Precast Wall Connection Wire Rope Boxes

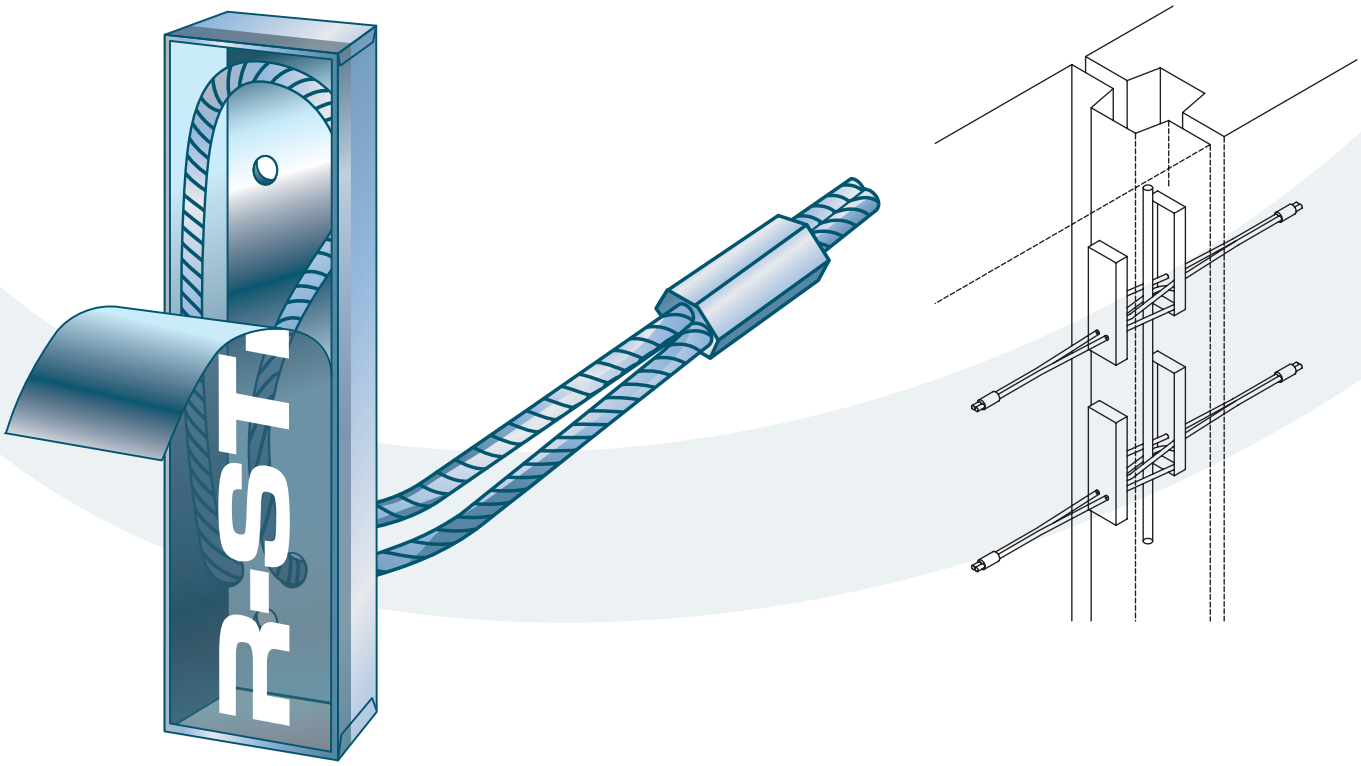
Contents

Wire Boxes for Precast Panels

Wire Rope Boxes are designed to be used as a structural connection for pre-cast units with recesses, or between precast units and in-situ concrete components. The casing of the box eliminates the need for additional formwork.

The rope boxes are very easy to use on site, with proven no-tool tear-off tape that releases the flexible loops. The loops are stitched into the adjoining element with rods and insitu concrete.

