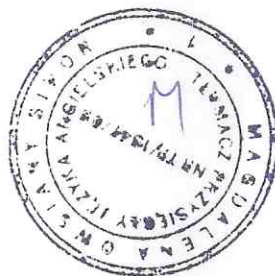




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[Certified translation from the Polish language]---

[Translation from the original document]---





MEMBER of EOTA and UEAtc



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NATIONAL TECHNICAL ASSESSMENT ITB-KOT-2020/1115 1st edition

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 Instytut Techniki Budowlanej in Warsaw, at the request of:

ARVEX Grobelny Sp. z o.o.
ul. Makuszyńskiego 4, 30-969 Kraków

The National Technical Assessment ITB-KOT-2020/1115 1st edition is a positive assessment of the performance of the following construction products for their intended use:

ARVEX
plastic and metal expansion fasteners

Expiry date of the National Technical Assessment:

27.03.2025

DIRECTOR
of Instytut Techniki Budowlanej
D.Eng Robert Geryło

Warsaw, 27.03.2020

The National Technical Assessment document ITB-KOT-2020/1115 1st edition contains 41 pages, including 3 appendices. The content of this document can only be copied in full. Publication or circulation in any other form of extracts from the text of the National Technical Assessment requires written agreement with Instytut Techniki Budowlanej.





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1. TECHNICAL DESCRIPTION OF THE PRODUCT

The subject of this National Technical Assessment is ARVEX plastic and metal expansion fasteners, manufactured by ARVEX Grobelny Sp. z o.o., ul. Makuszyńskiego 4, 30-969 Kraków, at its manufacturing plant in Kraków.

This National Technical Assessment covers the product types specified by the manufacturer, resulting from the performance characteristics given in section 3.

The components of ARVEX expansion fasteners are plastic sleeves and steel cores (screws). The range and dimensions of the ARVEX expansion fasteners are shown in Fig. A1-A68 and listed in tables A1-A18. Fixing with ARVEX expansion fasteners is shown in Figures B1 and B2.

ARVEX expansion fastener sleeves with designations: A, AG, KARS, AL and KARL are made from polyamide PA6, a virgin material characterised by a differential scanning calorimetry (DSC) curve according to PN-EN ISO 11357-1:2016, which conforms to the standard established by the National Technical Assessment procedure.

ARVEX expansion fastener sleeves with designations: AT and AGT are made of polypropylene (PP), a virgin material characterised by a differential scanning calorimetry (DSC) curve according to PN-EN ISO 11357-1:2016, which conforms to the standard established by the National Technical Assessment procedure.

The expansion cores of the ARVEX expansion fasteners are made of galvanised ordinary carbon steel with a yield strength of not less than 340 MPa and a tensile strength of not less than 420 MPa, with a mechanical property class of not less than 4.8 according to PN-EN ISO 898-1:2013. The fasteners are coated with an electrolytic zinc coating with a thickness of not less than 5 µm, according to PN-EN ISO 4042:2018.

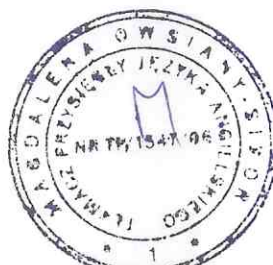
ARVEX plastic and metal expansion fasteners can be used with the EASA plastic masking cap (Figures A18 and A65) and with an N steel nut and EAUM plastic nut (Figures A19, A66 and A67).

The dimensional tolerances of the fasteners correspond to tolerance class *m* according to PN-EN 22768-1:1999.

2. INTENDED USE OF THE PRODUCT

ARVEX expansion fasteners are designed for non-structural multi-point fixings of statically loaded building components, in substrates made of:

- normal concrete of a class not lower than C20/25, according to PN-EN 206+A1:2016,
- full solid bricks, according to PN-EN 771-1+A1:2015, with a compressive strength of not less than 20 N/mm² (class not lower than 20),
- ceramic hollow bricks, according to PN-EN 771-1+A1:2015, with a wall thickness of not less than 10 mm and a compressive strength of not less than 15 N/mm² (class not lower than 15),



- autoclaved aerated concrete elements, according to PN-EN 771-4+A1:2015, with a compressive strength of not less than 2.0 N/mm² (class not less than 2) and a gross density in the dry state of not less than 350 kg/m³.

Due to the corrosive aggressiveness of the environment, ARVEX expansion fasteners should be used in accordance with the requirements given in PN-EN ISO 12944-2:2018, PN-EN ISO 9223:2012 and PN-EN ISO 2081:2018.

To determine the design resistance of ARVEX expansion fasteners to pull-out from a concrete substrate, divide the characteristic pull-out resistance given in Appendix C by a safety factor of 1.8.

To determine the design resistance of ARVEX expansion fasteners to pull-out from a clay substrate, divide the characteristic pull-out resistance given in Appendix C by a safety factor of 2.5.

To determine the design resistance of the ARVEX expansion fasteners to pull-out from an autoclaved aerated concrete substrate, divide the characteristic pull-out resistance given in Appendix C by a safety factor of 2.0.

To determine the design shear resistances of ARVEX expansion fasteners, divide the characteristic shear resistances given in Appendix C by a safety factor of 1.25.

Parameters for the installation and placement of ARVEX expansion fasteners in the substrate are given in Appendix B.

To fit the ARVEX expansion fasteners, a hole is drilled in the substrate and a plastic sleeve is fitted therein. A steel screw is then screwed into the sleeve, causing the body to be pressed against the inner surface of the hole and creating a permanent anchorage for the fastener.

ARVEX expansion fasteners should be used in accordance with the technical design, developed taking into account Polish building standards and regulations, the findings of this National Technical Assessment and the manufacturer's instructions regarding the conditions for fixing with the above mentioned fasteners.

3. PRODUCT PERFORMANCE AND THE METHODS USED TO ASSESS IT

3.1. Product performance

3.1.1. Characteristic resistance of fastener fixings. The values of characteristic resistance of the ARVEX expansion fasteners to pull-out and shear is given in Appendix C.

3.1.2. Fastener durability. A zinc coating of not less than 5 µm on the steel cores ensures the durability of the fasteners in accordance with section 2.

3.2. Methods used to assess performance

3.2.1. Characteristic resistance of fastener fixings. Testing of the characteristic resistance of the ARVEX expansion fasteners is carried out in accordance with ETAG 020:2012, on fasteners embedded in the substrate described in Annex C.

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



4. PACKAGING, TRANSPORT AND STORAGE, AND LABELLING OF THE PRODUCT

ARVEX expansion fasteners should be supplied in sets and stored and transported in such a way as to ensure that their technical properties remain unchanged.

The method of marking products with the construction mark should be consistent 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 the construction mark (Journal of Laws of 2016, item 1966, as amended).

The marking of the product with the construction mark should 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 registered office of the manufacturer or an identification mark enabling the name and address of the registered office of the manufacturer to be clearly identified,
- the name and designation of the construction product type,
- the number and year of issue of the National Technical Assessment according to which the performance was declared (ITB-KOT-2020/1115 1st edition),
- the number of the National Declaration of Performance,
- the level or class of performance declared,
- the name of the certification body involved in the assessment and verification of constancy of performance of the construction product,
- the website address, if the national declaration of performance is made available thereon.

A safety data sheet and/or information on hazardous substances contained in a construction product, as referred to in Article 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), establishing a European Chemicals Agency, should be provided or made available, as appropriate, together with the national declaration of performance.

In addition, the labelling of a construction product that constitutes a hazardous mixture according to 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, 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 the method of declaring the performance of construction products and the method of marking them with the construction mark (Journal of Laws 2016, item 1966, as amended), the 2+ system of assessment and verification of constancy of performance applies.



5.2. Type testing

The performance characteristics assessed in section 3 constitute type testing of the product as long as there are no changes to raw materials, components, production line or facility.

5.3. Factory production control

The manufacturer shall have a factory production control system in place at the production facility. All the elements of the system, requirements and provisions adopted by the manufacturer shall be documented in an ongoing manner in the form of policies and procedures, including records of tests performed. The factory production control shall be adapted to the production technology and ensure that the declared performance of the product is maintained in series production.

The factory production control includes specification and testing of raw materials and components, inspection and testing in the manufacturing process as well as control tests (according to section 5.4), carried out by the manufacturer in accordance with the established test plan and according to the principles and procedures set out in the factory production control documentation.

The results of production control shall be systematically registered. The records of the register shall confirm that the products meet the criteria for assessment and verification of constancy of performance. Individual products or batches of products and their associated manufacturing details shall be fully identifiable and reproducible.

5.4. Control tests

5.4.1. Test programme. The test programme includes:

- a) ongoing tests,
- b) periodic tests.

5.4.2. Ongoing tests. Ongoing tests include checking:

- a) the shape and dimensions,
- b) the thickness of the zinc coating.

5.4.3. Periodic tests. Periodic tests include checking the characteristic resistance of the fasteners.

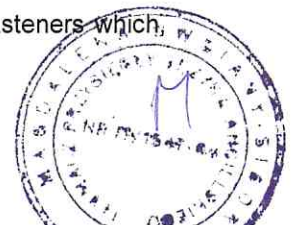
5.5. Testing frequency

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

Periodic tests should be performed at least once every three years.

6. DISCLAIMER

6.1. The National Technical Assessment ITB-KOT-2020/1115 1st edition is a positive assessment of the performance of those essential characteristics of ARVEX plastic and metal expansion fasteners which,



according to the intended use resulting from the provisions of the Assessment, affect the compliance of the construction works in which the product will be used with the basic requirements.

6.2. The National Technical Assessment ITB-KOT-2020/1115 1st edition is not a document authorising the marking of a construction product with a construction mark.

According to the Act on construction products of 16 April 2004 (Journal of Laws of 2004, item 215), products covered by this National Technical Assessment may be marketed or made available on the domestic market if the manufacturer has assessed and verified the constancy of performance, prepared a national declaration of performance in accordance with the National Technical Assessment ITB-KOT-2020/1115 1st edition and labelled the products with the construction mark, in accordance with the applicable regulations.

6.3. The National Technical Assessment ITB-KOT-2020/1115 1st edition does not infringe the rights arising from the provisions on industrial property protection, in particular the Act of 30 June 2000 – Industrial Property Law (Journal of Laws of 2017, item 776, as amended). It is the responsibility of the users of this ITB's National Technical Assessment to ensure these rights.

6.4. ITB, in issuing the National Technical Assessment, assumes no liability for possible 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 the construction contractors from the responsibility for their correct application.

6.6. The validity of the National Technical Assessment may be renewed for successive periods not exceeding 5 years.

7. LIST OF DOCUMENTS USED IN THE PROCEEDINGS

7.1. Reports, test reports, assessments, classifications

- 1) LZK01-01727/19/Z00NZK. Test report. ITB Building Structures, Geotechnics and Concrete Department, Katowice 2019.
- 2) LZK00-01727/19/Z00NZK. Test report. ITB Building Structures, Geotechnics and Concrete Department, Katowice 2019.
- 3) LOKOO-1263/13/Z00OSK. Test report and additional information on ARVEX plastic-metal fasteners. Department of Buildings and Structures Sited in Mining Areas, Katowice 2013.
- 4) LOK00-02544/13/Z00OSK. Test report and additional information on ARVEX plastic-metal fasteners. Department of Buildings and Structures Sited in Mining Areas, Katowice 2013.
- 5) DSC curve. Polyamide (PA6). 29.01.2020
- 6) DSC curve. Polypropylene (PP). 21.08.2019



7.2. Standards and related documents

PN-EN 22768-1:1999	<i>General tolerances. Tolerances for linear and angular dimensions without individual tolerance indications</i>
PN-EN ISO 11357-1:2016	<i>Plastics. Differential scanning calorimetry (DSC). Part 1: General principles</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 4042:2018	<i>Fasteners. Electroplated coating systems</i>
PN-EN 206+A1:2016	<i>Concrete. Specification, performance, production and conformity</i>
PN-EN 771-1+A1.-2015	<i>Specification for masonry units. Part 1: Clay masonry units</i>
PN-EN 771-4+A1:2015	<i>Specification for masonry units. Part 4: Autoclaved aerated concrete masonry units</i>
PN-EN ISO 12944-2:2018	<i>Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Part 2: Classification of environments</i>
PN-EN ISO 9223:2012	<i>Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, determination and estimation</i>
PN-EN ISO 2178:2016	<i>Non-magnetic coatings on magnetic substrates. Measurement of coating thickness. Magnetic method</i>
PN-EN ISO 2081:2018	<i>Metallic and other inorganic coatings. Electroplated coatings of zinc with supplementary treatments on iron or steel</i>
PN-EN ISO 3497:2004	<i>Metallic coatings. Measurement of coating thickness. X-ray spectrometric methods</i>
ETAG 020:2012	<i>Plastic fasteners for multiple use in concrete and masonry for non-structural applications</i>

APPENDICES

Appendix A. Shape and dimensions of the component parts of the expansion joints	9
Appendix B. Mounting and arrangement parameters for expansion joints	32
Appendix C. Characteristic resistance of anchorages for expansion fasteners.	34



Appendix A.

