



Technical Manual

Technical changes and
errors reserved

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RLK and RLKP Slab Supports

Design according to Eurocodes
(Swedish NA)



2017
R-Group Finland OY

asiakastieto.fi

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1. Description of the system

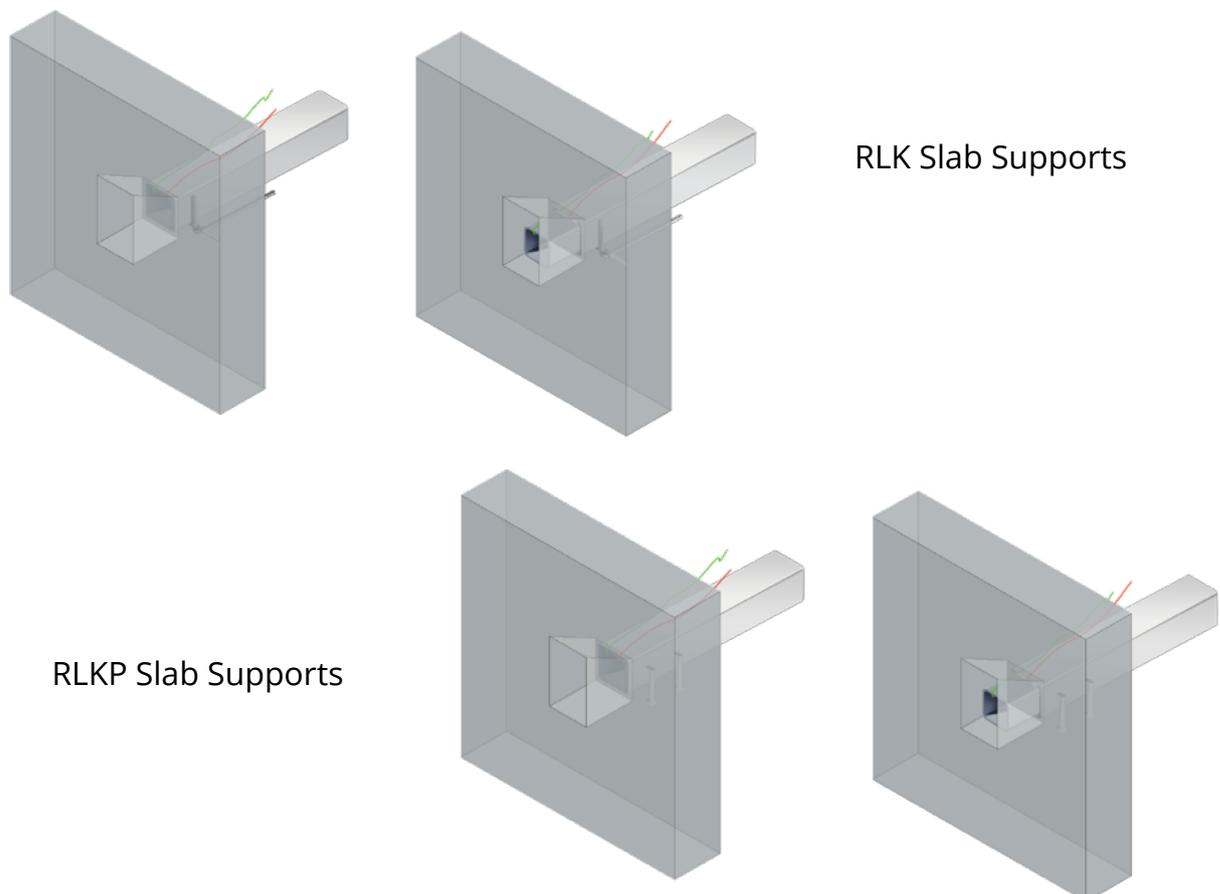
RLK and RLKP slab supports are steel parts intended for support of precast massive concrete slabs. RLK and RLKP slab support transfers the slab support reaction to supporting walls or other structures.

RLK slab support consists of two square structural hollow section steel tubes that are installed one inside another and ribbed steel bond bars, which are welded to the outer tube.

RLKP slab support consists of two square structural hollow section steel tubes that are installed one inside another and studded steel bars, which are welded to the outer tube.