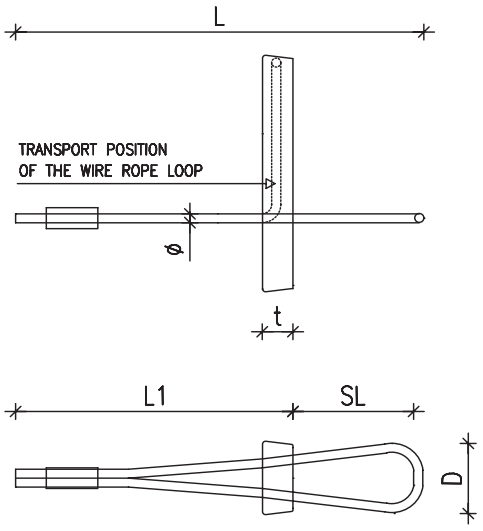
We can provide boxes either containing a single loop or a double loop, depending on the load capacities that are required.



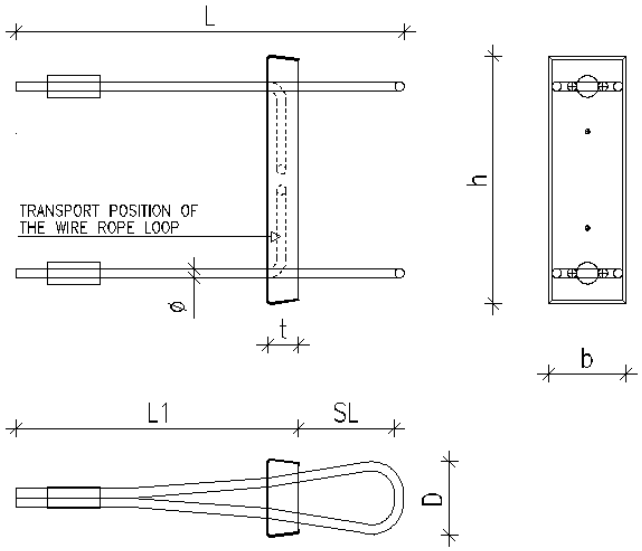
Selection

Our range includes Standard wire boxes, a Maxi wire box and Double wire rope boxes. The four types of Standard wire boxes have the same load capacity, selection should be made based on the thickness of the joint. For greater loads, use the Maxi box or Doube wire rope boxes.

Dimensions



Standard and Maxi Wire Loop Boxes



Double Wire Loop Boxes

Box Type	Part No	SL (mm) ± 10	L (mm) ± 20	L1 (mm) ± 10	h (mm) ± 2	b (mm) ± 2	t (mm) ± 2	ø(mm) Note 1	D (mm)
Standard	CFS-RVL-60	60	336	270	160	50	20	6	55
	CFS-RVL-80	80		250					60
	CFS-RVL-100	100		230					65
	CFS-RVL-120	120		210					70
Maxi	CFS-RVL-140	140	528	370	200	50	20	8	100
Double	CFS-RWL-THIN	80	306	220	180	50	20	6	60
	CFS-RWL-WIDE	100	331	225	220	80	25	6	60

Thickness of steel plate of the box is 0,7mm. Note 1 – according to SFS-EN 12385

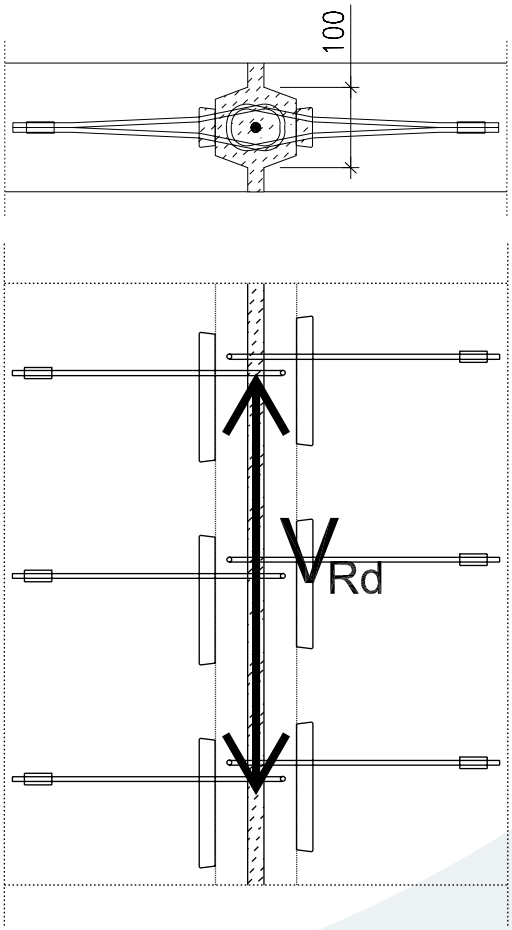
Materials

Part	Material	Standard
Steel box	1.0330	SFS-EN 10130
Wire rope	high strength steel wire rope SE-Zn	SFS-EN 12385
Compression sleeve	1.0046	SFS-EN 10025