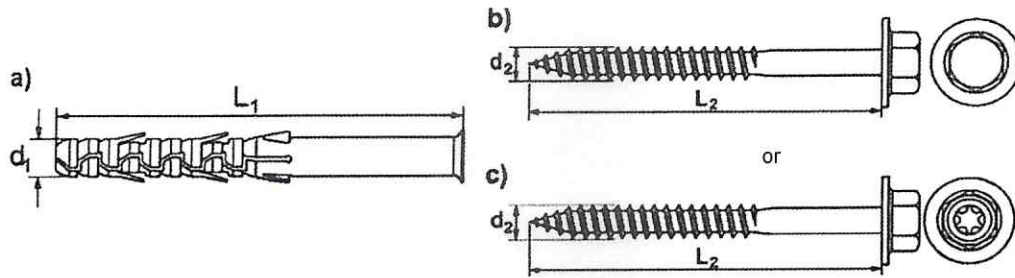


Figure A1. AC plastic and metal expansion fasteners
 a) KARL plastic sleeve, b) WSK steel core, c) WSKT steel core

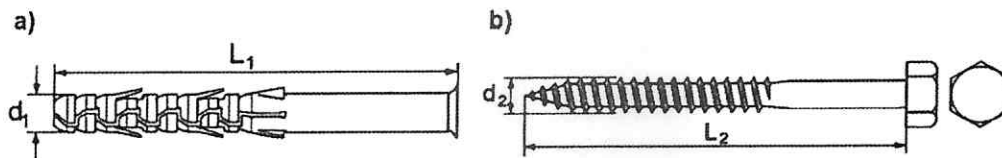


Figure A2. ARL plastic and metal expansion fastener
 a) KARL plastic sleeve, b) WS or WSR steel core

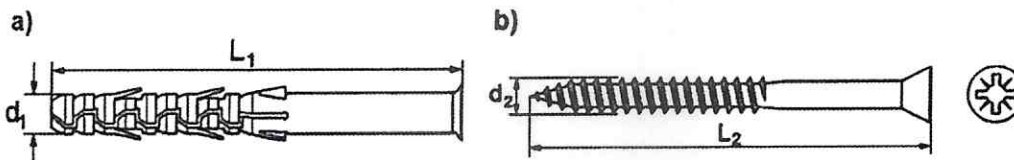


Figure A3. ASL plastic and metal expansion fastener
 a) KARL plastic sleeve, b) WASL steel core

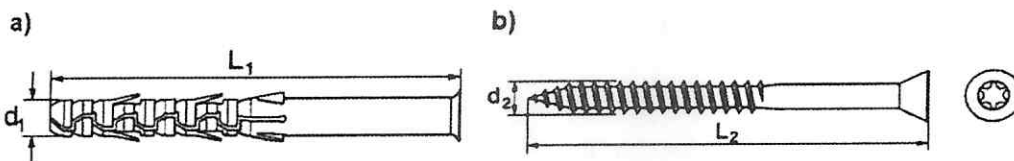


Figure A4. AST plastic and metal expansion fastener
 a) KARL plastic sleeve, b) WAST steel core

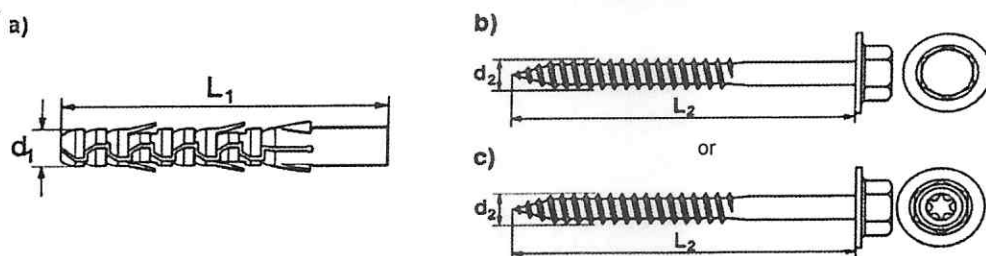
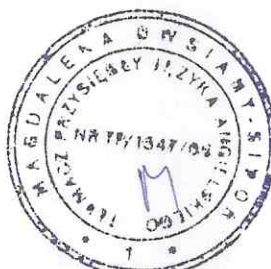


Figure A5. ALC plastic and metal expansion fastener
 a) AL plastic sleeve, b) WSK steel core, c) WSKT steel core



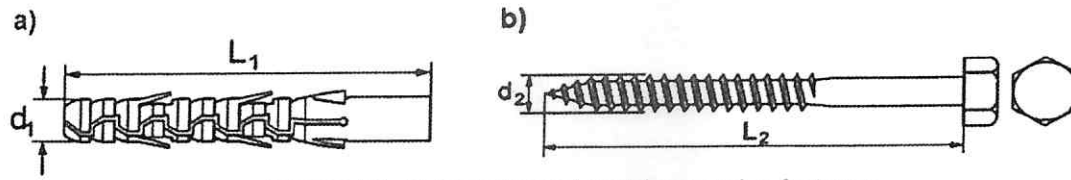


Figure A6. ALS plastic and metal expansion fastener
a) AL plastic sleeve, b) WS or WSR steel core

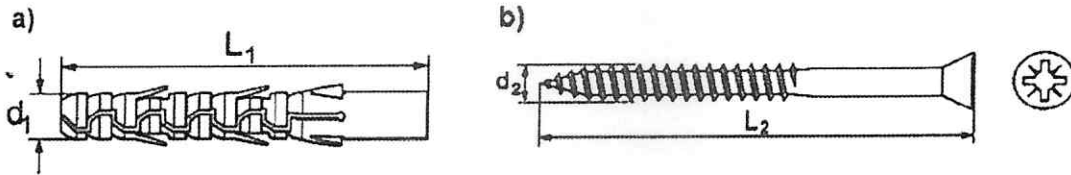


Figure A7. ALK plastic and metal expansion fastener
a) AL plastic sleeve, b) WKN/WKF/WASL steel core

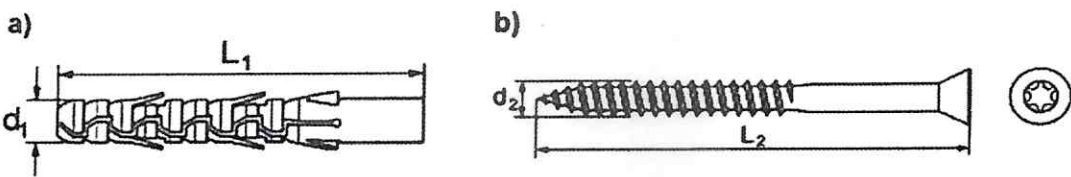


Figure A8. ALX plastic and metal expansion fastener
a) AL plastic sleeve, b) WT steel core

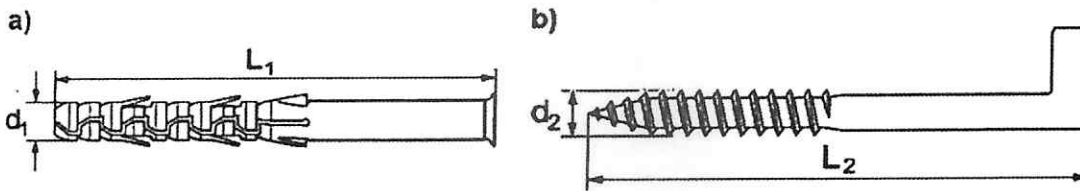


Figure A9. ARL HK plastic and metal expansion fastener
a) KARL plastic sleeve, b) HKR steel core

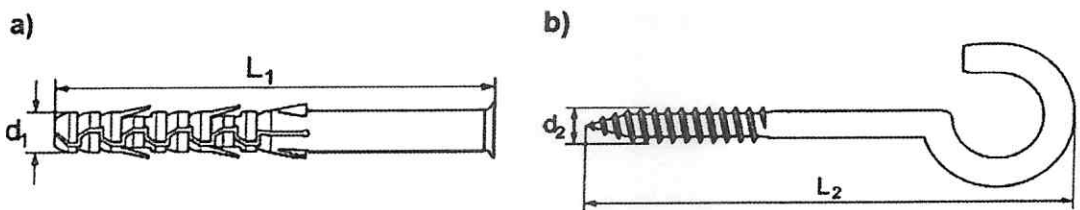


Figure A10. ARL HS plastic and metal expansion fastener
a) KARL plastic sleeve, b) HSR steel core

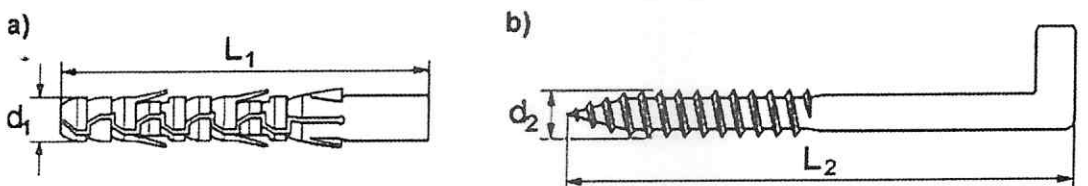
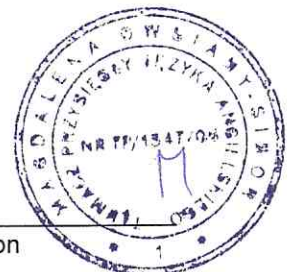


Figure A11. ALHK plastic and metal expansion fastener
a) AL plastic sleeve, b) HK steel core



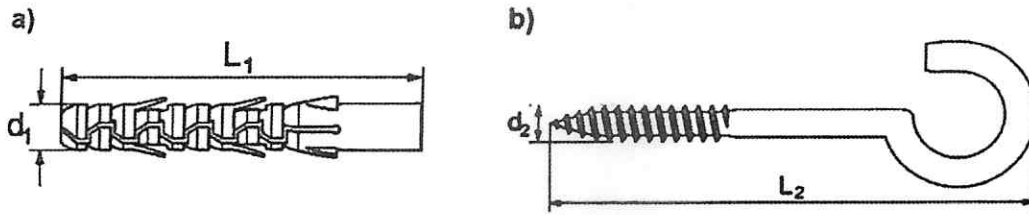


Figure A12. ALHS plastic and metal expansion fastener

a) AL plastic sleeve, b) HS steel core

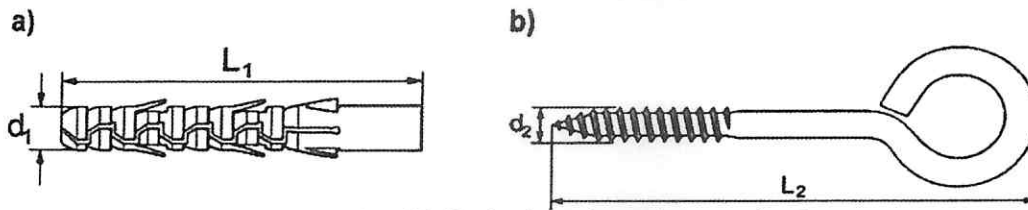


Figure A13. ALHO plastic and metal expansion fastener

a) AL plastic sleeve, b) HO steel core

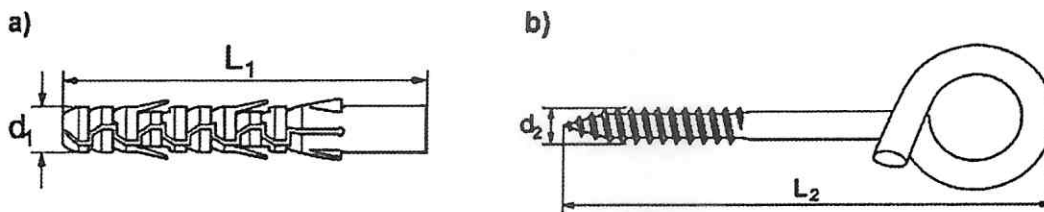


Figure A14. ALHZ plastic and metal expansion fastener

a) AL plastic sleeve, b) HZ steel core

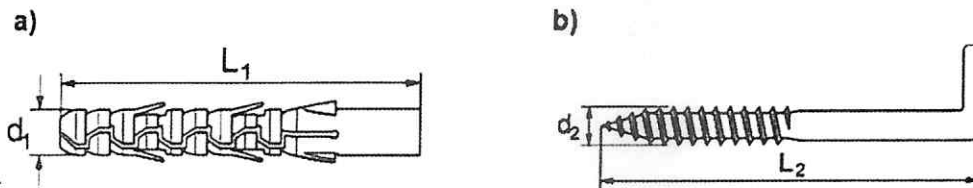


Figure A15. ALHB plastic and metal expansion fastener

a) AL plastic sleeve, b) HB steel core

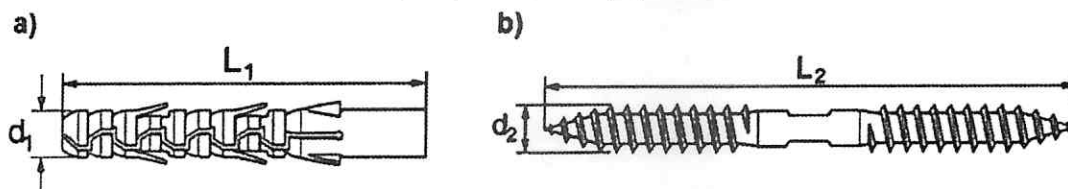


Figure A16. ALDD plastic and metal expansion fastener

a) AL plastic sleeve, b) SDD steel core

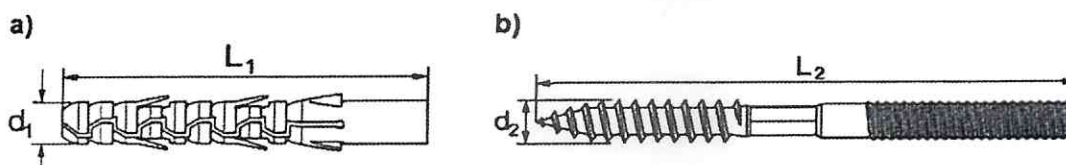
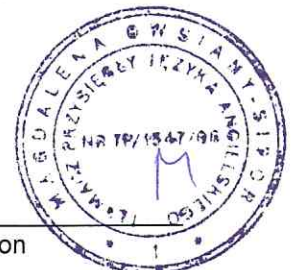


Figure A17. ALDG plastic and metal expansion fastener

a) AL plastic sleeve, b) SDG steel core



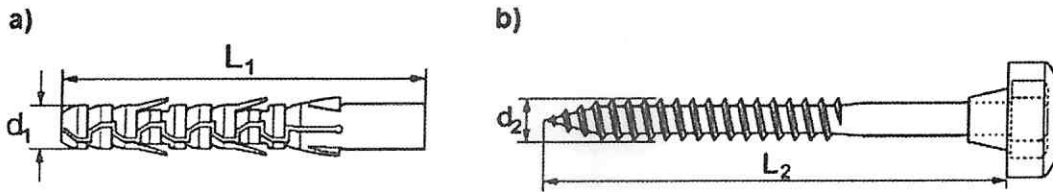


Figure A18. ALSA plastic and metal expansion fastener
a) AL plastic sleeve, b) WS steel core with EASA plastic masking cap

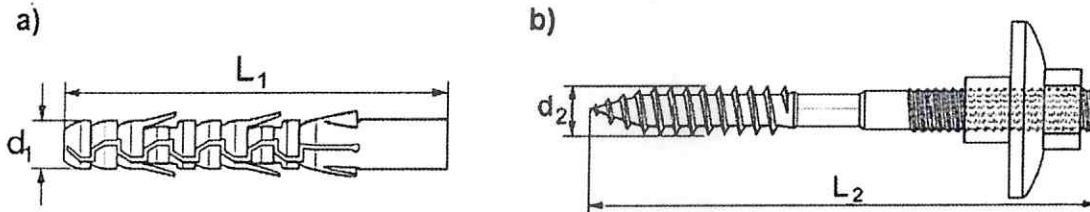


Figure A19. ALUM plastic and metal expansion fastener
a) KARL plastic sleeve, b) SDG steel core with N steel nut and EAUM plastic nut

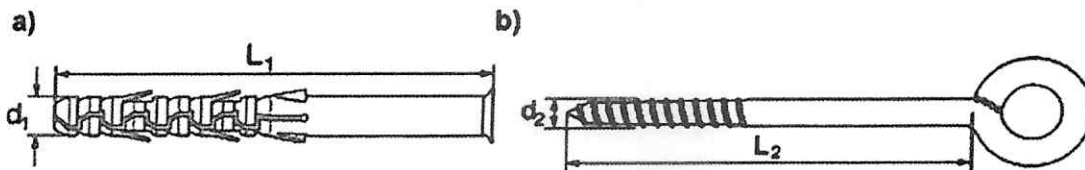


Figure A20. WRL plastic and metal expansion fastener
a) KARL plastic sleeve, b) WR steel core

