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Series: TECHNICAL APPROVALS

ITB TECHNICAL APPROVAL AT-15-7280/2014

Pursuant to the Regulation of the Minister of Infrastructure of 8 November 2004 on technical approvals and organizational units authorized to issue them (unified text: Journal of Laws of 2014, item 1040), as a result of approval procedures carried out at the Building Research Institute in Warsaw, upon the request of:

RAWLPLUG S.A.

ul. Kwidzyńska 6, 51-416 Wrocław

it is hereby certified that the products named below:

Steel expansion anchors R-RB

are suitable for use in the construction industry within the scope and in compliance with the rules defined in the Annex constituting an integral part of the ITB Technical Approval.

English translation prepared by RAWLPLUG S.A. - Original version in Polish language

Validity date:

19 December 2019

[stamp:]

MANAGER

Building Research Institute

/illegible signature/

Michał Wójtowicz

Annex:

General and Technical Provisions

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BUILDING RESEARCH INSTITUTE *

Warsaw, 19 December 2014

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1. SUBJECT OF APPROVAL

The subject of this ITB Technical Approval are steel expansion anchors marketed under the trade name R-RB. The manufacturer of the products being the subject of this Approval is RAWLPLUG S.A., ul. Kwidzyńska 6, 51-416 Wrocław.

The Approval includes the following R-RB expansion anchors range:

- R-RBP (Figure 1) – expansion anchor with rod and nut,
- R-RBL (Figure 2) – expansion anchor with bolt,
- R-RBL-H (Figure 3) – expansion anchor with hook,
- R-RBL-E (Figure 4) – expansion anchor with eye.

The R-RB anchors consist of an expansion sleeve and threaded shaft. The expansion sleeves M6 to M16 are made of galvanized common carbon steel, classified in the mechanical property grade not lower than 5.8 as per PN-EN ISO 898-1:2013. The anchor expansion sleeves M20 are made of EN-GJMB-300-6 malleable cast iron as per PN-EN 1562:2012. The R-RB anchor expansion sleeves may be additionally equipped with a polypropylene flange (Figure 5) which facilitates the installation into hollow substrates. The flanged anchors are additionally designated with PF. The R-RBL and R-RBP anchor shafts are made of galvanized common carbon steel, classified in the mechanical property grade not lower than 5.8 as per PN-EN ISO 898-1:2013.

The R-RBL-E and R-RBL-H anchor eyes and hooks are made of galvanized common carbon steel, classified in the mechanical property grade not lower than 3.6 as per PN-EN ISO 898-1:2013. The nuts and washers are made of galvanized common carbon steel, classified in the mechanical property grade 5 as per PN-EN ISO 898-2:2012.

The thickness of the zinc coating on the R-RB anchor components is not lower than 5µm.

Tightening of the R-RB anchor results in the outward movement of the shaft out of the sleeve, opening of the cut through expansion ring parts, and a fixed anchoring in the substrate. The installation with the use of the R-RB anchors is shown in the Figures 9 to 12.

The required technical properties of the R-RB steel expansion anchors are specified in section 3.

2. INTENDED USE, SCOPE AND CONDITIONS OF USE

The R-RB expansion anchors are intended to be used for making fixtures of statically or quasi-statically loaded construction elements in the substrates made of:

- reinforced or plain, cracked or non-cracked normal concrete C20/25 to C50/60 as per PN-EN 206:2014 – in the case of R-RBL-H and R-RBL-E anchors with M6 to M12 diameters,

- solid ceramic bricks, with compressive strength not lower than 20 MPa (class not lower than 20) as per PN-EN 771-1:2011 – in the case of R-RB anchors with M6 to M12 diameters,

- solid blocks of lightweight aggregate concrete (LAC 5), with compressive strength not lower than 5 N/mm² (compressive strength class not lower than 5) as per PN-EN 771-3:2011 – in the case of R-RB anchors with M6 to M12 diameters,

- Silka silicate hollow blocks, with compressive strength not lower than 15 N/mm² (compressive strength class not lower than 15) as per PN-EN 771-2:2011 – in the case of all R-RB anchors with M6 diameter,

- Teriva 4.0/2 ceiling concrete hollow blocks as per PN-B-19504:2004, with the component wall thickness not lower than 25 mm – in the case of R-RB anchors with M6 to M8 diameters,

- hollow-core slabs of concrete C20/25 as per PN-EN 206:2014, with the component wall thickness not lower than 50 mm – in the case of R-RB anchors with M6 to M20 diameters,

- hollow-core slabs of concrete C30/37 to C50/60 as per PN-EN 206:2014, with the component wall thickness not lower than 23 mm – in the case of R-RB anchors with M6 to M12 diameters.

Due to environmental corrosion aggressiveness, the R-RB expansion anchors may be used in environments with the atmospheric corrosivity category as per PN-EN ISO 12944-2:2001 and PN-EN 10152:2011.

The characteristic and design resistances of the fixtures made with the anchors referred to in the Approval are specified in Tables 5 to 11.

The installation parameters of the R-RB anchors in the substrates are specified in Tables 2 to 4. The substrate parameters are specified in Table 1. The hole in the substrate should be drilled perpendicularly to the substrate surface with the use of a drifter drill. The expansion anchor should offer a possibility to be inserted into the hole drilled in the substrate by means of light hammer taps. In the case of R-RBL and R-RBP anchors, the nut washer or the bolt head should be strongly pressed to the element being fixed after the anchor is expanded. The R-RBL-H and R-RBL-E anchors should be tightened with the use of a torque wrench specified by the manufacturer.

The R-RB steel expansion anchors should be used in accordance with a technical design prepared subject to Polish standards and building regulations, provisions of this Technical Approval, and the Manufacturer's instructions for use, concerning conditions of making connections with the use of the anchors.

3. TECHNICAL PROPERTIES. REQUIREMENTS

3.1. Materials

The expansion sleeves M6 to M16 should be made of common carbon steel, of the mechanical property grade 5.8 at minimum as per PN-EN ISO 898-1:2013, and galvanized with a zinc coating layer of at least 5 μ m.

The expansion sleeves M20 should be made of EN-GJMB-300-6 malleable cast iron as per PN-EN 1562:2012, and galvanized with a zinc coating layer of at least 5 μ m.

The R-RBL and R-RBP anchor shafts should be made of common carbon steel, of the mechanical property grade 5.8 at minimum as per PN-EN ISO 898-1:2013, and galvanized with a zinc coating layer of at least 5 μ m.

The R-RBL-E and R-RBL-H anchor eyes and hooks should be made of common carbon steel, of the mechanical property grade 3.6 at minimum as per PN-EN ISO 898-1:2013, and galvanized with a zinc coating layer of at least 5 μ m.