The steel box and the wire rope are zinc coated. Zinced products are passivated with min. 1 month of storage.

Capacities

The Standard boxes (RVL-60, -80, -100 and -120) all have equal capacities. For greater loads, use the Maxi box (RVL-140) or the Double boxes (RWL-THIN and –WIDE).



Design Principles

The capacities presented in the tables below are calculated for static loads. Our wire rope loops are not designed to be used for dynamic loading or for lifting. For the capacities to be achieved, there should be no cracks or deformations in the joints.

The capacities of the wire rope loops are calculated for a joint as presented in the diagram with seam thickness and reinforcement as outlined in the following sections. The steel boxes and the seam must be fully filled with concrete.

The capacities given are the resistances in ultimate limit state, so please compare to design loads.

Longitudinal Force Capacity

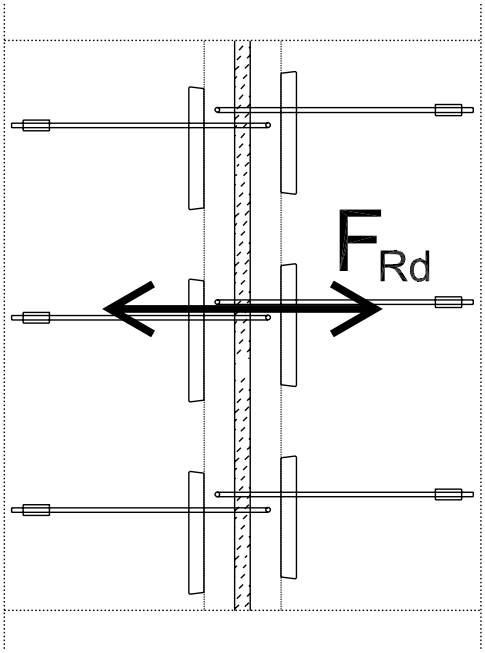
Boxes Centre to Centre	Design Value of Longitudinal Shear Resistance, VRd (kN/m)							
	Standard		Maxi		Double Thin		Double Wide	
	CFS-RVL-60, -80, -100, -120		CFS-RVL-140		CFS-RWL-THIN		CFS-RWL-WIDE	
	C25/30	C40/50	C25/30	C40/50	C25/30	C40/50	C25/30	C40/50
250	125	159			112	116		
300	117	148			94	98	141	154
350	101	128	182	230	81	84	120	132
400	89	112	163	207	70	74	106	118
450	79	100	146	184	63	66	95	106
500	72	91	131	166	56	59	85	96
550	66	83	120	152	51	54	77	87
600	60	76	110	139	46	49	70	80
650	56	71	102	129	43	45	64	73
700	52	66	95	120	40	43	60	69
750	49	62			37	40	55	63

The resistance is defined by the weakest concrete in the system, either to fill the joint or the concrete used to make the precast element.

Tensile Capacity

Capacities are shown here per box, thus for Standard and Maxi boxes the capacities are for a single wire rope pair, and for the double boxes are for two wire rope pairs.

Box Type	Part No	Design Value of Tensile Resistance, FRd (kN)	
		C25/30	C40/50
Standard	CFS-RVL-60	12.9	12.9
	CFS-RVL-80		
	CFS-RVL-100		
	CFS-RVL-120		
Maxi	CFS-RVL-140	23.1	23.1
Double	CFS-RWL-THIN	17	25.8
	CFS-RWL-WIDE		

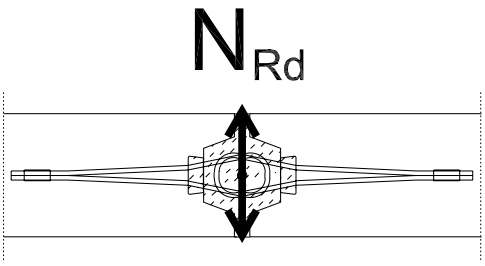


The resistance is defined by the weakest concrete in the system, either to fill the joint or the concrete used to make the precast element. The distance between wire loop boxes must be as defined later in this section.

