

RSTEEL[®]



RSK-N Wall Shoe

Technical manual

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1. DESCRIPTION OF THE SYSTEM

RSK-N wall shoes are fastening components that are used with RPP base bolts to create tension resisting connections across joints between two precast wall elements or between precast wall element and a cast-in-situ structure. Compression stresses are transferred directly across the grout filled joint. Shear stresses along the joint are transferred by friction or by additional installed shear studs for this purpose. Tension stresses developed at the joint are transferred within the wall, via reinforcement, to the next wall joint above and below. The RSK-N wall shoes are designed with matching design tension resistance of the associated RPP base bolts.

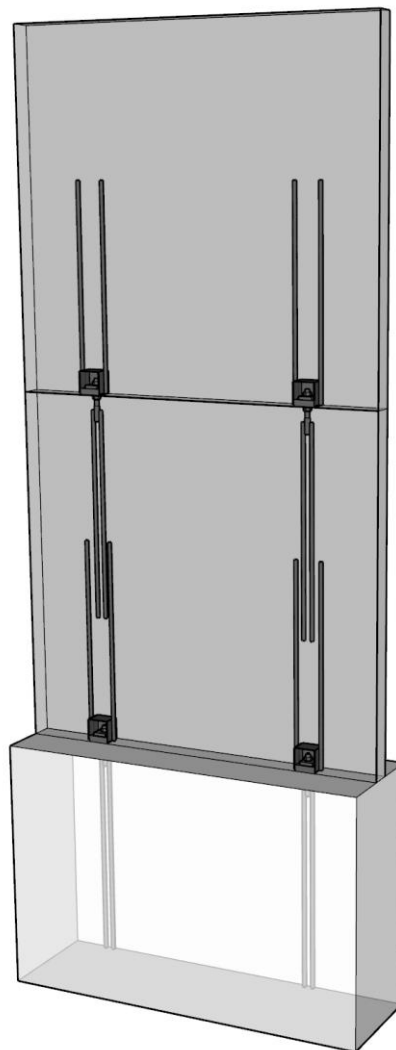


Figure 1. Example of using wall shoes

2. MATERIALS AND DIMENSIONS

Table 1. Materials and standards of RSK-N wall shoe

Part	Material	Standard
Plates	S355J2	EN 10025
	S355J2+N	EN 10025
Rebars	B500B	EN 10080 (SFS 1268)

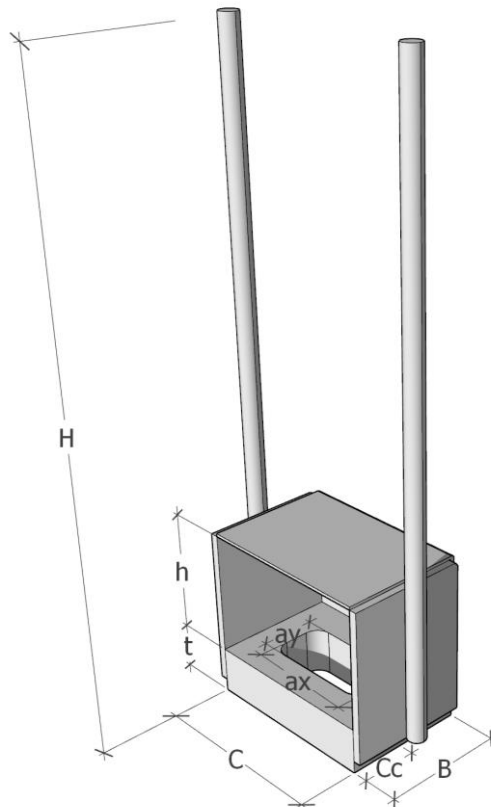


Figure 2. RSK-N type wall shoe

Table 2. Dimensions of RSK-N wall shoe

Type	Size	B [mm]	C [mm]	n×Ø [mm]	H [mm]	h [mm]	t [mm]	ax [mm]	ay [mm]	Weight [kg]	Color
RSK-N	M16	80	119	2×Ø12	630	80	30	76	36	4.0	Yellow
	M20	90	124	2×Ø16	800	90	35	80	40	6.3	Blue
	M24	110	129	2×Ø20	965	105	35	84	49	10.1	Grey
	M30	120	144	2×Ø25	1170	115	40	90	55	16.2	Green
	M39	145	165	2×Ø32	1600	140	50	99	64	34.1	Orange

Note: n – the number of side bar, Ø is diameter of side bar.

