BUILDING RESEARCH INSTITUTE
PL 00-611 WARSAW, 1, Filtrowa Street, www.itb.pl

MEMBER OF EOTA and UEAtc

NATIONAL TECHNICAL ASSESSMENT ITB-KOT-2017/0049 Edition 1

This National Technical Assessment was issued pursuant to the Regulation of the Minister of Infrastructure and Construction of 17 November 2016 on national technical assessments (Law Journal of 2016, item 1968) by the Building Research Institute in Warsaw, at the request of:

fischerpolska Sp. z o.o.
2, Albatrosów Street, 30-716 Krakow

The National Technical Assessment ITB-KOT-2017/0049 Edition 1 is a positive assessment of performance of the following construction products for their intended use:

Plastic/metal expansion plugs SX, S, UX, UX-R, UX RH, UX WH, N-S, N-F, N-P, M-S, FU, S ROE, UV II, UV II R, USP, FUR 8, DUOPOWER and DUOPOWER S

Expiry date of the National Technical Assessment:
13 June 2022

DIRECTOR
pp. Deputy Director for
Technical Assessment and
European Harmonisation
Anna Panek, MSc

Warsaw, 13 June 2017

Building Research Institute
1, Filtrowa Street, 00-611 Warsaw
phone no.: 22 825 04 71; VAT No.: 525 000 93 58; National Court Register (KRS) No.: 0000158785

1. TECHNICAL DESCRIPTION OF THE PRODUCT

The subject of this National Technical Assessment is plastic/metal expansion plugs SX, S, UX, UX-R, UX RH, UX WH, N-S, N-F, N-P, M-S, FU, S ROE, UV II, UV II R, USP, FUR 8, DUOPOWER and DUOPOWER S, manufactured in Germany by fischerwerke GmbH & Co. KG, Klaus-Fischer-Strasse 1, 72176 Waldachtal, Germany. The manufacturer's authorised representative in Poland is fischerpolska Sp. z o.o., 2 Albatrosów Street, 30-716 Krakow.

This National Technical Assessment includes the types of products as specified by the manufacturer, differing in diameter and type of sleeve and pin, and those resulting from the performance specified in clause 3.

The plugs covered by this National Technical Assessment consist of a plastic sleeve and an expansion element in the form of a steel screw, bolt or rod with metric thread, double-threaded screw, driven pin, straight, eye or ceiling hook. The plastic sleeve is expanded as a result of screwing in (for SX, S, UX, UX-R, UX RH, UX WH, M-S, FU, S ROE, UV II, UV II R, USP, FUR 8 DUOPOWER and DUOPOWER S plugs) or driving in (for N-S, N-F and N-P plugs) the steel expansion element, which presses the sleeve against the wall of a hole drilled in the base material.

The shape and dimensions of the plugs covered by this National Technical Assessment are specified in Appendix A. The dimensional tolerances for steel expansion elements meet the medium product grade M according to DIN EN 22768-1:1999, while the dimensional tolerances for plastic sleeves meet the coarse grade C according to EN 22768-1:1999. The dimensional tolerances for metric threads comply with ISO 965-2:2001.

Sleeves of SX, S, UX, UX-R, UX RH, UX WH, N-S, N-F, N-P, M-S, FU, S ROE, UV II, UV II R, USP, FUR 8, DUOPOWER and DUOPOWER S plugs are made of polyamide (PA). Sleeves of DUOPOWER and DUOPOWER S plugs consist of two combined elements: one made of polyamide (PA) and the other made of polypropylene (PP). The materials used in the manufacture of products are characterised by differential scanning calorimetry (DSC) curves, determined according to EN ISO 11357-1:2016, complying with the reference standards defined in the National Technical Assessment granting procedure.

The expansion elements of plugs in the form of screws and hooks are made of ordinary carbon steel, characterised by tensile strength R_m of no less than 300 MPa, while the expansion elements in the form of bolts or bars with metric thread are made of ordinary carbon steel in mechanical property class of no less than 4.6 according to DIN EN ISO 898-1:2013. The expansion elements in the form of driven pins are made of ordinary carbon steel, characterised by tensile strength R_m of no less than 300 MPa, or of stainless steel 1.4301 according to DIN EN 10088-1: 2014. The expansion elements made of ordinary carbon steel are plated with electrolytic zinc coating, thickness no less than 5 µm, according to EN ISO 4042: 2001.

2. INTENDED USE OF THE PRODUCT

The plastic/metal expansion plugs SX, S, N-S, N-F, N-P, M-S, S ROE and USP are designed for multiple fixing of statically loaded construction elements for non-structural applications. The S ROE plugs are used for fixing self-supporting scaffoldings to walls of buildings, and they only transfer forces pulling them out of the base material. The plastic/metal expansion plugs SX, S, N-S, N-F, N-P, M-S, S ROE and USP are designed for use in base materials made of:

- reinforced or non-reinforced normal concrete, class C20/25 ÷ C50/60, according to EN 206+A1:2016,
- clay solid bricks with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015,
- calcium silicate solid bricks with compressive strength of no less than 20 N/mm^2 (class no less than 20) according to EN-771-2+A1:2015.

The plastic/metal expansion plugs DUOPOWER are designed for multiple fixing of statically loaded construction elements for non-structural applications in base materials made from:

- reinforced or non-reinforced normal concrete, class C20/25 ÷ C50/60, according to EN 206+A1:2016,
- clay solid bricks with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015,
- calcium silicate solid bricks with compressive strength of no less than 20 N/mm^2 (class no less than 20) according to EN-771-2+A1:2015,
- calcium silicate cored bricks with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015, wall thickness no less than 20 mm.

The plastic/metal expansion plugs DUOPOWER S are designed for for multiple fixing of statically loaded construction elements for non-structural applications in base materials made from:

- reinforced or non-reinforced normal concrete, class C20/25 ÷ C50/60, according to EN 206+A1:2016,
- clay solid bricks with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015,
- clay hollow bricks (Porotherm) with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015, wall thickness no less than 12 mm,
- autoclaved aerated concrete according to EN 771-4+A1:2015 with compressive strength of no less than 4 N/mm^2 (class no less than 4) and gross dry density of no less than 575 kg/m^3.

The plastic/metal expansion plugs UX, UX-R, UX RH, UX WH and FU are designed for multiple fixing of statically loaded construction elements for non-structural applications in base materials made from:

- reinforced or non-reinforced normal concrete, class C20/25 + C50/60, according to EN 206+A1:2016,
- clay hollow bricks (Porotherm) with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015, wall thickness no less than 12 mm,
- calcium silicate cored bricks with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015, wall thickness no less than 20 mm.

The plastic/metal expansion plugs UV II, UV II R and FUR 8 are designed for for multiple fixing of statically loaded construction elements for non-structural applications in base materials made from:

- reinforced or non-reinforced normal concrete, class C20/25 + C50/60, according to EN 206+A1:2016,
- clay solid bricks with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015,
- calcium silicate solid bricks with compressive strength of no less than 20 N/mm^2 (class no less than 20) according to EN-771-2+A1:2015,
- clay hollow bricks (Porotherm) with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015, wall thickness no less than 12 mm,
- clay hollow bricks (chequer bricks) with compressive strength of no less than 15 N/mm^2 (class no less than 15) according to EN-771-1+A1:2015, wall thickness no less than 14 mm.

In view of the corrosive power of the environment, the plastic/metal expansion plugs covered by this National Technical Assessment including expansion elements made of ordinary zinc-coated carbon steel should be used in accordance with the requirements as set out in EN ISO 12944-2:2001 and EN ISO 9223:2012, while the plugs including expansion elements made of stainless steel 1.4301 acc. to EN 10088-1:2014 should be used in accordance with the requirements as set out in PN-H-86020:1971 for OH18N9 steel.

The plugs covered by this National Technical Assessment should be used for multiple fixing. For this fixing, it is assumed that in the event when one of the plugs gets significantly loosened or damaged, the loads can be transferred to neighbouring plugs without causing significant changes in the requirements put to the fixing at its ultimate and serviceability limit states.

The design resistances of installed plugs are presented in Appendix C, while the installation and spacing parameters of plugs are presented in Appendix B.

The hole in the base material should be drilled perpendicular to its surface. The plugs are fixed by putting the plastic sleeve in the hole drilled in the base material followed by screwing or driving in the expansion element into the sleeve, depending on the type of the plug. When screwing or driving in, the expansion element expands the expandable part of the sleeve making it pressed against the side surface of the hole drilled in the base material.

The plastic/metal plugs SX, S, UX, UX-R, UX RH, UX WH, N-S, N-F, N-P, M-S, FU, S ROE, UV II, UV II R, USP, FUR 8, DUOPOWER and DUOPOWER S should be used in accordance with the technical design prepared based on the Polish building standards and regulations, findings of this National Technical Assessment as well as in accordance with the manufacturer's instructions concerning the conditions for fixing with use of the above-mentioned plugs.

3. PERFORMANCE OF THE PRODUCT AND METHODS USED FOR ITS ASSESSMENT

3.1. Performance of the product

3.1.1. Characteristic resistances of installed plugs. The characteristic resistances of installed plugs for pull-out from base material and shear are given in Appendix C.

3.1.2. Durability of plugs. The zinc coating thickness on the expansion elements of plugs made of ordinary carbon steel is no less than 5 µm.