Horizontal Shear Force

Capacities are shown here per box, thus for Standard and Maxi boxes the capacities are for a single wire rope pair, and for the double boxes are for two wire rope pairs.

Box Type	Part No	Design Value of Horizontal Shear Resistance, NRd (kN)	
		C25/30	C40/50
Standard	CFS-RVL-60	4.6	5.8
	CFS-RVL-80		
	CFS-RVL-100		
	CFS-RVL-120		
Maxi	CFS-RVL-140	8.2	10.3
Double	CFS-RWL-THIN	10.8	13.6
	CFS-RWL-WIDE		



The resistance is defined by the weakest concrete in the system, either to fill the joint or the concrete used to make the precast element. The distance between wire loop boxes must be as defined later in this section.

Combined Forces

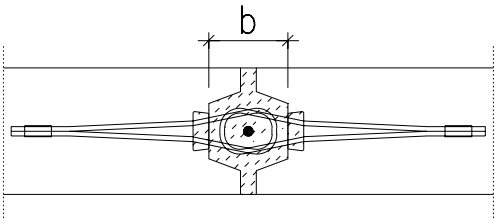
For circumstances where there is a combination of forces on the wire loop joints, the following must apply:

$$\frac{V_{Applied}}{V_{Rd}} + \frac{F_{Applied}}{F_{Rd}} + \frac{N_{Applied}}{N_{Rd}} \leq 1$$

Installation

Seam Thickness

The size of the wire rope loops must be chosen according to the thickness of the joint to enable the vertical ribbed steel bar in the joint to pass through the wire rope loops on both side of the joint.



Box Type	Part No	Recommended thickness of rope loop seam (mm)
Standard	CFS-RVL-60	70-90
	CFS-RVL-80	90-110
	CFS-RVL-100	110-140
	CFS-RVL-120	140-190
Maxi	CFS-RVL-140	160-220
Double	CFS-RWL-THIN	90-130
	CFS-RWL-WIDE	110-160

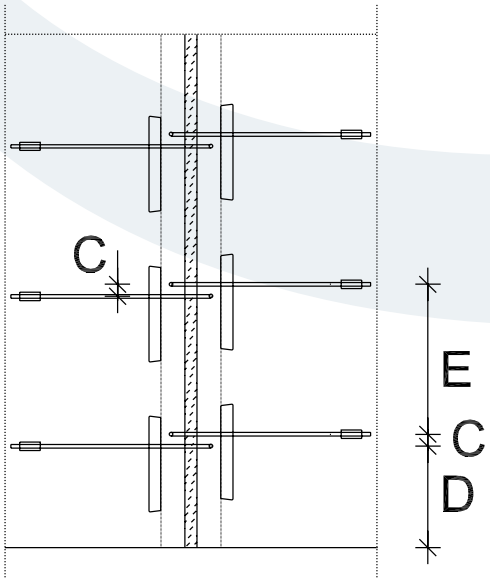
Minimum Edge Distance and Spacing

Centre to centre E_{min} = minimum distance between wire rope loops at the same side of the joint.

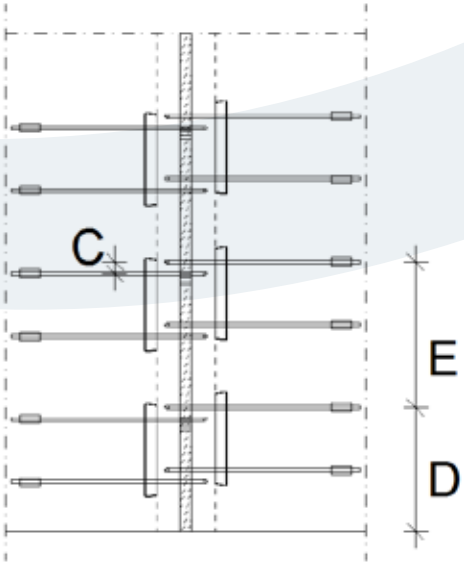
Edge distance D_{min} = the minimum distance of the wire rope loop to the upper and lower edge of the concrete element (see diagram for double boxes).