Table 3. Wall shoe non-centric washer dimensions

Type	Size	e [mm]	c [mm]	D [mm]	t [mm]
RAL	N16	25.0	60	17	12
	N20	27.5	65	21	15
	N24	30.0	80	25	20
	N30	37.5	95	31	20
	N39	47.5	115	40	30

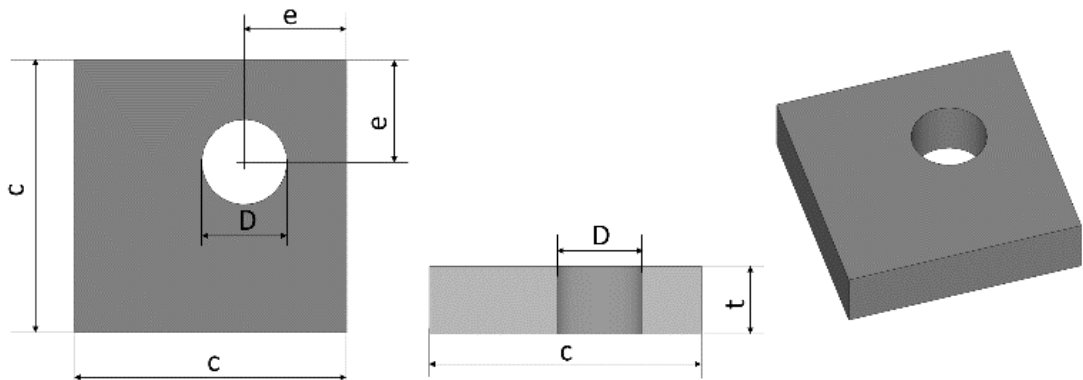


Figure 3. RAL type wall shoe non-centric washer

3. MANUFACTURING AND TOLERANCES

3.1. Manufacturing method

Plates:	Thermal or mechanical cutting
Rebars:	Mechanical cutting
Welding:	MAG welding, manual or robotic
Welding class:	B (EN ISO 5817)
Surface treatment:	Untreated as standard
Execution class:	EXC2 (EN 1090-2) [more demanding classes according to a separate guideline]



The product shall be produced clean and dry. Light surface rusting may be present at delivery of the product. The product is to be stored in dry conditions. The product may be installed with light surface rusting, and in accordance with general requirements for reinforcement bars.

3.2. Manufacturing tolerances

Overall length: ± 10 mm

3.3. Quality control

R-Group Baltic OÜ internal manufacturing and quality control in accordance with EN 1090-2. External quality control provided to R-Group Baltic OÜ by Kiwa Inspecta OÜ.

3.4. Markings

RSK-N wall shoes are marked with at least the RSTEEL® logo, type and identifier, manufacturing date, FI and BY (Concrete Association of Finland) logo.

4. RESISTANCES

The tension capacities of RSK-N wall shoes, calculated in accordance with EN 1992 and EN 1993, are governed by the tension capacity of the connected RPP base bolt. More information is provided in the RSTEEL® RPP base bolt technical manual.

The anchorage length is determined according to the diameter of the anchor bar.

Minimum concrete grade is C25/30.

Anchorage coefficients, $\eta_1 = 1.0$ (good), lap factor $\alpha_6 = 1.5$, $\alpha_2 = 0.7$, others $\alpha_1 \dots \alpha_5 = 1.0$.

Table 4. Nominal RSK-N wall shoe design tension resistances

RSK-N	RAL	RPP base bolt	N_{Rd} [kN]
M16	N16	M16	62.2
M20	N20	M20	97.0
M24	N24	M24	139.4
M30	N30	M30	222.2
M39	N39	M39	386.5



RAL non-centric washers are supplied with RPP base bolts on request.

Shear forces acting on the wall can be resisted by friction between the grout and concrete in the case of compression at the joint. A friction coefficient of 0.2 can be adopted for a sand-cement grout, without additional tests.