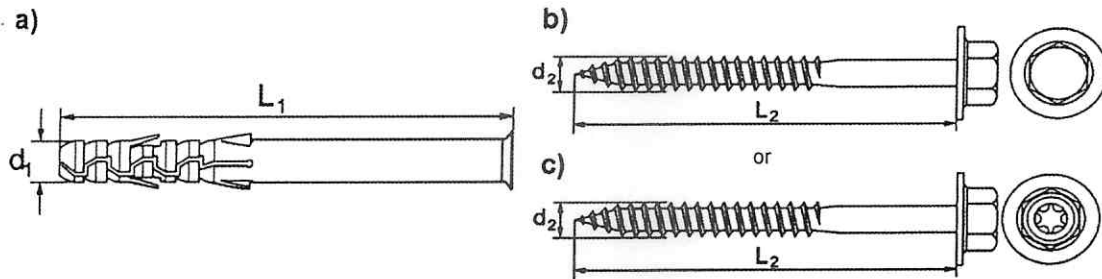


Figure A21. ACZ plastic and metal expansion fastener
a) KARS plastic sleeve, b) WSK steel core, c) WSKT steel core

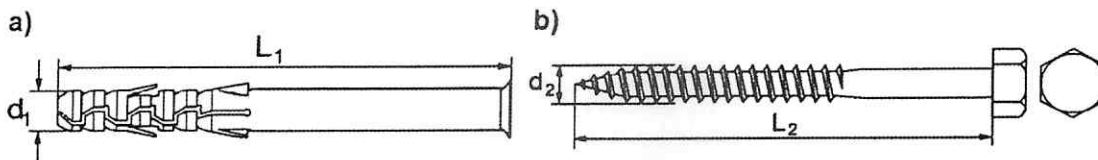


Figure A22. ARZ plastic and metal expansion fastener
a) KARS plastic sleeve, b) WSR or WS steel core

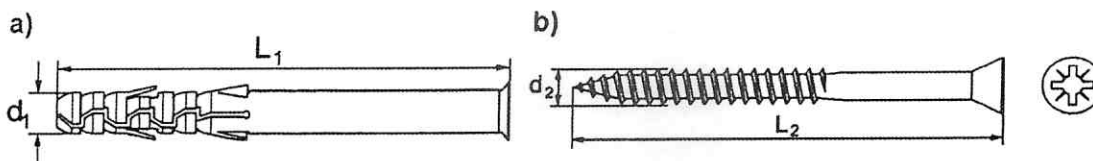
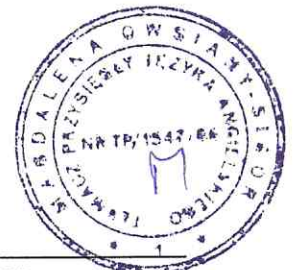


Figure A23. ARS plastic and metal expansion fastener
a) KARS plastic sleeve, b) WASL steel core



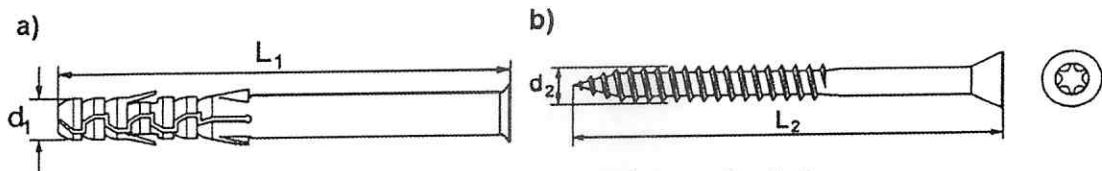


Figure A24. ART plastic and metal expansion fastener
 a) KARS plastic sleeve, b) WAST steel core

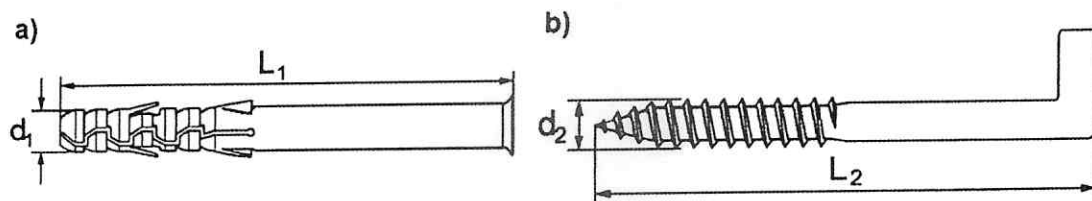


Figure A25. ARS HK plastic and metal expansion fastener
 a) KARS plastic sleeve, b) HKR steel core

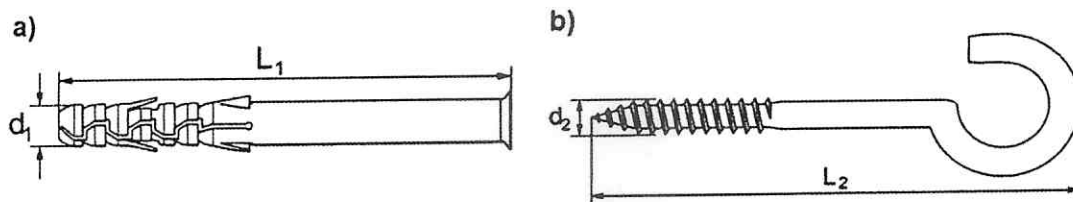


Figure A26. ARS HS plastic and metal expansion fastener
 a) KARS plastic sleeve, b) HSR steel core

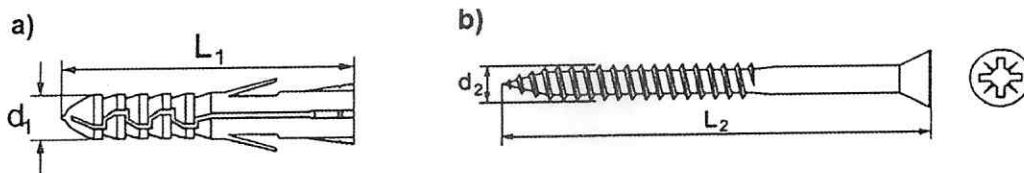


Figure A27. AK plastic and metal expansion fastener
 a) A plastic sleeve, b) WKN/WKF/WASL steel core

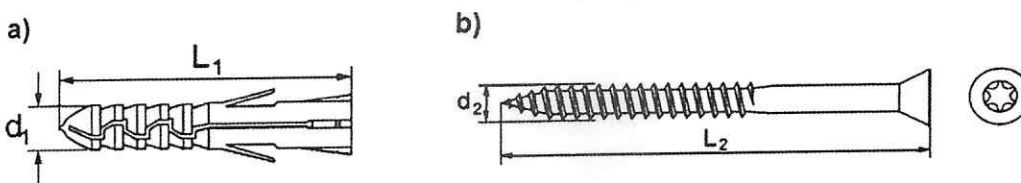


Figure A28. AX plastic and metal expansion fastener
 a) A plastic sleeve, b) WT steel core

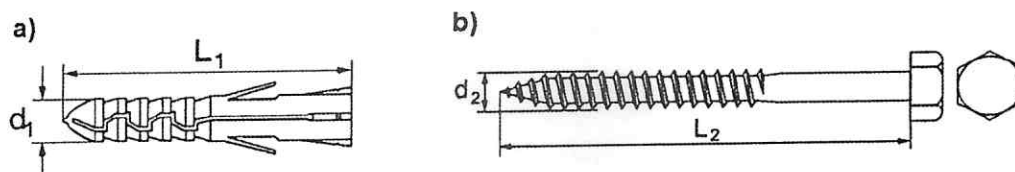


Figure A29. AS plastic and metal expansion fastener
 a) A plastic sleeve, b) WS steel core



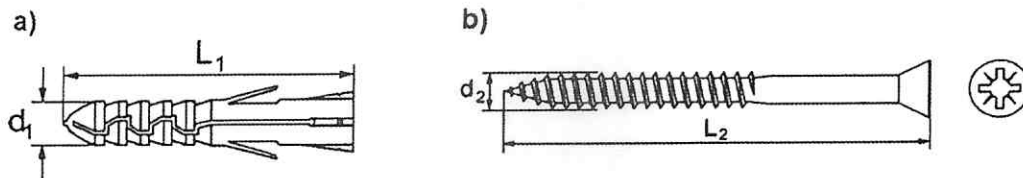


Figure A30. ATK plastic and metal expansion fastener
a) AT plastic sleeve, b) WKN/WKF/WASL steel core

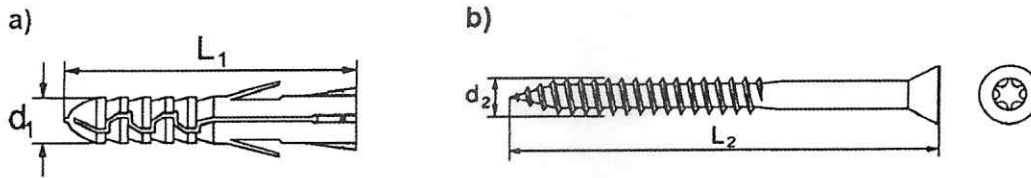


Figure A31. ATX plastic and metal expansion fastener
a) AT plastic sleeve, b) WT steel core

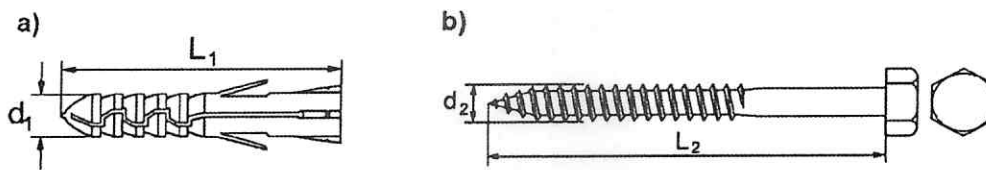


Figure A32. ATS plastic and metal expansion fastener
a) AT plastic sleeve, b) WS steel core

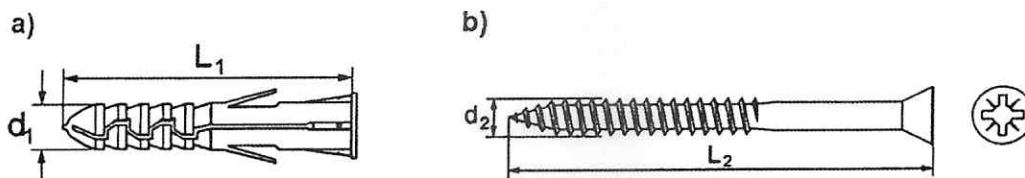


Figure A33. AGK plastic and metal expansion fastener
a) AG plastic sleeve, b) WKN/WKF/WASL steel core

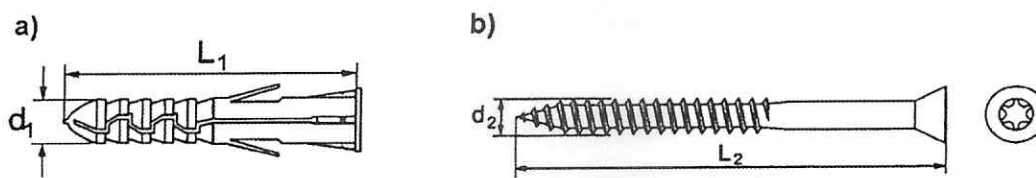


Figure A34. AGX plastic and metal expansion fastener
a) AG plastic sleeve, b) WT steel core

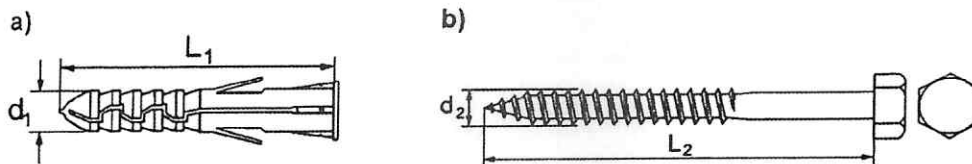


Figure A35. AGS plastic and metal expansion fastener
a) AG plastic sleeve, b) WS steel core



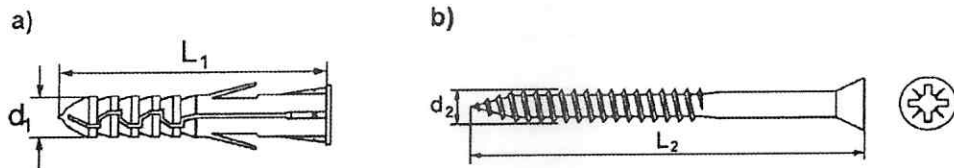


Figure A36. AGTK plastic and metal expansion fastener
 a) AGT plastic sleeve, b) WKN/WKF/WASL steel core

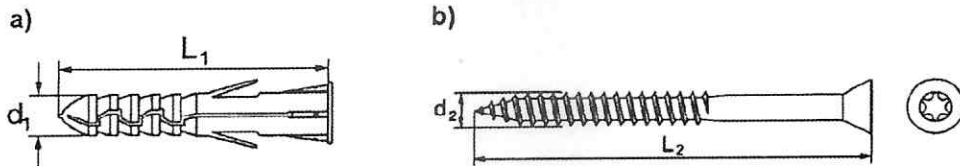


Figure A37. AGTX plastic and metal expansion fastener
 a) AGT plastic sleeve, b) WT steel core

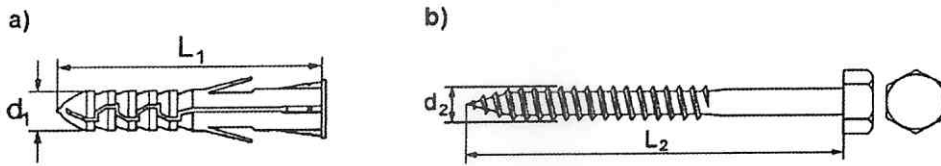


Figure A38. AGTS plastic and metal expansion fastener
 a) AGT plastic sleeve, b) WS steel core

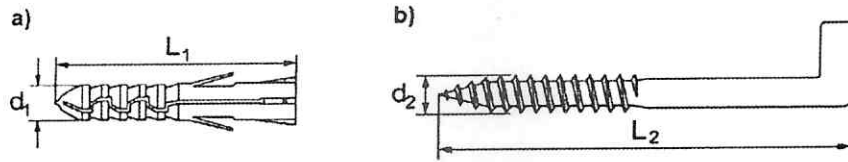


Figure A39. AHK plastic and metal expansion fastener
 a) A plastic sleeve, b) HK steel core

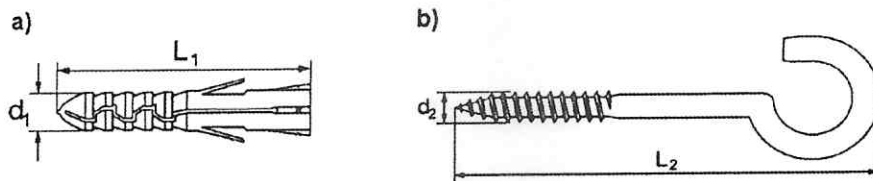


Figure A40. AHS plastic and metal expansion fastener
 a) A plastic sleeve, b) HS steel core