3.2. Methods used for the performance assessment

3.2.1. Characteristic resistances of installed plugs. The testing of characteristic resistances of installed plugs is performed in accordance with ETAG 020:2012 on plugs fixed in base materials as described in Appendix C. The measurements of forces should be taken using an equipment with a range selected according to the expected break force value, which allows for a continuous and slow increase in force until damage. The measurement error shall not exceed 3% over the entire measuring range.

3.2.2. Durability of plugs. The measurement of the zinc coating thickness is taken in accordance with EN ISO 2178:2016 or EN ISO 3497:2004.

4. PACKAGING, TRANSPORT AND STORAGE AS WELL AS METHOD OF PRODUCT MARKING

The plugs covered by this National Technical Assessment should be delivered as a complete unit, in the manufacturer's original packaging and stored and transported in a way that ensures maintaining their properties.

The way of marking the product with the construction mark should be compliant 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 (Law Journal of 2016, item 1966).

The marking of the product with the 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 the registered address of the manufacturer, or the identification mark to allow the name and the registered address of the manufacturer to be determined unambiguously,
- name and designation of the construction product,
- the number and the year of issue of the national technical assessment according to which the performance was declared (ITB-KOT-2017/0049 Edition 1),
- the number of the national declaration of performance,
- the level or class of the performance declared,
- the name of the certification body which participated in the assessment and verification of constancy of performance of the construction product,
- the address of the manufacturer's website if the national declaration of performance is made available there.

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

In addition, the labelling of the construction product, which is a dangerous mixture according to the REACH Regulation should comply with the requirements of the 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 for the assessment and verification of constancy of performance

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 (Law Journal of 2016, item 1966), the system 2+ for the assessment and verification of constancy of performance applies:

5.2. Type testing

The performance, assessed in clause 3, represents the product type testing valid until changes are made to raw materials, components, production line or production plant.

5.3. Factory production control

The manufacturer shall have a factory production control system in place at its production plant. All elements of this system, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of policies and procedures, including records related to the testing being performed. The factory production control should be adapted to the production technology and ensure that the declared performance is maintained in series production.

The factory production control includes the specification and inspection of raw materials and components, control and testing during the production process as well as control tests (according to clause 5.4) carried out by the manufacturer in accordance with the established test schedule as well as the policies and procedures specified in the factory production control documentation.

The results of production control should be recorded systematically. The entries into records should confirm that the products meet the criteria of the assessment and verification of constancy of performance. Particular products or product batches and production details related to them have to be fully identifiable and reproducible.

5.4. Control tests

5.4.1. Testing scheme. The testing scheme includes:

a) ongoing tests,
b) periodic tests.

5.4.2. Ongoing tests. The ongoing tests include inspection of:

a) shape and dimensions,
b) zinc coating thickness (for expansion elements of ordinary carbon steel).

5.4.3. Periodic tests. The periodical tests include inspection of the characteristic resistances of installed plugs.

5.5. Frequency of tests

The ongoing tests should be carried out in accordance with the established test schedule, at least for each batch of products. The size of the batch of products should be determined in documentation of the factory production control.
The periodic tests should be carried out at least every 3 years.

6. FORMAL AND LEGAL ARRANGEMENTS

6.1. The National Technical Assessment ITB-KOT-2017/0049 Edition 1 is a positive assessment of performance for the essential characteristics of plastic/metal expansion plugs SX, S, UX, UX-R, UX RH, UX WH, N-S, N-F, N-P, M-S, FU, S ROE, UV II, UV II R, USP, FUR 8, DUOPOWER and DUOPOWER S which, in accordance with their intended use resulting from provisions of the Assessment, affect the fulfilment of the basic requirements by civil structures the product will be used in.

6.2. The National Technical Assessment ITB-KOT-2017/0049 Edition 1 is not a document which entitles to mark a construction product with the construction mark.

Pursuant to the Act of 16 April 2004 on construction products (consolidated text in Law Journal of 2016, item 1570 as amended), the products which are covered by this National Technical Assessment can be placed and made available on the domestic market when the manufacturer has assessed and verified constancy of performance, issued the national declaration of performance in accordance with the National Technical Assessment ITB-KOT-2017/0049 Edition 1 and marked the products with the construction mark in compliance with the applicable provisions.

6.3. The National Technical Assessment ITB-KOT-2017/0049 Edition 1 does not prejudice any rights resulting from the regulations referring to the protection of industrial property, in particular the Industrial Property Law Act of 30 June 2000 (consolidated text in Law Journal of 2013, item 1410 as amended). It is the obligation of all users of this National Technical Assessment issued by the Building Research Institute to provide these rights.

6.4. By issuing this National Technical Assessment, the Building Research Institute does not take responsibility for possible infringements of exclusive and acquired rights.

6.5. The National Technical Assessment does not exempt the manufacturer of the products from responsibility for appropriate quality of products and the constructors for building works from responsibility for their proper use.

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

7. LIST OF DOCUMENTS USED IN THE PROCEEDING

7.1. Reports on research, assessments and classifications

1) LOK00-02357/14/Z00OSK. Report on research for plastic/metal expansion plugs SX, S, UX, M-S, N, FU, USP, UV II, FUR, Fasteners and Construction Products Laboratory – LOK, Building Research Institute, Silesian Branch, Katowice, Poland
2) LOK00-00971/14/Z00OSK. Report on research for universal plugs UX, TBB, TB, Fasteners and Construction Products Laboratory – LOK, Building Research Institute, Silesian Branch, Katowice, Poland
3) 02463/15/Z00OSK. Technical Opinion on UX and S 14 ROE plugs, Department of Building Construction Elements and Building in Mining Areas, Building Research Institute, Silesian Branch, Katowice, Poland
4) LOK00-00564/16/Z00OSK. Report on research for plastic/metal expansion plugs SX, S, GS12, DUOPOWER, Fasteners and Construction Products Laboratory – LOK, Building Research Institute, Silesian Branch, Katowice, Poland
5) LOK00-01073/16/Z00OSK. Report on research for Fischer plastic plug SX 8 x 40, Building Structures and Geotechnics Laboratory, Building Research Institute, Katowice, Poland
6) LOK00-01525/16/Z00OSK. Report on research for plastic plugs type N and FUR 8, Building Structures and Geotechnics Laboratory, Building Research Institute, Katowice, Poland
7) LZK00-01418/16/Z00NZK. Technical Opinion defining the characteristic resistances of installed plugs for pull-out of base material, shear and bending for the purpose of specifying them in the Building Research Institute's Technical Approval as well as installation parameters, Building Structures and Geotechnics Department of the Building Research Institute, Katowice, Poland
8) LZK00-02833/16/Z00NZK. Report on research for plastic/metal expansion plugs FISCHER DUOPOWER and DUOTEC, Building Constructions and Geotechnics Laboratory of the Building Research Institute, Katowice, Poland 2016
9) 01077/17/Z00NZK. Technical opinion on Fischer DUOPOWER plugs for the purpose of granting the National Technical Assessment under the application no. EJ-1077/177, Building Structures and Geotechnics Department of the Building Research Institute, Katowice, Poland

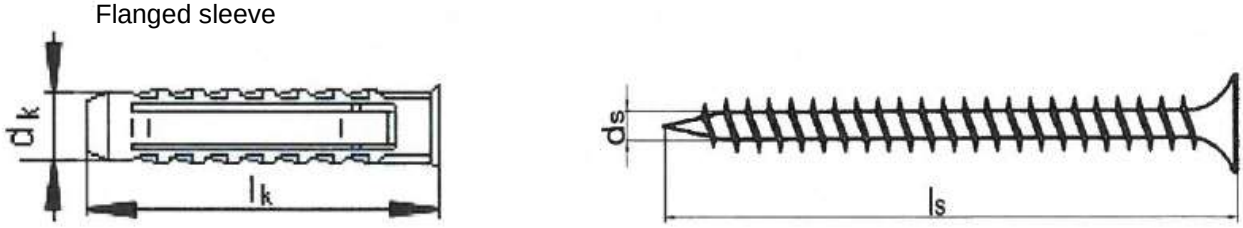
10) NZK-02045R:04/PK/17. A letter regarding the resistances of plastic/metal DUOPOWER plugs, Building Structures and Geotechnics Department of the Building Research Institute
11) 81/2017 Test report on DSC analysis – determination of temperature and enthalpy of melting and crystallisation for plastics, Institute for Engineering of Polymer Materials and Dyes, Paint and Plastic Department, Division of Research and Analysis, Gliwice, Poland