RSTEEL® Design Tool software for wall shoe connections on rsteel-design.com.

Wall shoe installation and additional reinforcement must be in accordance with instructions in this user guide.

5. USER INSTRUCTIONS

5.1. Limits of Use

The capacities of the wall shoes have been calculated for static loads. Increased load factors are to be adopted for case specific dynamic and fatigue effects. For design in accordance with the Eurocodes, the lowest operating temperature is calculated from EN 1991-1-5.

5.2. Design Guidance

Grout is to be applied to the joint as soon as possible after the wall element has been lifted into position. Other structures can be installed on top of the wall element after the grout has hardened. Out-of-plane (transverse) support of the wall element must always be considered carefully.

The RSK-N wall shoe is to be installed in the middle of the precast wall element, and the anchor bars are to be tied to the reinforcement of the wall. Minimum wall thickness and associated minimum concrete cover to the anchor bars of the wall shoe, are given in the table below. Minimum wall thickness is determined considering minimum requirements presented in EN 1992-1-1 for concrete cover to the anchor bars of the wall shoe.

The wall shoe is designed for environmental condition exposure class XC1. Design standard requirements must be carefully considered for other exposure classes, for example minimum wall thickness and concrete cover for fire and exposure classes.

Table 5. Minimum wall thickness and concrete cover

Type	Size	Wall thickness t_w [mm]	Concrete cover c_c [mm]	Figure
RSK-N	M16	90	39	
	M20	90	37	
	M24	110	45	
	M30	120	48	
	M39	145	57	

Table 6. Minimum edge distance and spacing

Type	Size	Edge distance R [mm]	Spacing c/c [mm]	Figure
RSK-N	M16	140	220	
	M20	150	240	
	M24	160	250	
	M30	170	280	
	M39	200	320	

5.3. Reinforcement instructions

Reinforcement of the wall according to EN 1992-1-1 and following details:

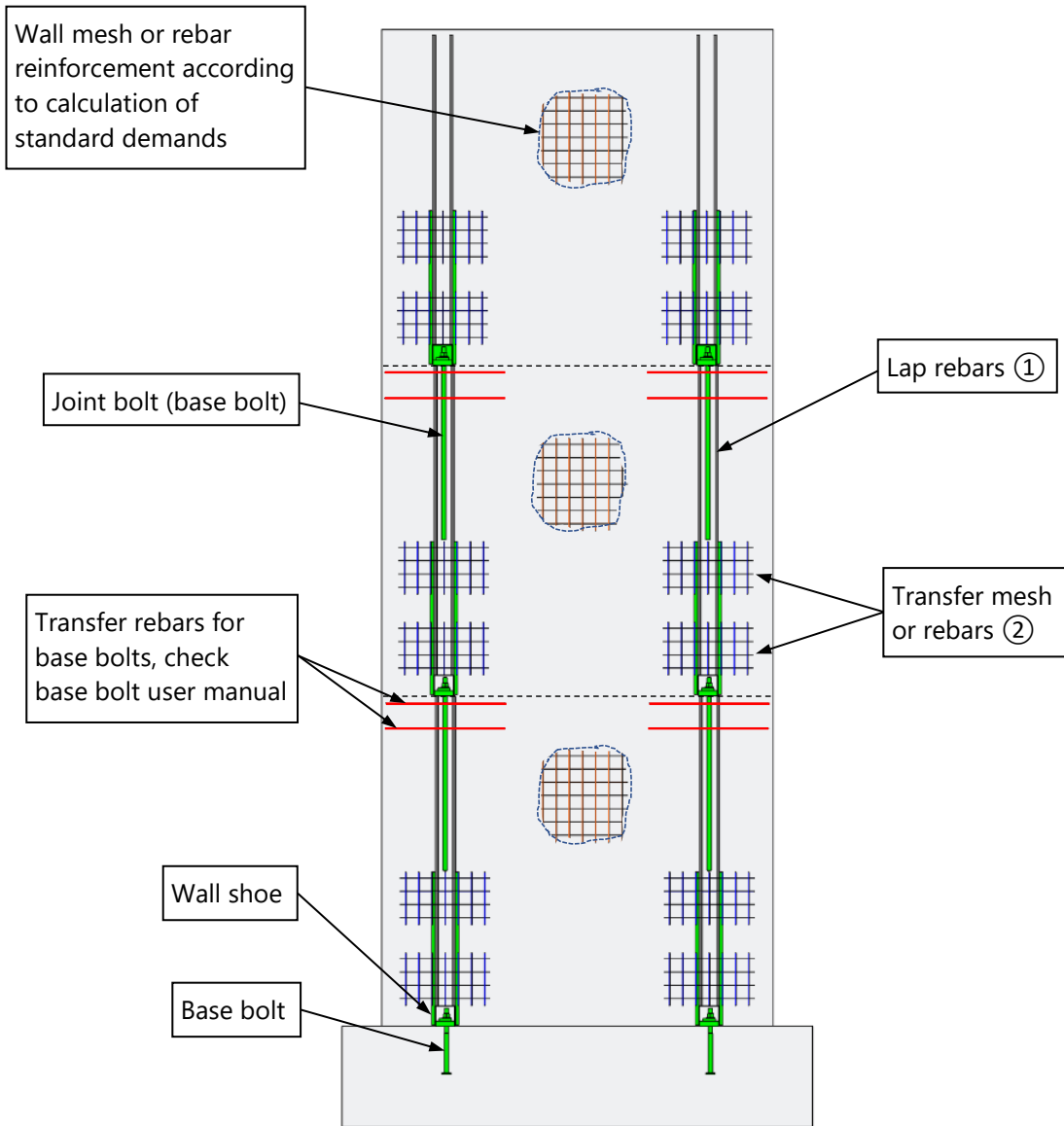


Figure 4. Overview of the reinforced structure

Supplementary transfer reinforcement for the wall shoes must be added according to shoe size. Related values are given in Table 7 to Table 11 based on the shoe type and size. This reinforcement is transverse reinforcement for lapped bars in tension and is applied in the lapping zone between wall shoe sidebars and lapping rebar. Transverse reinforcement is required in the lap zone to resist transverse tension forces, and it must be used independently of the main wall reinforcement. Only if the diameter of the lapped bars is less than 20 mm, then any transverse reinforcement or links necessary for other reasons may be assumed sufficient for the transverse tensile forces without further justification according to EN 1992-1-1: 8.7.4.1.

Reinforcement mesh or rebar according to calculation or standard demands.

Minimum mesh requirement on the wall is defined in EN 1992-1-1 section 9.6. Vertical reinforcement should be not less than $0.002A_c$. Horizontal reinforcement is 25% of vertical reinforcement or $0.001A_c$. Greater value should be used (National Annexes should be checked).

Table 7. Supplementary transfers reinforcement on one side mesh

RSK-N	Lapping rebars ①	Horizontal bars ②		a [mm]	L_{B1} [mm]	L_{A1} [mm]	L_{S1} [mm]
		\varnothing_{m1}	n				
M16	2x $\varnothing 12$	$\varnothing 6$	2	100	200	560	204
M20	2x $\varnothing 16$	$\varnothing 6$	3	100	300	560	197
M24	2x $\varnothing 20$	$\varnothing 8$	2	100	200	670	245
M30	2x $\varnothing 25$	$\varnothing 8$	4	100	400	680	237
M39	2x $\varnothing 32$	$\varnothing 10$	4	150	600	830	291