The nuts and washers should be made of common carbon steel, of the mechanical property grade 5 at minimum as per PN-EN ISO 898-1:2013, and galvanized with a zinc coating layer of at least 5 μ m.

The zinc coating should be compliant with the requirements of PN-EN ISO 4042:2001.

The PF flange should be made of polypropylene (PP).

3.2. Expansion anchors

3.2.1. Shape and dimensions. The shape and dimensions of the anchors referred to in the Approval should be as per Figures 1 to 5 and tables in Figures 6 to 8.

3.2.2. External appearance of the anchors. The anchor surface should be plain, without any cracks, pulls, convexities and concavities.

3.2.3. Characteristic resistances of the expansion anchor fixtures. The characteristic resistances of the anchor fixtures should not be lower than the values specified in Tables 5 to 11.

4. PACKAGING, STORAGE AND TRANSPORT

4.1 Packaging

The steel expansion anchors referred to in the Approval should be delivered in the Manufacturer original packaging, in a manner which ensures the consistency of their technical properties. Each packaging should come with a label containing at least the following data:

- the name and designation of the product,
- dimensions,
- the name and address of the Manufacturer,
- the number of the ITB Technical Approval AT-15-7280/2014,
- the number and issue date of the national declaration of conformity,
- the name of the certification body which was involved in the assessment of conformity,
- the construction mark.

The method of product marking with the construction mark should be compatible with the Regulation of the Minister of Infrastructure of 11 August 2004 on the method of declaring the conformity of construction products and the method of marking them with a construction mark (Journal of Laws No. 198/2004, item. 2041, as amended).

4.2 Storage

The steel expansion anchors referred to in the Approval should be stored in a manner protecting them against damages, recommended by the Manufacturer.

4.3 Transport

The steel expansion anchors referred to in the Approval should be transported in a manner protecting them against damages, recommended by the Manufacturer.

5. ASSESMENT OF CONFORMITY

5.1. General conditions

Pursuant to Article 4, Article 5 paragraph 1 point 3, and Article 8 paragraph 1 of the Act of 16 April 2004 on construction products (Journal of Laws No. 92/2004, item 881, as amended), the products referred to in this ITB Technical Approval may be placed on the market and used in construction works to the extent of their performance properties and intended use, if the Manufacturer has made an assessment of conformity, issued a national declaration of conformity with the ITB Technical Approval AT-15-7280/2014, and marked the products with a construction mark in accordance with applicable regulations.

Pursuant to the Regulation of the Minister of Infrastructure of 11 August 2004 on the method of declaring the conformity of construction products and the method of marking them with a construction mark (Journal of Laws No. 198/2004, item. 2041, as amended), the assessment of conformity of the R-RB steel expansion anchors with the ITB Technical Approval AT-15-7280/2014 shall be made by the Manufacturer, using system 1.

In the case of conformity assessment system 1, the Manufacturer may issue a national declaration of conformity with the ITB Technical Approval AT-15-7280/2014, if the accredited certification body has issued a certificate of conformity of the product based on:

a) tasks of the Manufacturer:

- factory production control,
- further testing of finished products (samples) taken at the factory, conducted by the Manufacturer, in accordance with the established test schedule including tests specified in point 5.4.3,

b) tasks of the accredited certification body:

- initial type-testing,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control.

5.2. Initial type-testing

The initial type-testing is an examination confirming the required technical and performance properties, conducted before launching the product onto the market.

The initial type-testing of the R-RB expansion anchors includes the characteristic resistances of the anchor fixtures and the thickness of the anchor zinc coating.

The tests which in the approval procedure formed the basis to determine the technical and performance properties of the products are the initial type-testing in the assessment of conformity.

5.3. Factory production control

The factory production control includes:

- 1) specifications and checking components and materials,
- 2) control and testing in the manufacturing process and testing of finished products (see 5.4.2), conducted by the Manufacturer in accordance with the established test schedule and the rules and procedures specified in the documentation of the factory production control, adjusted to the technologies of production, and aimed at obtaining products of required properties.

The production control should ensure that the products comply with the ITB Technical Approval AT-15-7280/2014. The results of the production control should be systematically recorded. The records should confirm that the products meet the conformity assessment criteria. Each product or product batch and related production details must be fully identifiable and reproducible.

5.4. Finished product testing

5.4.1. Testing program. Testing program includes:

- current testing,
- further testing.

5.4.2. Current testing. Current testing includes checking:

- external appearance, shape and dimensions,
- zinc coating thickness.

5.4.3. Periodic testing. Periodic testing includes checking characteristic resistances of the anchor fixtures.

5.5. Frequency of tests

Testing should be carried out in accordance with the established test schedule, but not less frequently than for every product batch. The size of the product batch should be specified in the documentation of factory production control.

Periodic testing should be carried out not less frequently than once every 3 years.

5.6. Test methods

5.6.1. Checking shape and dimensions. The shape and dimensions of the anchors should be checked with measuring instruments that ensure the measurement accuracy of 0.01 mm.

5.6.2. Checking the external appearance. The external appearance should be checked visually, with a naked eye.

5.6.3. Checking zinc coating thickness. The thickness of the anchor zinc coating should be checked as per PN-EN ISO 3497:2004.

5.6.4. Checking characteristic resistances of the anchor fixtures.

The characteristic resistances of anchor fixtures should be checked by means of pulling out of the anchors embedded in the substrates specified in Table 1. The force measurement should be taken using a device with a range adapted to the expected value of breaking force, allowing a continuous and slow increase of the force until breaking. The measurement error should not exceed 3% within the entire measuring range.

5.7. Taking samples for testing

Test samples should be taken at random, as per PN-N-03010:1983.

5.8. Evaluation of test results

The manufactured products should be considered compliant with the requirements of this Technical Approval, if all test results are positive.

6. FORMAL AND LEGAL ARRANGEMENTS

6.1. This Approval replaces the ITB Technical Approval AT-15-7280/2007.

6.2. The ITB Technical Approval AT-15-7280/2014 is a document confirming the suitability of the R-RB steel expansion anchors for use in the construction industry to the extent resulting from the provisions of the Approval.

Pursuant to Article 4, Article 5 paragraph 1 point 3, and Article 8 paragraph 1 of the Act of 16 April 2004 on construction products (Journal of Laws No. 92/2004, item 881, as amended), the products referred to in this ITB Technical Approval may be placed on the market and used in construction works to the extent of their performance properties and intended use, if the Manufacturer has made an assessment of conformity, issued a national declaration of conformity with the ITB Technical Approval AT-15-7280/2014, and marked the products with a construction mark in accordance with applicable regulations.