7.2. Standards and related documents

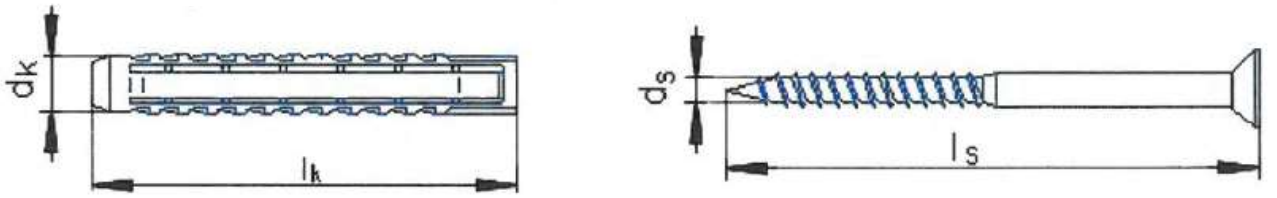
EN 206+A1:2016	*Concrete. Requirements, characteristics, production and conformity*
EN 771-1+A1:2015	*Specification for masonry units. Part 1: Clay masonry units*
EN 771-2+A1:2015	*Specification for masonry units. Part 2: Calcium silicate masonry units*
EN 771-4+A1:2015	*Specification for masonry units. Part 4: Autoclaved aerated concrete masonry units*
EN ISO 4042:2001	*Fasteners. Electroplated coatings*
EN ISO 2178:2016	*Non-magnetic coatings on magnetic substrates. Measurement of coating thickness. Magnetic method*
EN ISO 3497:2004	*Metallic coatings. Measurement of coating thickness. X-ray spectrometric methods*
EN ISO 9223:2012	*Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, determination and estimation*
EN ISO 11357-1:2016	*Plastics. Differential scanning calorimetry (DSC) Part 1: General principles*
EN ISO 12944-2:2001	*Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Part 2: Classification of environments*
ISO 965-2:2001	*ISO general purpose metric screw threads. Tolerances. Part 2: Limits of sizes for general purpose external and internal screw threads. Medium quality*
H-86020:1971	*Corrosion resisting steel (stainless steel and acid resistant steel). Grades*
ET AG 020:2012	*Plastic plugs for multiple use in concrete and masonry for non-structural applications*
AT-15-7487/2016	*Plastic/metal expansion plugs SX, S, UX, UX-R, UX-R RH, UX-R WH, N-S, N-F, N-P, M-S, FU, S ROE, UV II, UV II R, USP, FUR i Duo Power*

APPENDIXES

Flanged sleeve

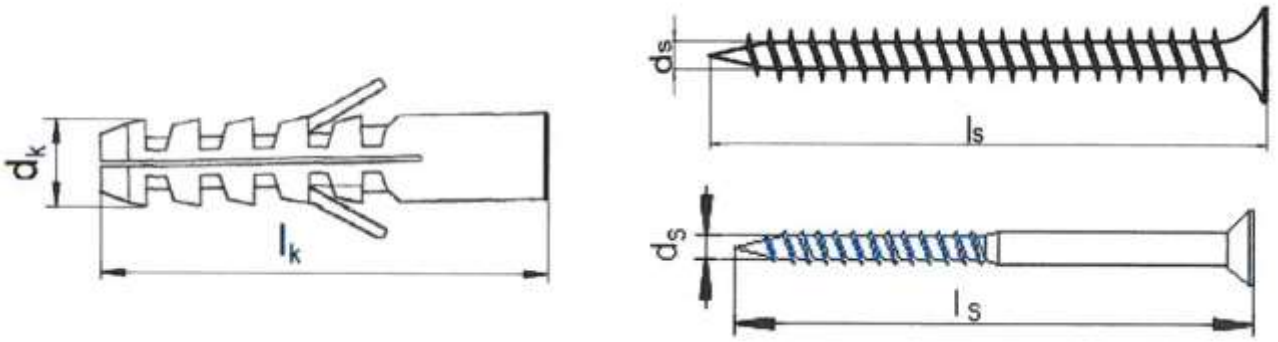


Non-flanged sleeve



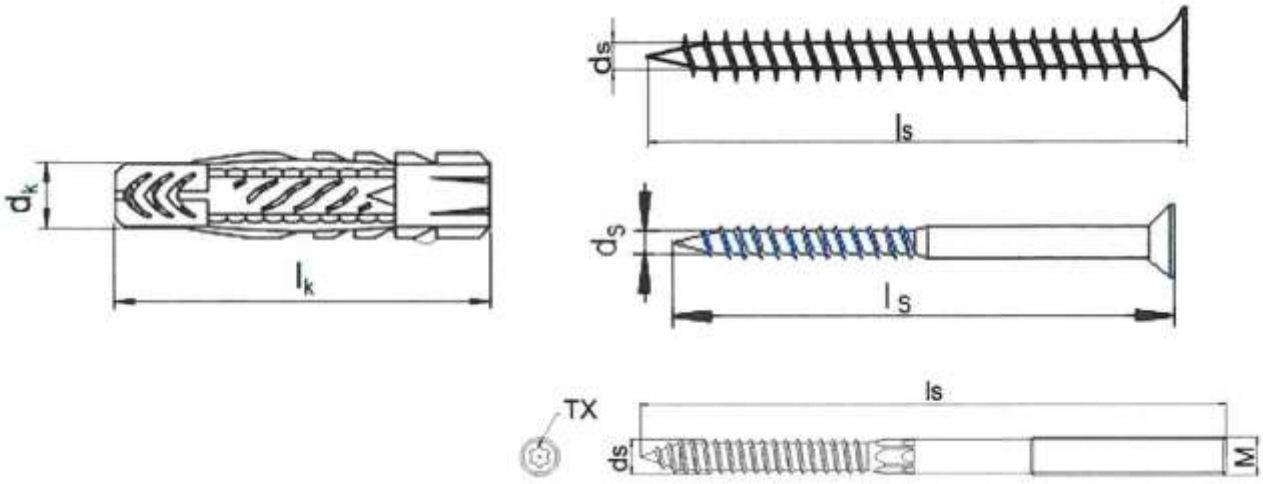
Plug designation	Sleeve type	Dimensions, mm			
		d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**	**6**
SX 4x20	flanged	4	20	3	≥ 30
SX 5x25	flanged	5	25	3.5 ÷ 4	≥ 40
SX 6x30	flanged	6	30	4.5 ÷ 5	≥ 40
SX 6x50	flanged	6	50	5	≥ 60
SX 8x40	flanged	8	40	5 ÷ 6	≥ 60
SX 10x50	flanged	10	50	6 ÷ 8	≥ 80
SX 10x80	non-flanged	10	80	8	≥ 100
SX 12x60	flanged	12	60	8 ÷ 10	≥ 80
SX 14x70	flanged	14	70	10 ÷ 12	≥ 100
SX 16x80	flanged	16	80	12	≥ 100

Figure A1. Plastic/metal expansion plugs SX



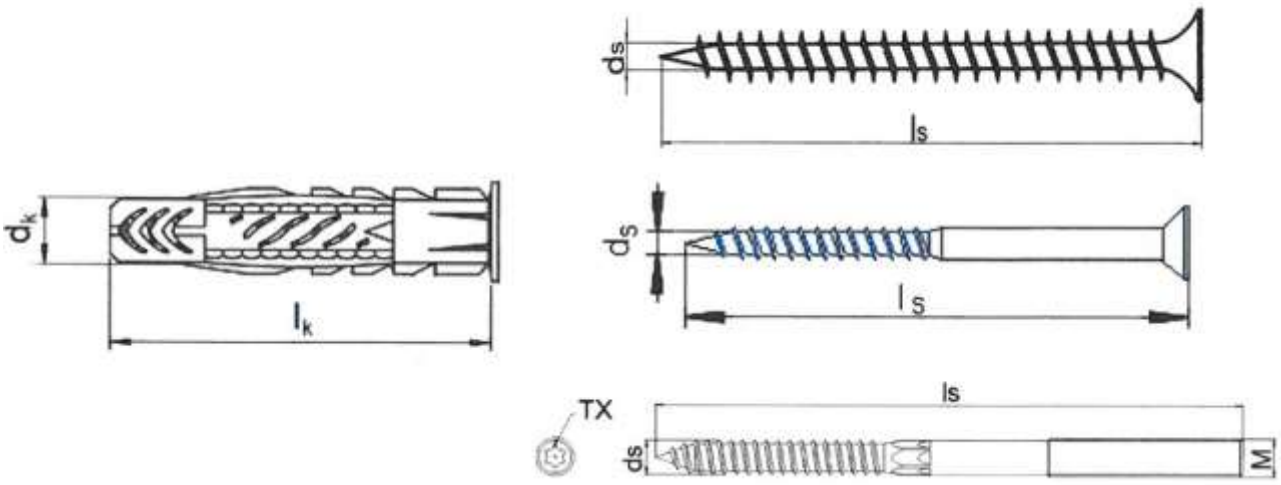
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
S4x20	4	20	3	≥ 30
S5x25	5	25	3.5 ÷ 4	≥ 35
S6x30	6	30	4.5 ÷ 5	≥ 40
S8x40	8	40	6	≥ 50
S10x50	10	50	7 ÷ 8	≥ 60
S12x60	12	60	8 ÷ 10	≥ 70
S14x75	14	75	10 ÷ 12	≥ 90
S16x80	16	80	12	≥ 90