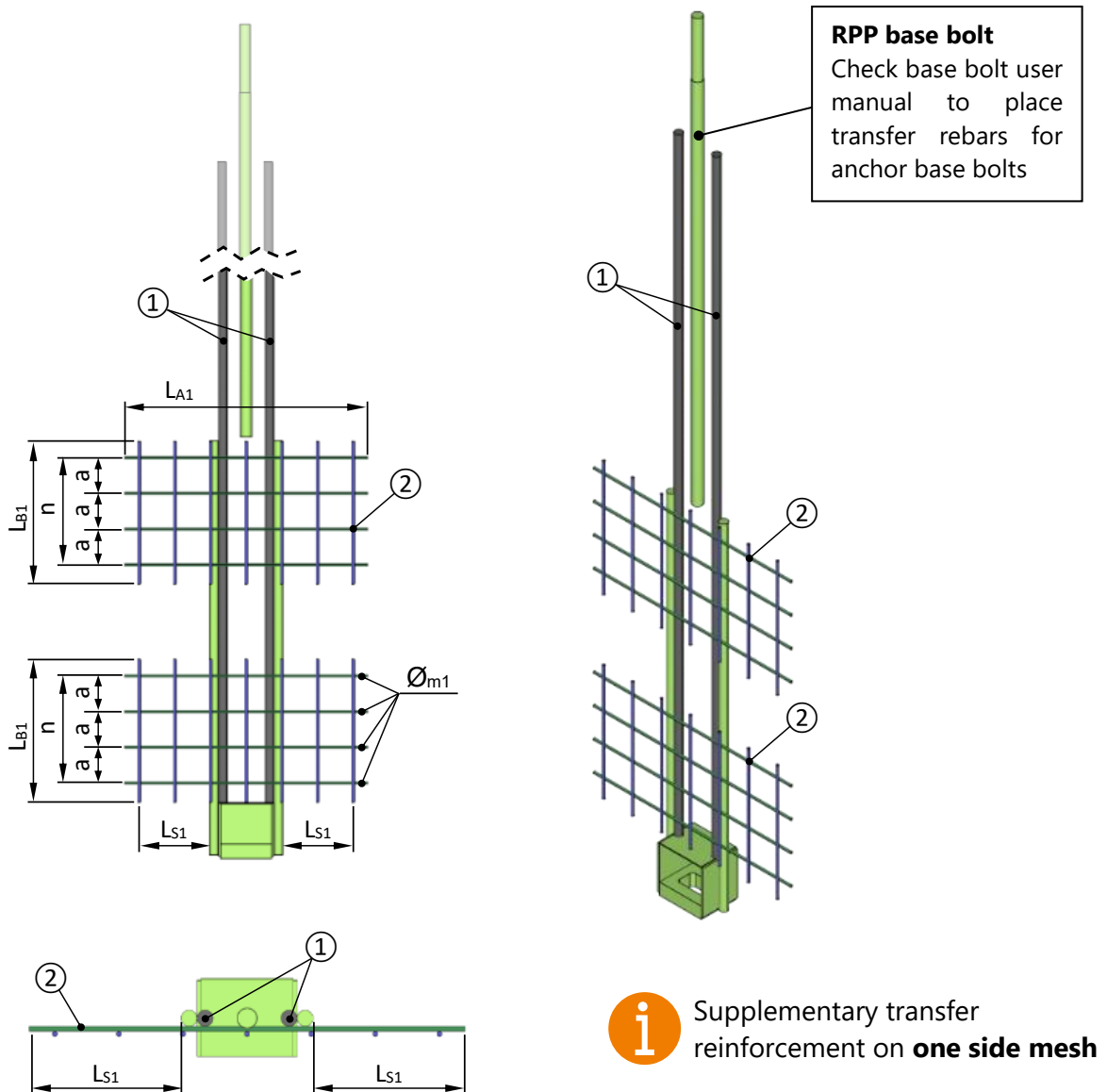


Figure 5. Supplementary transfer reinforcement with one side mesh

Table 9. Supplementary transfers reinforcement two sides mesh

RSK-N	Lapping rebars ①	Horizontal bars ②		a [mm]	L _{A2} [mm]	L _{S2} [mm]
		Ø _{m2}	n			
M16	2×Ø12	Ø6	2	100	560	204
M20	2×Ø16	Ø6	2	100	560	197
M24	2×Ø20	Ø6	2	100	670	245
M30	2×Ø25	Ø8	2	150	680	237
M39	2×Ø32	Ø10	2	150	830	291

