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CZŁONEK EOTA i UEAtc

NATIONAL TECHNICAL ASSESSMENT ITB-KOT-2020/1231 edition 1

This National Technical Assessment has been issued in accordance with the Regulation of the Minister of Infrastructure and Construction of 17 November 2016 on National Technical Assessments (Journal of Laws of 2016, item 1968) by the Building Research Institute in Warsaw, upon request of:

RAWLPLUG S.A.
ul. Kwidzyńska 6, 51-416 Wrocław

National Technical Assessment ITB-KOT-2020/1231 edition 1 is a positive assessment of the performance of the following construction products for the intended use:

Steel expansion anchors
R-RB

Validity date of the National Technical Assessment:

18 czerwca 2025 r.

[*stamp:*]
MANAGER
Building Research Institute
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Warsaw, 18 June 2020.

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1. TECHNICAL DESCRIPTION OF THE PRODUCT

The subject of this National Technical Assessment are R-RB steel expansion anchors, manufactured by RAWLPLUG S.A., ul. Kwidzyńska 6, 51-416 Wrocław, in the following production facilities in Poland.

This National Technical Assessment covers the following types of R-RB anchors:

- R-RBP (according to Annex C, tables C3, C6 and C7) - expander anchors with bar and nut,
- R-RBL (according to Annex C, tables C3, C6 and C7) - expansion anchors with screw,
- R-RBL-H (as per Annex C, tables C1, C2, C5, C6 and C7) - open hook expansion anchors
- R-RBL-E (according to Annex C, tables C1, C2, C4, C6 and C7) - expansion anchors with closed hook.

R-RB couplings consist of an expansion sleeve, a conical sleeve with internal thread of the stem (rod, screw or hook).

Expansion sleeves for R-RBP and R-RBL M6 ÷ M16 connectors are made of cold rolled steel strip, according to PN-EN 10139:2016 standard, with a tensile strength of not less than 290 MPa and yield strength of not less than 170 MPa. Conical bushings of R-RBPi R-RBL M6 ÷ M16 connectors are made of ordinary carbon steel, with mechanical properties class not less than 5 according to PN-EN ISO 898-2:2012. Expansion sleeves and conical bushings of R-RBPi R-RBL M20 connectors are made of ductile cast iron grade EN-GJMB-300-6 according to PN-EN 1562:2012. Expansion sleeves of R-RBP and R-RBL connectors can be additionally equipped with a flange. made of polypropylene (Annex A, figure A5), which makes it easy to install the connector in hollow substrates. The flanged fittings are additionally marked PF.

The mandrels of R-RBL and R-RBP anchors are made of galvanised ordinary steel, carbon, in mechanical properties class not lower than 5.8 according to the PN-EN ISO 898-1:2013 standard. Nuts are made of galvanised ordinary, carbon steel, classified in mechanical properties class 5 according to the PN-EN ISO 898-2:2012 standard. Washers are made of galvanised ordinary, carbon steel.

Closed and open hooks of R-RBL-E and R-RBL-H anchors are made of galvanised ordinary, carbon steel, with a tensile strength of not less than 300 MPa and a yield strength of not less than 180 MPa.

The thickness of the zinc coating on the elements of R-RB anchors, applied using the electrolytic method, according to PN-EN ISO 2081:2018 standard, is not less than 5 μm.

Tightening the stem / hook of the R-RB anchors causes the conical sleeve to move inside the expansion sleeve; opening the cut pieces of the sleeve (segments) and creating a permanent anchorage of the fastener in the substrate. Fixing with R-RB anchors is shown in Annex B, Figure B1 ÷ B4. The shape and dimensions of the anchors covered by this National Technical Assessment are given in Annex A.

2. INTENDED USE OF THE PRODUCT

R-RB steel expansion anchors are intended for fixing statically loaded elements of building structures in the ground with:

- normal concrete, reinforced or unreinforced, non-cracked or scratched, class C20/25 ÷ C50/60 according to PN-EN 206+A1:2016 - for R-RBL-H anchors and R-RBL-E, with diameters M6 to M12,
- solid ceramic bricks with a compressive strength not less than 20 MPa (class not less than 20) and a volumetric density not less than 2 kg/dm3, according to the PN-EN standard 771-1+A1:2015 - for R-RB anchors with diameters M6 to M12,
- solid blocks made of aggregate concrete, lightweight (LAC 5), with a compressive strength of not less than 5 N/mm2 and a volumetric density of not less than 0.8 kg/dm3, according to the PN-EN 771-3+A1:2015 standard - in the case of R-RB anchors with diameters M6 to M12,
- hollow silicate hollow bricks, with a wall thickness of not less than 35 mm, with a compressive strength of not less than 15 N/mm2 (class not less than 15) and a volumetric density of not less than 1.4 kg/dm3, according to PN-EN 771-2+A1:2015 standard - for all types of R-RB anchors with diameter M6,
- Teriva 4.0/2 concrete floor blocks according to PN-B-19504:2004 standard, with an element wall thickness of not less than 25 mm - in case of R-RB anchors with diameters M6 to M8,
- channel slabs made of ordinary concrete, class C20/25 according to PN-EN 206:2014 standard, with an element wall thickness of not less than 50 mm - in the case of R-RB anchors with diameters M6 to the M20,
- Channel concrete slabs of ordinary concrete class C30/37 ÷ C50/60 according to PN-EN 206:2014 standard, with a wall thickness of not less than 23 mm - for R-RB anchors with diameters M6 to M12.

Due to the environmental corrosive aggressiveness, the steel anchors covered by this National Technical Assessment should be used in accordance with the requirements set out in the standards PN-EN ISO 12944-2:2018 and PN-EN ISO 9223:2012.

The characteristic shear and pull-out resistances of anchor fixings are given The parameters for the installation and arrangement of the fasteners are shown in Annex C and the parameters for the installation and arrangement of the fasteners are shown in Annex B.

In order to determine the design resistances of R-RB anchorages, the characteristic resistances given in Annex C shall be divided by partial safety factors:

- 1,80 - in the case of pulling out of the base from ordinary concrete, concrete channel slabs and concrete floor blocks Teriva 4.0/2,
- 2,50 - in the case of pulling ceramic bricks, silicate blocks and blocks from the ground made of aggregate concrete, lightweight (LAC 5),
- 1,25 - for shearing.

For installation of R-RB anchors, a hole should be drilled perpendicularly to the ground surface. The anchors should be inserted into the hole, which has been cleaned from the drill hole, and then hammered in with light hammer blows, which will open the sleeve. In the case of R-RBL and R-RBP fasteners, the fastening element must be placed. Then, using a torque spanner, the nut washer or bolt head must be pressed firmly against the fastener (in the case of R-RBL and R-RBP fasteners) or the base
(in the case of R-RBL-H and R-RBL-E fasteners). The method of installation of the R-RB couplings is shown in Annex B, Figure B1 ÷ B4.