Figure A2. Plastic/metal expansion plugs S



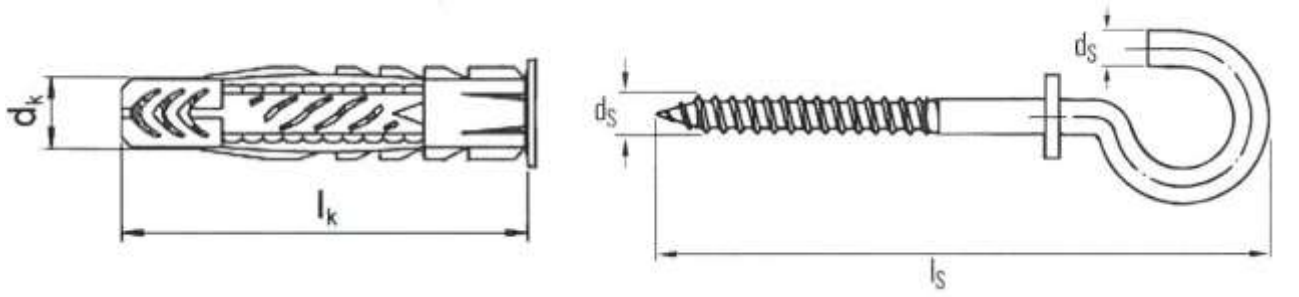
Plug designation	Dimensions, mm				
	d_k	l_k	d_s	l_s	M
1	**2**	**3**	**4**	**5**	**6**
UX 5x30	5	30	3.5 ÷ 4	≥ 40	-
UX 6x35	6	35	4.5 ÷ 5	≥ 45	-
UX 6x50	6	50	4.5 ÷ 5	≥ 60	-
UX 8x50	8	50	5 ÷ 6	≥ 60	-
UX 10x60	10	60	6 ÷ 8	≥ 70	M6/M8
UX 12x70	12	70	8 ÷ 10	≥ 80	M8/M10
UX 14x75	14	75	10 ÷ 12	≥ 90	M10/M12

Figure A3. Plastic/metal expansion plugs UX



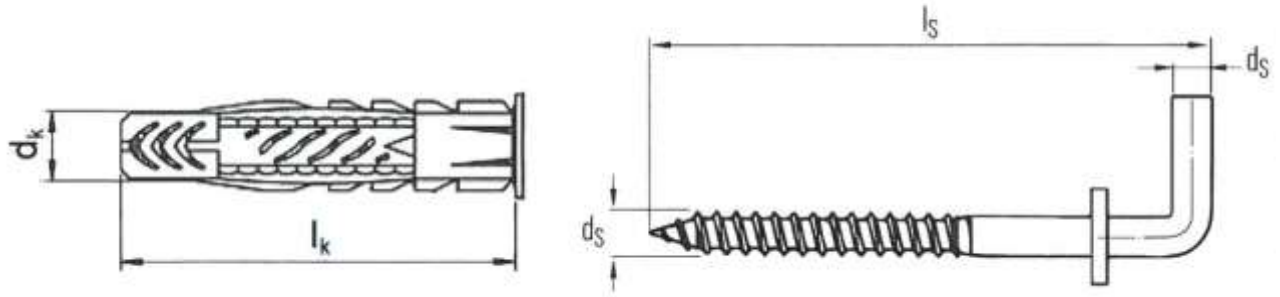
Plug designation	Dimensions, mm				
	d_k	l_k	d_s	l_s	M
1	**2**	**3**	**4**	**5**	**6**
UX 5x30R	5	30	3.5 ÷ 4	≥ 40	-
UX 6x35R	6	35	4.5 ÷ 5	≥ 45	-
UX 6x50R	6	50	4.5 ÷ 5	≥ 60	-
UX 8x40R	8	40	5 ÷ 6	≥ 50	-
UX 8x50R	8	50	5 ÷ 6	≥ 60	-
UX 10x60R	10	60	6 ÷ 8	≥ 70	M6/M8

Figure A4. Plastic/metal expansion plugs UX-R



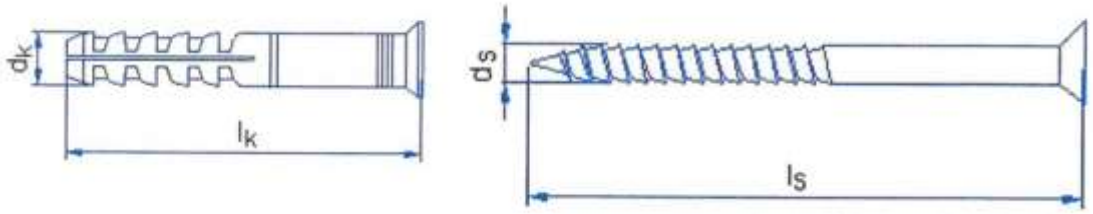
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
UX 6x35RH	6	35	4.5	≥ 68
UX 8x50RH	8	50	5.5	≥ 87

Figure A5. Plastic/metal expansion plugs UX RH



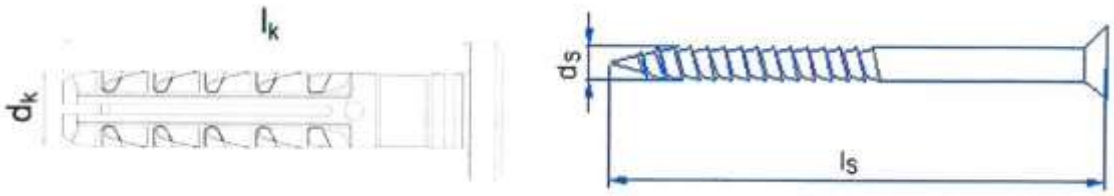
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
UX 6x35WH	6	35	4.5	≥ 53
UX 8x50WH	8	50	5.5	≥ 70

Figure A6. Plastic/metal expansion plugs UX WH



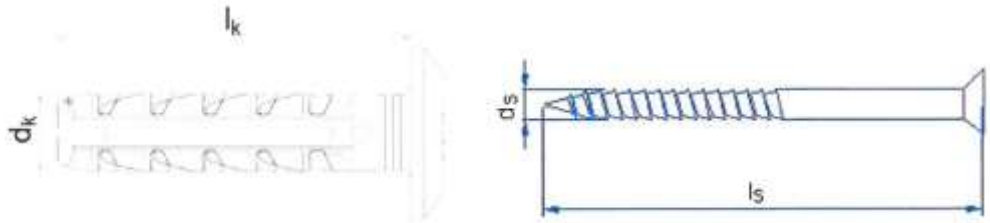
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
N 5x30/5S	5	30	3.5	38
N 5x40/15S	5	40	3.5	48
N 5x50/25S	5	50	3.5	58
N 6x40/10S	6	40	4	48
N 6x60/30S	6	60	4	64
N 6x80/50S	6	80	4	88
N 8x60/20S	8	60	5	65
N 8x80/40S	8	80	5	85
N 8x100/60S	8	100	5	105
N 8x120/80S	8	120	5	125
N 10x100/50S	10	100	7	110
N 10x135/85S	10	135	7	145
N 10x160/110S	10	160	7	170
N 10x230/180S	10	230	7	240

Figure A7. Plastic/metal expansion plugs N-S



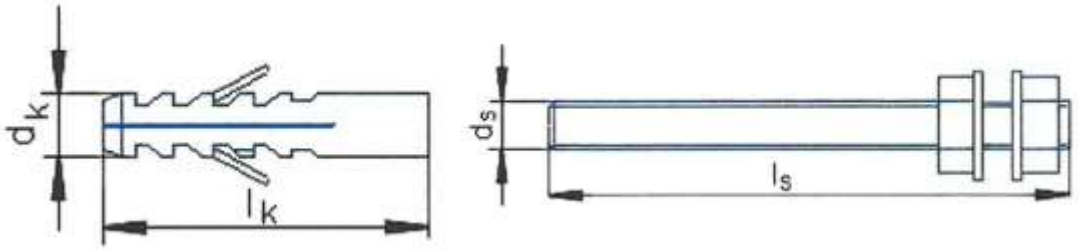
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
N 5x25/1F	5	25	3.5	33
N 5x30/5F	5	30	3.5	38
N 5x40/15F	5	40	3.5	48
N 5x50/25F	5	50	35	58
N 6x40/10F	6	40	4	48
N 6x60/30F	6	60	4	64
N 6x80/50F	6	80	4	88
N 8x60/20F	8	60	5	65
N 8x80/40F	8	80	5	85
N 8x100/60F	8	100	5	105
N 8x120/80F	8	120	5	125

Figure A8. Plastic/metal expansion plugs N-F



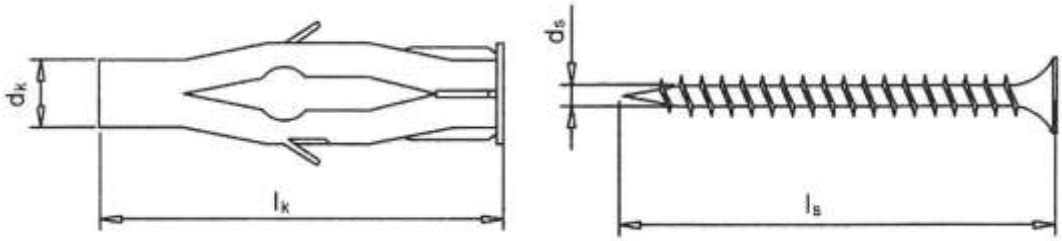
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
N 5x30/5P	5	30	3.5	38
N 6x30/1P	6	30	4	38
N 6x40/7P	6	40	4	48
N 8x40/1P	8	40	5	65