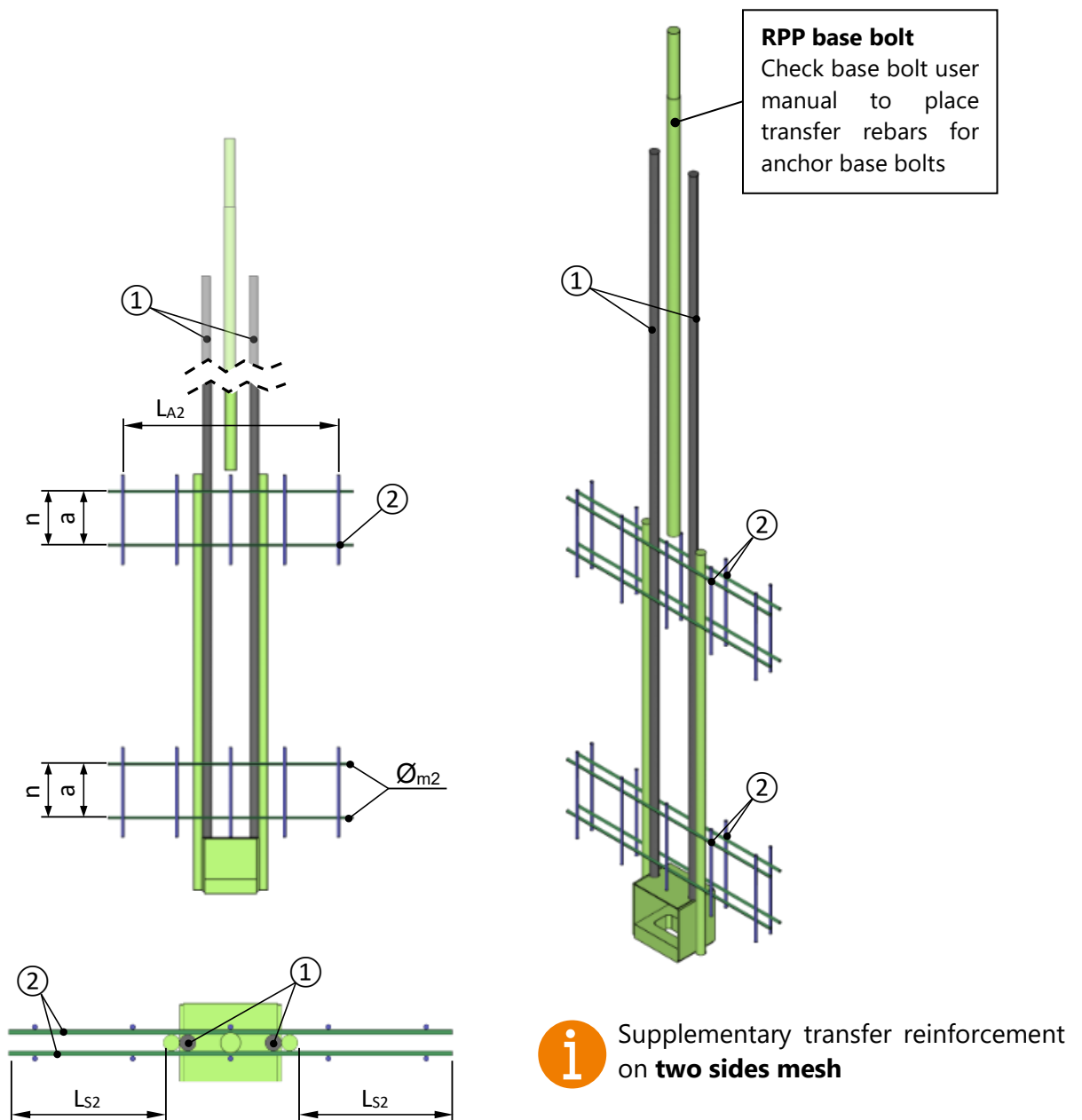


Figure 7. Supplementary transfer reinforcement with two sides mesh

Table 10. Supplementary transfers reinforcement two sides rebar

RSK-N	Lapping rebar ①	Horizontal bars ②		a [mm]	L _{A2} [mm]	L _{S2} [mm]
		Ø _{m2}	n			
M16	2×Ø12	Ø6	2	100	670	259
M20	2×Ø16	Ø6	2	100	670	252
M24	2×Ø20	Ø6	2	100	870	345
M30	2×Ø25	Ø8	2	150	885	340
M39	2×Ø32	Ø10	2	150	1080	416