R-RB anchors should be used in accordance with the technical design, prepared taking into account Polish construction standards and regulations, the findings of this National Technical Assessment and the manufacturer's instructions concerning the conditions of performing fixings with the above mentioned fittings.

3 THE PERFORMANCE OF THE PRODUCT AND THE METHODS USED TO ASSESS THEM

3 .1haracteristic load capacities of anchors The characteristic shear and pull-

out resistances of anchor fixings are given in Annex C.

3.1.2. Durability of connectors. The zinc coating with a thickness of not less than 5 μm ensures the durability of the fasteners made of ordinary carbon steel, in the range resulting from point 2.

1.1. Methods used to assess performance

1.1.1. Characteristic load capacities of fastener fixings. The load capacity of characteristic

fastener fixings is tested on fasteners seated in substrates according to point 2. The forces should be measured by means of a device with a range selected according to the expected value of the destructive force, enabling constant and slow increase of force until destruction.

3.2.2. Durability of connectors. Testing of zinc coating thickness is carried out according to the standard
PN-EN ISO 2178:2016 or PN-EN ISO 3497:2004.

4. PACKAGING, TRANSPORT AND STORAGE AND PRODUCT LABELLING

The anchors covered by this National Technical Assessment should be supplied in sets, in the manufacturer's packaging and stored and transported in such a way as to ensure that their technical characteristics remain unchanged.

The method of marking products with a construction mark should be in accordance with the

Regulation of the Minister of Infrastructure and Construction of 17 November 2016 on the method of declaring the performance of construction products and the method of marking them with a construction mark

(Journal of Laws of 2016, item 1966, as amended).

The marking of a product with a construction mark shall be accompanied by the following information:

- the last two digits of the year in which the construction mark was first placed on the construction product,
- the name and address of the manufacturer's registered office or an identification mark allowing the name and address of the manufacturer to be clearly identified,
- name and type designation of the construction product,
- number and year of issue of the national technical assessment according to which performance has been declared (ITB-KOT-2020/1231 edition 1),
- number of the national declaration of performance,
- level or class of declared performance,
- the name of the certification body which took part in the assessment and verification of constancy of performance of the construction product,
- the website address of the manufacturer, where the national declaration of performance is made available on that website.

A safety data sheet and/or information on hazardous substances contained in a construction product referred to in Articles 31 or 33 of Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and establishing a European Chemicals Agency should be provided or made available, as appropriate, together with the national declaration of performance.

Furthermore, the labelling of a construction product which is a hazardous mixture under REACH should comply with the requirements of Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (CLP), amending and repealing Directives 67/548/EEC and 1999/45/EC and amending Regulation (EC) No 1907/2006.

5. ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

5.1. National system of assessment and verification of constancy of performance

In accordance with the Regulation of the Minister of Infrastructure and Construction of 17 November 2016. on how to declare the performance of construction products and how to mark them with a construction mark (Journal of Laws of 2016, item 1966, as amended), system 1 of assessment and verification of constancy of performance applies.

5.2. Type testing

The performance characteristics assessed in point 3 constitute a product-type examination until there are changes in raw materials, components, production line or plant.

5.3. Factory production control

The manufacturer should have a system of factory production control in place. All elements of this system, requirements and provisions adopted by the manufacturer should be documented in a systematic manner, in the form of rules
and procedures, including records of research. Factory production control should be adapted to the production technology and ensure that the declared performance of the product is maintained in series production.

Factory production control includes specification and checking of raw materials and components, control and in-process tests and control tests (according to point 5.4), carried out by the manufacturer in accordance with a prescribed test plan and according to the rules and procedures laid down in the factory production control documentation.

The results of production controls should be systematically recorded. The records in the register should confirm that the products meet the criteria for assessment and verification of constancy of performance. Individual products or batches of products and related manufacturing details shall be fully traceable and traceable.

5.4. Control tests

5.4.1. Research programme. The research programme includes:

a) ongoing research,
b) periodic examinations.

5.4.2. Current research. Current research includes checking:

a) shape and dimensions,
b) zinc coating thickness

5.4.3. Periodic research. Periodic tests include checking the load capacity of the characteristic fastener fixings.

5.5. Frequency of tests

Current tests should be carried out in accordance with the established test plan, but not less frequently than for each batch of products. The size of the product batch should be specified in the documentation of the factory production control.

Periodic tests should be carried out at least once every 3 years.

6. POINT

6.1 The National Technical Assessment ITB-KOT-2020/1231 edition 1 is a positive assessment of the performance of those essential characteristics of R-RB steel expansion joints which, in accordance with the intended use resulting from the provisions of the Assessment, have an impact on the fulfilment of the essential requirements by the works in which the product will be used.

6.2 National Technical Assessment ITB-KOT-2020/1231 edition 1 is not a document authorising to mark a construction product with a construction mark.

In accordance with the Construction Products Act of 16 April 2004 (OJ of 2020, item 215), products covered by this National Technical Assessment may be placed on the market or made available on the national market, if the manufacturer has assessed and verified the constancy of performance, has drawn up a National Declaration of Performance in accordance with National Technical Assessment ITB-KOT-2020/1231 edition 1 and has marked the products with the construction mark, in accordance with the applicable regulations.

6.3 The National Technical Assessment ITB-KOT-2020/1231 edition 1 does not violate the rights resulting from the provisions on industrial property protection, in particular the Act of 30 June 2000. - Industrial Property Law (Journal of Laws of 2020, item 286). Ensuring these rights is the responsibility of the users of this National Technical Assessment of ITB.

6.4 When issuing the National Technical Assessment, ITB shall not be liable for any infringement of exclusive and acquired rights.

6.5 The National Technical Assessment does not relieve the manufacturer of the products from the responsibility for their proper quality, and contractors from the responsibility for their proper application.