Structural hollow section steel tube with the larger section dimensions is installed to the concrete slab before concrete is cast. The end of the steel tube closer to slab edge is pressed against the mold and the other ends is closed with a welded steel plate, which prevents concrete from entering the steel tube during casting.

During the installation of the precast slab the smaller tube is inserted in to the larger tube. Smaller tube is left protruding from the slab for approximately 95 mm and acts as a cantilever support, see picture 12.



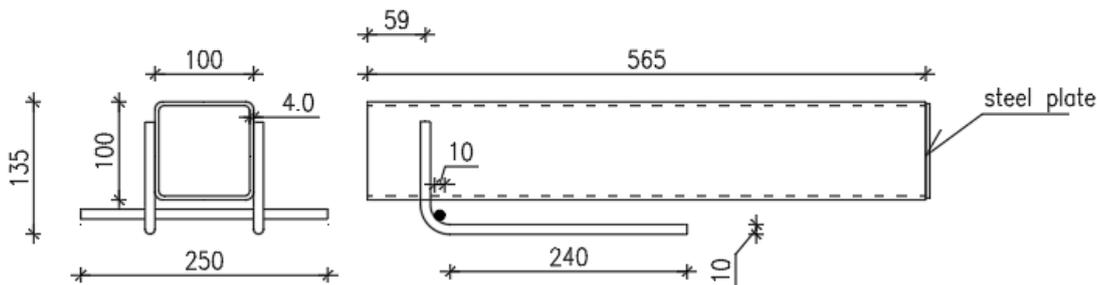
2. Dimensions and Materials

2.1 Materials and standards of the support

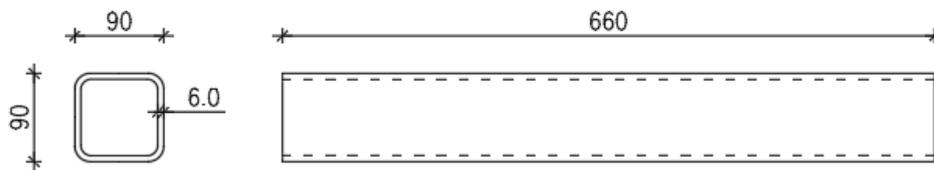
Part	Material	Standard
Steel tube	S355J2H	EN 10025
Studded steel bar	S235JR+AR	EN 10025
Ribbed steel bar	B500B K500C-T	EN 10080 SS 212540:2014
Steel plate	S235JR	EN 10025

2.2 Dimensions RLK10 slab support

Tube 1 (outer tube)



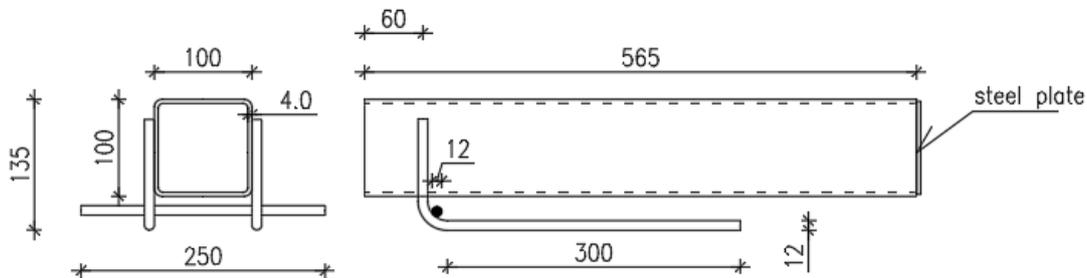
Tube 2 (installed inside tube 1)



Picture 1. RLK10 slab support dimensions and structure

2.3 Dimensions RLK12 slab support

Tube 1 (outer tube)



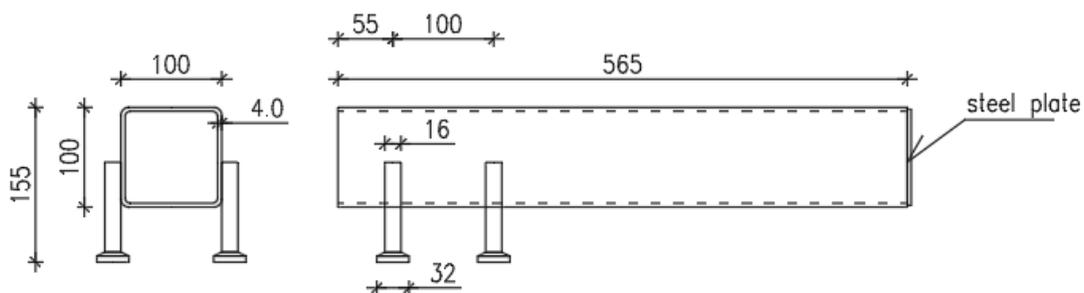
Tube 2 (installed inside tube 1)