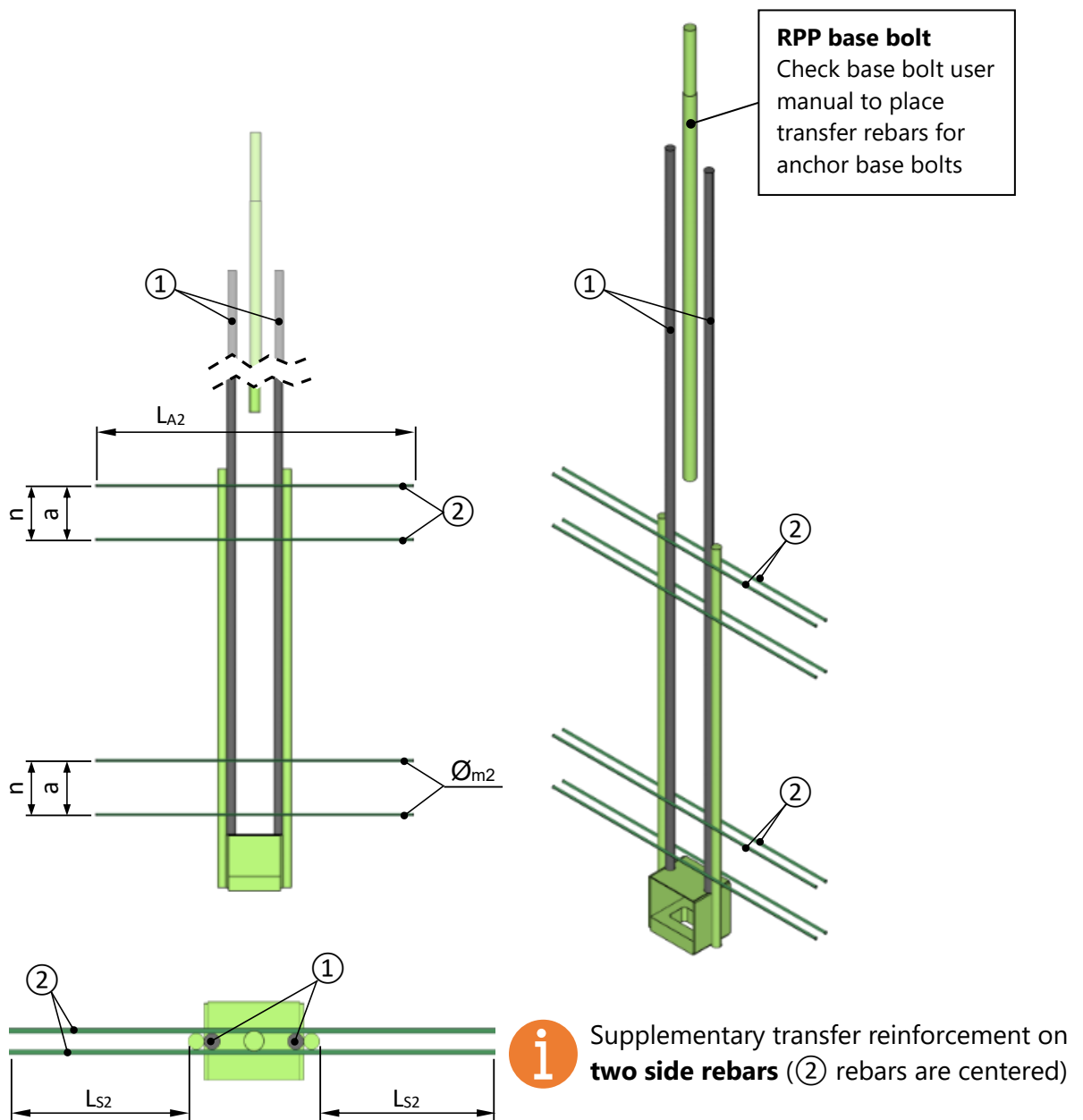


Figure 8. Supplementary transfer reinforcement with two side rebar

6. INSTALLATION

The wall shoe is secured to the reinforcement of the wall, and its base plate is connected, for example, by clamping to the formwork. Additional reinforcement is to be installed according to requirements set out in Section 5.3. The gap between the wall shoe and the top of the foundation or wall is 20 mm.

