RSTEEL®

Technical Manual

Technical changes and errors reserved

Version 16.7.2019

RCL Lifting Parts

According to Eurocodes, EU Machinery directive 2006/42/EC and VDI/BV-BS 6205
CE Approved

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Highest Creditworthiness
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THE STRONGEST IN FINLAND
2017
R-Group Finland OY
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1 DESCRIPTION OF THE SYSTEM

RCL lifting parts are flat steel parts with ribbed steel bar for anchoring. RCL lifting parts are embedded in concrete elements before concrete casting.

Main usage of RCL lifting parts is lifting of one-story high balcony columns.

RCL lifting parts are made entirely of stainless steel. RCL lifting parts are not removed or cut after installation of column. RCL lifting parts remain in structure and can be used eg. for anchoring horizontal forces in connection between balcony column and balcony slab.

RCL lifting parts can be used in all lifting directions and for lifting angles up to 90 degrees.

RCL lifting parts are designed and manufactured in accordance with EU Machinery Directive 2006/42/EC and VDI/BV-BS 6205. RCL lifting parts meet the requirements for safe lifting and handling of concrete elements.

1.1 Manufacturing markings

RCL lifting parts are marked with R-Steel logo, type and load class of lifting anchor and CE-marking.

Products are delivered [in cardboard boxes] on a truck palette. Product package is equipped with an R-Steel Pallet Label, which contains the following information: product type, product name, quantity, ISO9001 and ISO14001 quality and environment system markings, and CE, FI and BY (Concrete Association of Finland) logo

1.2 Quality control

Quality control of lifting anchors 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.

2 RCL LIFTING PARTS

2.1 RCL lifting parts dimensions and tolerances

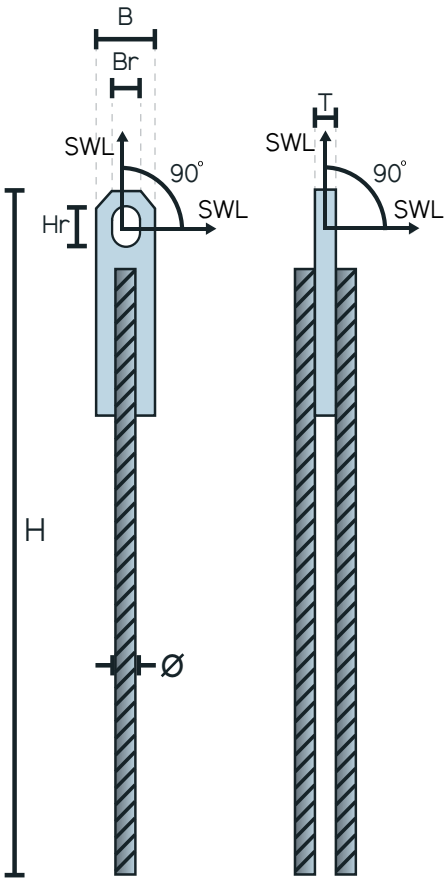

Figure 1. RCL lifting parts dimensions

Table 1. RCL lifting parts dimensions and tolerances

Lifting part	H [mm] ±6	B [mm] 1)	T [mm] 1)	Br [mm] ±1	Hr [mm] ±1	φ [mm]	n [pcs]
RCL2	390	30	10	14	20	11	1+1
RCL4	470	40	15	17	25	11	2+2

1) According to SFS-EN 10278

n = number of ribbed steel bars

2.2 RCL lifting parts materials and standards

Table 2. RCL lifting parts materials and standards

Part	Material	Standard
Flat steel	1.4301	SFS-EN 10088
Ribbed steel bar	B600KX	SFS 1259
	B600KB	SFS 1259:2016
	B600KC	SFS 1259:2016

3 SAFE WORKING LOADS

3.1 Design concept

Safe working loads of RCL lifting parts are calculated according to following standards and instructions:

EN 1992: Eurocode 2
EN 1993: Eurocode 3
Machinery directive 2006/42/EC
VDI/BV-BS 6205

Global safety factors used in calculation of safe working loads are

Steel failure γ = 3,05
Concrete failure γ = 3,05

Safe working loads are based on concrete dimensions, anchor steel bars and lifting anchor edge distances given in the following sections.

Safety concept

$E \leq SWL$

Where E = action placed on lifting anchor
SWL = safe working load of lifting anchor

Actions placed on lifting anchors must take into account all loads and load distribution to lifting anchors according to following sections.