6.3. The ITB Technical Approval does not infringe the rights resulting from the regulations on the protection of industrial property, in particular the Act of 30 June 2000 — Industrial Property Law

(unified text: Journal of Laws of 2013, item 1410, as amended). All persons who make use of this ITB Technical Approval are obliged to ensure these rights.

6.4. While issuing this Technical Approval, the ITB does not accept any liability for any infringement of exclusive and acquired rights.

6.5. The ITB Technical Approval does not release the Manufacturer of the products referred to in the Approval from the liability for the proper product quality, and the building contractors from the liability for their proper application.

6.6. The published brochures, advertisements and other documents related to the marketing and use in construction of the R-RB steel expansion anchors should include information about the issued ITB Technical Approval AT-15-7280/2014 for these products.

7. VALIDITY DATE

The ITB Technical Approval AT-15-7280/2014 is valid until 19 December 2019.

The validity of the ITB Technical Approval may be extended for further periods, if the Applicant or its formal successor submits the relevant request to the Building Research Institute not later than 3 months before the expiry date of this document.

E N D

ADDITIONAL INFORMATION

Related standards

PN-EN 206:2014	<i>Concrete. Requirements, properties, production and conformity</i>
PN-EN 771-1:2011	<i>Requirements for masonry units. Part 1: Ceramic masonry units</i>
PN-EN 771-3:2011	<i>Requirements for masonry units. Part 3: Aggregate concrete masonry units (dense and lightweight aggregates)</i>

PN-EN ISO12944-2:2001	<i>Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Part 2: Classification of environments</i>
PN-EN ISO 4042:2001	<i>Fasteners. Electroplated coatings</i>
PN-EN ISO 898-1:2013	<i>Mechanical properties of fasteners made of carbon steel and alloy steel. Part 1: Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread</i>
PN-EN ISO 898-2:2012	<i>Mechanical properties of fasteners made of carbon steel and alloy steel. Part 2: Nuts with specified proof load values. Coarse thread and fine pitch thread</i>
PN-EN 1562:2012	<i>Founding. Malleable cast irons</i>
PN-EN ISO 3497:2004	<i>Metallic coatings. Measurement of coating thickness. X-ray spectrometric methods</i>
PN-B-19504:2004	<i>Precast concrete products. Beam-and-block floor systems. Blocks</i>
PN-N-03010:1983	<i>Statistical quality control. Random sampling</i>

Reports, test reports, classification and assessment

1. OSK-00030R:77/KK/14 and OSK-00030R:62/KK/14. Opinions, the Silesian Branch of the Building Research Institute, Katowice.
2. LOK00-02328/13/R44OSK. Test report concerning the RAWLBOLT steel mechanical anchors. The Silesian Branch of the Building Research Institute, Katowice, Fasteners and Building Products Laboratory LOK.
3. LOK00-2328/12/R32OSK. Test report concerning the RAWLBOLT mechanical anchors. The Silesian Branch of the Building Research Institute, Katowice, Fasteners and Building Products Laboratory LOK.
4. Report No. LOK-1105/A/08. The Silesian Branch of the Building Research Institute, Katowice, Fasteners and Building Products Laboratory LOK.
5. LOK-691/A/06. Test report concerning the L, P, E and H steel expansion anchors. The Silesian Branch of the Building Research Institute, Katowice, Fasteners and Building Products Laboratory LOK.
6. Technical assessment of the approval procedure to the test report no. LOK-691/A/06. The Silesian Branch of the Building Research Institute, Katowice, Fasteners and Building Products Laboratory LOK.

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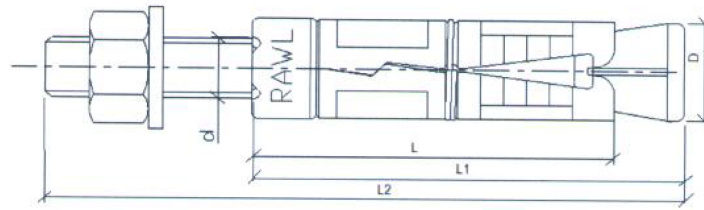


Figure 1 R-RBP expansion anchor

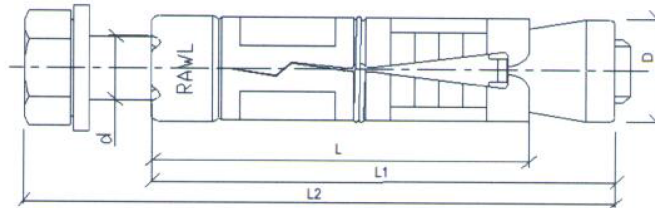


Figure 2 R-RBL expansion anchor

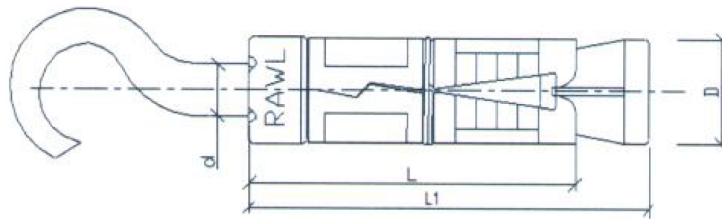


Figure 3 R-RBL-H expansion anchor

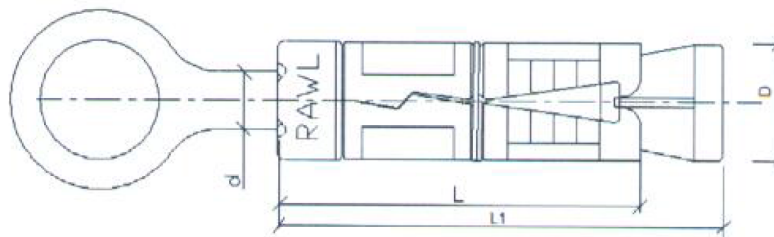


Figure 4 R-RBL-E expansion anchor



Figure 5 PF plastic flange

Size	Product code		Anchor			Fixture	
	R-RBL	R-RBP	Thread diameter	External diameter	Length	Max. thickness	Hole diameter
			d	d _{nom}	L	t _{fix}	d _r
			[mm]	[mm]	[mm]	[mm]	[mm]
M6	R-RBL-M06/10	-	6.0	12	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			as per PN-EN ISO 898-1:2013	± 0.5	± 2.5	-	-