6.6 The validity of the National Technical Assessment may be extended for subsequent periods, not longer than 5 years.

7. LIST OF DOCUMENTS USED IN THE PROCEEDINGS

7.1. Reports, test reports, evaluations, classifications

1) NZk-03972R:28/LS/19. Opinion. Building Research Institute for Construction, Geotechnics and Concrete, Katowice 2020.
2) RB-08_12_19. Research report of 09.12.2019. RAWLPLUG laboratory, Wrocław 2019.
3) 32/06/2017. Study report of 21.09.2017. RAWLPLUG laboratory, Wrocław 2017.
4) OSK-00030R:77/KK/14 and OSK-00030R:62/KK/14. Opinions. Silesian Branch of ITB, Katowice 2014.
5) LOK00-02328/13/R44OSK. Report from research... Silesian Branch of Building Research Institute, Switches Laboratory
   The company's management team will be working with the LOK and LOK Building Products Committee, Katowice, 2013.
6) LOK00-2328/12/R32OSK. Research report. Silesian Branch of Building Research Institute, Switches Laboratory
   LOK, Katowice, 2012
7) LOK-1105/A/08. Research report. Silesian Branch of Building Research Institute, Switches and Construction Products Laboratory LOK, Katowice, 2008.
8) LOK-691/A/06. Test report and technical evaluation. Silesian Branch of Building Research Institute, Switches Laboratory
   The company's main focus is on the development of the LOK Building Products and Construction Products Division, Katowice 2006.

7.2. Standards and related documents

N-EN 206+A1:2016	*Concrete. Requirements, properties, production and conformity*
N-EN 771-1+A1:2015	*Requirements for masonry components. Part 1: Ceramic masonry units*
N-EN 771-2+A1:2015	*Requirements for masonry components. Part 2: Silicate brickwork elements*
N-EN 771-3+A1:2015	*Requirements for masonry components. Part 3: Masonry units Aggregate concrete (with regular and lightweight aggregates)*
N-EN 1562:2012	*Foundry. Malleable cast iron*
N-B-19504:2004	*Prefabricated concrete products. Dense ribbed composite floors. Empties*
PN-EN 22768-1:1999	*General tolerances. Tolerances for linear and angular dimensions without individual tolerance markings*
N-ISO 965-2:2001	*ISO general purpose metric threads. Tolerances. Part 2: Limit dimensions for general purpose male and female threads. Medium accuracy class*

NN-EN ISO 898-1:2013 *Mechanical properties of fasteners made of carbon and alloy steel. Part 1:*

Bolts and studs with certain property classes. Normal and fine threads

PN-EN ISO 898-2:2012 *Mechanical properties of carbon steel and alloy steel fasteners. Part 2: Nuts*

with specified test load. Normal and fine threads

N°EN ISO 2081:2018 *Metal and other inorganic coatings. Electrolytic zinc coatings with additional treatment on iron or steel*

PN-EN ISO 2178:2016 *Non-magnetic coatings on magnetic substrate. Measurement of coating thickness. Magnetic method of steel*

NN-EN ISO 3497:2004 *Metal coatings. Measurement of coating thicknesses. X-ray spectrometry methods*

NN-EN ISO 9223:2012 *Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, designation and evaluation*

PN-EN ISO 12944-2:2018 *Paints and varnishes. Corrosion protection of steel structures with protective paint systems. Part 2: Classification of environments*

N-EN 10139:2016 *Uncoated narrow strip of low carbon steel for cold forming. Technical delivery conditions*

AT-15-7280/2014 *R-RB* steel *expander switches*

ANNEXES

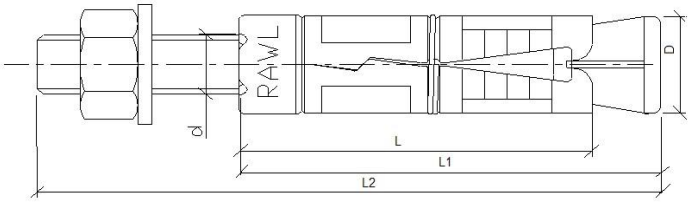


Figure A1. R-RBP expansion anchor

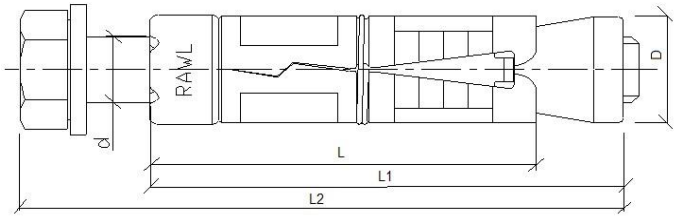


Figure A2. R-RBL expansion anchor

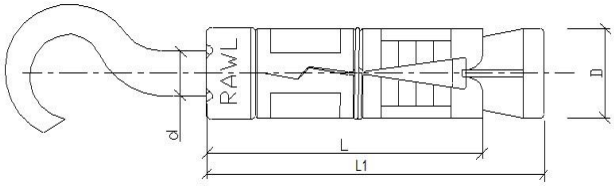


Figure A3. Expansion anchor R-RBL-H

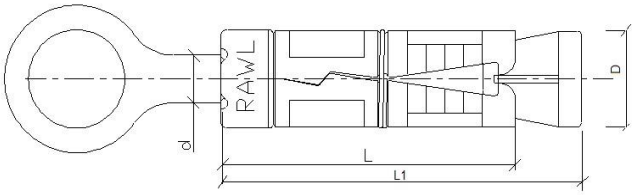


Figure A4. Expansion anchor R-RBL-E

Figure A5. Plastic flange (PF)

Table A1. Dimensions of R-RBL and R-RBP anchors

Size	Designation		Anchor			Fixture	
	R-RBL	R-RBP	Thread diameter	External diameter	Length	Max. thickness	Bore diameter
			d	dnom	L	tfix	df
			[mm]	[mm]	[mm]	[mm]	[mm]
M6	R-RBL M06/10	-	6,0	12,0	55	10	6,5
	-	R-RBP M06/10	6,0	12,0	65	10	6,5
	R-RBL M06/25	-	6,0	12,0	70	25	6,5
	-	R-RBP M06/25	6,0	12,0	80	25	6,5
	R-RBL M06/40	-	6,0	12,0	85	40	6,5
	-	R-RBP M06/60	6,0	12,0	115	60	6,5
M8	R-RBL M08/10	-	8,0	14,0	65	10	9,0
	-	R-RBP M08/10	8,0	14,0	75	10	9,0
	R-RBL M08/25	-	8,0	14,0	80	25	9,0
	-	R-RBP M08/25	8,0	14,0	90	25	9,0
	R-RBL M08/40	-	8,0	14,0	95	40	9,0
	-	R-RBP M8/60	8,0	14,0	125	60	9,0
M10	R-RBL M10/10	-	10,0	16,0	75	10	11,0
	-	R-RBP M10/15	10,0	16,0	90	15	11,0
	R-RBL M10/25	-	10,0	16,0	90	25	11,0
	-	R-RBP M10/30	10,0	16,0	105	30	11,0
	R-RBL M10/50	-	10,0	16,0	115	50	11,0
	-	R-RBP M10/60	10,0	16,0	135	60	11,0
	R-RBL M10/75	-	10,0	16,0	140	75	11,0
M12	R-RBL M12/10	-	12,0	20,0	90	10	13,0
	-	R-RBP M12/15	12,0	20,0	110	15	13,0
	R-RBL M12/25	-	12,0	20,0	105	25	13,0
	-	R-RBP M12/30	12,0	20,0	125	30	13,0
	R-RBL M12/40	-	12,0	20,0	120	40	13,0
	R-RBL M12/60	-	12,0	20,0	140	60	13,0
	-	R-RBP M12/75	12,0	20,0	170	75	13,0
M16	R-RBL M16/15	-	16,0	25,0	135	15	17,0
	-	R-RBP M16/15	16,0	25,0	150	15	17,0
	R-RBL M16/30	-	16,0	25,0	150	30	17,0
	-	R-RBP M16/35	16,0	25,0	170	35	17,0
	R-RBL M16/60	-	16,0	25,0	180	60	17,0
	-	R-RBP M16/75	16,0	25,0	210	75	17,0
M20	-	R-RBP M20/15	20,0	32,0	170	15	22,0
	-	R-RBP M20/30	20,0	32,0	185	30	22,0
	R-RBL M20/60	-	20,0	32,0	195	60	22,0
	R-RBL M20/100	-	20,0	32,0	235	110	22,0
	-	R-RBP M20/100	20,0	32,0	255	100	22,0