Figure A9. Plastic/metal expansion plugs N-P



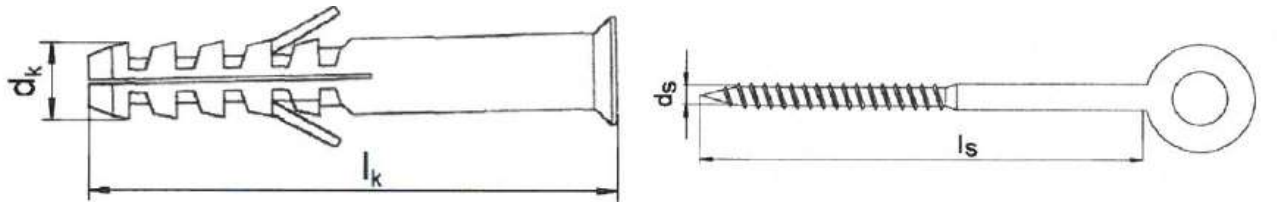
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
M 6x40S	8	40	M6	≥ 60
M 8x50S	10	50	M8	≥ 80
M 10x70S	14	70	M10	≥ 100
M 12x80S	16	80	M12	≥ 100

Figure A10. Plastic/metal expansion plugs M-S



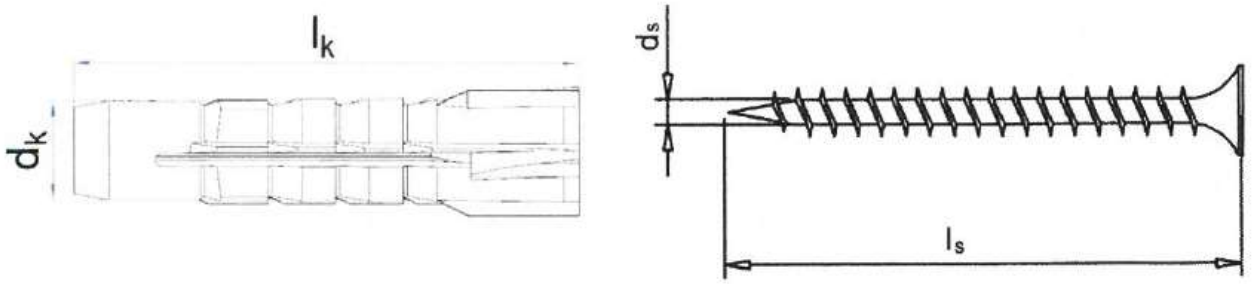
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
FU 6x35	6	35	3.5	≥ 45
FU 6x45	6	45	3.5	≥ 55
FU 8x50	8	50	4.5	≥ 60
FU 10x60	10	60	6	≥ 80

Figure A11. Plastic/metal expansion plugs FU



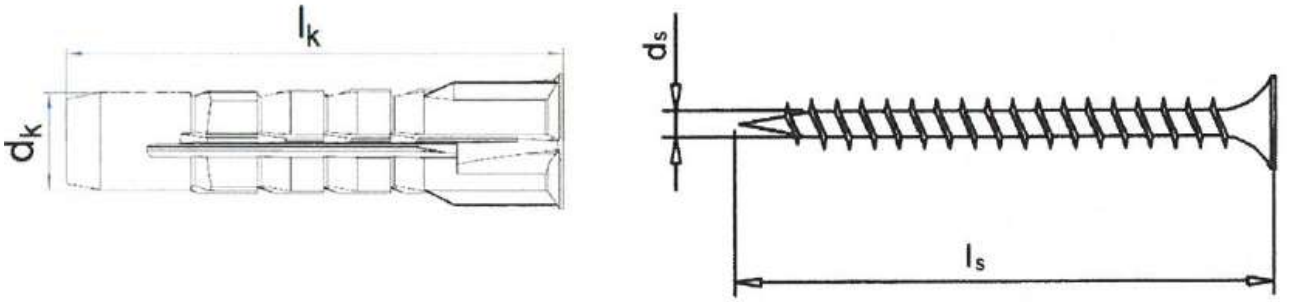
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
2	**3**	**4**	**5**	**6**
S 14 ROE 100	14	100	12	90,120,160, 190, 230, 300, 350
S 14 ROE 135	14	135	12	
S 14 ROE 185	14	185	12	

Figure A12. Plastic/metal expansion plugs S ROE



Plug designation	Dimensions, mm			
	d_k, mm	l_k, mm	d_s, mm	l_s, mm
1	**2**	**3**	**4**	**5**
UV II 5x25	5	25	3.5	≥ 35
UV II 6x30	6	30	4.5	≥ 45
UV II 6x50	6	50	4.5	≥ 60
UV II 8x40	8	40	5	≥ 50
UV II 10x50	10	50	6	≥ 60
UV II 12x60	12	60	8 ÷ 10	≥ 80

Figure A13. Plastic/metal expansion plugs UV

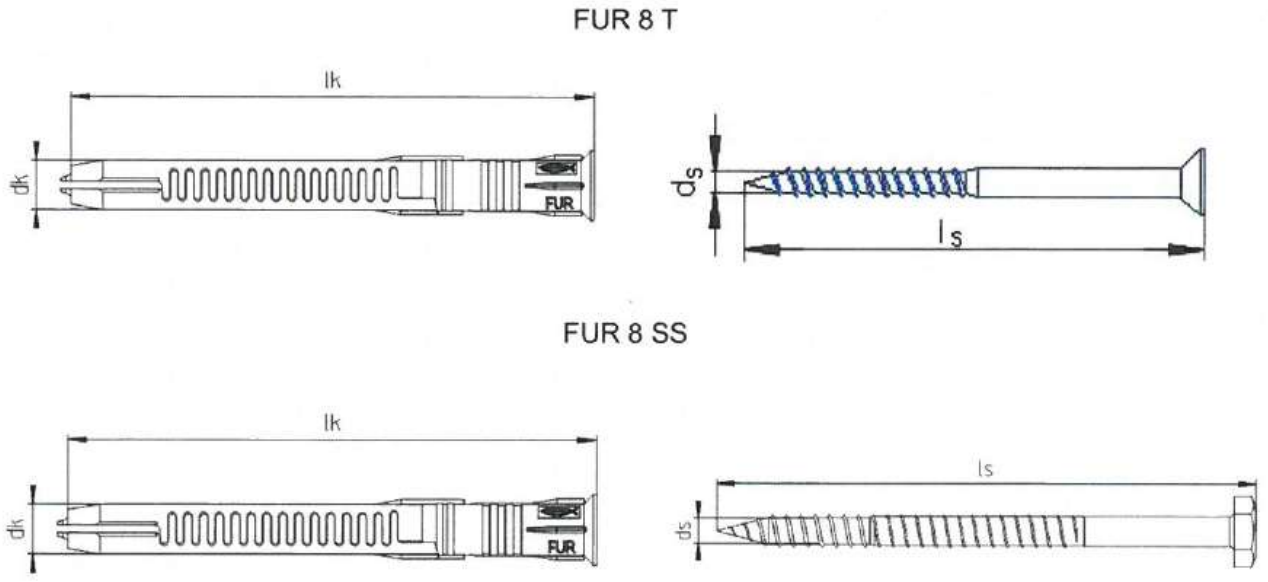


Plug designation	Dimensions, mm			
	d_k, mm	l_k, mm	d_s, mm	l_s, mm
1	**2**	**3**	**4**	**5**
UV II 6x30R	6	30	4.5	≥ 45
UV II 6x50R	6	50	4.5	≥ 60
UV II 8x40R	8	40	5	≥ 50
UV II 10x50R	10	50	6	≥ 60

Figure A14. Plastic/metal expansion plugs UV II R

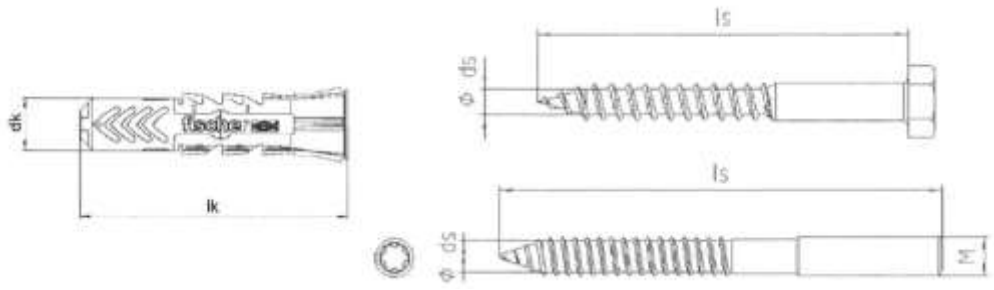
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
USP 5x25	5	25	3.5	≥ 35
USP 6x30	6	30	4.5	≥ 40
USP 8x40	8	40	5	≥ 50
USP 10x50	10	50	6	≥ 60
USP 12x60	12	60	8	≥ 70
USP 14x70	14	70	10	≥ 80