Centre to centre C_{max} = minimum distance between wire rope loops at opposite sides of the joint.

Minimum width B_{min} = minimum total wall width.



Dimensions for Standard and Maxi Boxes



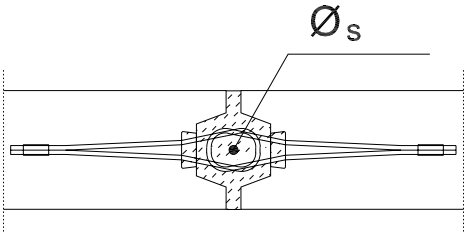
Dimensions for Double Boxes

Box Type	Part No	Centre to Centre E_{min}	Edge Distance D_{min}	Centre to Centre C_{max}	Minimum Width B_{min}
		mm			
Standard	CFS-RVL-60	250	100	20	120
	CFS-RVL-80				
	CFS-RVL-100				
	CFS-RVL-120				
Maxi	CFS-RVL-140	350	200	25	150
Double	CFS-RWL-THIN	250	250	20	80
	CFS-RWL-WIDE	300	300	25	100

Reinforcement of the joint

When using wire rope loops, a vertical ribbed steel bar must always be installed through the wire loops as shown here.

Box Type	Part No	Diameter of the ribbed steel bar Øs
Standard	CFS-RVL-60	12
	CFS-RVL-80	
	CFS-RVL-100	
	CFS-RVL-120	
Maxi	CFS-RVL-140	16
Double	CFS-RWL-THIN	12
	CFS-RWL-WIDE	



Reinforcing steel A500HW or similar

Reinforcement of Concrete Elements

The wall elements must be reinforced according to the wall element design.

Case 1 – Where wire loops are used to transfer forces

When RVL wire rope loops are used to transfer forces in the joint, anchorage of the wire rope loop must be secured by overlapping the wire rope loop sufficiently with the reinforcement of the concrete element. This should be done to the engineer's design depending on your precise arrangement.

Where the wire loop is used in a corner joint a reinforcing bar should be installed into the inner edge of the fold of the RVL wire rope loop, the diameter of this bar should be the same as the reinforcement installed in the joint.

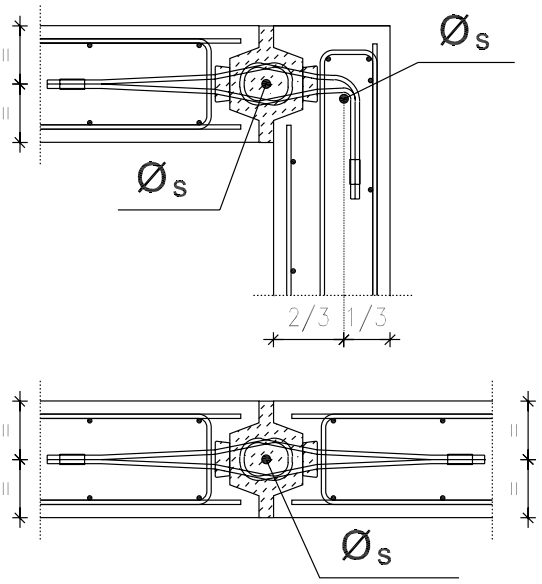
Case 2 – Where RVL wire loops are not used to transfer forces

When wire rope loops are used to limit cracking of the seam or to tie elements together without defining the required force, additional reinforcement in the wall is recommended as shown here, including 2 No 10mm diameter additional bars in each piece.