Figure 6 R-RBL and R-RBP anchor dimensions

Size	Product code		Anchor			
	R-RBL-E	R-RBL-H	Thread diameter	External diameter	Length	Eye / hook diameter
			d	d _{nom}	L	
			[mm]	[mm]	[mm]	[mm]
M6	R-RBL-06E	-	6.0	12.0	73	10
	-	R-RBL-06H	6.0	12.0	83	8
M8	R-RBL-08E	-	8.0	14.0	87	12
	-	R-RBL-08H	8.0	14.0	98	10
M10	R-RBL-10E	-	10.0	16.0	108	14
	-	R-RBL-10H	10.0	16.0	120	12
M12	R-RBL-12E	-	12.0	20.0	130	17
	-	R-RBL-12H	12.0	20.0	145	16
Tolerances			as per PN-EN ISO 898-1:2013	± 0.5	± 2.0	± 0.5

Figure 7 R-RBL-E and R-RBL-H anchor dimensions

Size	Product code	PF flange		
		Internal diameter	External diameter	Flange diameter
		d _w	d _z	d _k
		[mm]	[mm]	[mm]
M6	R-RBP-M06, R-RBL-M06, R-RBL-06E, R-RBL-06H	12	13	21
M8	R-RBP-M08, R-RBL-M08, R-RBL-08E, R-RBL-08H	14	15	23
M10	R-RBP-M10, R-RBL-M10, R-RBL-10E, R-RBL-10H	16	17	25
M12	R-RBP-M12, R-RBL-M12, R-RBL-12E, R-RBL-12H	20	21	29
Tolerances		± 0.5	± 0.5	± 0.5

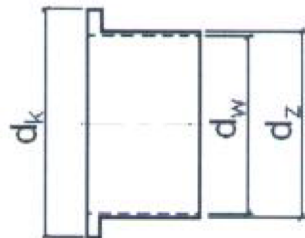
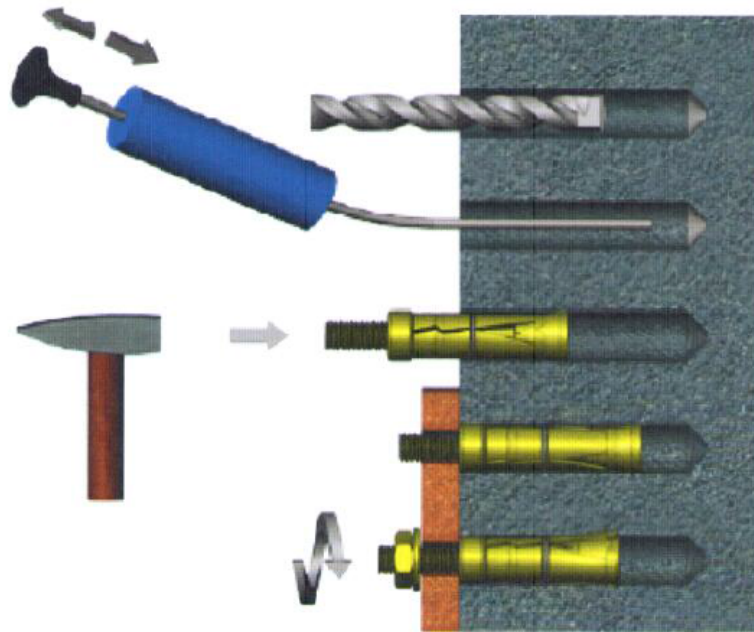
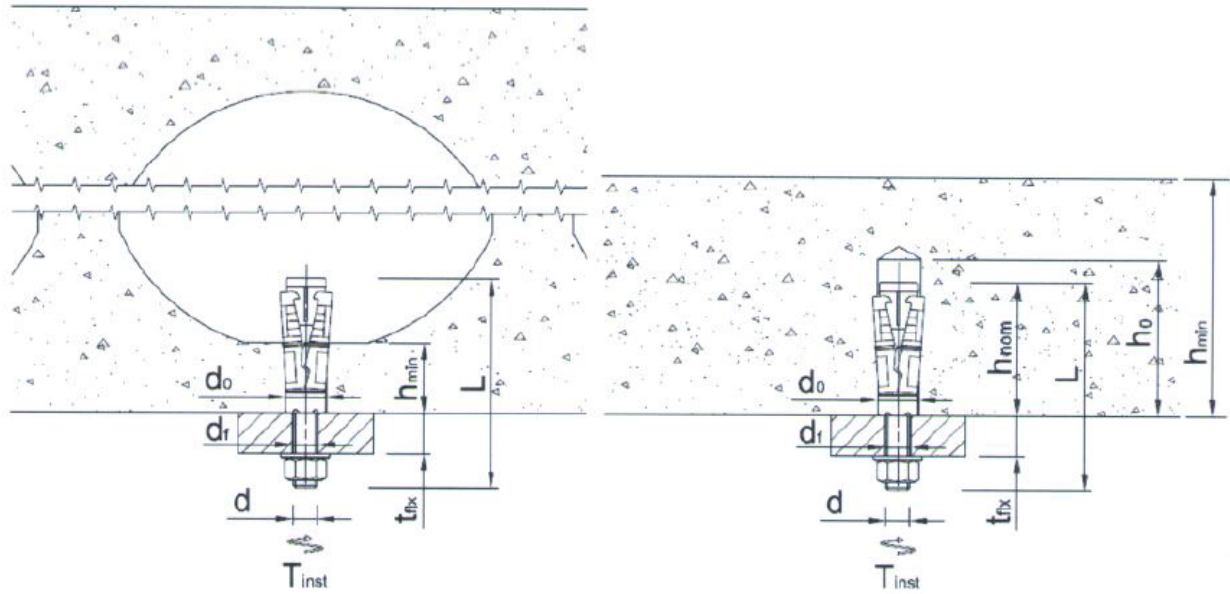
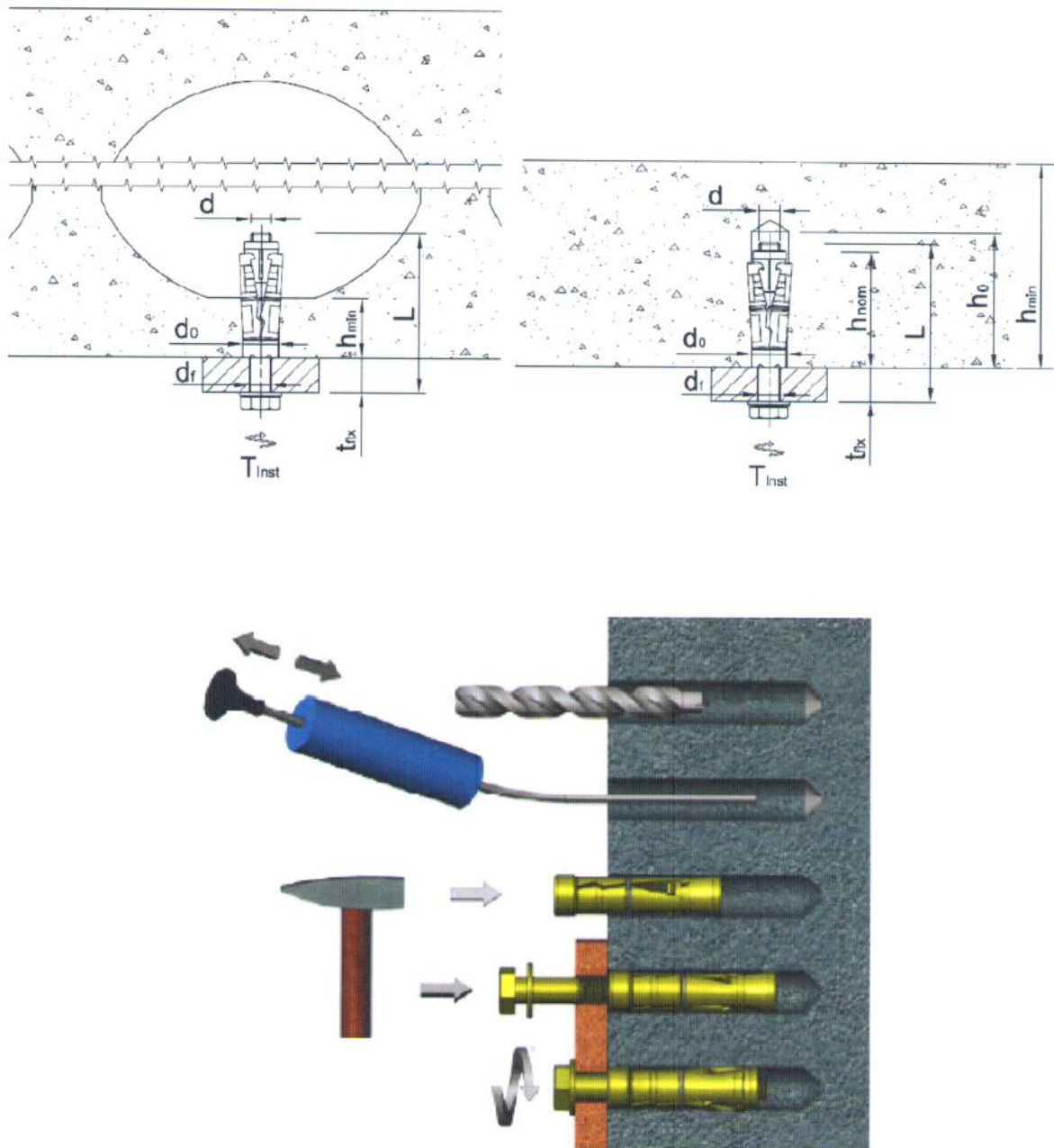