Figure A15. Plastic/metal expansion plugs USP



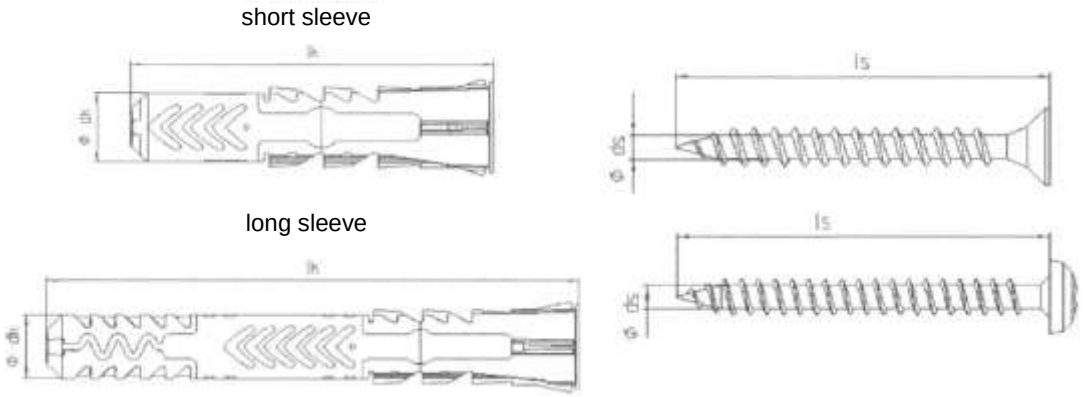
Plug designation	Dimensions, mm			
	d_k	l_k	d_s	l_s
1	**2**	**3**	**4**	**5**
FUR 8x80T FUR 8x80SS	8	80	6	≥ 85
FUR 8x100T FUR 8x100SS	8	100	6	≥ 105
FUR 8x120T FUR 8x120SS	8	120	6	≥ 125

Figure A16. Plastic/metal expansion plugs FUR 8



Plug designation	Dimensions, mm				
	d_k	l_k	d_s	l_s	M
1	2	3	4	5	6
DUOPOWER 6x30	6	30	5.0	≥ 40	-
DUOPOWER 6x50	6	50	5.0	≥ 60	-
DUOPOWER 8x40	8	40	6.0	≥ 50	-
DUOPOWER 8x65	8	65	6.0	≥ 75	-
DUOPOWER 10x50	10	50	8.0	≥ 60	M8
DUOPOWER 10x80	10	80	7.0 ÷ 8.0	≥ 90	M8
DUOPOWER 12x60	12	60	8.0 ÷ 10.0	≥ 70	M8
DUOPOWER 14x70	14	70	10.0 ÷ 12.0	≥ 80	M10

Figure A17. Plastic/metal expansion plugs DUOPOWER



Plug designation	Sleeve type	Dimensions, mm			
		d_k	l_k	d_s	l_s
1	2	3	4	5	6
DUOPOWER 5x25S	short	5	25	4.0	≥ 35
DUOPOWER 6x30S	short	6	30	4.5	≥ 40
DUOPOWER 6x50S	long	6	50	4.5	≥ 60
DUOPOWER 8x40S	short	8	40	5.0	≥ 50
DUOPOWER 8x65S	long	8	65	5.0	≥ 75
DUOPOWER 10x50S	short	10	50	7.0	≥ 60
DUOPOWER 10x80S	long	10	80	7.0	≥ 90
DUOPOWER 12x60S	short	12	60	8.0	≥ 70
DUOPOWER 14x70S	short	14	70	10.0	≥ 80

Figure A18. Plastic/metal expansion plugs DUOPOWER S

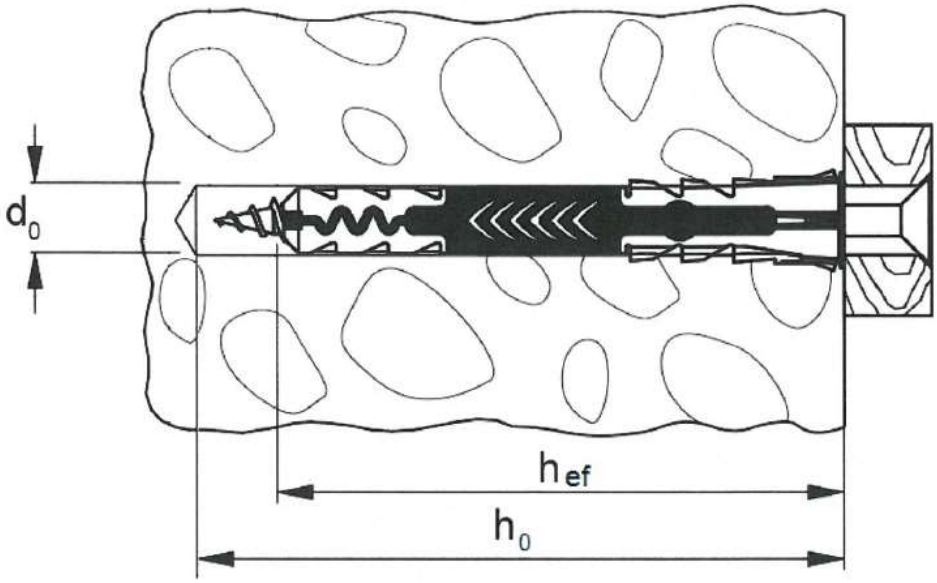


Figure B1. Installation parameters of plastic/metal expansion plugs

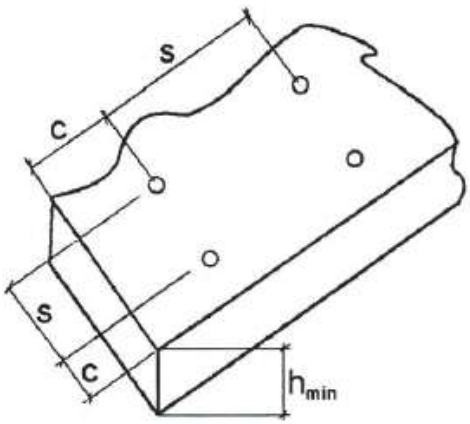


Figure B2. Spacing parameters of plastic/metal expansion plugs in base material

Table B1. Installation and spacing parameters of plastic/metal expansion plugs SX, S, UX, UX-R, UX RH, UX WH, N-S, N-F, N-P, M-S, FU, S ROE, UV II, UV II R, USP, FUR 8, DUOPOWER and DUOPOWER S

Item	Plug designation	Hole diameter d_0, mm	Minimum hole depth h_0, mm	Effective plugage depth h_{ef}, mm	Minimum thickness of base material h, mm	Minimum distance from edge c, mm	Plug spacing s, mm
1	2	3	4	5	6	7	8
Plastic/metal expansion plugs SX							
1	SX 4x20	4	25	20	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
2	SX 5x25	5	30	25			
3	SX 6x30	6	35	30			
4	SX 6x50	6	55	50			
5	SX 8x40	8	50	40			
6	SX 10x50	10	60	50			
7	SX 10x80	10	90	80	1.5 x h_{ef}		
8	SX 12x60	12	70	60			
9	SX 14x70	14	80	70			
10	SX 16x80	16	90	80			
Plastic/metal expansion plugs S							
11	S4x20	4	25	20	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
12	S5x25	5	30	25			
13	S6x30	6	35	30			
14	S8x40	8	50	40			
15	S10x50	10	60	50			
16	S12x60	12	70	60	1.5 x h_{ef}		
17	S14x75	14	85	75			
18	S16x80	16	90	80			
Plastic/metal expansion plugs UX, UX-R, UX RH and UX WH							
19	UX 5x30 UX 5x30R	5	35	30	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
20	UX 6x35 UX 6x35R UX 6x35RH UX 6x35WH	6	40	35			
21	UX 6x50 UX 6x50R	6	55	50			
22	UX 8x40R	8	50	40			
23	UX 8x50 UX 8x50R UX 8x50RH UX 8x50WH	8	60	50			
24	UX 10x60 UX 10x60R	10	70	60	1.5 x h_{ef}		
25	UX 12x70	12	80	70			
26	UX 14x75	14	85	75			
Plastic/metal expansion plugs N-S, N-F and N-P							
27	N 5x25/1 F N 5x30/5S N 5x30/5F N 5x30/5P	5	30	25	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
28	N 5x40/15S N 5x40/15F	5	30	25			
29	N 5x50/25S N 5x50/25F	5	30	25			
30	N 6x30/1P N 6x40/10S N 6x40/10 F N 6x40/7P	6	35	30			

[1)] for base material of normal concrete, class C20/25 + C50/60 acc. to EN 206:2014
[2)] for other base materials

Item	Plug designation	Hole diameter d_0, mm	Minimum hole depth h_0, mm	Effective plugage depth h_{ef}, mm	Minimum thickness of base material h, mm	Minimum distance from edge c, mm	Plug spacing s, mm
1	2	3	4	5	6	7	8
Plastic/metal expansion plugs N-S, N-F and N-P							
31	N 6x60/30S N 6x60/30F	6	35	30	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
32	N 6x80/50S N 6x80/50F	6	35	30			
33	N 8x40/1P N 8x60/20S N 8x60/20F	8	50	40			
34	N 8x80/40S N 8x80/40F	8	50	40			
35	N8x100/60S N8x100/60F	8	50	40			
36	N8x120/80S N8x120/80F	8	50	40			
37	N 10x100/50S	10	60	50			
38	N 10x135/85S	10	60	50			
39	N 10x160/110S	10	60	50			
40	N 10x230/180S	10	60	50			
Plastic/metal expansion plugs M-S							
41	M 6x40S	8	45	40	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
42	M 8x50S	10	60	50			
43	M 10x70S	14	80	70	1.5 x h_{ef}		
44	M 12x80S	16	90	80			
Plastic/metal expansion plugs FU							
45	FU 6x35	6	40	35	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
46	FU 6x45	6	50	45			
47	FU 8x50	8	60	50			
48	FU 10x60	10	70	60	1.5 x h_{ef}		
Plastic/metal expansion plugs S ROE							
49	S 14ROE100 cm	14	85	75	1.5 x h_{ef}	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
50	S 14ROE135 cm	14	85	75			
51	S 14ROE185 cm	14	85	75			
Plastic/metal expansion plugs UV II and UV II R							
52	UV II 5x25	5	30	25	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
53	UV II 6x30 UV II 6x30R	6	35	30			
54	UV II 6x50 UV II 6x50R	6	55	50			
55	UV II 8x40 UV II 8x40R	8	50	40			
56	UV II 10x50 UV II 10x50R	10	60	50			
57	UV II 12x60	12	70	60	1.5 x h_{ef}		
Plastic/metal expansion plugs USP							
58	USP 5x25	5	30	25	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
59	USP 6x30	6	35	30			
60	USP 8x40	8	50	40			
61	USP 10x50	10	60	50			
62	USP 12x60	12	70	60	1.5 x h_{ef}		
63	USP 14x70	14	80	70			