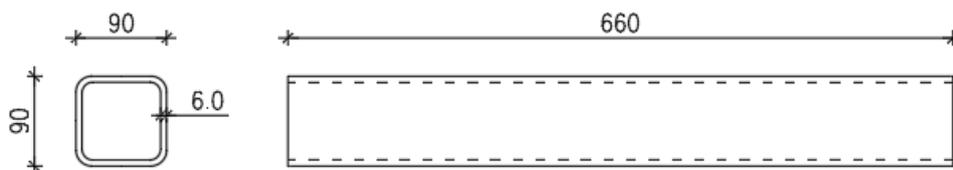
Picture 2. RLK12 slab support dimensions and structure

2.4 Dimensions RLKP slab support

Tube 1 (outer tube)



Tube 2 (installed inside tube 1)



Picture 3. RLKP slab support dimensions and structure

2.5 Ordering code

Ordering code of RLK10 slab support is RLK10.

Ordering code of RLK12 slab support is RLK12.

Ordering code of RLKP slab support is RLKP.

3. Manufacturing

3.1 Manufacturing method RLK10 and RLK12

Structural hollow sections and steel plate are mechanically cut to correct length. Steel plate is welded to the end of the outer tube. Ribbed steel bars are mechanically cut to correct length, bent to shape and welded to correct positions. Horizontal ribbed steel bar is welded to the bent steel bars.

3.2 Manufacturing method RLKP

Structural hollow sections and steel plate are mechanically cut to correct length. Steel plate is welded to the end of the outer tube. Steel bars are mechanically cut to correct length, the other end is studded and the bars are welded to correct positions.

3.3 Manufacturing markings

Product package is equipped with an R-Steel –sticker, which contains the following information: product type, product name, quantity ISO9001 and ISO14001 quality and environment system markings, FI marking and product picture.

Products are delivered in cardboard boxes on a truck palette. Cardboard boxes are marked with FI and BY (Concrete Association of Finland) logo and the number of certified product declaration, numbers of the ISO-certificates and the product type and name.

3.4 Quality control

Quality control of the inserts is done according to the requirements of EN 1090-2 and the instructions according to quality and environment system of the R-Group Finland Oy (ISO9001 and ISO14001). R-Group Finland Oy has a quality control contract with Inspecta Sertifiointi Oy..

4. Resistances

4.1 Design principles

Capacities of RLK and RLKP slab supports are calculated for static loads according to the limit state dimensioning method presented in Eurocodes.

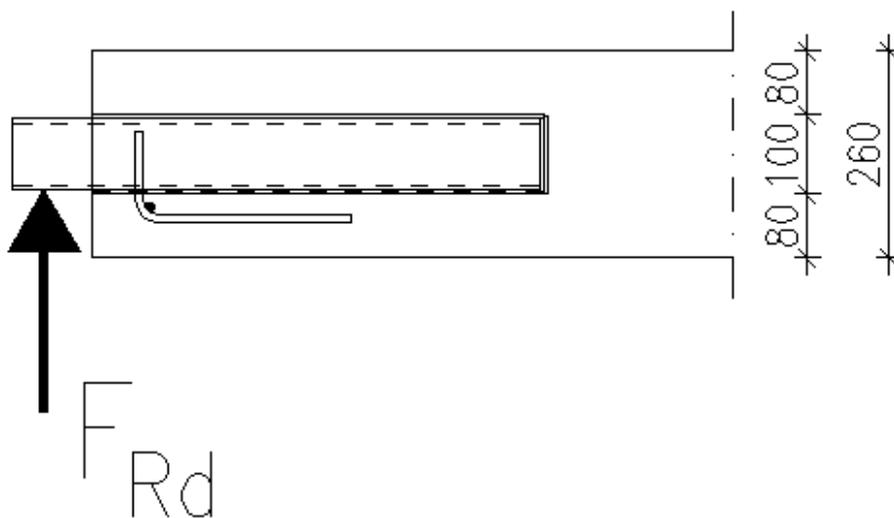
The calculations are done according to the following regulations and instructions (with Swedish National Annexes):