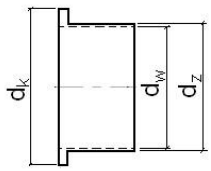
Tolerances:	according to PN-EN ISO 898-1:2013	± 0,5	± 2,5	-	-

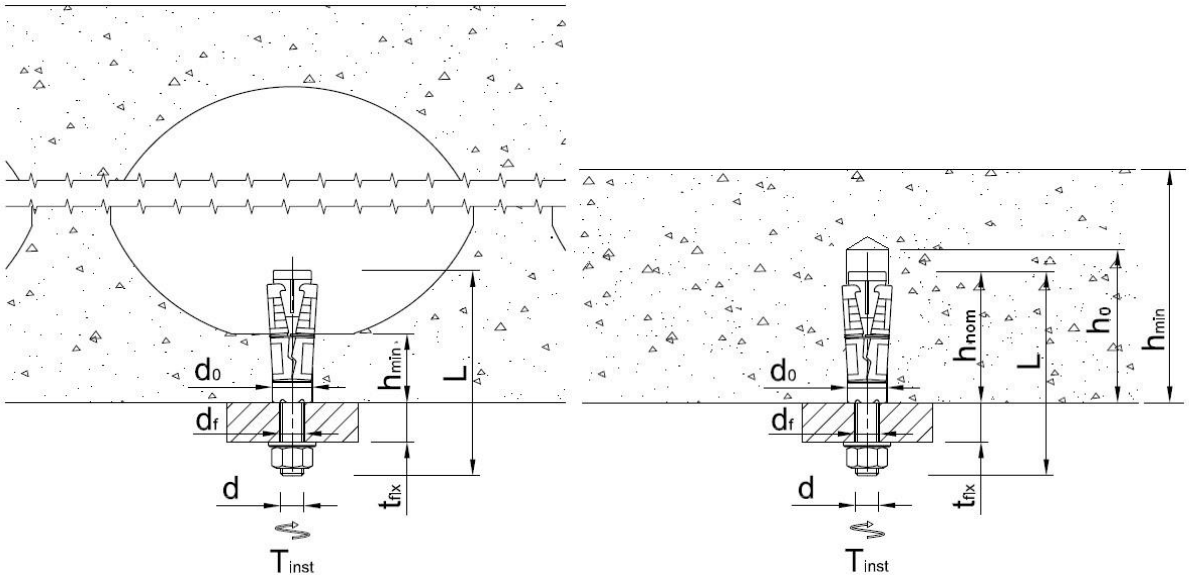
Table A2. Dimensions of the connectors R-RBL-E and R-RBL-H

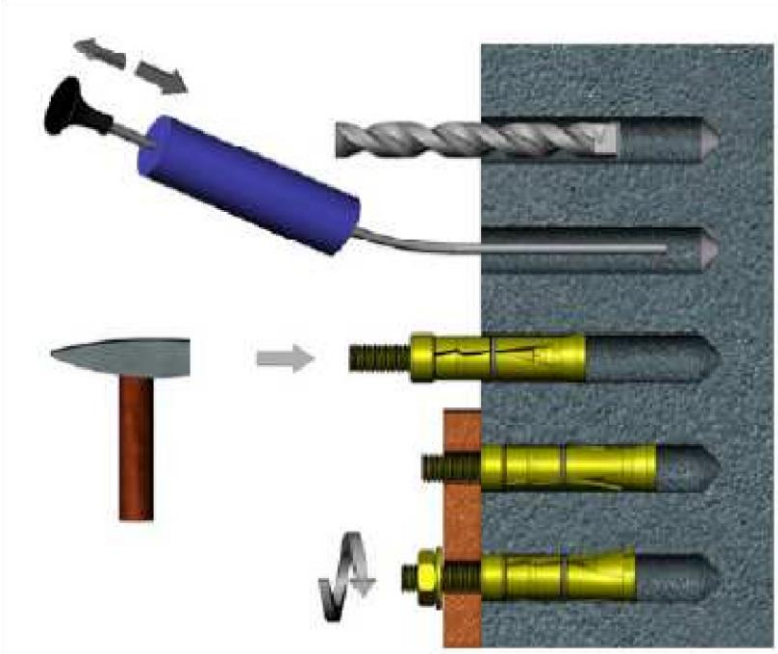
Size	Designation		Anchor			
	R-RBL-E	R-RBL-H	Thread diameter	External diameter	Length	Eye / hook diameter
			d	dnom	L	
			[mm]	[mm]	[mm]	[mm]
M6	R-RBL-E M06	-	6,0	12,0	73	10
	-	R-RBL-H M06	6,0	12,0	83	8
M8	R-RBL-E M08	-	8,0	14,0	87	12
	-	R-RBL-H M08	8,0	14,0	98	10
M10	R-RBL-E M10	-	10,0	16,0	108	14
	-	R-RBL-H M10	10,0	16,0	120	12
M12	R-RBL-E M12	-	12,0	20,0	130	17
	-	R-RBL-H M12	12,0	20,0	145	16
Tolerances:			according to PN-EN ISO 898-1:2013	± 0,5	± 2,0	± 0,5