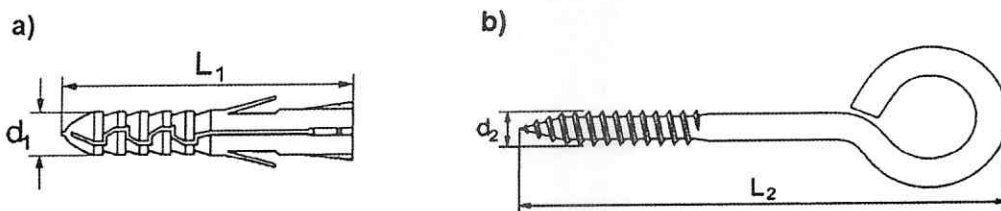
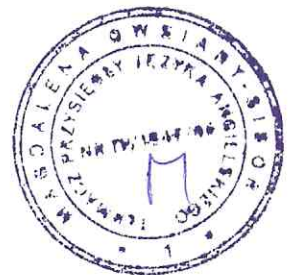


Figure A41. AHO plastic and metal expansion fastener
 a) A plastic sleeve, b) HO steel core



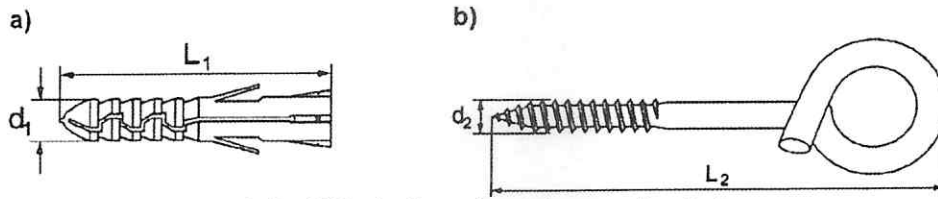


Figure A42. AHZ plastic and metal expansion fastener
a) A plastic sleeve, b) HZ steel core

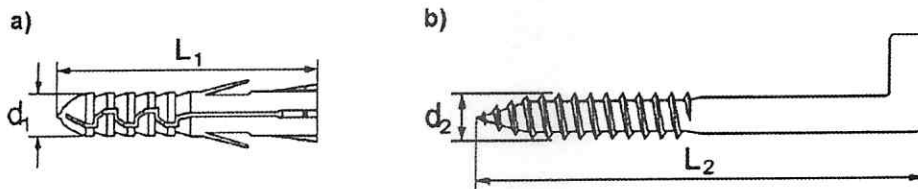


Figure A43. ATHK plastic and metal expansion fastener
a) AT plastic sleeve, b) HK steel core

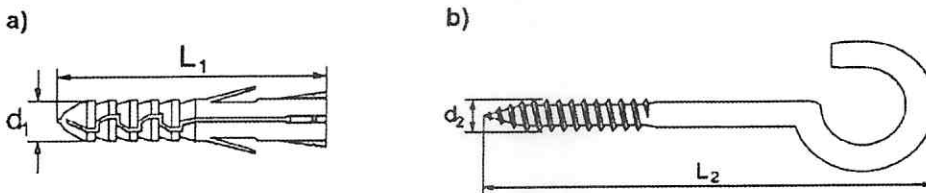


Figure A44. ATHS plastic and metal expansion fastener
a) AT plastic sleeve, b) HS steel core

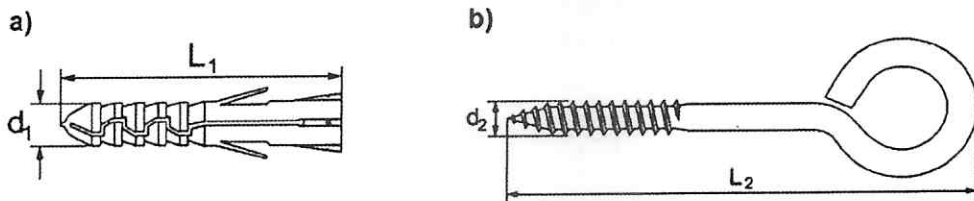


Figure A45. ATHO plastic and metal expansion fastener
a) AT plastic sleeve, b) HO steel core

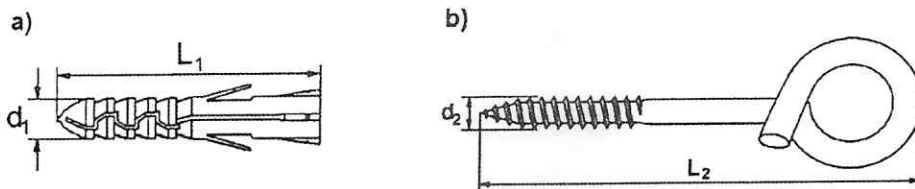


Figure A46. ATHZ plastic and metal expansion fastener
a) AT plastic sleeve, b) HZ steel core

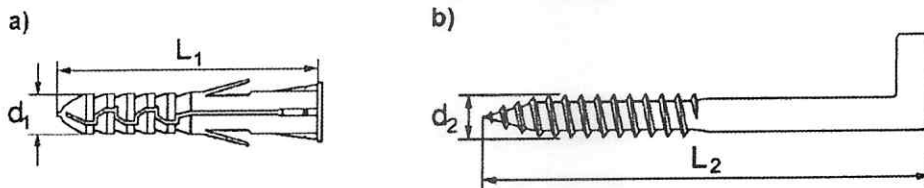
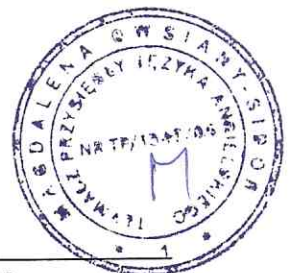


Figure A47. AGHK plastic and metal expansion fastener
a) AG plastic sleeve, b) HK steel core



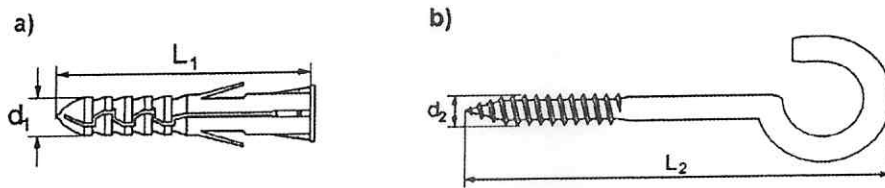


Figure A48. AGHS plastic and metal expansion fastener

a) AG plastic sleeve, b) HS steel core

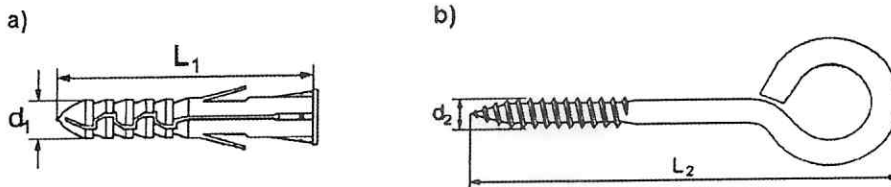


Figure A49. AGHO plastic and metal expansion fastener

a) AG plastic sleeve, b) HO steel core

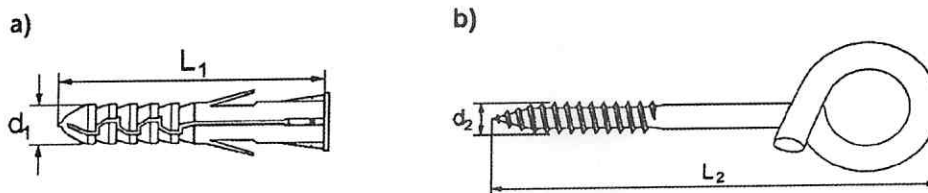


Figure A50. AGHZ plastic and metal expansion fastener

a) AG plastic sleeve, b) HZ steel core

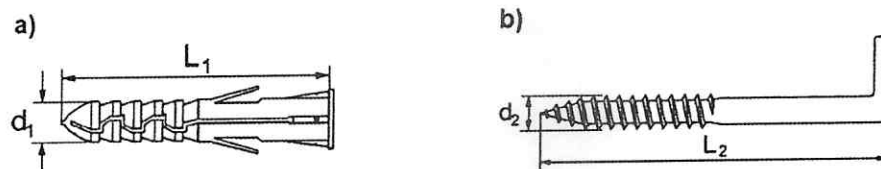


Figure A51. AHB plastic and metal expansion fastener

a) AG plastic sleeve, b) HB steel core

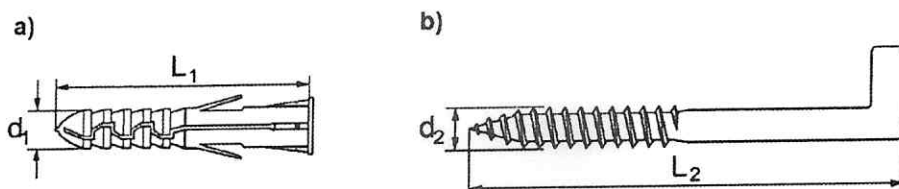


Figure A52. AGTHK plastic and metal expansion fastener

a) AGT plastic sleeve, b) HK steel core

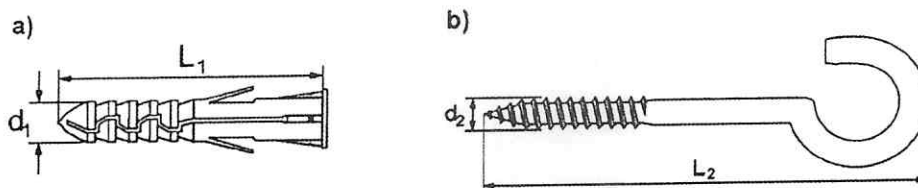
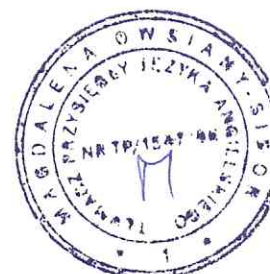


Figure A53. AGTHS plastic and metal expansion fastener

a) AGT plastic sleeve, b) HS steel core



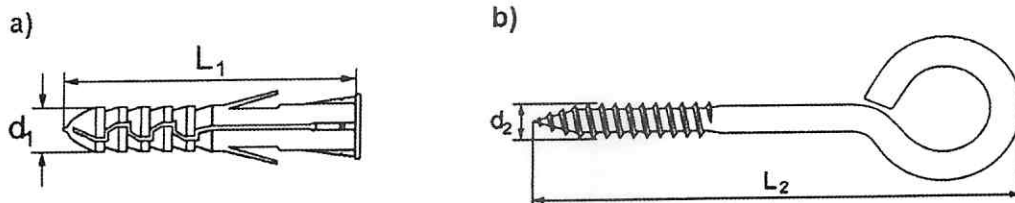


Figure A54. AGTHO plastic and metal expansion fastener
a) AGT plastic sleeve, b) HO steel core

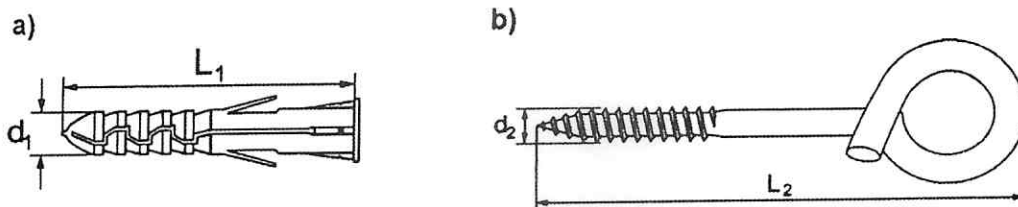


Figure A55. AGTHZ plastic and metal expansion fastener
a) AGT plastic sleeve, b) HZ steel core

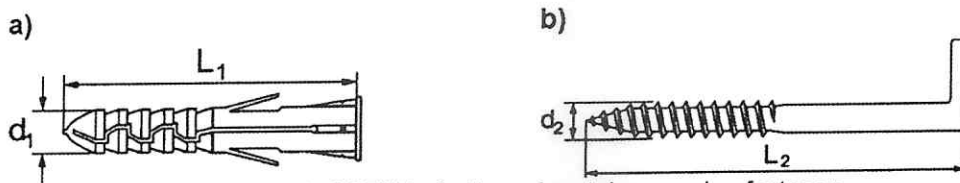


Figure A56. AGTHB plastic and metal expansion fastener
a) AGT plastic sleeve, b) HB steel core

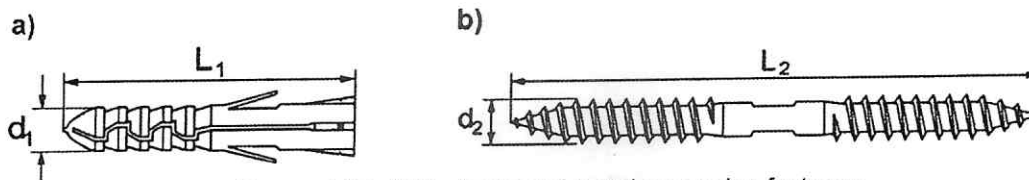


Figure A57. ADD plastic and metal expansion fastener
a) A plastic sleeve, b) SDD steel core

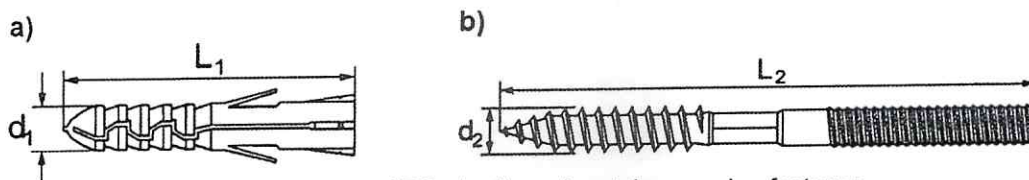


Figure A58. ADG plastic and metal expansion fastener
a) A plastic sleeve, b) SDG steel core