EN 1992: Eurocode 2

EN 1993: Eurocode 3

CEN/TS 1992-4

4.2 RLK slab support resistances without additional reinforcement



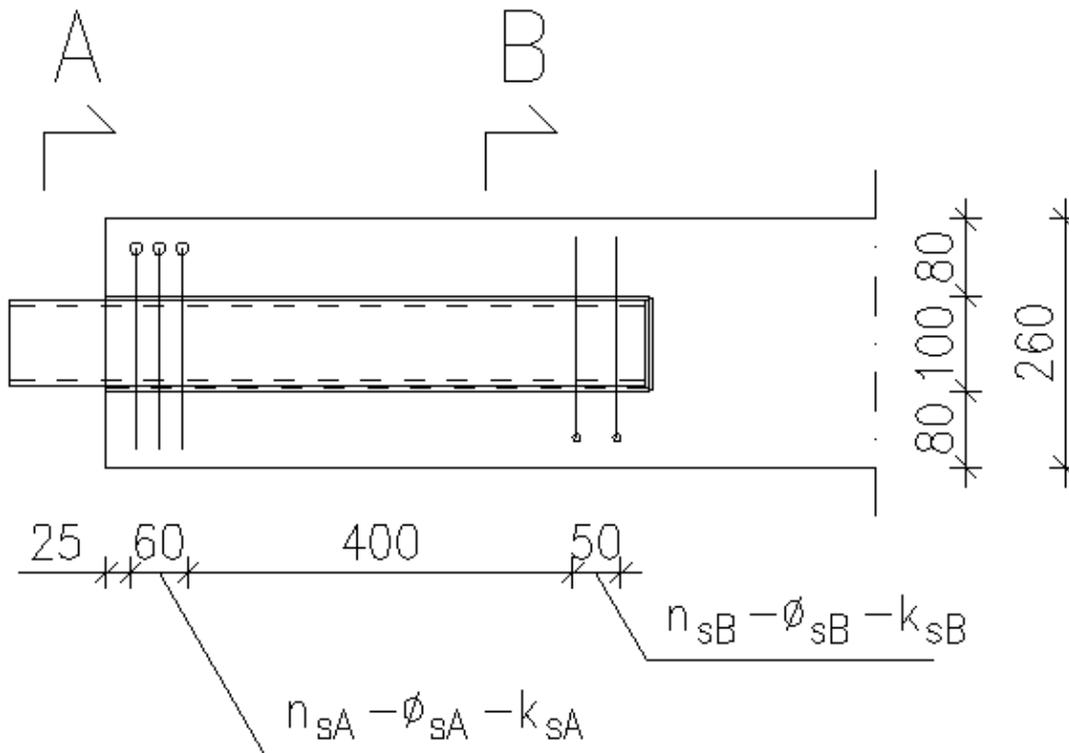
Picture 4. RLK slab support resistance without additional reinforcement

Table 1. RLK slab support resistance without additional reinforcement for edge distance $e_r \geq 150$ mm and center to center distance $e_k \geq 2e_r (\geq 300$ mm)

RLK slab support maximum resistance F_{Rd} [kN] in ultimate limit state			
RLK slab support type	Slab height h_{slab} [mm]	Concrete strength class	
		C25/30	C30/37
RLK10	260	40	45
RLK12	260	50	55

RLK slab support resistances given in table 1 require slab reinforcement according to chapter 4.5 and dimensions according to chapters 4.6 and 4.7. Resistances also require slab height and RLK slab support vertical position in slab according to picture 4.