Figure 8 PF flange dimensions



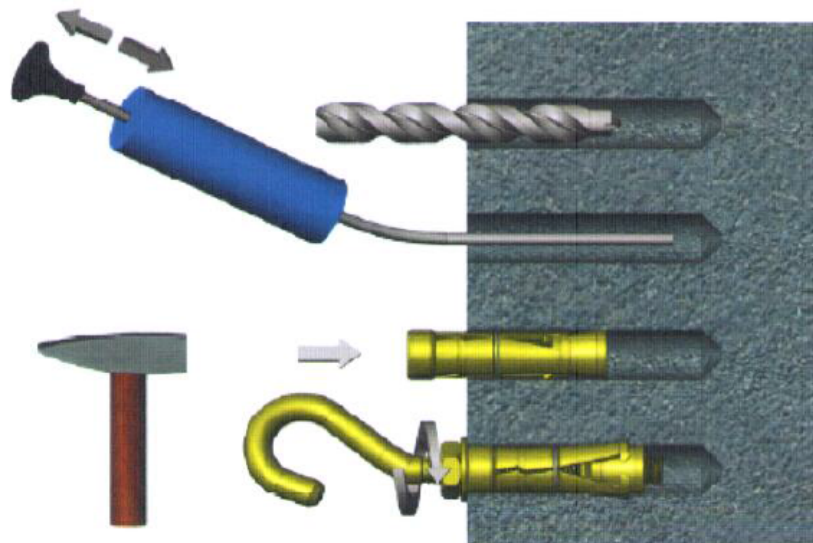
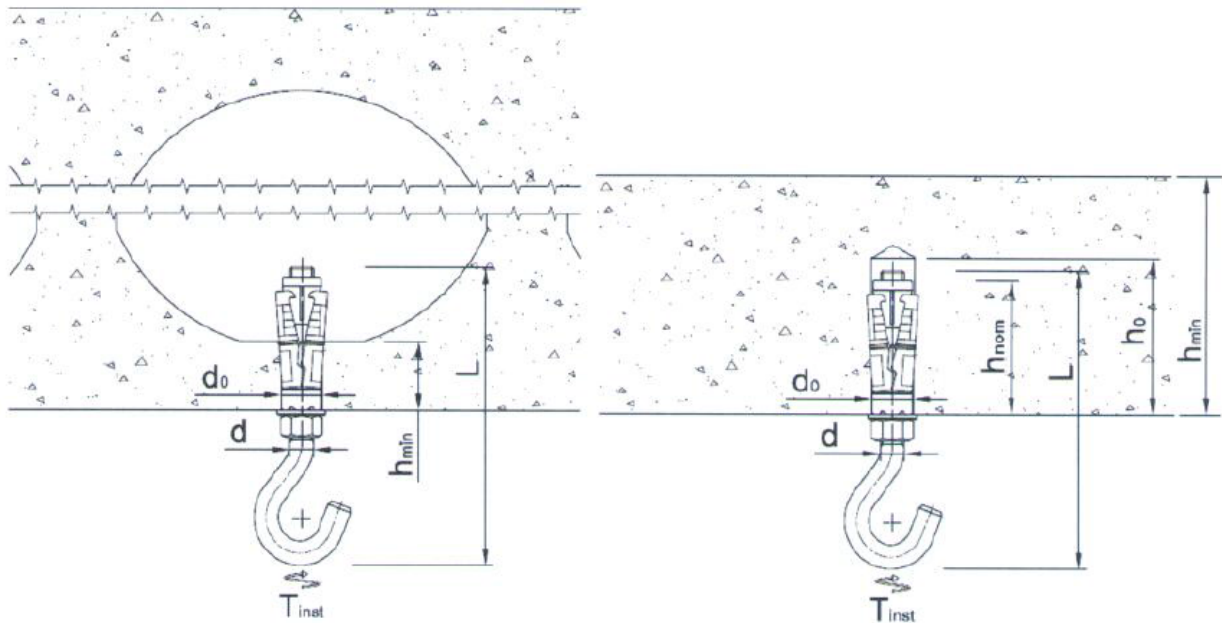
1. Drill a hole of appropriate diameter and depth.
2. Remove drillings from the hole with the use of a hand pump.
3. Insert the anchor sleeve into the hole and tap it with a hammer until it is flush with the substrate.
4. Apply the fixed element, place a washer and nut on the anchor rod inserted in the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