Table 12. Installation tolerances for RSK-N wall shoe

RSK-N	Transversal direction $T_{w,t}$ [mm]	Longitudinal direction $T_{w,l}$ [mm]
M16	± 2	± 5
M20	± 2	± 5
M24	± 3	± 5
M30	± 3	± 5
M39	± 3	± 5

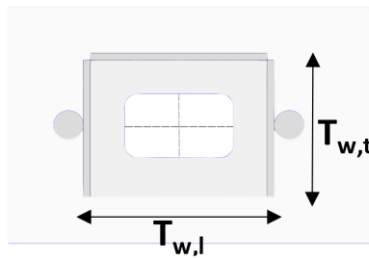


Figure 10. Installation tolerances for RSK-N wall shoe

Table 13. Installation dimensions and tolerances for RPP base bolts

RPP base bolt	Bolt length h [mm]	Installation tolerance T [mm]
M16	100	± 3
M20	110	± 3
M24	115	± 3
M30	135	± 3
M39	160	± 3



RPP base bolt tolerances are in accordance with their respective technical user manuals.

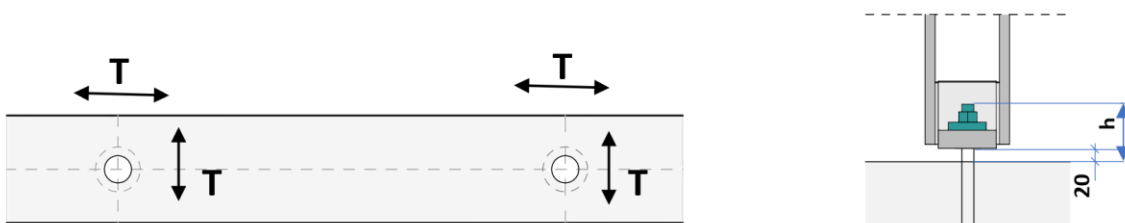


Figure 11. Installation dimensions and tolerances for RPP base bolts

6.1. Inspection instructions for installation of the wall shoe

Checklist before casting:

- The correct shoe type and size is installed.
- The positioning of the shoe is correct and according to installation tolerances.
- The shoe is properly secured in the reinforcement and formwork.
- The correct supplementary reinforcement is installed according to manufacturing drawings.

Checklist after casting:

- Position of the shoe is correct and according to tolerances.
- Shoes are cleaned and any casting boxes are removed.

6.2. Inspection instructions for installation of the wall

The precast wall element is installed at the correct level by using packer plates. The wall element is to be temporarily supported during erection, and its level and inclination checked. Before the nuts are tightened, the position of the RAL washer plates inside the wall shoe must be checked. Nuts are to be firmly tightened, for example using an impact wrench. Following tightening of the nuts, lifting connections can be disconnected. Erection must follow the erection scheme that is approved by the responsible engineer.

Space required for tightening the nut with an impact wrench is verified in accordance with DIN 7444.

Once the wall element is set at the correct level and inclination, and the nuts are tightened, the base is to be grouted in accordance with the manufacturer's guidance. The grout must be of a non-shrinking type and with strength greater than the weakest of the concrete structures connected with the bolt and shoe assembly.

TECHNICAL MANUAL REVISIONS

08.08.2022 (JK)

- RSK-N and RSK-E separated to own manuals

31.10.2022 (FA)

- New graphical layout

12.04.2023 (FA, AV)

- Supplementary reinforcement graphics and tables visually updated
- Stirrup version is added

30.06.2025 (AV)

- New graphical layout
- Shear capacity description changes

29.08.2025 (AV)

- Minor text changes

23.04.2026 (AV)

- Table 2: colors added

DESIGN TOOLS

RSTEEL® Design Tool was created to facilitate the work of designers and offer the best and most transparent design process on the market. The free and fully cloud-based software guarantees seamless workflow within the design organization, as well as continuous support and updates.

rsteel-design.com

DESIGN COMPONENTS

We have created design components for Tekla as well as Revit and AutoCAD. More products will be created, and existing products will receive steady updates and fixes when needed.

warehouse.tekla.com/#/organization/u7be79e90-ace8-46ca-a26c-849a5dc4c283

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DOCUMENTATION

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