4.3 RLK slab support resistances with additional reinforcement



Picture 5. RLK slab support with additional reinforcement

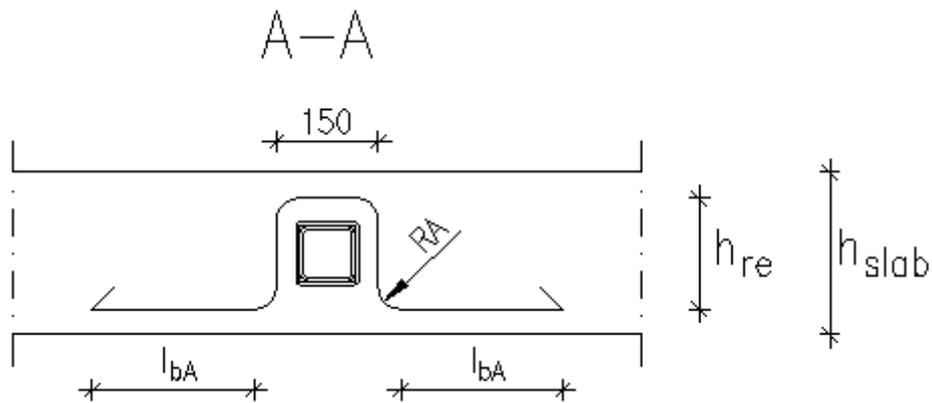
Sections A-A and B-B see pictures 6 and 7.

Table 2. RLK slab support resistance with additional reinforcement for edge distance $e_r \geq 150$ mm and center to center distance $e_k \geq 2e_r (\geq 300$ mm)

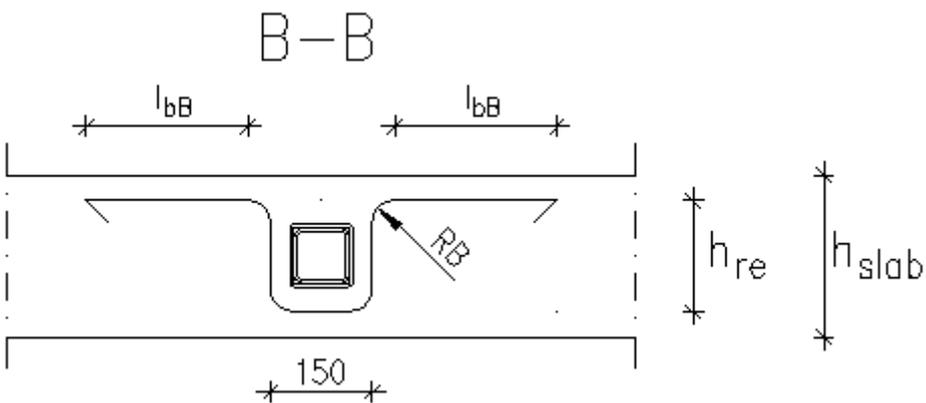
RLK slab support maximum resistance F_{Rd} [kN] in ultimate limit state				
Concrete strength class	C25/30		C30/37	
Slab height h_{slab} [mm]	Reinforcement 1	Reinforcement 2	Reinforcement 1	Reinforcement 2
260	55	65	65	75

RLK slab support resistance with additional reinforcement is the same for both types (RLK10 and RLK12). Additional reinforcement 1 and 2 see table 3.

RLK slab support resistances given in table 2 require slab reinforcement according to table 3 and pictures 6 and 7. Resistances also require slab height and RLK slab support vertical position in slab according to picture 5.



Picture 6. Section A-A, reinforcement placement near the slab edge



Picture 7. Section B-B, reinforcement placement away from the slab edge

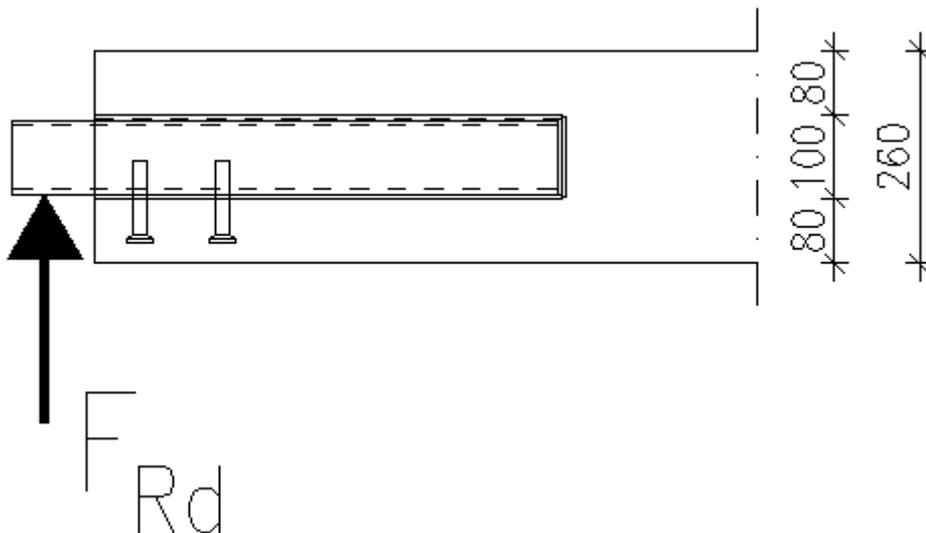
Table 3. Additional reinforcement of RLK slab support