3.2 Safe working loads

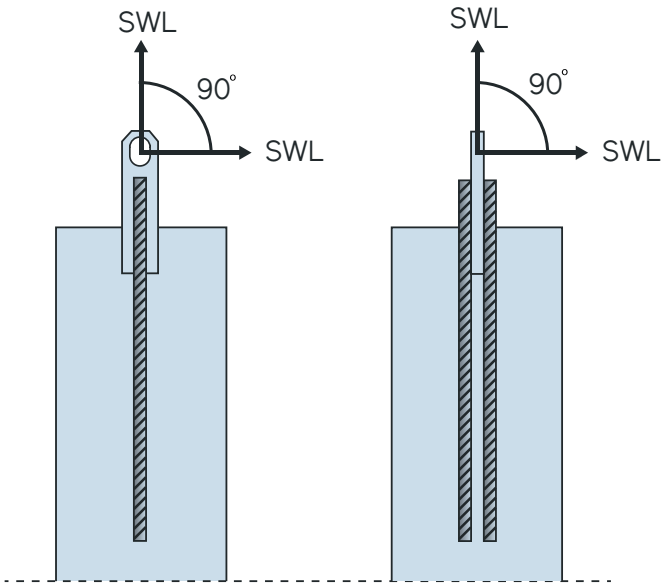

Figure 2. RCL lifting parts allowed lifting angles

Table 3. RCL lifting parts safe working loads

Load group	SWL [kN]		
	C12/15	C16/20	C20/25
RCL2	5,0	5,2	5,2
RCL4	9,3	12,4	13,2

Safe working loads are applicable with concrete strength in table 3, concrete edge distances according to section 3.3 and column reinforcement according to section 3.4.

3.3 Concrete edge distances

RCL lifting parts are placed on top of column and in the center of gravity of the column. Placement dimensions are given in figure 3.

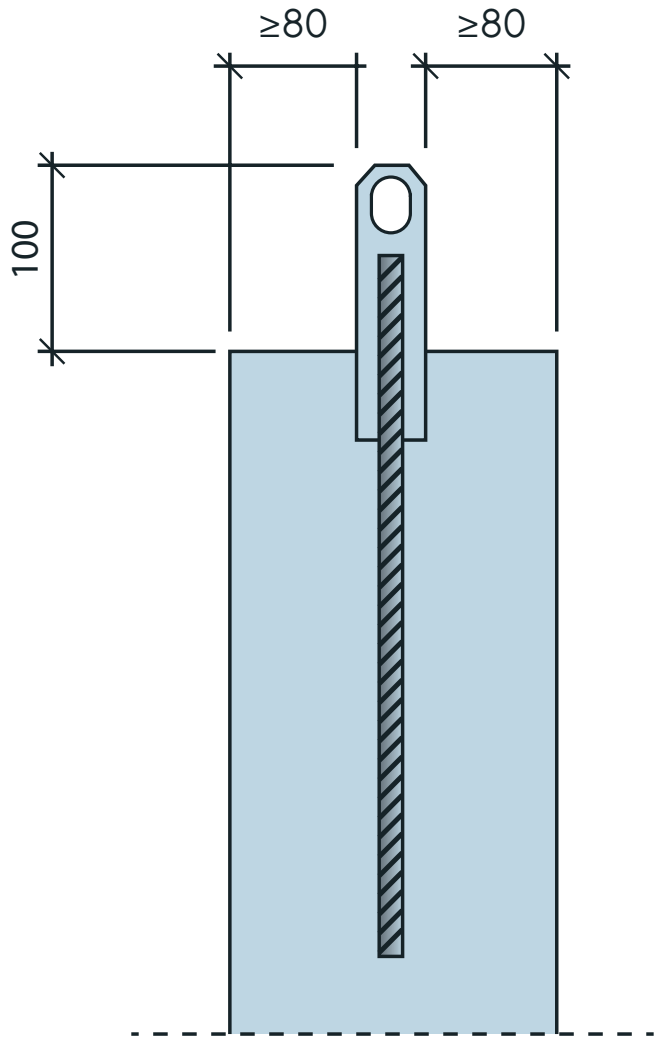

Figure 3. RCL lifting parts placement in column [dimensions in millimeters]

3.4 Reinforcement

3.4.1 Reinforcement of the pre-cast element

The concrete element must have at least minimum reinforcement according to EN 1992: Eurocode 2. Concrete element must be reinforced to withstand all actions from lifting, tilting and transport including dynamic actions. This reinforcement must be designed by the structural designer.

3.4.2 Additional reinforcement for RCL lifting parts

When using RCL lifting parts additional reinforcement according to figure 4 must always be installed (reinforcement 1+1 pcs φ8 mm A500HW, B500B or similar ribbed steel). Reinforcement of column may be used as reinforcement of RCL lifting parts.