[1)] for base material of normal concrete, class C20/25 + C50/60 acc. to EN 206:2014
[2)] for other base materials

Item	Plug designation	Hole diameter d_0, mm	Minimum hole depth h_0, mm	Effective plugage depth h_{ef}, mm	Minimum thickness of base material h, mm	Minimum distance from edge c, mm	Plug spacing s, mm
1	2	3	4	5	6	7	8
Plastic/metal expansion plugs FUR							
64	FUR 8x80T FUR 8x80 SS FUR 8x100T FUR 8x100 SS FUR 8x120 T FUR 8x120 SS	8	80	70	1.5 x h_{ef}	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
Plastic/metal expansion plugs DUOPOWER							
65	DUOPOWER6x30	6	40	30	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
66	DUOPOWER6x50	6	60	50			
67	DUOPOWER8x40	8	50	40			
68	DUOPOWER 8x65	8	75	65	1.5 x h_{ef}		
69	DUOPOWER 10x50	10	60	50	80		
70	DUOPOWER 10x80	10	90	80	1.5 x h_{ef}		
71	DUOPOWER 12x60	12	70	60			
72	DUOPOWER 14x70	14	80	70			
Plastic/metal expansion plugs DUOPOWER S							
73	DUOPOWER 5x25S	5	35	25	80	2 x h_{ef}	2 x h_{ef} [1)] or 3 x h_{ef} [2)]
74	DUOPOWER 6x30S	6	40	30			
75	DUOPOWER 6x50S	6	60	50			
76	DUOPOWER 8x40S	8	50	40			
77	DUOPOWER 8x65S	8	75	65	1.5 x h_{ef}		
78	DUOPOWER 10x50S	10	60	50	80		
79	DUOPOWER 10x80S	10	90	80	1.5 x h_{ef}		
80	DUOPOWER 12x60S	12	70	60			
81	DUOPOWER 14x70S	14	80	70			

[1)] for base material of normal concrete, class C20/25 + C50/60 acc. to EN 206:2014
[2)] for other base materials

Table C1. Characteristic and design resistances of installed plastic/metal expansion plugs SX for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]
1	2	3	4	5	6
1	SX 4x20	20	0.1/0.05	0.2/0.08	0.4/0.16
2	SX 5x25	25	0.1/0.05	0.2/0.08	0.6/0.24
3	SX 6x30	30	0.2/0.11	1.2/0.48	0.9/0.36
4	SX 6x50	50	0.6/0.33	3.0/1.20	2.5/1.00
5	SX 8x40	40	0.4/0.22	1.2/0.48	0.9/0.36
6	SX 10x50	50	1.2/0.66	2.5/1.00	5.0/2.00
7	SX 10x80	80	3.5/1.94	5.0/2.00	6.0/2.40
8	SX 12x60	60	2.0/1.11	7.0/2.80	4.5/1.80
9	SX 14x70	70	3.0/1.66	-	7.0/2.80
10	SX 16x80	80	6.0/3.33	-	10.5/4.20

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015

Table C2. Characteristic and design resistances of installed plastic/metal expansion plugs S for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]
1	2	3	4	5	6
1	S 4x20 cm	20	-	0.1/0.04	0.2/0.08
2	S 5x25 cm	25	-	0.2/0.08	0.2/0.08
3	S 6x30 cm	30	0.2/0.11	0.6/0.24	0.9/0.36
4	S 8x40 cm	40	0.9/0.50	2.0/0.80	3.0/1.20
5	S 10x50 cm	50	1.2/0.66	5.0/2.00	5.5/2.20
6	S 12x60 cm	60	2.0/1.11	5.0/2.00	5.5/2.20
7	S 14x75 cm	75	6.0/3.33	5.0/2.00	5.5/2.20
8	S 16x80 cm	80	6.5/3.61	-	-

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015

Table C3. Characteristic and design resistances of installed plastic/metal expansion plugs UX for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay hollow brick (Porotherm)[2)]	calcium silicate cored brick[3)]
1	**2**	**3**	**4**	**5**	**6**
1	UX 5x30	30	0.1/0.05	0.6/0.24	0.75/0.30
2	UX 6x35	35	0.1/0.05	0.75/0.30	0.9/0.36
3	UX 6x50	50	0.4/0.22	1.2/0.48	0.9/0.36
4	UX 8x50	50	-	1.5/0.60	1.5/0.60
5	UX 10x60	60	-	1.5/0.60	-
6	UX 12x70	70	-	1.5/0.60	-
7	UX 14x75	75	-	2.0/0.80	4.0/1.60

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
[3)] calcium silicate cored brick, class 15 acc. to EN 771-2+A1:2015, wall thickness no less than 20 mm

Table C4. Characteristic and design resistances of installed plastic/metal expansion plugs UX-R for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay hollow brick (Porotherm)[2)]	calcium silicate cored brick[3)]
1	**2**	**3**	**4**	**5**	**6**
1	UX 5x30R	30	0.1/0.05	0.6/0.24	0.75/0.30
2	UX 6x35R	35	0.1/0.05	0.75/0.30	0.9/0.36
3	UX 6x50R	50	0.4/0.22	1.2/0.48	0.9/0.36
4	UX 8x40R	40	-	1.5/0.60	0.9/0.36
5	UX 8x50R	50	-	1.5/0.60	1.5/0.60
6	UX 10x60R	60	-	1.5/0.60	-

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
[3)] calcium silicate cored brick, class 15 acc. to EN 771-2+A1:2015, wall thickness no less than 20 mm

Table C5. Characteristic and design resistances of installed plastic/metal expansion plugs UX RH and UX WH for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay hollow brick (Porotherm)[2)]	calcium silicate cored brick[3)]
1	2	3	4	5	6
1	UX6x35 RH	35	0.1/0.05	0.5/0.20	0.5/0.20
2	UX 6x35 WH	35	0.1/0.05	0.75/0.30	0.9/0.36
3	UX 8x50 RH UX 8x50 WH	50	0.6/0.33	1.2/0.48	1.2/0.48

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
[3)] calcium silicate cored brick, class 15 acc. to EN 771-2+A1:2015, wall thickness no less than 20 mm

Table C6. Characteristic and design resistances of installed plastic/metal expansion plugs N-S, N-F and N-P for pull-out of base material.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]
1	2	3	4	5	6
1	N 5x25/1F N 5x30/5S N 5x30/5F N 5x30/5P	25	0.1/0.05	0.2/0.08	0.9/0.36
2	N 5x40/15S N 5x40/15 F	25	0.1/0.05	0.2/0.08	0.9/0.36
3	N 5x50/25S N 5x50/25F	25	0.1/0.05	0.2/0.08	0.9/0.36
4	N 6x30/1P N 6x40/10S N 6x40/10F N 6x40/7P	30	0.4/0.22	0.75/0.30	1.5/0.60
5	N 6x60/30S N 6x60/30 F	30	0.4/0.22	0.75/0.30	1.5/0.60
6	N 6x80/50S N 6x80/50F	30	0.4/0.22	0.75/0.30	1.5/0.60
7	N 8x40/1P N 8x60/20S N 8x60/20F	40	0.9/0.50	0.9/0.36	-
8	N 8x80/40S N 8x80/40F	40	0.9/0.50	0.9/0.36	-
9	N 8x100/60S N 8x100/60F	40	0.9/0.50	0.9/0.36	-
10	N 8x120/80S N 8x120/80F	40	0.9/0.50	0.9/0.36	-
11	N 10x100/50S	50	1.2/0.65	1.5/0.60	3.0/1.20
12	N 10x135/85S	50	1.2/0.66	1.5/0.60	3.0/1.20
13	N 10x160/110S	50	1.2/0.66	1.5/0.60	3.0/1.20
14	N 10x230/180S	50	1.2/0.66	1.5/0.60	3.0/1.20