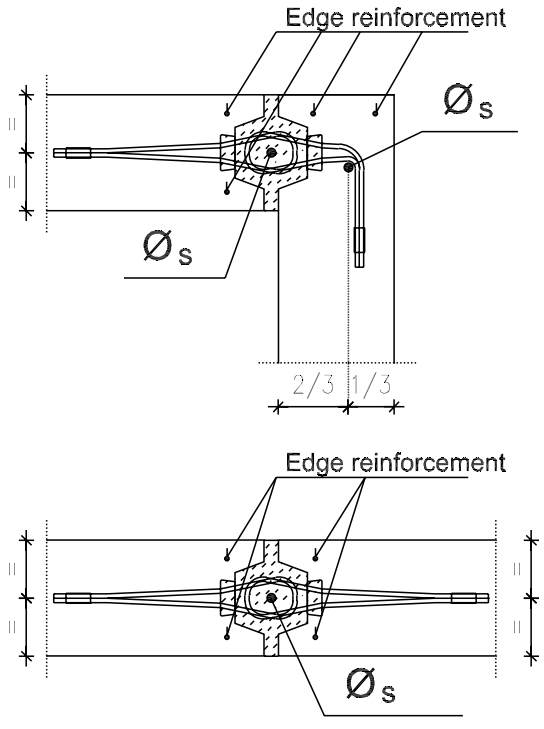
Attachment to the formwork

The wire rope loop box must be attached securely so it cannot move during casting of the concrete. At the wire rope loop, the concrete must be compacted carefully as the loop cannot be vibrated. The wire rope loops Loop boxes may be fastened to formwork with nails or by magnets. The part of the wire rope which enters the concrete element is installed amidst the reinforcement and does not need to be tied to the reinforcement.

Case Study 1 Diagrams



Case Study 2 Diagrams



Supervision of Installation

Check list before casting:

- Wire rope loop is in good condition
- Wire rope loop is according to designs and in the right place
- Wire rope loop is attached firmly
- The required additional reinforcement is installed.

During the casting:

- Wire rope loop stays in the right place
- The concrete is thoroughly vibrated around the RVL wire rope loop.

After the casting:

- The tape covering the steel box is removed at the factory after the concrete is cured.

Manufacturing

Our RVL wire rope loops are manufactured by R-Group Finland Oy.

Manufacturing markings

The product packaging includes a R-Steel sticker, containing the following information: product type, product name, quantity, ISO9001 and ISO14001 quality and environmental system markings, FI marking and product picture.

Products are delivered in cardboard boxes 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.

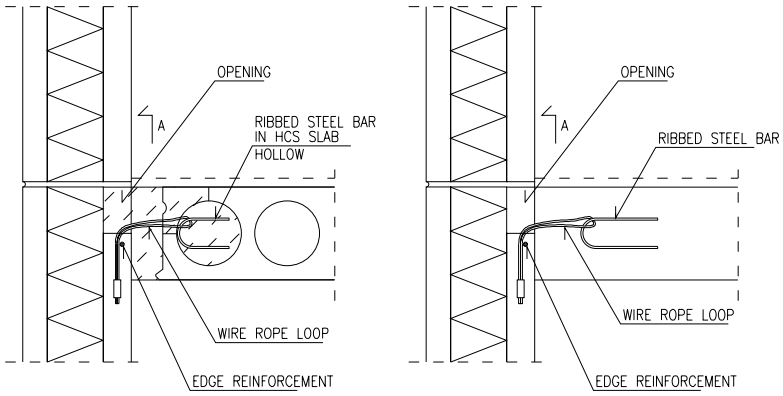
Quality control

Quality control of the wire rope loops is done according to the requirements of the Finish Code of Building Regulation and the instructions according to the quality and environment system of R-Group Finland Oy (ISO 9001 and ISO 14001).

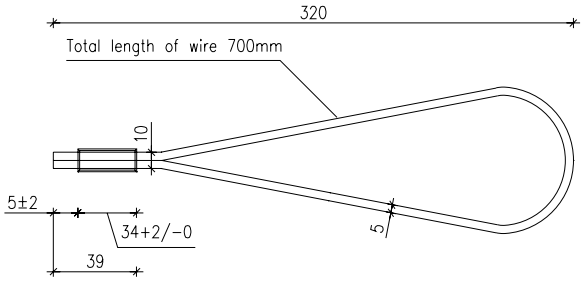
R-Steel Loops

R-Steel Loops are used to tie precast concrete elements to the building frame using a reinforcement bar through the loops and casting some concrete insitu.