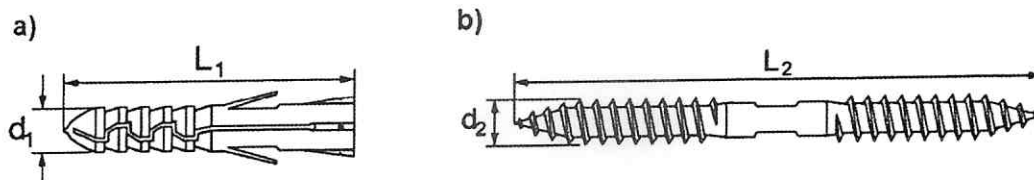
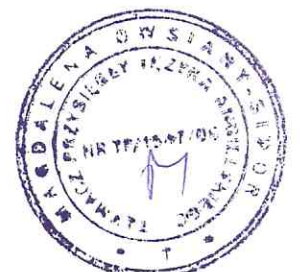
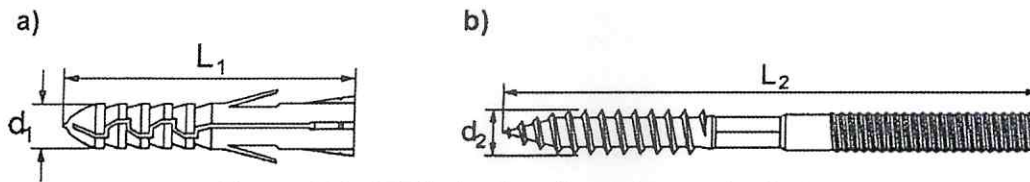
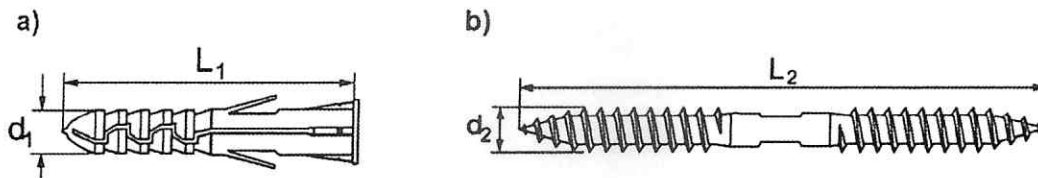


Figure A59. ATDD plastic and metal expansion fastener
a) AT plastic sleeve, b) SDD steel core

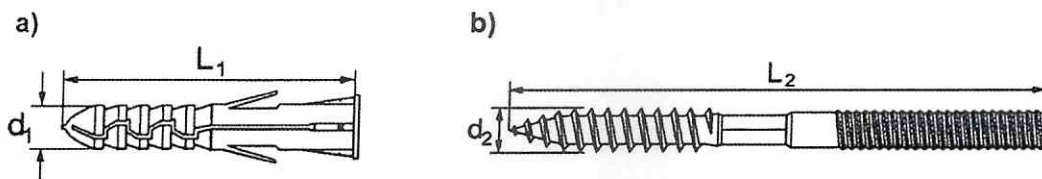



Figure A60. ATDG plastic and metal expansion fastener

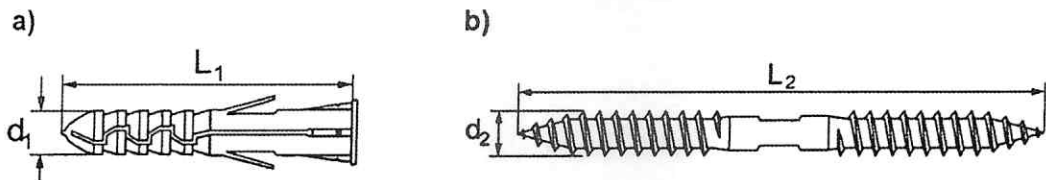
a) AT plastic sleeve, b) SDG steel core


Figure A61. AGDD plastic and metal expansion fastener

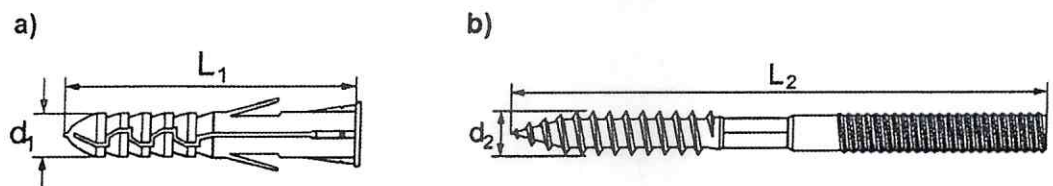
a) AG plastic sleeve, b) SDD steel core


Figure A62. AGDG plastic and metal expansion fastener

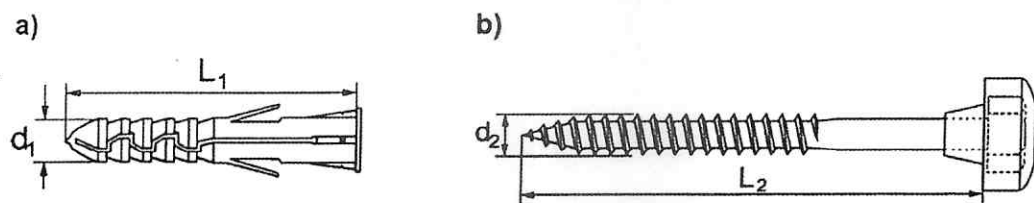
a) AG plastic sleeve, b) SDG steel core


Figure A63. AGTDD plastic and metal expansion fastener

a) AGT plastic sleeve, b) SDD steel core


Figure A64. AGTDG plastic and metal expansion fastener

a) AGT plastic sleeve, b) SDG steel core


Figure A65. ASA plastic and metal expansion fastener

a) AG plastic sleeve, b) WS steel core with EASA plastic masking cap



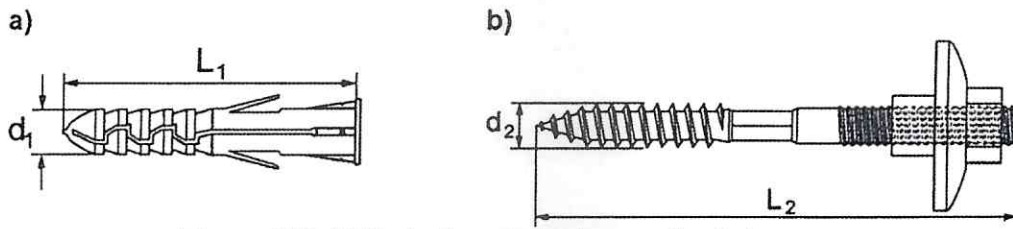


Figure A66. AUM plastic and metal expansion fastener
a) AG plastic sleeve, b) SDG steel core with N steel nut and EAUM plastic nut

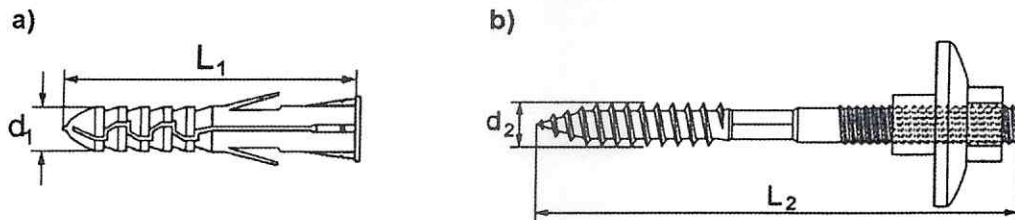


Figure A67. AGTUM plastic and metal expansion fastener
a) AGT plastic sleeve, b) SDG steel core with N steel nut and EAUM plastic nut

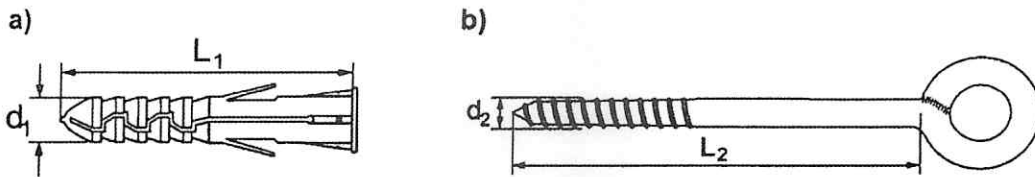


Figure A68. WRK plastic and metal expansion fastener
a) AG plastic sleeve, b) WR steel core



Table A1. Dimensions of AC, ARL, ASL and AST plastic and metal expansion fasteners

Item	Fastener designation				KARL fastener sleeve		WSK / WSKT/ WS / WSR / WASL / WAST core	
	AC (KARL + WSK / WSKT)	ARL (KARL + WS / WSR)	ASL (KARL + WASL)	AST (KARL + WAST)	d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	L ₂ [mm]
	2	3	4	5	6	7	8	9
1	AC 8/80	ARL 8/80	ASL 8/80	AST 8/80	8	80	5.5; 6.0	85
2	AC 8/100	ARL 8/100	ASL 8/100	AST 8/100	8	100	5.5; 6.0	105
3	AC 8/120	ARL 8/120	ASL 8/120	AST 8/120	8	120	5.5; 6.0	125
4	AC 8/140	ARL 8/140	ASL 8/140	AST 8/140	8	140	5.5; 6.0	140 - 145
5	AC 8/160	ARL 8/160	ASL 8/160	AST 8/160	8	160	5.5; 6.0	165
6	AC 10/80	ARL 10/80	ASL 10/80	AST 10/80	10	80	7.0	85
7	AC 10/100	ARL 10/100	ASL 10/100	AST 10/100	10	100	7.0	105
8	AC 10/115	ARL 10/115	ASL 10/115	AST 10/115	10	115	7.0	120 +125
9	AC 10/120	ARL 10/120	ASL 10/120	AST 10/120	10	120	7.0	120 - 125
10	AC 10/135	ARL 10/135	ASL 10/135	AST 10/135	10	135	7.0	140 - 145
11	AC 10/140	ARL 10/140	ASL 10/140	AST 10/140	10	140	7.0	140 - 145
12	AC 10/160	ARL 10/160	ASL 10/160	AST 10/160	10	160	7.0	165
13	AC 10/180	ARL 10/180	ASL 10/180	AST 10/180	10	180	7.0	185
14	AC 10/200	ARL 10/200	ASL 10/200	AST 10/200	10	200	7.0	205
15	AC 10/220	ARL 10/220	ASL 10/220	AST 10/220	10	220	7.0	225
16	AC 10/240	ARL 10/240	ASL 10/240	AST 10/240	10	240	7.0	245
17	AC 10/260	ARL 10/260	ASL 10/260	AST 10/260	10	260	7.0	265
18	AC 10/280	ARL 10/280	ASL 10/280	AST 10/280	10	280	7.0	285
19	AC 10/300	ARL 10/300	ASL 10/300	AST 10/300	10	300	7.0	305
20	AC 10/320	ARL 10/320	ASL 10/320	AST 10/320	10	320	7.0	325
21	AC 12/100	ARL 12/100	-	-	12	100	8.0; 9.0; 10.0	100 - 105
22	AC 12/120	ARL 12/120	-	-	12	120	8.0; 9.0; 10.0	120 - 125
23	AC 12/140	ARL 12/140	-	-	12	140	8.0; 9.0; 10.0	140 - 145
24	AC 12/160	ARL 12/160	-	-	12	160	8.0; 9.0; 10.0	160 - 165
25	AC 12/180	ARL 12/180	-	-	12	180	8.0; 9.0; 10.0	180 - 185
26	AC 12/200	ARL 12/200	-	-	12	200	8.0; 9.0; 10.0	200 - 205
27	AC 12/220	ARL 12/220	-	-	12	220	8.0; 9.0; 10.0	220 - 225
28	AC 12/240	ARL 12/240	-	-	12	240	8.0; 9.0; 10.0	240 - 245
29	AC 12/280	ARL 12/280	-	-	12	280	8.0; 9.0; 10.0	280 - 285
30	AC 12/300	ARL 12/300	-	-	12	300	8.0; 9.0; 10.0	300 - 305
31	AC 12/320	ARL 12/320	-	-	12	320	8.0; 9.0; 10.0	320 - 325
32	AC 12/360	ARL 12/360	-	-	12	360	8.0; 9.0; 10.0	360 - 365
33	AC 12/400	ARL 12/400	-	-	12	400	8.0; 9.0; 10.0	400 - 405
34	AC 14/100	ARL 14/100	-	-	14	100	10.0	100 - 105
35	AC 14/120	ARL 14/120	-	-	14	120	10.0	120 - 125
36	AC 14/140	ARL 14/140	-	-	14	140	10.0	140 - 145
37	AC 14/160	ARL 14/160	-	-	14	160	10.0	160 - 165
38	AC 14/180	ARL 14/180	-	-	14	180	10.0	180 - 185
39	AC 14/200	ARL 14/200	-	-	14	200	10.0	200 - 205
40	AC 14/220	ARL 14/220	-	-	14	220	10.0	220 - 225
41	AC 14/240	ARL 14/240	-	-	14	240	10.0	240 - 245
42	AC 14/280	ARL 14/280	-	-	14	280	10.0	280 - 285
43	AC 14/300	ARL 14/300	-	-	14	300	10.0	300 - 305
44	AC 14/320	ARL 14/320	-	-	14	320	10.0	320 - 325
45	AC 14/360	ARL 14/360	-	-	14	360	10.0	360 - 365
46	AC 14/400	ARL 14/400	-	-	14	400	10.0	400 - 405
47	AC 16/140	ARL 16/140	-	-	16	140	12.0	140 - 150
48	AC 16/160	ARL 16/160	-	-	16	160	12.0	160 - 170
49	AC 16/200	ARL 16/200	-	-	16	200	12.0	200 - 210
50	AC 16/240	ARL 16/240	-	-	16	240	12.0	240 - 250
51	AC 16/280	ARL 16/280	-	-	16	280	12.0	280 - 290
52	AC 16/300	ARL 16/300	-	-	16	300	12.0	300 - 310
53	AC 16/320	ARL 16/320	-	-	16	320	12.0	320 - 330
54	AC 16/340	ARL 16/340	-	-	16	340	12.0	340 - 350
55	AC 16/360	ARL 16/360	-	-	16	360	12.0	360 - 370
56	AC 16/400	ARL 16/400	-	-	16	400	12.0	400 - 410



Table A2. Dimensions of ALC, ALS, ALK and ALX plastic and metal expansion fasteners