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015

Table C7. Characteristic and design resistances of installed plastic/metal expansion plugs N-S, N-F and N-P for shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]
1	2	3	4	5	6
1	N 5x25/1F N 5x30/5S N 5x30/5F N 5x30/5P	25	2.0/1.6	0.2/0.08	0.9/0.36
2	N 5x40/15S N5x40/15F	25	2.0/1.6	0.2/0.08	0.9/0.36
3	N 5x50/25S N 5x50/25F	25	2.0/1.6	0.2/0.08	0.9/0.36
4	N 6x30/1P N 6x40/10S N 6x40/10F N 6x40/7P	30	3.0/2.4	0.75/0.30	1.5/0.60
5	N 6x60/30S N 6x60/30F	30	3.0/2.4	0.75/0.30	1.5/0.60
6	N6x80/50S N 6x80/50F	30	3.0/2.4	0.75/0.30	1.5/0.60
7	N 8x40/1P N 8x60/20S N 8x60/20F	40	3.5/2.8	0.9/0.36	-
8	N 8x80/40S N 8x80/40F	40	3.5/2.8	0.9/0.36	-
9	N 8x100/60S N 8x100/60F	40	3.5/2.8	0.9/0.36	-
10	N 8x120/80S N 8x 120/80 F	40	3.5/2.8	0.9/0.36	-
11	N 10x100/50S	50	7.0/5.6	1.5/0.6	3.0/1.20
12	N 10x135/85S	50	7.0/5.6	1.5/0.6	3.0/1.20
13	N 10x160/110S	50	7.0/5.6	1.5/0.6	3.0/1.20
14	N 10x230/180S	50	7.0/5.6	1.5/0.6	3.0/1.20

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015

Table C8. Characteristic and design resistances of installed plastic/metal expansion plugs M-S for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]
1	2	3	4	5	6
1	M 6x40S	40	0.9/0.50	0.6/0.24	0.5/0.20
2	M 8x50S	50	0.9/0.50	2.0/0.80	0.9/0.36
3	M 10x70S	70	0.9/0.50	2.0/0.80	2.5/1.00
4	M 12x80S	80	2.0/1.11	4.0/1.60	5.0/2.00

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015

Table C9. Characteristic and design resistances of installed plastic/metal expansion plugs M-S for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay hollow brick (Porotherm)[2)]	calcium silicate cored brick[3)]
1	2	3	4	5	6
1	FU 6x35	35	0.2/0.11	0.9/0.36	0.9/0.36
2	FU 6x45	45	0.2/0.11	0.9/0.36	1.2/0.48
3	FU 8x50	50	0.4/0.22	1.5/0.60	1.5/0.60
4	FU 10x60	60	0.4/0.22	1.5/0.60	2.0/0.80

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
[3)] calcium silicate cored brick, class 15 acc. to EN 771-2+A1:2015, wall thickness no less than 20 mm

Table C10. Characteristic and design resistances of installed plastic/metal expansion plugs S ROE for pull-out of base material.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]
1	2	3	4	5	6
1	S 14 ROE 100	75	6.0/3.33	5.0/2.00	5.5/2.20
2	S 14 ROE 135	75	6.0/3.33	5.0/2.00	5.5/2.20
3	S 14 ROE 185	75	6.0/3.33	5.0/2.00	5.5/2.20

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015

Table C11. Characteristic and design resistances of installed plastic/metal expansion plugs UV II and UV II R for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN				
			Type of base material				
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]	clay hollow brick (Porotherm)[4)]	clay hollow brick (chequer brick)[5)]
1	2	3	4	5	6	7	8
1	UV II 5x25	25	0.1/0.05	0.2/0.08	0.2/0.08	0.3/0.12	0.3/0.12
2	UV II 6x30 UV II 6x30 R	30	0.2/0.11	0.2/0.08	0.5/0.20	0.6/0.24	0.5/0.20
3	UV II 6x50 UV II 6x50 R	50	0.3/0.16	0.2/0.08	0.5/0.20	0.6/0.24	0.6/0.24
4	UV II 8x40 UV II 8x40R	40	0.2/0.11	0.6/0.24	0.5/0.20	0.9/0.36	0.9/0.36
5	UV II 10x50 UV II 10x50R	50	0.4/0.22	0.75/0.30	0.6/0.24	0.9/0.36	0.9/0.36
6	UV II 12x60	60	0.6/0.33	1.2/0.48	2.0/0.80	1.2/0.48	0.9/0.36

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015
[4)] clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
[5)] clay hollow brick (chequer brick), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 14 mm

Table C12. Characteristic and design resistances of installed plastic/metal expansion plugs USP for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN		
			Type of base material		
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]
1	2	3	4	5	6
1	USP 5x25	25	0.1/0.05	0.3/0.12	0.2/0.08
2	USP 6x30	30	0.2/0.11	0.5/0.20	0.4/0.16
3	USP 8x40	40	0.3/0.16	0.5/0.20	0.4/0.16
4	USP 10x50	50	0.5/0.27	0.75/0.30	0.6/0.24
5	USP 12x60	60	1.5/0.83	3.5/1.40	2.0/0.80
6	USP 14x70	70	2.0/1.11	9.0/3.60	6.5/2.60

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015

Table C13. Characteristic and design resistances of installed plastic/metal expansion plugs FUR 8 for pull-out of base material.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN				
			Type of base material				
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]	clay hollow brick (Porotherm)[4)]	clay hollow brick (chequer brick)[5)]
1	2	3	4	5	6	7	8
1	FUR 8x80 T FUR 8x80 SS FUR 8x100 T FUR 8x100 SS FUR 8x120 T FUR 8x120 SS	70	5.0/2.77	2.5/1.00	2.5/1.00	0.75/0.30	1.2/0.48

1) normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
2) clay solid brick, class 15 acc. to EN 771-1+A1:2015
3) calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015
4) clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
5) clay hollow brick (chequer brick), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 14 mm

Table C14. Characteristic and design resistances of installed plastic/metal expansion plugs FUR for pull-out of base material.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance, kN				
			Type of base material				
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]	clay hollow brick (Porotherm)[4)]	clay hollow brick (chequer brick)[5)]
1	2	3	4	5	6	7	8
1	FUR 8x80T FUR 8x80 SS FUR 8x100 T FUR 8x100 SS FUR 8x120 T FUR 8x120 SS	70	12.5/10.0	2.5/1.00	2.5/1.00	0.75/0.30	1.2/0.48

1) normal concrete, class C20/25 + C50/60 acc. to EN 206:2014
2) clay solid brick, class 15 acc. to EN 771-1+A1:2015
3) calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015
4) clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
5) clay hollow brick (chequer brick), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 14 mm

Table C15. Characteristic and design resistances of installed plastic/metal expansion plugs DUOPOWER for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance for pull-out of base material and shear, kN			
			Type of base material			
			normal concrete[1)]	clay solid brick[2)]	calcium silicate solid brick[3)]	calcium silicate brick with holes[4)]
1	2	3	4	5	6	7
1	DUOPOWER 6x30	30	0.9/0.50	0.9/0.36	3.5/1.4	1.5/0.6
2	DUOPOWER 6x50	50	0.9/0.50	0.9/0.36	-	-
3	DUOPOWER 8x40	40	0.9/0.50	0.9/0.36	4.5/1.8	2.0/0.8
4	DUOPOWER 8x65	65	0.9/0.50	0.9/0.36	-	-
5	DUOPOWER 10x50	50	1.2/0.66	7.0/2.8	6.0/2.4	2.5/1.0
6	DUOPOWER 10x80	80	7.5/4.16	12.0/4.8	-	-
7	DUOPOWER 12x60	60	1.2/0.66	-	-	-
8	DUOPOWER 14x70	70	2.5/1.38	8.0/3.20	-	-

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] calcium silicate solid brick, class 20 acc. to EN 771-2+A1:2015
[4)] calcium silicate cored brick, class 15 acc. to EN 771-2+A1:2015, wall thickness no less than 20 mm

Table C16. Characteristic and design resistances of installed plastic/metal expansion plugs DUOPOWER S for pull-out of base material and shear.

Item	Plug designation	Effective plugage depth h_{ef}, mm	Characteristic resistance / design resistance for pull-out of base material and shear, kN			
			Type of base material			
			normal concrete[1)]	clay solid brick[2)]	clay hollow brick[5)]	aerated concrete[6)]
1	2	3	4	5	6	7
1	DUOPOWER 5x25 S	25	0.1/0.05	0.6/0.24	0.6/0.24	0.2/0.1
2	DUOPOWER 6x30 S	30	0.2/0.11	0.9/0.36	0.9/0.36	0.2/0.1
3	DUOPOWER 6x50 S	50	0.9/0.50	0.9/0.36	0.9/0.36	0.6/0.3
4	DUOPOWER 8x40 S	40	0.4/0.22	0.9/0.36	0.9/0.36	0.6/0.3
5	DUOPOWER 8x65 S	65	0.9/0.50	0.9/0.36	0.9/0.36	0.9/0.45
6	DUOPOWER 10x50 S	50	1.2/0.66	6.0/2.4	0.9/0.36	1.2/0.6
7	DUOPOWER 10x80 S	80	7.5/4.16	12.0/4.8	1.2/0.48	2.5/1.25
8	DUOPOWER 12x60 S	60	1.2/0.66	-	1.2/0.48	1.2/0.6
9	DUOPOWER 14x70 S	70	2.5/1.38	8.0/3.20	1.2/0.48	2.0/1.0

[1)] normal concrete, class C20/25 + C50/60 acc. to EN 206+A1:2016
[2)] clay solid brick, class 15 acc. to EN 771-1+A1:2015
[3)] clay hollow brick (Porotherm), class 15 acc. to EN 771-1+A1:2015, wall thickness no less than 12 mm
[4)] autoclaved aerated concrete, class 4 acc. to EN 771-4+A1:2015