Table A3. Flange dimensions PF

Size	Connector designation	PF flange		
		Internal diameter	External diameter	Flange diameter
		d_w		dk
		[mm]	[mm]	[mm]
M6	R-RBP M06, R-RBL M06, R-RBL-E M06, R-RBL-H M06	12	13	21
M8	R-RBP M08, R-RBL M08, R-RBL-E M08, R-RBL-H M08	14	15	23
M10	R-RBP M10, R-RBL M10, R-RBL-E M10, R-RBL-H M10	16	17	25
M12	R-RBP M12, R-RBL M12, R-RBL-E M12, R-RBL-H M12	20	21	29
Tolerances:		± 0,5	± 0,5	± 0,5

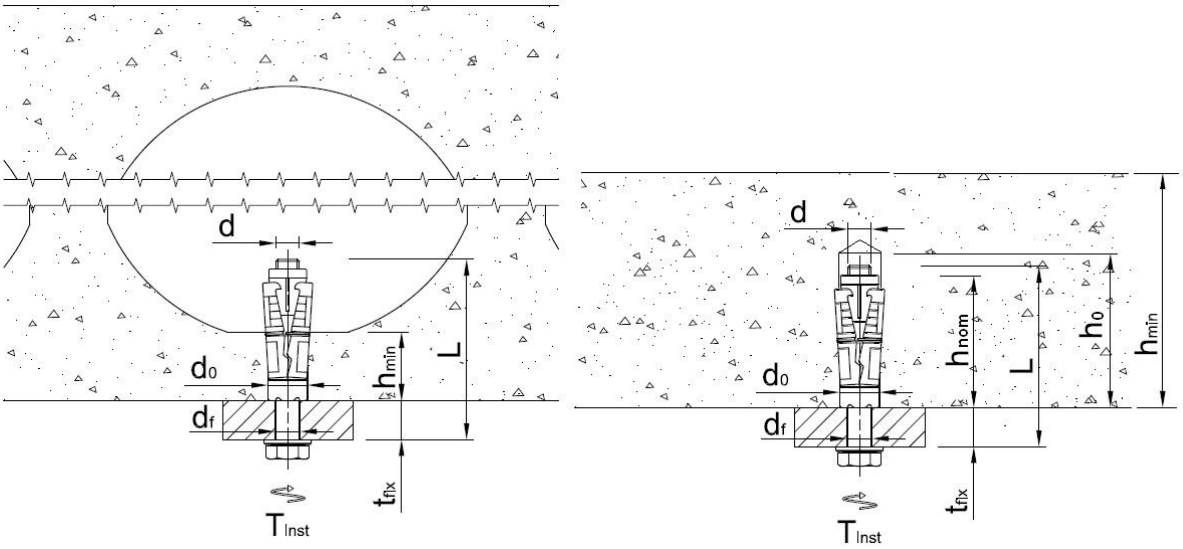


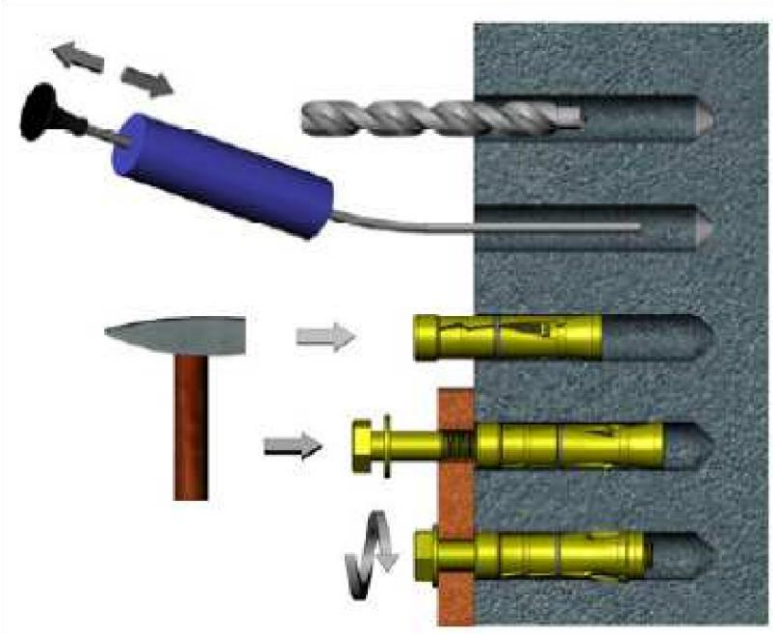




1. Drill a hole of sufficient diameter and depth.
2. Remove the drilling from the hole with a hand pump.
3. Insert the connector sleeve into the hole and hammer it down until it is flush with the ground.
4. Place the fastener, place the washer and the nut on the fastener bar, which is in the hole.
5. using a torque spanner, tighten the fastener nut to the required tightening torque.

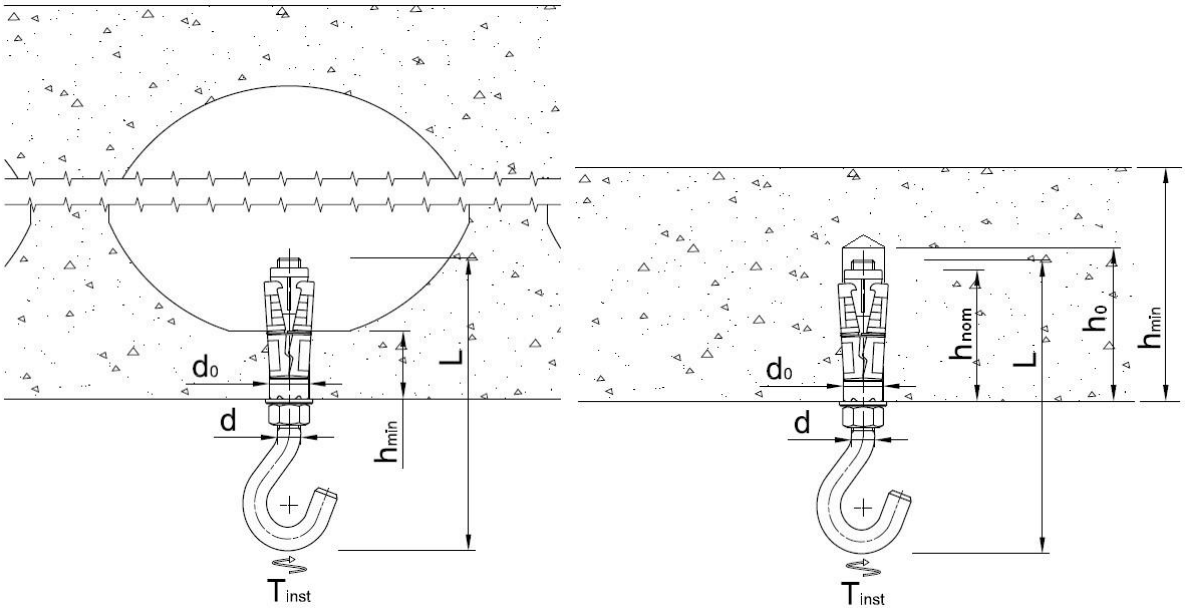
Figure B1. Assembly instructions for R-RBP connectors