Reinforcement type	n_{sA} [kpl]	ϕ_{sA} [mm]	k_{sA} [mm]	l_{bA} [mm]	RA [mm]	n_{sB} [kpl]	ϕ_{sb} [mm]	k_{sB} [mm]	l_{bB} [mm]	RB [mm]
Reinforcement 1	3	10	25	410	35	2	8	50	330	26
Reinforcement 2	3	12	25	500	46	2	8	50	330	26

Reinforcement steel material B500B (K500C-T).

Height of reinforcement h_{re} must be designed taking into account slab concrete cover and slab reinforcement.

4.4 RLKP slab support resistances



Picture 8. RLKP slab support resistance

Table 4. RLKP slab support resistance for different edge and center distances

RLKP slab support maximum resistance F_{Rd} [kN] in ultimate limit state			
Slab height h_{slab} [mm]	Edge distance e_r [mm] (c/c-distance $e_k \geq 2 e_r$)	Concrete strength class	
		C25/30	C30/37
260	150	22	24
	250	27	35
	350	38	43

RLKP slab support resistances given in table 4 require slab reinforcement according to chapter 4.5 and dimensions according to chapters 4.6 and 4.7. Resistances also require slab height and RLK slab support vertical position in slab according to picture 8.

Resistances given in table 4 may be linearly interpolated for edge distance e_r 150...350 mm. When edge distance exceeds 350 mm resistance does not increase. Smaller edge distance than 150 mm is not applicable.

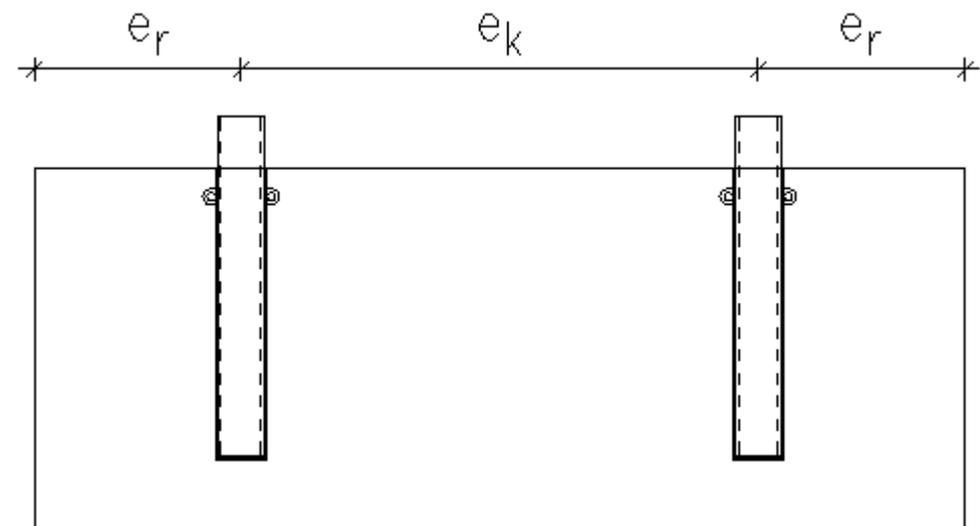
4.5 Precast concrete slab reinforcement

Precast concrete slab must be designed and reinforced to withstand all loads applied to it. Local effects of RLK and RLKP slab supports must be taken into account in the design and reinforcement of the slab.

When using RLK and RLKP slab supports the minimum reinforcement of the concrete slab is mesh 8-150 at both surfaces, edge stirrups $\phi 8$ -c/c150 and edge reinforcement 2- $\phi 10$ around the slab. Reinforcement steel material $f_{yk} \geq 500$ MPa.