Figure 9 R-RBP anchor installation instruction



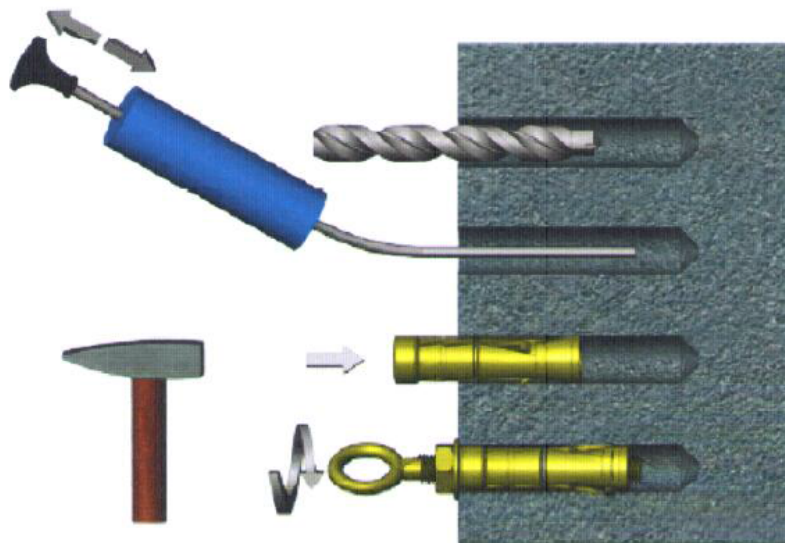
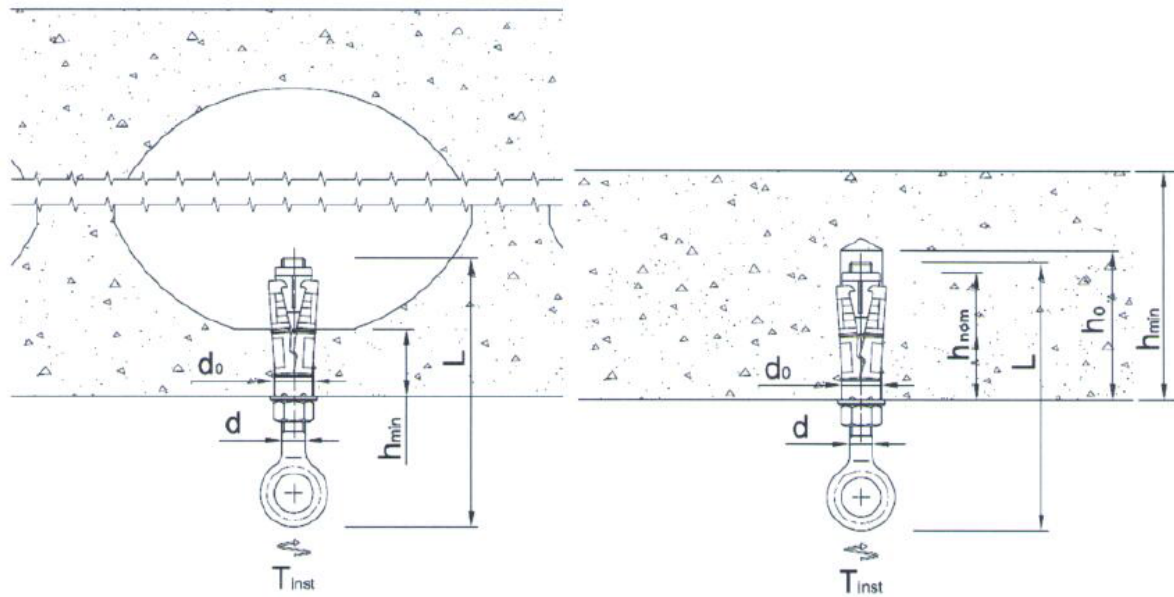
1. Drill a hole of appropriate diameter and depth.
2. Remove drillings from the hole with the use of a hand pump.
3. Insert the anchor sleeve into the hole and tap it with a hammer until it is flush with the substrate.
4. Apply the fixed element, and place a bolt with washer in the anchor sleeve inserted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

Figure 10 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. 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 11 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 12 R-RBL-E anchor installation instruction

Table 13 Substrate types and properties

Substrate type	Number of standard	Bulk density [kg/dm ³]	Compressive strength [N/mm ²]
Concrete C20/25 to C50/60	PN-EN 206:2014	-	-
Full ceramic brick 	PN-EN 771-1:2011	≥ 2.0	≥ 20.0
Blocks of LAC 5 lightweight concrete 	PN-EN 771-3:2011	≥ 0.8	≥ 5.0
Silicate hollow block (e.g. Silka) 	PN-EN 771-2:2011	≥ 1.4	≥ 15.0
Ceiling concrete hollow block Teriva 4.0/2 	PN-B-19504:2004	-	-
Hollow core slabs of concrete C20/25 	PN-EN 206:2014	-	-
Hollow core slabs of concrete C30/37 to C50/60 	PN-EN 206:2014	-	-

Table 14 R-RBL-H and R-RBL-E anchor installation parameters.
Concrete substrate

Anchor size		M6	M8	M10	M12	M16	M20
Nominal embedment depth	h_{nom} [mm]	45	50	60	80	120	135
Effective embedment depth	h_{ef} [mm]	35	40	50	60	95	115
Nominal hole diameter	$d_o =$ [mm]	12	14	16	20	25	32
Hole depth in the deepest point	$h_o \geq$ [mm]	50	55	65	85	125	140
Hole diameter in fixture	$d_f \leq$ [mm]	6.5	9.0	11.0	13.0	17.0	22.0
Tightening torque	$T_{inst} =$ [Nm]	6.5	15	27	50	120	230
Minimum substrate thickness	h_{min} [mm]	100	100	100	100	142.5	172.5
Minimum spacing	s_{min} [mm]	35	40	50	60	95	115
Minimum edge distance	c_{min} [mm]	52.5	60	75	90	142.5	172.5

Table 15 R-RB anchor installation parameters
Substrates: full ceramic brick, lightweight concrete, silicate hollow blocks