Item	Fastener designation				AL fastener sleeve		WSK / WSKT / WS / WSR / WKN / WKF / WASL / WT steel core	
	ALC (AL + WSK/WSKT)	ALS (AL + WS/WSR)	ALK (AL + WKN/WKF/WASL)	ALX (AL + WT)	d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	L ₂ [mm]
1	2	3	4	5	6	7	8	9
1	-	-	ALK 6/60	ALX 6/60	6	55	4.0	60
2	-	-	ALK 6/70	ALX 6/70	6	55	4.0	70
3	-	-	ALK 6/80	ALX 6/80	6	55	4.0	80
4	-	-	ALK 8/70	ALX 8/70	8	65	5.0; 5.5; 6.0	70
5	ALC 8/80	ALS 8/80	ALK 8/80	ALX 8/80	8	65	5.0; 5.5; 6.0	80 - 85
6	-	-	ALK 8/90	ALX 8/90	8	65	5.0; 5.5; 6.0	90
7	ALC 8/100	ALS 8/100	ALK 8/100	ALX 8/100	8	65	5.0; 5.5; 6.0	100-105
8	ALC 8/120	ALS 8/120	ALK 8/120	ALX 8/120	8	65	5.0; 5.5; 6.0	120 - 125
9	ALC 8/80/120	ALS 8/80/120	ALK 8/80/120	ALX 8/80/120	8	80	5.0; 5.5; 6.0	120 - 125
10	ALC 10/80	ALS 10/80	ALK 10/80	ALX 10/80	10	80	6.0; 7.0	80 - 85
11	ALC 10/100	ALS 10/100	ALK 10/100	ALX 10/100	10	80	6.0; 7.0	100 - 105
12	ALC 10/120	ALS 10/120	ALK 10/120	ALX 10/120	10	80	6.0; 7.0	120
13	ALC 10/130	ALS 10/130	ALK 10/130	ALX 10/130	10	80	6.0; 7.0	130
14	ALC 10/140	ALS 10/140	ALK 10/140	ALX 10/140	10	80	6.0; 7.0	140
15	ALC 10/160	ALS 10/160	ALK 10/160	ALX 10/160	10	80	6.0; 7.0	160 - 165
16	ALC 12/100	ALS 12/100	-	-	12	95	8.0; 9.0; 10.0	100 - 105
17	ALC 12/120	ALS 12/120	-	-	12	95	8.0; 9.0; 10.0	120 - 125
18	ALC 12/140	ALS 12/140	-	-	12	95	8.0; 9.0; 10.0	140 - 145
19	ALC 12/160	ALS 12/160	-	-	12	95	8.0; 9.0; 10.0	160 - 165
20	ALC 12/200	ALS 12/200	-	-	12	95	8.0; 9.0; 10.0	200 - 205
21	ALC 14/100	ALS 14/100	-	-	14	100	10.0	100 - 105
22	ALC 14/120	ALS 14/120	-	-	14	100	10.0	120 - 125
23	ALC 14/140	ALS 14/140	-	-	14	100	10.0	140 - 145
24	ALC 14/160	ALS 14/160	-	-	14	100	10.0	160 - 165
25	ALC 14/180	ALS 14/180	-	-	14	100	10.0	180 - 185
26	ALC 14/200	ALS 14/200	-	-	14	100	10.0	200 - 205
27	ALC 16/140	ALS 16/140	-	-	16	140	12.0	140 - 150
28	ALC 16/160	ALS 16/160	-	-	16	140	12.0	160 - 170
29	ALC 16/200	ALS 16/200	-	-	16	140	12.0	200 - 210
30	ALC 16/240	ALS 16/240	-	-	16	140	12.0	240 - 250

Table A3. Dimensions of ARL HK and ARL HS plastic and metal expansion fasteners

Item	Fastener designation		KARL fastener sleeve			HKR / HSR steel core	
	ARL HK (KARL + HKR)	ARL HS (KARL + HSR)	d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	angle hook L ₂ [mm]	ceiling hook L ₂ [mm]
1	2	3	4	5	6	7	8
1	ARL HK 8/80	ARL HS 8/80	8	80	5.5	95	120
2	ARL HK 8/100	ARL HS 8/100	8	100	5.5	115	140
3	ARL HK 8/120	ARL HS 8/120	8	120	5.5	135	160
4	ARL HK 8/140	ARL HS 8/140	8	140	5.5	155	180
5	ARL HK 8/160	ARL HS 8/160	8	160	5.5	175	200
6	ARL HK 10/80	ARL HS 10/80	10	80	7.0	95	120
7	ARL HK 10/100	ARL HS 10/100	10	100	7.0	115	140
8	ARL HK 10/115	ARL HS 10/115	10	115	7.0	130 - 135	155 - 160
9	ARL HK 10/120	ARL HS 10/120	10	120	7.0	130 - 135	155 - 160
10	ARL HK 10/135	ARL HS 10/135	10	135	7.0	150 - 155	175 - 180
11	ARL HK 10/140	ARL HS 10/140	10	140	7.0	150 - 155	175 - 180
12	ARL HK 10/160	ARL HS 10/160	10	160	7.0	175	200
13	ARL HK 10/200	ARL HS 10/200	10	200	7.0	215	240



Table A4. Dimensions of plastic and metal expansion fasteners ALHS, ALHO, ALHZ and ALHB

Item	Fastener designation					AL fastener sleeve		HK, HS, HO, HZ and HB steel core		
	ALHK (AL + HK)	ALHS (AL + HS)	ALHO (AL + HO)	ALHZ (AL + HZ)	ALHB (AL + HB)	d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	angle hook / boiler hook	ceiling hook / eye hook / pigtail hook
									L ₂ [mm]	L ₂ [mm]
1	2	3	4	5	6	7	8	9	10	11
1	ALHK 6	ALHS 6	-	-	-	6	55	4.0	70	80
2	ALHK 8	ALHS 8	-	-	-	8	65	5.0	80	100
3	ALHK 10	ALHS 10	-	ALHZ 10	-	10	80	6.0	100	110
4	ALHK 12	ALHS 12	-	ALHZ 12	ALHB 12	12	95	8.0	120	130
5	ALHK 12	ALHS 12	ALHO 12	ALHZ 12	ALHB 12	12	95	10.0	120	130

Table A5. Dimensions of ALDD and ALDG plastic and metal expansion fasteners

Item	Designation of ALDG (AL + SDG) ALDD (AL + SDD) fastener	AL fastener sleeve		SDG and SDD steel core	
		d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	L ₂ [mm]
1	2	3	4	5	6
1	ALDG 10/100	10	80	6.0	100
2	ALDG 10/120	10	80	6.0	120
3	ALDD 12/120 ALDG 12/120	12	95	8.0	120
4	ALDG 12/140	12	95	8.0	140
5	ALDG 12/150	12	95	8.0	150
6	ALDG 12/160	12	95	8.0	160
7	ALDD 14/120 ALDG 14/120	14	100	10.0	120
8	ALDG 14/140	14	100	10.0	140
9	ALDG 14/160	14	100	10.0	160
10	ALDG 16/160	16	140	12.0	160
11	ALDG 16/180	16	140	12.0	180
12	ALDG 16/200	16	140	12.0	200

Table A6. Dimensions of WRL plastic and metal expansion fasteners

Item	Designation of WRL (KARL + WR) fastener	KARL fastener sleeve		WR steel core	
		d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	L ₂ [mm]
1	2	3	4	5	6
1	WRL 16/160	16	140	12.0	160
2	WRL 16/190	16	140	12.0	190
3	WRL 16/230	16	140	12.0	230
4	WRL 16/260	16	140	12.0	260
5	WRL 16/280	16	140	12.0	280
6	WRL 16/300	16	140	12.0	300
7	WRL 16/320	16	140	12.0	320
8	WRL 16/350	16	140	12.0	350
9	WRL 16/400	16	140	12.0	400
10	WRL 16/450	16	140	12.0	450
11	WRL 16/500	16	140	12.0	500

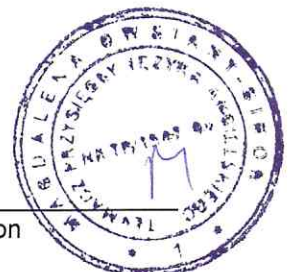


Table A7. Dimensions of ALSA plastic and metal expansion fasteners

Item	Fastener designation ALSA (AL + WS + EASA)	AL fastener sleeve		WS steel core	
		d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	L ₂ [mm]
1	2	3	4	5	6
1	ALSA 8/100	8	65	5.5; 6.0	100

Table A8. Dimensions of ALUM plastic and metal expansion fasteners

Item	Fastener designation (KARL+ SDG + N+ EAUM)	KARL fastener sleeve		SDG steel core	
		d ₁ [mm]	L ₁ [mm]	d ₂ [mm]	L ₂ [mm]
1	2	3	4	5	6
1	ALUM 12/150	12	100	8.0	150

Table A9. Dimensions of plastic and metal expansion fasteners ACZ, ARZ, ARS and ART

Item	Fastener designation				KARS fastener sleeve		WSK / WSKT / WSR / WS / WASL / WAST expansion core	
	ACZ (KARS + WSK/WSKT)	ARZ (KARS + WSR/WS)	ARS (KARS + WASL)	ART (KARS + WAST)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
1	2	3	4	5	6	7	8	9
1	ACZ 8/60	ARZ 8/60	ARS 8/60	ART 8/60	8	60	5.5	65
2	ACZ 8/80	ARZ 8/80	ARS 8/80	ART 8/80	8	80	5.5	85
3	ACZ 8/100	ARZ 8/100	ARS 8/100	ART 8/100	8	100	5.5	105
4	ACZ 8/120	ARZ 8/120	ARS 8/120	ART 8/120	8	120	5.5	125
5	ACZ 8/135	ARZ 8/135	ARS 8/135	ART 8/135	8	135	5.5	140 - 145
6	ACZ 8/140	ARZ 8/140	ARS 8/140	ART 8/140	8	140	5.5	140 - 145
7	ACZ 8/160	ARZ 8/160	ARS 8/160	ART 8/160	8	160	5.5	165
8	ACZ 10/60	ARZ 10/60	ARS 10/60	ART 10/60	10	60	7.0	65
9	ACZ 10/70	ARZ 10/70	ARS 10/70	ART 10/70	10	70	7.0	75
10	ACZ 10/80	ARZ 10/80	ARS 10/80	ART 10/80	10	80	7.0	85
11	ACZ 10/100	ARZ 10/100	ARS 10/100	ART 10/100	10	100	7.0	105
12	ACZ 10/120	ARZ 10/120	ARS 10/120	ART 10/120	10	120	7.0	120 - 125
13	ACZ 10/140	ARZ 10/140	ARS 10/140	ART 10/140	10	140	7.0	140 - 145
14	ACZ 10/160	ARZ 10/160	ARS 10/160	ART 10/160	10	160	7.0	165
15	ACZ 10/200	ARZ 10/200	ARS 10/200	ART 10/200	10	200	7.0	205
16	ACZ 10/240	ARZ 10/240	ARS 10/240	ART 10/240	10	240	7.0	245
17	ACZ 10/260	ARZ 10/260	ARS 10/260	ART 10/260	10	260	7.0	265
18	ACZ 10/280	ARZ 10/280	ARS 10/280	ART 10/280	10	280	7.0	285
19	ACZ 10/300	ARZ 10/300	ARS 10/300	ART 10/300	10	300	7.0	305
20	ACZ 10/320	ARZ 10/320	ARS 10/320	ART 10/320	10	320	7.0	325
21	ACZ 14/100	ARZ 14/100	-	-	14	100	10.0	100
22	ACZ 14/120	ARZ 14/120	-	-	14	120	10.0	120
23	ACZ 14/140	ARZ 14/140	-	-	14	140	10.0	140
24	ACZ 14/160	ARZ 14/160	-	-	14	160	10.0	160
25	ACZ 14/180	ARZ 14/180	-	-	14	180	10.0	180
26	ACZ 14/200	ARZ 14/200	-	-	14	200	10.0	200
27	ACZ 14/240	ARZ 14/240	-	-	14	240	10.0	240
28	ACZ 14/260	ARZ 14/260	-	-	14	260	10.0	260
29	ACZ 14/280	ARZ 14/280	-	-	14	280	10.0	280
30	ACZ 14/320	ARZ 14/320	-	-	14	320	10.0	320
31	ACZ 14/360	ARZ 14/360	-	-	14	360	10.0	360

Table A10. Dimensions of ARS HK and ARS HS plastic and metal expansion fasteners

Item	Fastener designation		KARS fastener sleeve		HKR / HSR expansion core		
	ARS HK (KARS + HKR)	ARS HS (KARS + HSR)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	angle hook, L ₂ mm	ceiling hook, L ₂ , mm
1	2	3	4	5	6	7	8
1	ARS HK 8/80	ARS HS 8/80	8	80	5.5	95	120
2	ARS HK 8/100	ARS HS 8/100	8	100	5.5	115	140
3	ARS HK 8/120	ARS HS 8/120	8	120	5.5	130	160
4	ARS HK 8/135	ARS HS 8/135	8	135	5.5	150	180
5	ARS HK 8/140	ARS HS 8/140	8	140	5.5	155	180
6	ARS HK 8/160	ARS HS 8/160	8	160	5.5	175	200
7	ARS HK 10/80	ARS HS 10/80	10	80	7.0	95	120
8	ARS HK 10/100	ARS HS 10/100	10	100	7.0	115	140
9	ARS HK 10/120	ARS HS 10/120	10	120	7.0	130 - 135	155 - 160
10	ARS HK 10/140	ARS HS 10/140	10	140	7.0	150 - 155	175 - 180
11	ARS HK 10/160	ARS HS 10/160	10	160	7.0	175	200
12	ARS HK 10/200	ARS HS 10/200	10	200	7.0	215	240



Table A11. Dimensions of AK, ATK, AGK, AGTK, AX, ATX, AGX, AGTX, AS, ATS, AGS and AGTS plastic and metal expansion fasteners

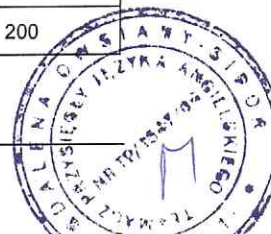
Item	Fastener designation			A/AT/AGT/AG fastener sleeve		WKF / WASL / WT / WASL / WS expansion core	
	AK (A + WKN/WKF/WASL) ATK (AT + WKN/WKF/WASL) AGK (AG + WKN/WKF/WASL) AGTK (AGT + WKN/WKF/WASL)	AX (A + WT) ATX (AT + WT) AGX (AG + WT) AGTX (AGT + WT)	AS (A + WS) ATS (AT + WS) AGS (AG + WS) AGTS (AGT + WS)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
1	2	3	4	5	6	7	8
1	AK 5/30 AGK 5/30	AX5/30 AGX 5/30	-	5	25	3.0	30
2	AK 5/40 AGK 5/40	AX 5/40 AGX 5/40	-	5	25	3.0	40
3	AK 6/30 ATK 6/30 AGK 6/30 AGTK 6/30	AX6/30 ATX 6/30 AGX 6/30 AGTX 6/30	-	6	30	4.0	30
4	AK 6/35 ATK 6/35 AGK 6/35 AGTK 6/35	AX6/35 ATX 6/35 AGX 6/35 AGTX 6/35	-	6	30	4.0	35
5	AK 6/40 ATK 6/40 AGK 6/40 AGTK 6/40	AX6/40 ATX 6/40 AGX 6/40 AGTX 6/40	-	6	30	4.0	40
6	AK 6/50 ATK 6/50 AGK 6/50 AGTK 6/50	AX 6/50 ATX 6/50 AGX 6/50 AGTX 6/50	-	6	30	4.0	50
7	AK 6/60 ATK 6/60 AGK 6/60 AGTK 6/60	AX 6/60 ATX 6/60 AGX 6/60 AGTX 6/60	-	6	30	4.0	60
8	AK 6/70 ATK 6/70 AGK 6/70 AGTK 6/70	AX 6/70 ATX 6/70 AGX 6/70 AGTX 6/70	-	6	30	4.0	70
9	AK 8/40 ATK 8/40 AGK 8/40 AGTK 8/40	AX 8/40 ATX 8/40 AGX 8/40 AGTX 8/40	-	8	40	5.0	40
10	AK 8/40 AGK 8/40	AX 8/40 AGX 8/40	-	8	40	5.5	40
11	AK 8/45 ATK 8/45 AGK 8/45 AGTK 8/45	AX 8/45 ATX 8/45 AGX 8/45 AGTX 8/45	-	8	40	5.0	45
12	AK 8/45 AGK 8/45	AX 8/45 AGX 8/45	-	8	40	5.5	45
13	AK 8/50 ATK 8/50 AGK 8/50 AGTK 8/50	AX 8/50 ATX 8/50 AGX 8/50 AGTX 8/50	-	8	40	5.0	50
14	AK 8/50 AGK 8/50	AX 8/50 AGX 8/50	-	8	40	5.5	50
15	AK 8/60 ATK 8/60 AGK 8/60 AGTK 8/60	AX 8/60 ATX 8/60 AGX 8/60 AGTX 8/60	AS 8/60 ATS 8/60 AGS 8/60 AGTS 8/60	8	40	5.0	60 - 65
16	AK 8/60 AGK 8/60	AX 8/60 AGX 8/60	AS 8/60 AGS 8/60	8	40	5.5	60 - 65
17	AK 8/70 ATK 8/70 AGK 8/70 AGTK 8/70	AX 8/70 ATX 8/70 AGX 8/70 AGTX 8/70	-	8	40	5.0	70 - 75
18	AK 8/70 AGK 8/70	AX 8/70 AGX 8/70	-	8	40	5.5	70 - 75
19	AK 8/80 ATK 8/80	AX 8/80 ATX 8/80	AS 8/85 ATS 8/85	8	40	5.0	80 - 85