4.6 RLK and RLKP slab support distances

4.6.1 RLK and RLKP slab support edge and center distances



Picture 9. RLK and RLKP slab support edge and center distances

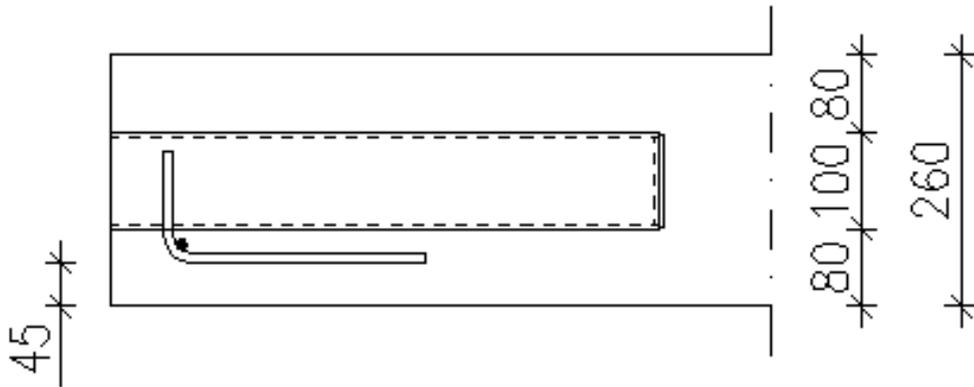
Minimum edge distance of RLK and RLKP slab support is $e_{r.min} = 150$ mm.

Minimum center distance $e_{k.min} = 2 \times e_{r.min} = 300$ mm.

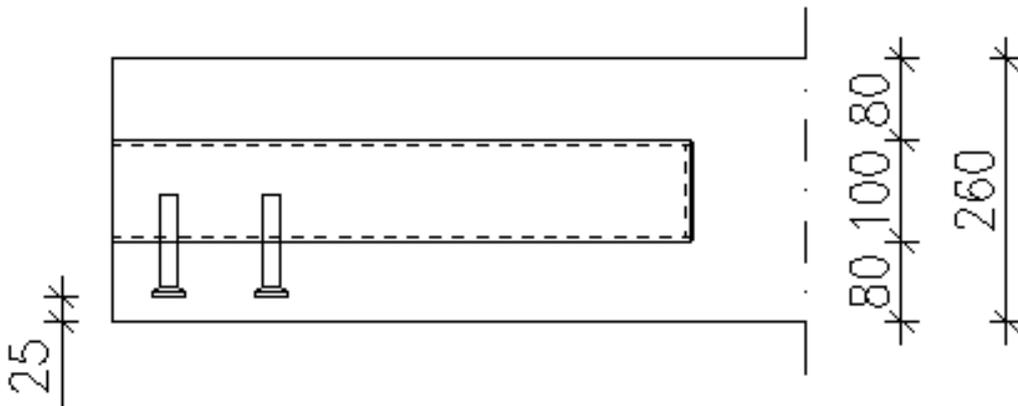
4.6.2 RLK and RLKP slab support concrete cover

RLK and RLKP slab supports are intended to be installed to the center of slab height of 250 mm thick concrete slab as in pictures 10 and 11. RLK and RLKP slab support concrete cover is given in pictures 10 and 11.

RLK and RLKP slab support installation tolerance is ± 10 mm.