Anchor size		M6	M8	M10	M12	M16	M20
Nominal embedment depth	h_{nom} [mm]	45	50	60	80	120	135
Effective embedment depth	h_{ef} [mm]	35	40	50	60	95	115
Nominal hole diameter	$d_o =$ [mm]	12	14	16	20	25	32
Hole depth in the deepest point	$h_o \geq$ [mm]	50	55	65	85	125	140
Hole diameter in fixture	$d_f \leq$ [mm]	6.5	9.0	11	13	17	22
Tightening torque	$T_{inst} =$ [Nm]	3	6.5* or 7**	12	20	30	50

* in the case of hollow blocks

** in the case of other substrates

Table 16 R-RB anchor installation parameters
Substrates: full ceramic brick, lightweight concrete and concrete hollow-core slabs

Anchor size		M6	M8	M10	M12	M16	M20
Nominal embedment depth	h_{ef} [mm]	45	50	60	80	120	135
Nominal hole diameter	$d_o =$ [mm]	12	14	16	20	25	32
Hole diameter in fixture	$d_f \leq$ [mm]	6.5	9.0	11.0	13.0	17.0	22.0
Tightening torque	$T_{inst} =$ [Nm]	6.5	15	27	50	120	230

Table 17 Characteristic and design resistances of R-RBL-H and R-RBL-E anchor fixtures to pull-out failure in non-cracked concrete

Product code	Substrate type	h_{ef}	N_{Rk}	N_{Rd}
		[mm]	[kN]	[kN]
R-RBL-H M6	non-cracked concrete C20/25 to C50/60 ¹	35	2.41	0.95
R-RBL-H M8		40	4.81	1.90
R-RBL-H M10		50	7.61	3.02
R-RBL-H M12		60	10.37	4.11
R-RBL-E M6		35	6.00	3.33
R-RBL-E M8		40	7.50	4.17
R-RBL-E M10		50	12.00	6.67
R-RBL-E M12		60	16.00	8.89

¹ as per PN-EN 206:2014**Table 18** Characteristic and design resistances of R-RBL-H and R-RBL-E anchor fixtures to pull-out failure in cracked concrete

Product code	Substrate type	h_{ef}	N_{Rk}	N_{Rd}
		[mm]	[kN]	[kN]
R-RBL-H M6	cracked concrete C20/25 to C50/60 ¹ crack width: 0.5 mm	35	2.41	0.95
R-RBL-H M8		40	4.81	1.90
R-RBL-H M10		50	6.00	3.02
R-RBL-H M12		60	10.37	4.11
R-RBL-E M6		35	4.00	2.22
R-RBL-E M8		40	5.00	2.78
R-RBL-E M10		50	6.00	3.33
R-RBL-E M12		60	12.00	6.67

¹ as per PN-EN 206:2014**Table 19** Characteristic and design resistances of R-RBL-H and R-RBL-E anchors to shearing

Product code	h_{ef}	$V_{Rk,s}$	$V_{Rd,s}$
	[mm]	[Nm]	[Nm]
R-RBP/R-RBL/R-RBL-E M6	35	5.03	4.02
R-RBP/R-RBL/R-RBL-E M8	40	9.15	7.32
R-RBP/R-RBL/R-RBL-E M6	50	14.5	11.60
R-RBP/R-RBL/R-RBL-E M8	60	21.08	16.86
R-RBP/R-RBL M16	95	39.25	31.40
R-RBP/R-RBL M20	115	61.25	49.00
R-RBL-H M6	35	2.41	1.34
R-RBL-H M8	40	4.81	2.67
R-RBL-H M10	50	7.61	4.23
R-RBL-H M12	60	10.37	5.76

Table 20 Characteristic and design resistances of R-RBL and R-RBP anchor fixtures to pull-out failure in concrete hollow-core slabs and ceiling concrete hollow blocks

Substrate type	Min. thin wall thickness h_{\min}	Product code	N_{Rk}	N_{Rd}
	[mm]		[kN]	[kN]
Hollow-core slab of concrete C20/25 ¹	≥ 50	R-RBL M6, R-RBP M6	8.45	3.35
		R-RBL M8, R-RBP M8	8.93	3.54
		R-RBL M10, R-RBP M10	8.93	3.54
		R-RBL M12, R-RBP M12	8.93	3.54
		R-RBL M16, R-RBP M16	8.93	3.54
		R-RBL M20, R-RBP M20	8.93	3.54
Hollow-core slab of concrete C30/37 ¹	≥ 23	R-RBL M6, R-RBP M6	4.36	1.73
		R-RBL M8, R-RBP M8	4.81	2.16
	≥ 35	R-RBL M6, R-RBP M6	6.61	2.62
		R-RBL M8, R-RBP M8	11.42	4.53
		R-RBL M10, R-RBP M10	16.07	6.38
	≥ 40	R-RBL M6, R-RBP M6	7.30	2.90
		R-RBL M8, R-RBP M8	16.94	6.72
		R-RBL M10, R-RBP M10	19.19	7.61
		R-RBL M12, R-RBP M12	25.46	10.10
	Hollow-core slab of concrete C35/45 ¹	≥ 23	R-RBL M6, R-RBP M6	2.41
R-RBL M8, R-RBP M8			4.81	2.16
≥ 35		R-RBL M6, R-RBP M6	7.31	2.90
		R-RBL M8, R-RBP M8	12.64	5.02
		R-RBL M10, R-RBP M10	17.78	7.06
≥ 40		R-RBL M6, R-RBP M6	8.08	3.20
		R-RBL M8, R-RBP M8	18.75	7.44
		R-RBL M10, R-RBP M10	21.23	8.43
		R-RBL M12, R-RBP M12	28.18	11.18
Hollow-core slab of concrete C45/55 ¹		≥ 23	R-RBL M6, R-RBP M6	2.41
	R-RBL M8, R-RBP M8		4.81	2.16
	≥ 35	R-RBL M6, R-RBP M6	8.11	3.22
		R-RBL M8, R-RBP M8	14.01	5.56
		R-RBL M10, R-RBP M10	19.71	7.82
	≥ 40	R-RBL M6, R-RBP M6	8.95	3.55
		R-RBL M8, R-RBP M8	20.78	8.25
		R-RBL M10, R-RBP M10	23.53	9.34
		R-RBL M12, R-RBP M12	31.23	12.39
	Hollow-core slab of concrete C50/60 ¹	≥ 23	R-RBL M6, R-RBP M6	2.41
R-RBL M8, R-RBP M8			4.81	2.16
≥ 35		R-RBL M6, R-RBP M6	8.81	3.50
		R-RBL M8, R-RBP M8	15.23	6.04
		R-RBL M10, R-RBP M10	21.42	8.50
≥ 40		R-RBL M6, R-RBP M6	9.73	3.86
		R-RBL M8, R-RBP M8	22.59	8.96
		R-RBL M10, R-RBP M10	25.58	10.15
		R-RBL M12, R-RBP M12	33.95	13.47
Ceiling concrete hollow block Teriva ²		≥ 25	R-RBL M6, R-RBP M6	1.21
	R-RBL M8, R-RBP M8		2.02	0.80