Item	Fastener designation			A/AT/AGT/AG fastener sleeve		WKF / WASL / WT / WASL / WS expansion core	
	AK (A + WKN/WKF/WASL) ATK (AT + WKN/WKF/WASL) AGK (AG + WKN/WKF/WASL) AGTK (AGT + WKN/WKF/WASL)	AX (A + WT) ATX (AT + WT) AGX (AG + WT) AGTX (AGT + WT)	AS (A + WS) ATS (AT + WS) AGS (AG + WS) AGTS (AGT + WS)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
	AGK 8/80 AGTK 8/80	AGX 8/80 AGTX 8/80	AGS 8/85 AGTS 8/85				
20	AK 8/80 AGK 8/80	AX8/80 AGX 8/80	AS 8/85 AGS 8/85	8	40	5.5	80 - 85
21	AK 8/100 ATK 8/100 AGK 8/100 AGTK 8/100	AX 8/100 ATX 8/100 AGX 8/100 AGTX 8/100	AS 8/105 ATS 8/105 AGS 8/105 AGTS 8/105	8	40	5.0	100 - 105
22	AK 8/100 AGK 8/100	AX 8/100 AGX 8/100	AS 8/105 AGS 8/105	8	40	5.5	100 - 105
23	AK 8/120 ATK 8/120 AGK 8/120 AGTK 8/120	AX 8/120 ATX 8/120 AGX 8/120 AGTX 8/120	AS 8/125 ATS 8/125 AGS 8/125 AGTS 8/125	8	40	5.0	120 - 125
24	AK 8/120 AGK 8/120	AX 8/120 AGX 8/120	AS 8/125 AGS 8/125	8	40	5.5	120 - 125
25	AK 10/50 ATK 10/50 AGK 10/50 AGTK 10/50	AX 10/50 ATX 10/50 AGX 10/50 AGTX 10/50	AS 10/50 ATS 10/50 AGS 10/50 AGTS 10/50	10	50	6.0	50 - 55
26	AK 10/50 AGK 10/50	AX 10/50 AGX 10/50	AS 10/50 AGS 10/50	10	50	7.0	50 - 55
27	AK 10/60 ATK 10/60 AGK 10/60 AGTK 10/60	AX 10/60 ATX 10/60 AGX 10/60 AGTX 10/60	AS 10/60 ATS 10/60 AGS 10/60 AGTS 10/60	10	50	6.0	60 - 65
28	AK 10/60 AGK 10/60	AX 10/60 AGX 10/60	AS 10/60 AGS 10/60	10	50	7.0	60 - 65
29	AK 10/70 ATK 10/70 AGK 10/70 AGTK 10/70	AX 10/70 ATX 10/70 AGX 10/70 AGTX 10/70	AS 10/70 ATS 10/70 AGS 10/70 AGTS 10/70	10	50	6.0	70 - 75
30	AK 10/70 AGK 10/70	AX 10/70 AGX 10/70	AS 10/70 AGS 10/70	10	50	7.0	70 - 75
31	AK 10/80 ATK 10/80 AGK 10/80 AGTK 10/80	AX 10/80 ATX 10/80 AGX 10/80 AGTX 10/80	AS 10/80 ATS 10/80 AGS 10/80 AGTS 10/80	10	50	6.0	80 - 85
32	AK 10/80 AGK 10/80	AX 10/80 AGX 10/80	AS 10/80 AGS 10/80	10	50	7.0	80 - 85
33	AK 10/100 ATK 10/100 AGK 10/100 AGTK 10/100	AX 10/100 ATX 10/100 AGX 10/100 AGTX 10/100	AS 10/100 ATS 10/100 AGS 10/100 AGTS 10/100	10	50	6.0	100 - 105
34	AK 10/100 AGK 10/100	AX 10/100 AGX 10/100	AS 10/100 AGS 10/100	10	50	7.0	100 - 105
35	AK 10/120 ATK 10/120 AGK 10/120 AGTK 10/120	AX 10/120 ATX 10/120 AGX 10/120 AGTX 10/120	AS 10/120 ATS 10/120 AGS 10/120 AGTS 10/120	10	50	6.0	120 - 125
36	AK 10/120 AGK 10/120	AX 10/120 AGX 10/120	AS 10/120 AGS 10/120	10	50	7.0	120 - 125
37	AK 10/140 ATK 10/140 AGK 10/140 AGTK 10/140	AX 10/140 ATX 10/140 AGX 10/140 AGTX 10/140	AS 10/140 ATS 10/140 AGS 10/140 AGTS 10/140	10	50	6.0	140 - 145
38	AK 10/140 AGK 10/140	AX 10/140 AGX 10/140	AS 10/140 AGS 10/140	10	50	7.0	140 - 145
39	AK 10/160 ATK 10/160 AGK 10/160 AGTK 10/160	AX 10/160 ATX 10/160 AGX 10/160 AGTX 10/160	AS 10/160 ATS 10/160 AGS 10/160 AGTS 10/160	10	50	6.0	160 - 165
40	AK 10/160 AGK 10/160	AX 10/160 AGX 10/160	AS 10/160 AGS 10/160	10	50	7.0	160 - 165
41	AK 12/70 ATK 12/70	AX 12/70 ATX 12/70	AS 12/70 ATS 12/70	12	60	8.0	70 - 75



Item	Fastener designation			A/AT/AGT/AG fastener sleeve		WKF / WASL / WT / WASL / WS expansion core	
	AK (A + WKN/WKF/WASL) ATK (AT + WKN/WKF/WASL) AGK (AG + WKN/WKF/WASL) AGTK (AGT + WKN/WKF/WASL)	AX (A + WT) ATX(AT + WT) AGX (AG + WT) AGTX (AGT + WT)	AS (A + WS) ATS (AT + WS) AGS (AG + WS) AGTS (AGT + WS)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
	AGK 12/70 AGTK 12/70	AGX 12/70 AGTX 12/70	AGS 12/70 AGTS 12/70				
42	AK 12/70 AGK 12/70	AX 12/70 AGX 12/70	AS 12/70 AGS 12/70	12	60	7.0	70 - 75
43	AK 12/80 ATK 12/80 AGK 12/80 AGTK 12/80	AX 12/80 ATX 12/80 AGX 12/80 AGTX 12/80	AS 12/80 ATS 12/80 AGS 12/80 AGTS 12/80	12	60	8.0	80 - 85
44	AK 12/80 AGK 12/80	AX 12/80 AGX 12/80	AS 12/80 AGS 12/80	12	60	7.0	80 - 85
45	AK 12/100 ATK 12/100 AGK 12/100 AGTK 12/100	AX 12/100 ATX 12/100 AGX 12/100 AGTX 12/100	AS 12/100 ATS 12/100 AGS 12/100 AGTS 12/100	12	60	8.0	100 - 105
46	AK 12/100 AGK 12/100	AX 12/100 AGX 12/100	AS 12/100 AGS 12/100	12	60	7.0	100 - 105
47	AK 12/120 ATK 12/120 AGK 12/120 AGTK 12/120	AX 12/120 ATX 12/120 AGX 12/120 AGTX 12/120	AS 12/120 ATS 12/120 AGS 12/120 AGTS 12/120	12	60	8.0	120 - 125
48	AK 12/120 AGK 12/120	AX 12/120 AGX 12/120	AS 12/120 AGS 12/120	12	60	7.0	120 - 125
49	-	-	AS 14/80 ATS 14/80 AGS 14/80 AGTS 14/80	14	70	10.0	80
50	-	-	AS 14/80 AGS 14/80	14	70	12.0	80
51	-	-	AS 14/100 ATS 14/100 AGS 14/100 AGTS 14/100	14	70	10.0	100
52	-	-	AS 14/100 AGS 14/100	14	70	12.0	100
53	-	-	AS 14/120 ATS 14/120 AGS 14/120 AGTS 14/120	14	70	10.0	120
54	-	-	AS 14/120 AGS 14/120	14	70	12.0	120
55	-	-	AS 14/140 ATS 14/140 AGS 14/140 AGTS 14/140	14	70	10.0	140
56	-	-	AS 14/140 AGS 14/140	14	70	12.0	140
57	-	-	AS 14/160 ATS 14/160 AGS 14/160 AGTS 14/160	14	70	10.0	160
58	-	-	AS 14/160 AGS 14/160	14	70	12.0	160
59	-	-	AS 14/180 ATS 14/180 AGS 14/180 AGTS 14/180	14	70	10.0	180
60	-	-	AS 14/180 AGS 14/180	14	70	12.0	180
61	-	-	AS 14/200 ATS 14/200 AGS 14/200 AGTS 14/200	14	70	10.0	200
62	-	-	AS 14/200 AGS 14/200	14	70	12.0	200



Item	Fastener designation			A/AT/AGT/AG fastener sleeve		WKF / WASL / WT / WASL / WS expansion core	
	AK (A + WKN/WKF/WASL) ATK (AT + WKN/WKF/WASL) AGK (AG + WKN/WKF/WASL) AGTK (AGT + WKN/WKF/WASL)	AX (A + WT) ATX (AT + WT) AGX (AG + WT) AGTX (AGT + WT)	AS (A + WS) ATS (AT + WS) AGS (AG + WS) AGTS (AGT + WS)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
63.	-	-	AS 16/100 AGS 16/100	16	80	12.0	100
64	-	-	AS 16/120 AGS 16/120	16	80	12.0	120
65	-	-	AS 16/140 AGS 16/140	16	80	12.0	140
66	-	-	AS 16/160 AGS 16/160	16	80	12.0	160

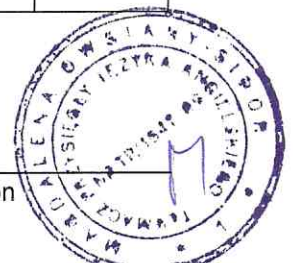


Table A12. Dimensions of AHK, ATHK, AGHK, AGTHK, AHS, ATHS, AGHS, AGTHS, AHO, ATHO, AGHO, AGTHO, AHZ, ATHZ, AGHZ, AGTHZ, AHB and AGTHB, plastic and metal expansion fasteners

Item	Fastener designation					AZ AT / AG / AGT fastener sleeve		HK/HS/HO/HZ/HB expansion core		
	AHK (A + HK), ATHK (AT + HK), AGHK (AG + HK), AGTHK (AGT + HK)	AHS (A + HS), ATHS (AT + HS), AGHS (AG + HS), AGTHS (AGT + HS)	AHO (A + HO), ATHO (AT + HO), AGHO (AG + HO), AGTHO (AGT + HO)	AHZ (A + HZ), ATHZ (AT + HZ), AGHZ (AG + HZ), AGTHZ (AGT + HZ)	AHB (AG + HB), AGTHB (AGT + HB)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	angle / boiler hook	ceiling / eye / pigtail hook
									L ₂ , mm	L ₂ , mm
1	2	3	4	5	6	7	8	9	10	11
1	AHK 6 ATHK 6 AGHK 6 AGTHK 6	AHS 6 ATHS 6 AGHS 6 AGTHS 6	-	-	-	6	30	4	46	65
2	AHK 8 ATHK 8 AGHK 8 AGTHK 8	AHS 8 ATHS 8 AGHS 8 AGTHS 8	-	-	-	8	40	5	60	70
3	AHK 10 ATHK 10 AGHK 10 AGTHK 10	AHS 10 ATHS 10 AGHS 10 AGTHS 10	-	AHZ 10 ATHZ 10 AGHZ 10 AGTHZ 10	-	10	50	6	60 - 65	80 - 100
4	-	-	-	-	AHB 12/75 AGTHB 12/75	12	60	8	75	
5	AHK 12 ATHK 12 AGHK 12 AGTHK 12	AHS 12 ATHS 12 AGHS 12 AGTHS 12	-	AHZ 12 ATHZ 12 AGHZ 12 AGTHZ 12	AHB 12/95 AGTHB 12/95	12	60	8	80 - 95	100 - 120
6	AHK 14 ATHK 14 AGHK 14 AGTHK 14	AHS 14 ATHS 14 AGHS 14 AGTHS 14	AHO 14 ATHO 14 AGHO 14 AGTHO 14	AHZ 14 ATHZ 14 AGHZ 14 AGTHZ 14	AHB 14/95 AGTHB 14/95	14	70	10	95 - 100	130 - 150
7	-	-	-	-	AHB 14/120 AGTHB 14/120	14	70	10	120	
8	-	AHS 16 AGHS 16	-	-	-	16	80	12	-	150

Table A13. Dimensions of ADD, ATDD, AGDD, AGTDD, ADG, ATDG, AGDG and AGTDG plastic and metal expansion fasteners

Item	Fastener designation		A / AT / AG / AGT fastener sleeve		SDD/SDG expansion core	
	ADD (A + SDD) ATDD (AT + SDD) AGDD (AG + SDD) AGTDD (AGT + SDD)	ADG (A + SDG) ATDG (AT + SDG) AGDG (AG + SDG) AGTDG (AGT + SDG)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
1	2	3	4	5	6	7
1	-	ADG 10/80 ATDG 10/80 AGDG 10/80 AGTDG 10/80	10	50	6	80
2	-	ADG 10/100 ATDG 10/100 AGDG 10/100 AGTDG 10/100	10	50	6	100
3	ADD 12/80 ATDD 12/80 AGDD 12/80 AGTDD 12/80	ADG 12/80 ATDG 12/80 AGDG 12/80 AGTDG 12/80	12	60	8	80
4	ADD 12/100 ATDD 12/100 AGDD 12/100 AGTDD 12/100	ADG 12/100 ATDG 12/100 AGDG 12/100 AGTDG 12/100	12	60	8	100