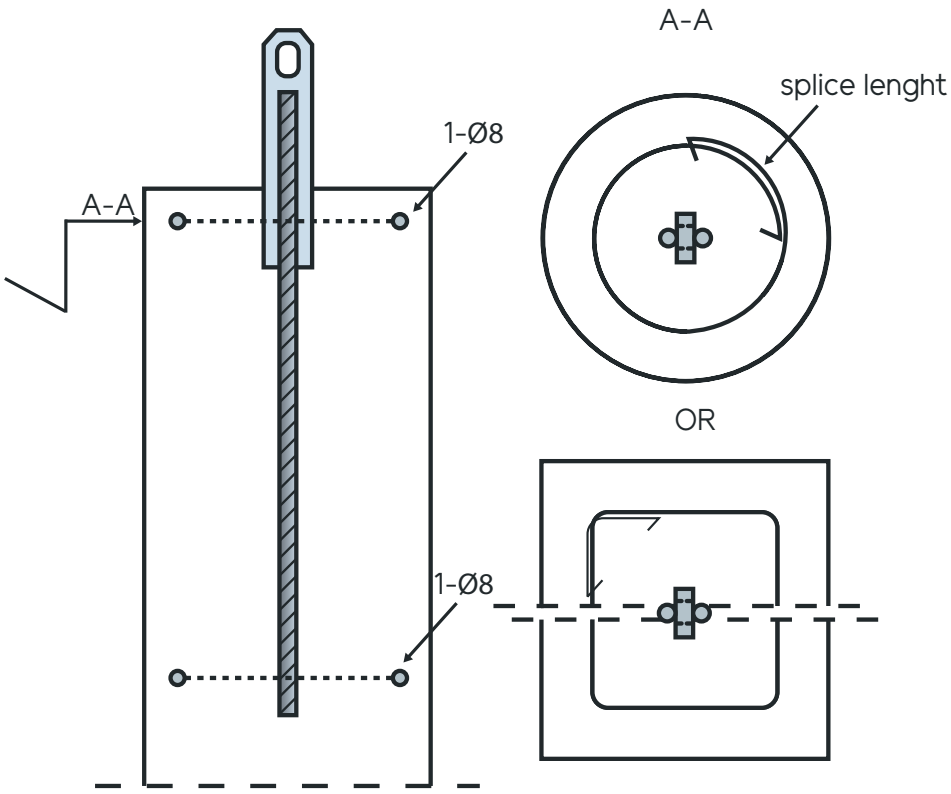

Figure 4. Additional reinforcement for RCL lifting parts

3.5 Actions on lifting parts

3.5.1 General

The loads acting on a lifting part shall be determined considering the following factors:

- statical system
- element self-weight
- adhesion and form friction
- dynamic effects
- position and number of lifting part
- type of lifting equipment and different load scenarios (tension, combined tension and shear, shear loading).

3.5.2 Self-weight

The self-weight FG of pre-cast elements shall be determined as

$F_G = V \cdot \rho_G$

where

V volume of the pre-cast element, in m^3

ρ_G density of the concrete, in kN/m^3

3.5.3 Adhesion and form friction

Adhesion and form friction are assumed to act simultaneously during the lifting of the precast element from the formwork. The actions for demolding situations is

$F_{adh} = q_{adh} \cdot A_f$

where

F_{adh} action due to adhesion and form friction, in kN

q_{adh} basic value of combined adhesion and form friction as per Table 4, in kN/m^2

A_f contact area between concrete and formwork, in m^2

Table 4. Minimum values of adhesion and form friction q_{adh}

Formwork and condition[a)]	q_{adh}[b)] [kN/m^2]
Oiled steel mold, oiled plastic-coated plywood	≥ 1,0
Varnished wooden mold with panel boards	≥ 2,0
Rough wooden mold	≥ 3,0

a) Structured surfaces should be considered separately.

b) The area to be used in the calculations is the total contact area between the concrete and the form.

Note: The minimum values of Table 4 are valid only if suitable measures to reduce adhesion and form friction are taken e. g. casting on tilting or vibrating the formwork during the demolding process.

3.5.4 Dynamic actions

During lifting and handling of the precast elements the lifting devices are subjected to dynamic actions. The magnitude of the dynamic actions depends on the type of lifting machinery. Dynamic effects shall be taken into account by the dynamic factor ψ_{dyn}. For further guidance values of ψ_{dyn} depending on the lifting machinery and characteristics of the terrain are given in Table 5.

Table 5. Dynamic factor ψ_{dyn}

Condition	Dynamic factor ψ_{dyn}
Tower crane, portal crane, mobile crane	1,3
Lifting and moving on flat terrain	2,5
Lifting and moving on rough terrain	≥ 4

Note: Other values of ψ_{dyn} than given in Table 5 based on reproducible tests or verified experience can be used in the design. In case of other lifting and handling conditions than reported in Table 5 the factor ψ_{dyn} shall be determined on the base of tests or engineering judgement.