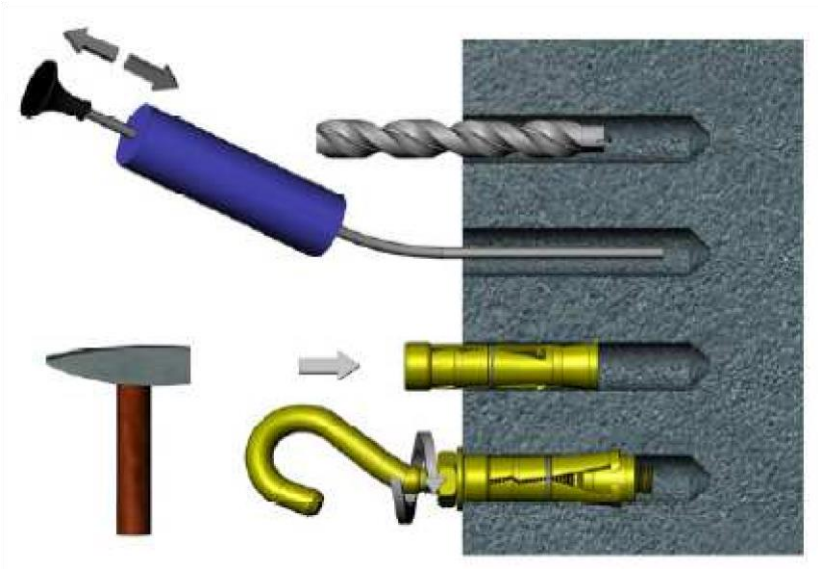




1. Drill a hole of appropriate diameter and depth.
2. Remove drillings from the hole with the use of a hand pump.
3. Insert the anchor sleeve into the hole and tap it with a hammer until it is flush with the substrate.
4. Apply the fixed element, place a washer and nut on the anchor rod inserted in the hole.
5. Using a torque wrench, tighten the anchor nut to the required tightening torque.

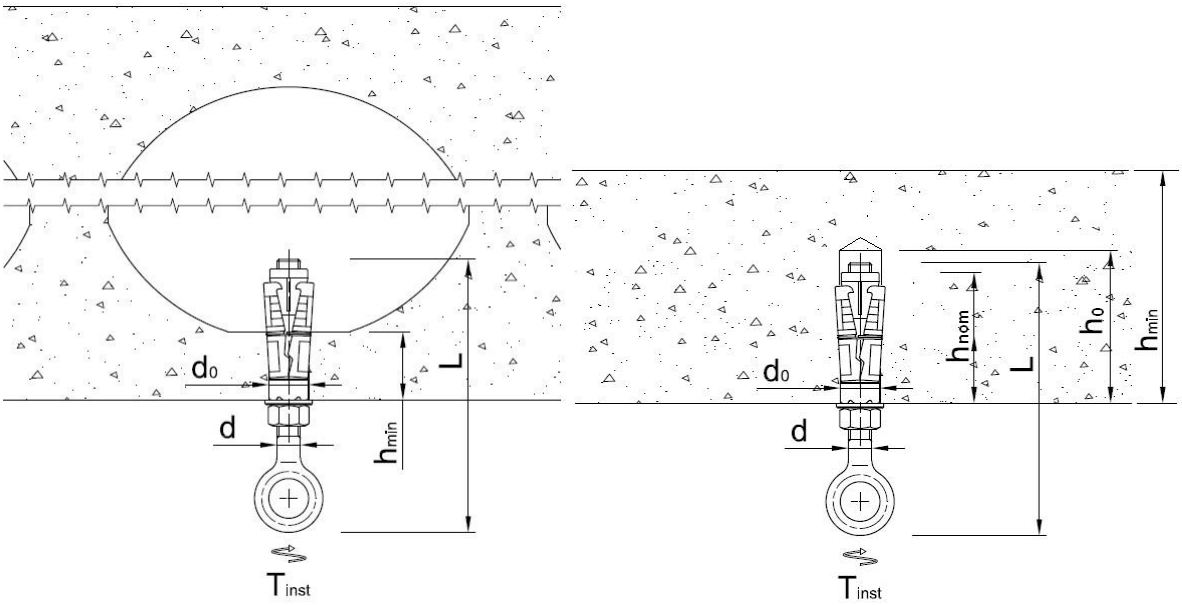
Figure B2. R-RBL anchor installation instruction

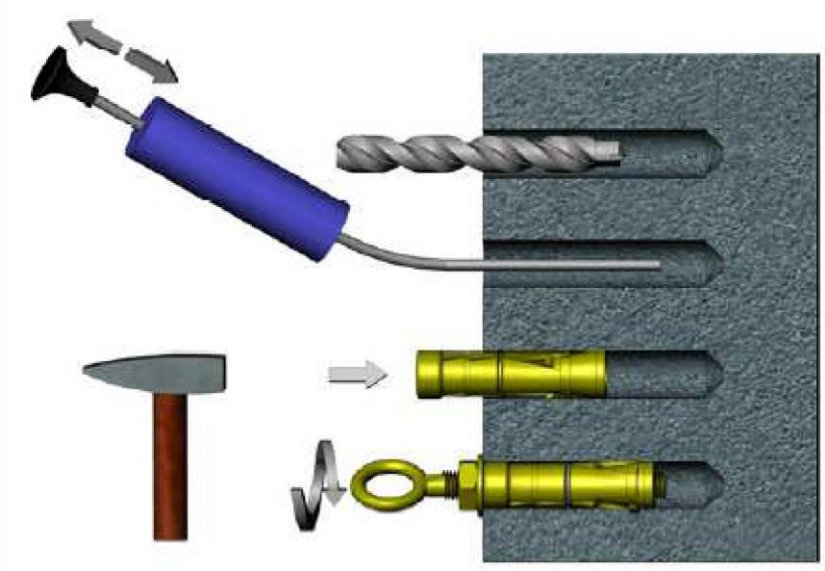




1. Drill a hole of appropriate diameter and depth.
2. Remove drillings from the hole with the use of a hand pump.
3. Insert the anchor sleeve into the hole and tap it with a hammer until it is flush with the substrate.
4. Apply the fixed element, and place a bolt with washer in the anchor sleeve inserted in the hole.
5. Using a torque wrench, tighten the anchor nut to the required tightening torque.

