,3	14,1	16,9	22,6
	285	11,5	14,4	17,3	23,0
	355	14,7	18,3	22,0	29,3
	435	18,3	22,8	27,4	36,6

If required concrete cover for additional rebar is greater than 20 mm, anchoring resistance in concrete cone must be calculated on a case-by-case basis and table 8 values can’t be used.

In ”good” bond conditions values in table 8 may be increased by factor 1,42.

4.10.2 REINFORCEMENT FOR SHEAR AND TORSION

Additional reinforcement for shear and torsion loads is to be placed to concrete as in figure 6. Shear reinforcement is to be placed in the direction of the applied shear load and as close as possible to the JKL steel plate. Additional reinforcement is bent and positioned to be in tight contact with JKL fastening plate anchors. Additional reinforcement is to be anchored outside the JKL concrete cone for full reinforcement tension force as in figure 6 section A-A.

It is vitally important to ensure tight contact between additional reinforcement and JKL anchors when using resistances in table 9. It is assumed the force from anchors is directly transferred to the reinforcement.

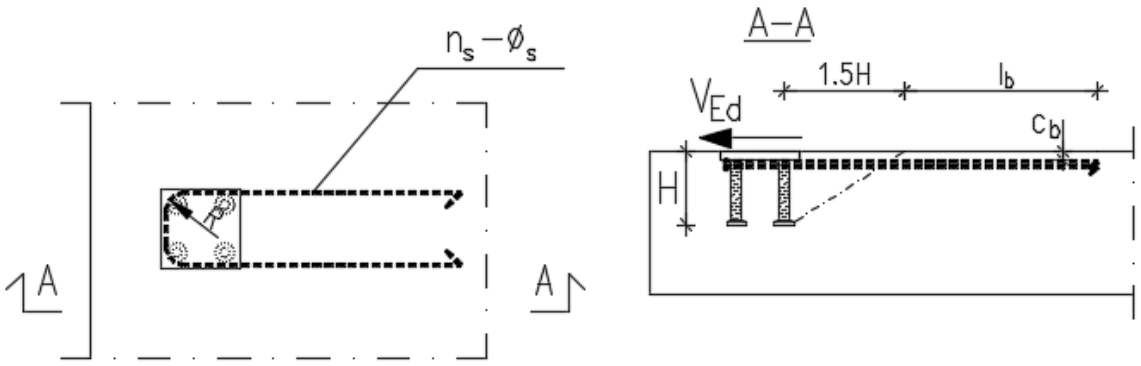

Figure 6. JKL fastening plate reinforcement for shear and torsion

c_b = concrete cover (20mm)
l_b = anchoring length in EN 1992-1-1
R = bending radius of reinforcement according to EN 1992-1-1

Values in table 9 are calculated for steel grade B500B or similar rebar.

Table 9. Shear resistances for JKL fastening plate additional reinforcement (one reinforcement loop positioned as in figure 6)

1	2	3	4	5
Fastening plate	Shear resistance of reinforcement $V_{Rd.s}$ [kN]			
	Rebar diameter Φs [mm]			
B x L	T8	T10	T12	T16
JKL JKLR ALL SIZES JKLH	10,9	17,1	24,6	43,7

From the eccentricity between shear force plane and reinforcement plane an additional tension force originates to the reinforcement. This additional tension force is calculated as follows:

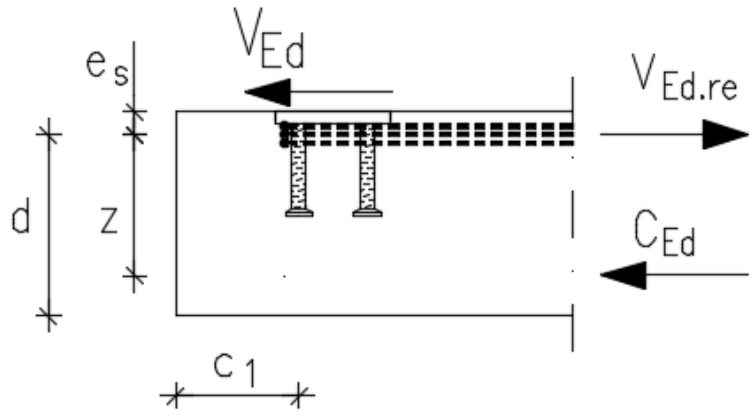

Figure 7. Additional tension force in shear force reinforcement

$$V_{Ed.re} = \left(\frac{e_s}{z} + 1\right) \cdot V_{Ed} \qquad (4)$$

where

e_s = distance between shear force (steel plate top) and middle of reinforcement

z = internal lever arm in concrete ≈ 0,85d ($d \leq \min\begin{Bmatrix} 2H \\ 2c_1 \end{Bmatrix}$)

See also EN 1992-4.

5 USE OF FASTENING PLATES

5.1 SERVICE LIFE AND ALLOWED EXPOSURE CLASSES

Service life of JKL fastening plates depends on the chosen fastening plate material. JKL fastening plates may be used in all concrete structure exposure classes when the requirements of the exposure classes for the concrete cover of steel parts of the fastening plate are complied with. If necessary, stainless JKLR or acid proof JKLH fastening plate types are to be used.

5.2 LIMITATIONS FOR USE

Capacities for JKL fastening plates are calculated for static loads. For dynamic or fatigue loads larger partial safety factors for loads must be used and the components of the connection must be checked on a case-by-case basis.

Resistances for JKL fastening plates have been calculated for cracked concrete with strength class C25/30.

A reinforcement to guarantee ductile action of the structure in ultimate limit state must always be installed in location of the JKL fastening plates.

6 STORAGE, TRANSPORTATION AND MARKING OF THE FASTENING PLATES

JKL fastening plates are to be stored protected from the rain.

Marking is made into JKL fastening plates that shows at least the manufacturer, type and identifier and manufacturing date of the fastening plate.