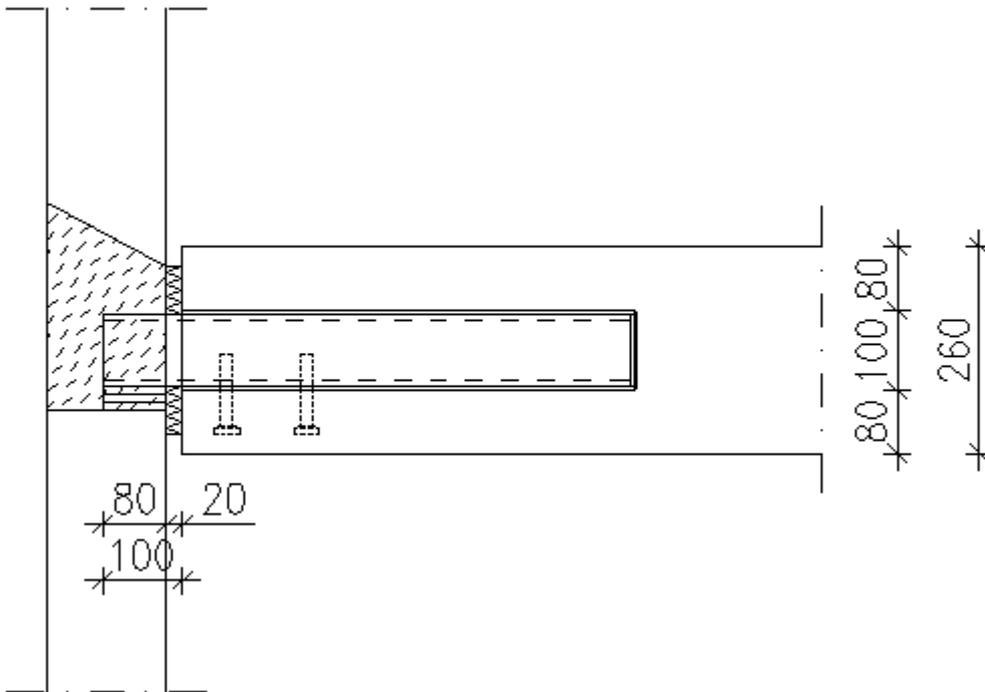
Picture 10. RLK slab support vertical position and concrete cover below support



Picture 11. RLKP slab support vertical position and concrete cover below support

4.7 RLK and RLKP slab support bearing

Resistances in tables 1, 2 and 4 are calculated for RLK and RLKP support length presented in picture 8.



Picture 12. RLK and RLKP bearing length

5. RLK and RLKP Slab Supports

5.1 Limitations of use

Resistances given in chapter 4 are defined for static loads. For dynamic and fatigue loads the resistance must be calculated separately.

When using RLK and RLKP slab supports the supported slab must always be reinforced according to chapter 4.5.

When using RLK and RLKP slab supports the supported slab must be designed and reinforced to withstand all forces and requirements in all limit states.

5.2 Installation of RLK and RLKP slab support

Before slab concrete is cast:

- outer tube (tube 1, 100x100x4) is installed according to slab design drawings to the correct place
- required reinforcement is installed to the correct position
- it is made sure no concrete can enter tube 1 during concrete casting and that tube 1 and the required reinforcement is securely in place and cannot move during casting

During concrete casting:

- concrete is carefully compacted around tube 1 and reinforcement
- tube 1 or reinforcement may not be compacted
- it is made sure tube 1 and the reinforcement stay in place

After concrete is cast:

- it is made sure tube 1 is in the correct place
- it is made sure tube 1 is free of concrete and if necessary concrete is cleaned from the inside of tube 1

At the work site during slab installation:

- it is checked that RLK and RLKP tubes are not damaged during transport
- slab element is lifted to the correct position
- inner tube (tube 2, 90x90x6,3) is installed to the outer tube (tube 1, 100x100x4) through holes in wall element and pushed to the bottom of the outer tube before slab element is lowered to wall element supports
- insulation for impact sound and fire proofing are done according to designers instruction

5.3 Safety of installation

RLK and RLKP slab supports and concrete slabs must be installed according to element installation design. In all phases of installation, it must be ensured that RLK and RLKP slab supports or concrete slabs cannot fall.

RLK and RLKP slab supports bearing surface must be according to picture 12 and element design. Support must be confirmed before unfastening the lifting loops or lifting lugs from concrete slab.

About R-Group

R-Group is a leading provider of steel connections for precast and cast-in- situ construction around the globe.

With over three decades of our participation in huge projects, we don't compromise on quality or customer satisfaction and we create connections for a lifetime.

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R-Group Finland Oy

Head Office:

Katajanokankatu 6B 12,
00160 Helsinki Finland
Tel : +358 (0)20 722 9420
VAT No. : FI- 2025044-5

RSTEEL®

-  www.repo.eu
-  info@repo.eu
-  [linkedin/rsteel](https://www.linkedin.com/company/rsteel)

R-Group Baltic OÜ

Lõõtsa 2B
11415 TALLINN
Mob. : +372 578 396 76



OOO R-Group

18A Bolshoj pr. V.O.
199034, St.Petersburg Russia
Tel : +358 (0)20 722 9420
+372 578 396 76

R-Group Gulf FZE

PO Box 14755
Ras Al Khaymah U.A.E
Tel : +971 505119223
+91 840 894 45 78

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