Figure B3. R-RBL-H anchor installation instruction





1. Drill a hole of appropriate diameter and depth.
2. Remove drillings from the hole with the use of a hand pump.
3. Insert the anchor sleeve into the hole and tap it with a hammer until it is flush with the substrate.
4. Place the hook bolt with washer and nut in the anchor sleeve inserted in the hole.
5. Using a torque wrench, tighten the anchor nut to the required tightening torque.

Figure B4 R-RBL-E anchor installation instruction

Table B1: R-RBL-H and R-RBL-E anchors anchor installation parameters.

Concrete substrate

Anchor size		M6	M8	M10	M12	M16	M20
Nominal anchorage depth	hnom [mm]	45	50	60	80	120	135
Effective anchorage depth	h_{ef} [mm]	35	40	50	60	95	115
Nominal bore diameter	up to = [mm].	12	14	16	20	25	32
Hole depth in the deepest point	h0 ≥ [mm]	50	55	65	85	125	140
Hole diameter in fixture	df ≤ [mm].	6,5	9,0	11,0	13,0	17,0	22,0
Tightening torque	Tinst = [Nm]	6,5	15	27	50	120	230
Minimum substrate thickness	hmin [mm]	100	100	100	100	143	173
Minimum spacing	s_{min} [mm]	35	40	50	60	95	115
Minimum edge distance	cmin [mm]	52,5	60	75	90	142,5	172,5

Table B2: R-RB anchors anchor installation parameters

Substrate: solid ceramic brick, light concrete, silicate blocks

Anchor size		M6	M8	M10	M12	M16	M20
Nominal anchorage depth	hnom [mm]	45	50	60	80	120	135
Effective anchorage depth	h_{ef} [mm]	35	40	50	60	95	115
Nominal bore diameter	up to = [mm].	12	14	16	20	25	32
Depth of the hole at its deepest point	h0 ≥ [mm]	50	55	65	85	125	140
Hole diameter in fixture	df ≤ [mm].	6,5	9,0	11,0	13,0	17,0	22,0
Tightening torque	Tinst = [Nm]	3	6,5* or 7**	12	20	30	50

* in the case of hollow bricks ** in the case of other substrates

Table B3: R-RB Hole depth in the deepest point.
Substrate: Teriva concrete floor blocks**,** concrete hollow-core slabs

Anchor size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Minimum wall thickness	hmin [mm]	according to tables C3, C4 and C5					
Nominal bore diameter	up to = [mm].	12	14	16	20	25	32
Hole diameter in fixture	df ≤ [mm].	6,5	9,0	11,0	13,0	17,0	22,0
Tightening torque	Tinst = [Nm]	6,5	15	27	50	120	230

Table C1: R-RBL-H and R-RBL-E pull-out ($_{NRk}$) from uncracked concrete

Anchors type	Type of substrate	$_{hef}$	$_{NRk}$
		[mm]	[kN]
R-RBL-H M6	non-cracked concrete of classes C20/25 ÷ C50/60[1]	35	2,0
R-RBL-H M8		40	4,5
R-RBL-H M10		50	7,5
R-RBL-H M12		60	10,0
R-RBL-E M6		35	6,00
R-RBL-E M8		40	7,50
R-RBL-E M10		50	12,00
R-RBL-E M12		60	16,00
[1] according to PN-EN 206+A1:2016 standard			

Table C2: R-RBL-H and R-RBL-E for pulling ($_{NRk}$) from cracked concrete

Anchor type	Type of substrate	$_{hef}$	$_{NRk}$
		[mm]	[kN]
R-RBL-H M6	scratched concrete of classes C20/25 ÷ C50/60[1]	35	2,0
R-RBL-H M8		40	4,5
R-RBL-H M10		50	6,00
R-RBL-H M12		60	10,0
R-RBL-E M6		35	4,00
R-RBL-E M8		40	5,00
R-RBL-E M10		50	6,00
R-RBL-E M12		60	12,00
[1] according to PN-EN 206+A1:2016 standard			

Table C3: Characteristic design resistances of R-RBL and R-RBP anchorages for pull-out ($_{NRk}$) from concrete hollow core slabs and concrete hollow-core slabs

Type of substrate	Min. wall thickness hmin [mm]	Connector type	$_{NRk}$ [kN]
Canalised concrete slab classes C20/251	≥ 50	R-RBL M6, R-RBP M6	8,0
		R-RBL M8, R-RBP M8	8,5
		R-RBL M10, R-RBP M10	8,5
		R-RBL M12, R-RBP M12	8,5
		R-RBL M16, R-RBP M16	8,5
		R-RBL M20, R-RBP M20	8,5
Canalised concrete slab classes C30/371	≥ 23	R-RBL M6, R-RBP M6	4,0
		R-RBL M8, R-RBP M8	4,5
	≥ 35	R-RBL M6, R-RBP M6	6,5
		R-RBL M8, R-RBP M8	11,0
		R-RBL M10, R-RBP M10	16,0
	≥ 40	R-RBL M6, R-RBP M6	7,0
		R-RBL M8, R-RBP M8	16,0
		R-RBL M10, R-RBP M10	19,0
		R-RBL M12, R-RBP M12	24,0
Canalised concrete slab classes C35/451	≥ 23	R-RBL M6, R-RBP M6	2,0
		R-RBL M8, R-RBP M8	4,5
	≥ 35	R-RBL M6, R-RBP M6	7,0
		R-RBL M8, R-RBP M8	12,0
		R-RBL M10, R-RBP M10	17,0
	≥ 40	R-RBL M6, R-RBP M6	8,0
		R-RBL M8, R-RBP M8	18,0
		R-RBL M10, R-RBP M10	20,0
		R-RBL M12, R-RBP M12	28,0
C45/551 concrete grade channel slab	≥ 23	R-RBL M6, R-RBP M6	2,0
		R-RBL M8, R-RBP M8	4,5
	≥ 35	R-RBL M6, R-RBP M6	8,0
		R-RBL M8, R-RBP M8	14,0
		R-RBL M10, R-RBP M10	19,0
	≥ 40	R-RBL M6, R-RBP M6	8,5
		R-RBL M8, R-RBP M8	20,0
		R-RBL M10, R-RBP M10	22,0
		R-RBL M12, R-RBP M12	30,0
C50/601 concrete grade channel slab	≥ 23	R-RBL M6, R-RBP M6	2,0
		R-RBL M8, R-RBP M8	4,5
	≥ 35	R-RBL M6, R-RBP M6	8,5
		R-RBL M8, R-RBP M8	15,0
		R-RBL M10, R-RBP M10	20,0