They are similar to the RVL Wire Loop in application. The wire boxes have the advantage of ease of casting and protection of the loop, however the R-Steel loops can be used in thinner panels and can also be used for lifting.



Dimensions



Materials

Part	Material	Standard
Wire rope	high strength steel wire SE-Zn	SFS-EN 12385
Compression sleeve	1.0046	SFS-EN 10025

Capacities

Design principles:

The capacities presented in the tables below are calculated for ultimate limit states according to the following codes and regulations:

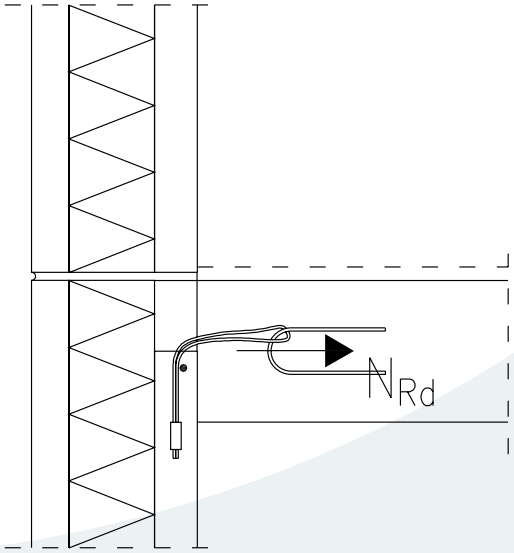
- SFS-EN1992-1-1
- SFS-EN1993-1-1

R Steel loops cannot be welded.

Capacity for element tying

Ultimate limit capacity for horizontal force, NRd = 4.8kN

Concrete strength ≥C25/30. This design is for a static load, for dynamic load please seek advice from CFS technical help.



Capacity for element lifting

The R-Steel Loop can be used for lifting concrete elements, according to the diagram below as long as the following are met:

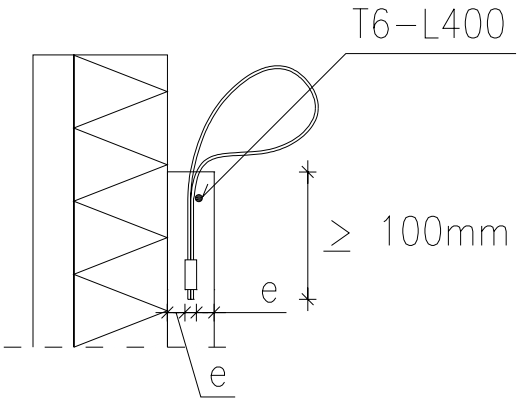
- Lifting angle must be between 0° and 45°
- R-Steel Loop resistance for lifting FRd = 1.9kN (concrete ≥ C15/20)
- Lifting device diameter must be ≥ 40mm

Installation

Minimum Edge Distance and Spacing

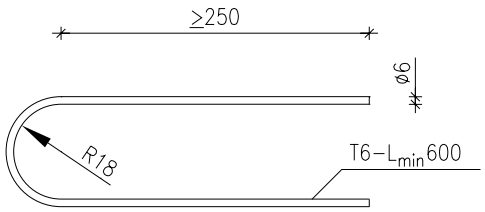
Minimum edge distance from sleeve, e = 15mm

A reinforcing bar needs to be provided in the element as shown above to prevent the loop bursting out of the wall.



Reinforcement

Anchoring reinforcement must be installed through the R-Steel Loop and it must be anchored to cast in situ concrete. Reinforcement to be A500HW or similar.



Attachment to the formwork

The R-Steel Loop and anchoring reinforcement must be securely attached and must not move during casting. The R-Steel Loop may not be vibrated during casting.

Supervision of Installation

Check before casting:

- R-Steel loop is in good condition
- R-Steel loop I according to design and in the right place
- R-Steel loop is attached firmly
- The additional reinforcement is installed

During casting:

- R-Steel loop stays in the right place
- The concrete is thoroughly vibrated around the R-Steel loop

After casting:

- The situation of the R-Steel loop is according to the design

Manufacturing

R-Steel loops are manufactured by R-Group Finland Oy.

Manufacturing markings

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Quality control

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