¹ as per PN-EN 206:2014² as per PN-B-19504:2004

Table 21 Characteristic and design resistances of R-RBL-E anchor fixtures to pull-out failure in concrete hollow-core slabs and ceiling concrete hollow blocks

Substrate type	Min. thin wall thickness h_{\min}	Product code	N_{Rk}	N_{Rd}
	[mm]		[kN]	[kN]
Hollow-core slab of concrete C20/25 ¹	≥ 50	R-RBL-E M6	6.61	3.35
		R-RBL-E M8	8.93	3.54
		R-RBL-E M10	8.93	3.54
		R-RBL-E M12	8.93	3.54
Hollow-core slab of concrete C30/37 ¹	≥ 23	R-RBL-E M6	4.36	1.73
		R-RBL-E M8	5.44	2.16
	≥ 35	R-RBL-E M6	6.61	2.62
		R-RBL-E M8	11.42	4.53
		R-RBL-E M10	16.07	6.38
	≥ 40	R-RBL-E M6	6.61	2.90
		R-RBL-E M8	13.13	6.72
		R-RBL-E M10	19.00	7.62
Hollow-core slab of concrete C35/45 ¹	≥ 23	R-RBL-E M6	4.82	1.91
		R-RBL-E M8	6.02	2.39
	≥ 35	R-RBL-E M6	6.61	2.90
		R-RBL-E M8	12.64	5.02
		R-RBL-E M10	17.78	7.06
	≥ 40	R-RBL-E M6	6.61	3.21
		R-RBL-E M8	13.13	7.44
		R-RBL-E M10	19.00	8.42
Hollow-core slab of concrete C45/55 ¹	≥ 23	R-RBL-E M6	5.35	2.12
		R-RBL-E M8	6.67	2.65
	≥ 35	R-RBL-E M6	6.61	3.22
		R-RBL-E M8	13.13	5.56
		R-RBL-E M10	19.00	7.82
	≥ 40	R-RBL-E M6	6.61	3.55
		R-RBL-E M8	13.13	8.25
		R-RBL-E M10	19.00	9.34
Hollow-core slab of concrete C50/60 ¹	≥ 23	R-RBL-E M6	5.81	2.31
		R-RBL-E M8	7.25	2.88
	≥ 35	R-RBL-E M6	6.61	3.50
		R-RBL-E M8	13.13	6.04
		R-RBL-E M10	19.00	8.50
	≥ 40	R-RBL-E M6	6.61	3.86
		R-RBL-E M8	13.13	8.96
		R-RBL-E M10	19.00	10.15
Ceiling concrete hollow block Teriva ²	≥ 25	R-RBL-E M6	1.21	0.48
		R-RBL-E M8	2.02	0.80

¹ as per PN-EN 206:2014² as per PN-B-19504:2004

Table 22 Characteristic and design resistances of R-RBL-H anchor fixtures to pull-out failure in concrete hollow-core slabs and ceiling concrete hollow blocks

Substrate type	Min. thin wall thickness h_{\min}	Product code	N_{Rk}	N_{Rd}
	[mm]		[kN]	[kN]
Hollow-core slab of concrete C20/25 ¹	≥ 50	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.54
		R-RBL-H M10	7.61	3.54
		R-RBL-H M12	8.93	3.54
Hollow-core slab of concrete C30/37 ¹	≥ 23	R-RBL-H M6	2.41	1.73
		R-RBL-H M8	4.81	2.16
	≥ 35	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
	≥ 40	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
Hollow-core slab of concrete C35/45 ¹	≥ 23	R-RBL-H M6	2.41	1.91
		R-RBL-H M8	4.81	2.39
	≥ 35	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
	≥ 40	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
		R-RBL-H M12	10.37	8.30
	Hollow-core slab of concrete C45/55 ¹	≥ 23	R-RBL-H M6	2.41
R-RBL-H M8			4.81	2.65
≥ 35		R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
≥ 40		R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
	R-RBL-H M12	10.37	8.30	
Hollow-core slab of concrete C50/60 ¹	≥ 23	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	2.88
	≥ 35	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
	≥ 40	R-RBL-H M6	2.41	1.93
		R-RBL-H M8	4.81	3.85
		R-RBL-H M10	7.61	6.09
R-RBL-H M12		10.37	8.30	
Ceiling concrete hollow block Teriva ²	≥ 25	R-RBL-H M6	1.21	0.48
		R-RBL-H M8	2.02	0.80

¹ as per PN-EN 206:2014² as per PN-B-19504:2004

Table 23 Characteristic and design resistances of R-RBL, R-RBP, R-RBL-H and R-RBL-E anchor fixtures to pull-out failure in masonry substrates

Substrate type	Min. thin wall thickness h_{\min}	Product code	N_{Rk}	N_{Rd}
	[mm]		[kN]	[kN]
full ceramic brick class 20 ¹	35	R-RBP, R-RBL, R-RBL-E M6	6.25	2.16
	40	R-RBP, R-RBL, R-RBL-E M8	6.37	2.20
	50	R-RBP, R-RBL, R-RBL-E M10	6.37	2.20
	60	R-RBP, R-RBL, R-RBL-E M12	6.37	2.20
	35	R-RBL-H M6	2.41	1.93
	40	R-RBL-H M8	4.81	2.20
	50	R-RBL-H M10	6.37	2.20
	60	R-RBL-H M12	6.37	2.20
full lightweight concrete LAC 5 ²	35	R-RBP, R-RBL, R-RBL-E M6	5.98	1.95
	40	R-RBP, R-RBL, R-RBL-E M8	5.99	1.96
	50	R-RBP, R-RBL, R-RBL-E M10	5.99	1.96
	60	R-RBP, R-RBL, R-RBL-E M12	5.99	1.96
	35	R-RBL-H M6	2.41	1.93
	40	R-RBL-H M8	4.81	1.96
	50	R-RBL-H M10	5.99	1.96
	60	R-RBL-H M12	5.99	1.96
silicate hollow block class 15 ³	35	R-RBP M6, R-RBL M6, R-RBL-E M6, R-RBL-H M6	1.90	0.75

¹ as per PN-EN 771-1:2011² as per PN-EN 771-3:2011³ as per PN-EN 771-2:2011