3.5.5 Load condition "erection in combination with adhesion and form friction"

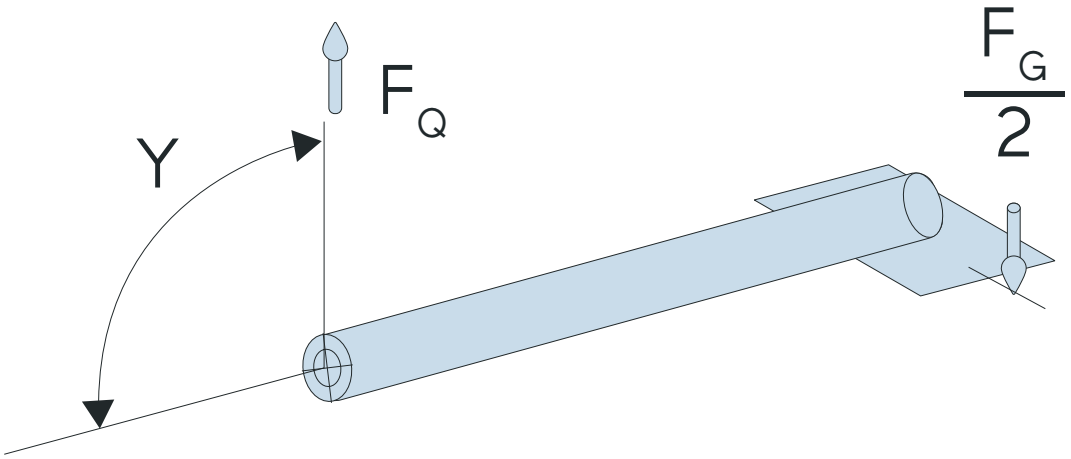

Figure 5. Erection in combination with adhesion and form friction

When pre-cast elements are lift from form according to Figure 5 the action F_Q on lifting anchors is

$$F_Q = \left(\frac{F_G}{2} + F_{adh}\right)$$

where

F_Q load acting on individual lifting anchor, in kN
F_G self-weight of the pre-cast element, section 3.5.2, in kN
F_{adh} action due to adhesion and form friction, section 3.5.3, in kN

3.5.6 Load condition “erection”

It is assumed that the pre-cast element rests one-sided in the form or has been tilted up and forces from adhesion and form friction are no longer present.

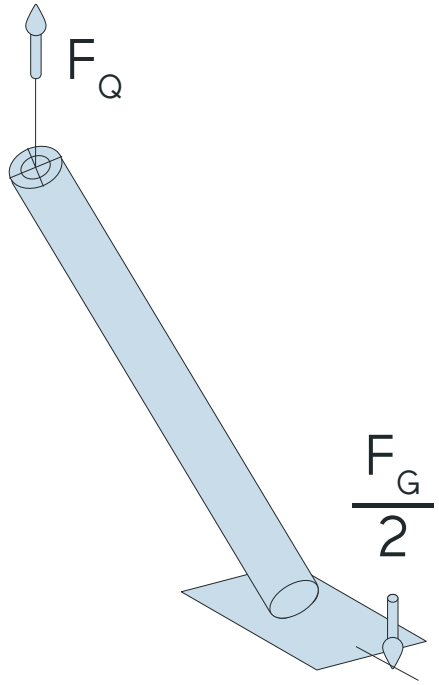

Figure 6. Element erection

Erection (Figure 6), action on lifting anchor is

$$F_Q = \left(\frac{F_G}{2}\right) \cdot \psi_{dyn}$$

where

F_Q load acting on individual lifting anchor, in kN
F_G self-weight of the pre-cast element, section 3.5.2, in kN
ψ_{dyn} dynamic factor, section 3.5.4

3.5.7 Load condition “lifting and handling”

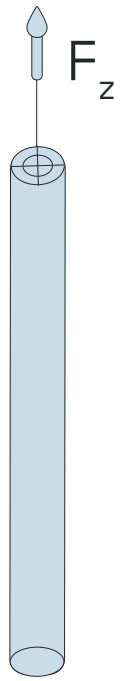

Figure 7. Lifting and handling

The load condition “lifting and handling” is presented in Figure 7. This is the most common lifting procedure. Action on lifting anchor is

$$F_Z = F_G \cdot \psi_{dyn}$$

where

F_Z load acting on the lifting anchor in direction of the sling axis, in kN

F_G self-weight of the pre-cast element, section 3.5.2, in kN

ψ_{dyn} dynamic factor, section 3.5.4

Notes

CREATE A NOTE

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.

Our customer-oriented service, excellent and reliable network of suppliers plus our extensive product portfolio ensure that we are able to offer professional and flexible solutions for any kind of projects.

In our operations we comply with the ISO 9001 and 14001 standards

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