	≥ 40	R-RBL M6, R-RBP M6	9,5
		R-RBL M8, R-RBP M8	22,0
		R-RBL M10, R-RBP M10	24,0
		R-RBL M12, R-RBP M12	32,0
Teriva [2] concrete floor block	≥ 25	R-RBL M6, R-RBP M6	1,2
		R-RBL M8, R-RBP M8	2,0
[1] according to PN-EN 206+A1:2016 standard [2] according to PN-B-19504:2004 standard			

Table C4: Characteristic load capacities of R-RBL-E anchorages for pull-out ($_{NRk}$) from concrete hollow core slabs and concrete hollow-core slabs

Type of substrate	Min. wall thickness hmin	Connector type	$_{NRk}$
	[mm]		[kN]
Canalised concrete slab classes C20/251	≥ 50	R-RBL-E M6	6,5
		R-RBL-E M8	8,5
		R-RBL-E M10	8,5
		R-RBL-E M12	8,5
Canalised concrete slab classes C30/371	≥ 23	R-RBL-E M6	4,0
		R-RBL-E M8	5,0
	≥ 35	R-RBL-E M6	6,5
		R-RBL-E M8	11,0
		R-RBL-E M10	16,0
	≥ 40	R-RBL-E M6	6,5
		R-RBL-E M8	13,0
		R-RBL-E M10	19,00
		R-RBL-E M12	22,0
Canalised concrete slab classes C35/451	≥ 23	R-RBL-E M6	4,5
		R-RBL-E M8	6,0
	≥ 35	R-RBL-E M6	6,5
		R-RBL-E M8	12,0
		R-RBL-E M10	17,0
	≥ 40	R-RBL-E M6	6,5
		R-RBL-E M8	13,0
		R-RBL-E M10	19,00
		R-RBL-E M12	22,0
C45/551 concrete grade channel slab	≥ 23	R-RBL-E M6	5,0
		R-RBL-E M8	6,5
	≥ 35	R-RBL-E M6	6,5
		R-RBL-E M8	13,0
		R-RBL-E M10	19,00
	≥ 40	R-RBL-E M6	6,5
		R-RBL-E M8	13,0

		R-RBL-E M10	19,00
		R-RBL-E M12	22,0
C50/601 concrete grade channel slab	≥ 23	R-RBL-E M6	5,5
		R-RBL-E M8	7,0
	≥ 35	R-RBL-E M6	6,5
		R-RBL-E M8	13,0
		R-RBL-E M10	19,00
	≥ 40	R-RBL-E M6	6,5
		R-RBL-E M8	13,0
		R-RBL-E M10	19,00
		R-RBL-E M12	22,0
Teriva2 concrete floor block	≥ 25	R-RBL-E M6	1,2
		R-RBL-E M8	2,0
[1] according to PN-EN 206+A1:2016 standard [2] according to PN-B-19504:2004 standard			

Table C5: Characteristic load capacities of R-RBL-H anchorages for pull-out (N_{Rk}) from concrete hollow core slabs and concrete floor slabs

Type of substrate	**Min. wall thickness hmin**	**Connector type**	**N_{Rk}**
	[mm]		**[kN]**
Canalised concrete slab classes C20/251	≥ 50	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
		R-RBL-H M12	8,5
Canalised concrete slab classes C30/371	≥ 23	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
	≥ 35	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
	≥ 40	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
		R-RBL-H M12	10,0
Canalised concrete slab classes C35/451	≥ 23	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
	≥ 35	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
	≥ 40	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5

		R-RBL-H M12	10,0
Canalised concrete slab classes C45/551	≥ 23	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
	≥ 35	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
	≥ 40	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
		R-RBL-H M12	10,
Channel plate made of concrete classes C50/601	≥ 23	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
	≥ 35	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
	≥ 40	R-RBL-H M6	2,0
		R-RBL-H M8	4,5
		R-RBL-H M10	7,5
		R-RBL-H M12	10,0
Teriva2 concrete floor block	≥ 25	R-RBL-H M6	1,2
		R-RBL-H M8	2,0
[1] according to PN-EN 206+A1:2016 standard [2] according to PN-B-19504:2004 standard			

Table C6: Characteristic load capacities of R-RBL, R-RBP, R-RBL-H and R-RBL-E anchorages for pull-out ($_{NRk}$) from masonry substrates

Type of substrate	**$_{hef}$ [mm]**	**Connector type**	**$_{NRk}$ [kN]**
Solid ceramic brick cl.$_{201}$	35	R-RBP, R-RBL, R-RBL-E M6	6,0
	40	R-RBP, R-RBL, R-RBL-E M8	6,0
	50	R-RBP, R-RBL, R-RBL-E M10	6,0
	60	R-RBP, R-RBL, R-RBL-E M12	6,0
	35	R-RBL-H M6	2,0
	40	R-RBL-H M8	4,5
	50	R-RBL-H M10	6,0
	60	R-RBL-H M12	6,0
Aggregate concrete, lightweight (LAC 5)[2]	35	R-RBP, R-RBL, R-RBL-E M6	5,5
	40	R-RBP, R-RBL, R-RBL-E M8	5,5
	50	R-RBP, R-RBL, R-RBL-E M10	5,5
	60	R-RBP, R-RBL, R-RBL-E M12	5,5
	35	R-RBL-H M6	2,0
	40	R-RBL-H M8	4,5
	50	R-RBL-H M10	5,5

	60	R-RBL-H M12	5,5
Hollow silicate hollow block cl.153	35	R-RBP M6, R-RBL M6, R-RBL-E M6, R-RBL-H M6	1,5

[1] according to PN-EN 771-1+A1:2015 standard
[2] according to the standard PN-EN 771-3+A1:2015
[3] according to PN-EN 771-2+A1:2015 standard, with wall thickness ≥ 35 m n

Table C7: characteristic load capacities of connectors R-RBL, R-RBP, R-RBL-H and R-RBL-E in shear (VRk)

Connector type	**h_{ef}**	**$VRk_{,s}$**
	[mm]	**[Nm]**
R-RBP, R-RBL, R-RBL-E M6	35	5,0
R-RBP, R-RBL, R-RBL-E M8	40	9,0
R-RBP, R-RBL, R-RBL-E M6	50	14,0
R-RBP, R-RBL, R-RBL-E M8	60	20,0
R-RBP, R-RBL M16	95	38,0
R-RBP, R-RBL M20	115	60,0
R-RBL-H M6	35	2,0
R-RBL-H M8	40	4,5
R-RBL-H M10	50	7,5
R-RBL-H M12	60	10,5