5	ADD 12/120 ATDD 12/120 AGDD 12/120 AGTDD 12/120	ADG 12/120 ATDG 12/120 AGDG 12/120 AGTDG 12/120	12	60	8	120
6	ADD 14/100 ATDD 14/100 AGDD 14/100 AGTDD 14/100	ADG 14/100 ATDG 14/100 AGDG 14/100 AGTDG 14/100	14	70	10	100
7	ADD 14/120 ATDD 14/120 AGDD 14/120 AGTDD 14/120	ADG 14/120 ATDG 14/120 AGDG 14/120 AGTDG 14/120	14	70	10	120
8	-	ADG 14/140 ATDG 14/140 AGDG 14/140 AGTDG 14/140	14	70	10	140
9	-	ADG 16/100 AGDG 16/100	16	80	12	100
10	-	ADG 16/120 AGDG 16/120	16	80	12	120
11	-	ADG 16/140 AGDG 16/140	16	80	12	140

Table A14. Dimensions of ASA plastic and metal expansion fasteners

Item	Fastener designation ASA (AG + WS + EASA)	AG fastener sleeve		WS expansion core	
		d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
1	2	3	4	5	6
1	ASA 8/80	8	40	5.5	80

Table A15. Dimensions of AUM and AGTUM plastic and metal expansion fasteners

Item	Fastener designation		AG / AGT fastener sleeve		SDG expansion core	
	AUM (AG + SDG + N + EAUM)	AGTUM (AGT + SDG + N + EAUM)	d ₁ [mm]	L ₁ [mm]	d ₂ , mm	L ₂ , mm
1	2	3	4	5	6	7
1	AUM 10/100	-	10	50	7	100
2	AUM 12/100	AGTUM 12/100	12	60	8	100
3	AUM 12/120	AGTUM 12/120	12	60	8	120
4	AUM 14/140	AGTUM 14/140	14	70	10	140
5	AUM 14/180	-	14	70	10	180

Table A16. Dimensions of WRK plastic and metal expansion fasteners with 14/70, 14/100 and 14/120 sleeves

Item	Expansion core		14/70 fastener with sleeve		14/100 fastener with sleeve		14/120 fastener with sleeve				
	WR		AG fastener sleeve	Fastener designation	AG fastener sleeve	Fastener designation	AG fastener sleeve	Fastener designation			
	d ₂ , mm	L ₂ , mm	d ₁ , mm L ₁ , mm	WRK (AG + WR)	d ₁ [mm] L ₁ [mm]	WRK (AG + WR)	d ₁ , mm L ₁ , mm	WRK (AG + WR)			
1	2	3	4	5	6	7	8	9	10	11	12
1	12	90	14	70	WRK 14/90	-	-	-	-	-	-
2	12	100	14	70	WRK 14/100	14	100	WRK 14/100/100	-	-	-
3	12	120	14	70	WRK 14/120	14	100	WRK 14/100/120	14	120	WRK 14/120/120
4	12	160	14	70	WRK 14/160	14	100	WRK 14/100/160	14	120	WRK 14/120/160
5	12	190	14	70	WRK 14/190	14	100	WRK 14/100/190	14	120	WRK 14/120/190
6	12	230	14	70	WRK 14/230	14	100	WRK 14/100/230	14	120	WRK 14/120/230
7	12	260	14	70	WRK 14/260	14	100	WRK 14/100/260	14	120	WRK 14/120/260
8	12	280	14	70	WRK 14/280	14	100	WRK 14/100/280	14	120	WRK 14/120/280
9	12	300	14	70	WRK 14/300	14	100	WRK 14/100/300	14	120	WRK 14/120/300
10	12	320	14	70	WRK 14/320	14	100	WRK 14/100/320	14	120	WRK 14/120/320
11	12	350	14	70	WRK 14/350	14	100	WRK 14/100/350	14	120	WRK 14/120/350
12	12	400	14	70	WRK 14/400	14	100	WRK 14/100/400	14	120	WRK 14/120/400
13	12	450	14	70	WRK 14/450	14	100	WRK 14/100/450	14	120	WRK 14/120/450
14	12	500	14	70	WRK 14/500	14	100	WRK 14/100/500	14	120	WRK 14/120/500



Table A17. Dimensions of WRK plastic and metal expansion fasteners with 14/140, 14/160 and 14/180 sleeves

Item	Expansion core		14/140 fastener with sleeve			Fastener with 14/160 sleeve			Fastener with 14/180 sleeve		
	WR		AG fastener sleeve		Fastener designation	AG fastener sleeve		Fastener designation	AG fastener sleeve		Fastener designation
	d ₂ , mm	L ₂ , mm	d ₁ , mm	L ₁ , mm	WRK (AG + WR)	d ₁ , mm	L ₁ , mm	WRK (AG + WR)	d ₁ , mm	L ₁ , mm	WRK (AG + WR)
1	2	3	4	5	6	7	8	9	10	11	12
1	12	160	14	140	WRK 14/140/160	14	160	WRK 14/160/160	-	-	-
2	12	190	14	140	WRK 14/140/190	14	160	WRK 14/160/190	14	180	WRK 14/180/190
3	12	230	14	140	WRK 14/140/230	14	160	WRK 14/160/230	14	180	WRK 14/180/230
4	12	260	14	140	WRK 14/140/260	14	160	WRK 14/160/260	14	180	WRK 14/180/260
5	12	280	14	140	WRK 14/140/280	14	160	WRK 14/160/280	14	180	WRK 14/180/280
6	12	300	14	140	WRK 14/140/300	14	160	WRK 14/160/300	14	180	WRK 14/180/300
7	12	320	14	140	WRK 14/140/320	14	160	WRK 14/160/320	14	180	WRK 14/180/320
8	12	350	14	140	WRK 14/140/350	14	160	WRK 14/160/350	14	180	WRK 14/180/350
9	12	400	14	140	WRK 14/140/400	14	160	WRK 14/160/400	14	180	WRK 14/180/400
10	12	450	14	140	WRK 14/140/450	14	160	WRK 14/160/450	14	180	WRK 14/180/450
11	12	500	14	140	WRK 14/140/500	14	160	WRK 14/160/500	14	180	WRK 14/180/500

Table A18. Dimensions of WRK plastic and metal expansion fasteners with 14/200 sleeves

Item	Fastener designation	AG fastener sleeve		WR expansion core	
	WRK (AG + WR)	d ₁ , mm	L ₁ , mm	d ₂ , mm	L ₂ , mm
1	2	3	4	5	6
1	WRK 14/200/230	14	200	12	230
2	WRK 14/200/260	14	200	12	260
3	WRK 14/200/280	14	200	12	280
4	WRK 14/200/300	14	200	12	300
5	WRK 14/200/320	14	200	12	320
6	WRK 14/200/350	14	200	12	350
7	WRK 14/200/400	14	200	12	400
8	WRK 14/200/450	14	200	12	450
9	WRK 14/200/500	14	200	12	500



Appendix B.

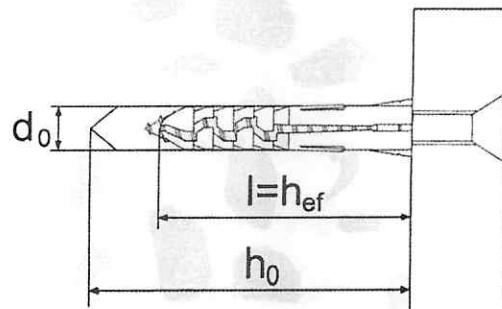


Figure B1. Installation parameters for ARVEX expansion fasteners consisting of steel cores and A, AT, AG, AGT and KARS plastic sleeves

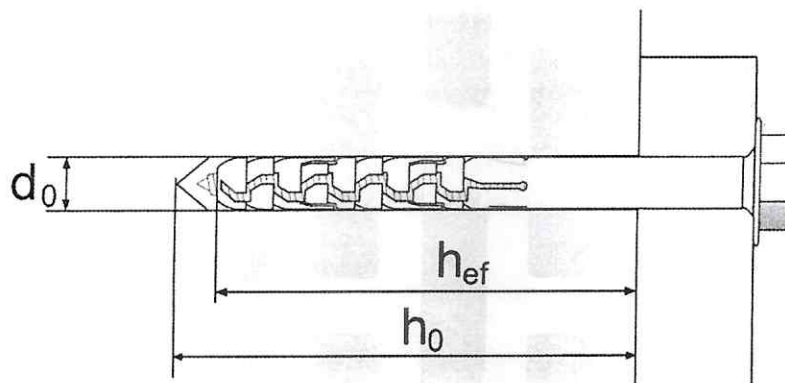


Figure B2. Installation parameters for ARVEX expansion fasteners consisting of steel cores and KARL and AL plastic sleeves

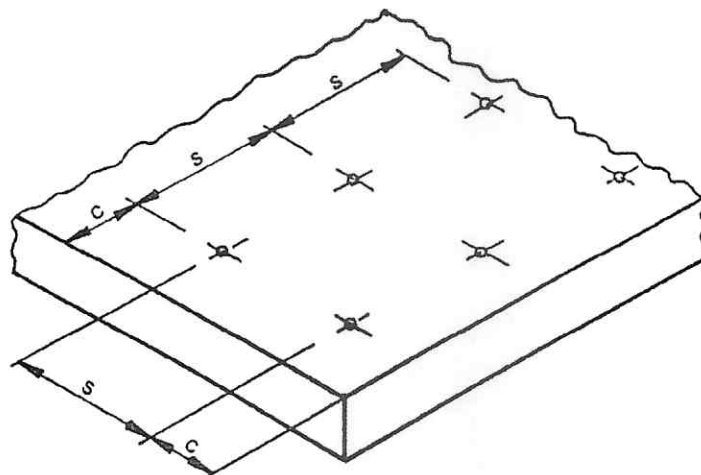


Figure B3. Placement parameters of ARVEX expansion fasteners in the substrate
 s - axial spacing of the fasteners, c - distance of the fastener from the edge of the substrate

Table B1. Installation and placement parameters for ARVEX expansion fasteners consisting of steel cores and A, AT, AG, AGT and KARS plastic sleeves

Item	Parameter	A / AT / AG / AGT / KARS plastic sleeve diameter, mm						
		5	6	8	10	12	14	16
1	2	3	4	5	6	7	8	9
1	Maximum hole diameter d_0 , equal to nominal drill diameter d_{nom} , mm	5	6	8	10	12	14	16
2	Minimum drill hole depth h_0 , mm	35	40	50	60	70	80	90
3	Effective fastener depth of fastener h_{ef} , mm	25	30	40	50	60	70	80
4	Minimum fastener spacing s , mm	$2 \times h_{ef}^{1)} / 3 \times h_{ef}^{2)}$						
5	Minimum distance of fastener from edge of substrate c , mm	$2 \times h_{ef}$						
6	Minimum substrate thickness h , mm	$1.5 \times h_{ef}$ but not less than 80						
¹⁾ for concrete substrate ²⁾ for other substrates								

Table B2. Installation and placement parameters for ARVEX expansion fasteners consisting of steel cores and AL and KARL plastic sleeves

Item	Parameter	AL / KARL plastic sleeve diameter, mm					
		6	8	10	12	14	16
1	2	3	4	5	6	7	8
1	Maximum hole diameter d_0 , equal to nominal drill diameter d_{nom} , mm	6	8	10	12	14	16
2	Minimum drill hole depth h_0 , mm	65	75	80	95	100	130
3	Effective fastener depth of fastener h_{ef} , mm	55	65	70	85	90	120
4	Minimum fastener spacing s , mm	$2 \times h_{ef}^{1)} / 3 \times h_{ef}^{2)}$					
5	Minimum distance of fastener from edge of substrate c , mm	$2 \times h_{ef}$					
6	Minimum substrate thickness h , mm	$1.5 \times h_{ef}$ but not less than 80					
¹⁾ for concrete substrate ²⁾ for other substrates							



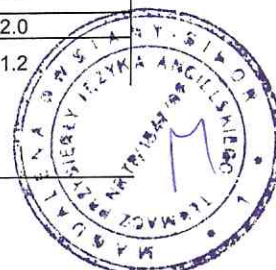
Appendix C.

Table C1. Characteristic resistance of ARVEX expansion fasteners to pull-out $N_{R,k}$ and to shear $V_{R,k}$

Item	Sleeve designation	Screw designation	Substrate type	Characteristic resistance to pull-out $N_{R,k}$, kN and shear $V_{R,k}$, kN
1	2	3	4	5
1	A / AG 5	WKN / WKF / WASL / WT / WS / SDD / SDG / WR3	Normal concrete C20/25 ⁽¹⁾	0.10
2			Full solid bricks ⁽²⁾ , class 20	0.40
3	A / AG 6	WKN / WKF / WASL / WT / WS / HK / HS / SDD / SDG / WR4	Normal concrete C20/25 ⁽¹⁾	0.20
4			Full solid bricks ⁽²⁾ , class 20	0.50
5	A / AG / KARS 8	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / HKR / HS / WR / SDD / SDG5	Normal concrete C20/25 ⁽¹⁾	0.60
6			Full solid bricks ⁽²⁾ , class 20	0.60
7	A / AG / KARS 8	HSR 5.5	Normal concrete C20/25 ⁽¹⁾	0.40
8			Full solid bricks ⁽²⁾ , class 20	0.40
9	A / AG / KARS 10	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / HS / HZ / WR / SDD / SDG6	Normal concrete C20/25 ⁽¹⁾	0.10
10			Full solid bricks ⁽²⁾ , class 20	0.20
11	A / AG / KARS 12	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / WR / SDD / SDG 7	Normal concrete C20/25 ⁽¹⁾	3.0
12			Full solid bricks ⁽²⁾ , class 20	4.5
13	A / AG / KARS 12	HKR 7	Normal concrete C20/25 ⁽¹⁾	3.0
14			Full solid bricks ⁽²⁾ , class 20	3.5
15	A / AG / KARS 12	HSR 7	Normal concrete C20/25 ⁽¹⁾	0.9
16			Full solid bricks ⁽²⁾ , class 20	0.9
17	A / AG / KARS 12	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / WR / SDD / SDG 8	Normal concrete C20/25 ⁽¹⁾	2.5
18			Full solid bricks ⁽²⁾ , class 20	5.0
19	A / AG / KARS 12	HK 8	Normal concrete C20/25 ⁽¹⁾	2.5
20			Full solid bricks ⁽²⁾ , class 20	4.0
21	A / AG / KARS 12	HS / HZ 8	Normal concrete C20/25 ⁽¹⁾	1.5
22			Full solid bricks ⁽²⁾ , class 20	1.5
23	A / AG / KARS 12	HB 8	Normal concrete C20/25 ⁽¹⁾	2.5
24			Full solid bricks ⁽²⁾ , class 20	3.5
25	A / AG / KARS 16	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / WR / SDD / SDG 12	Normal concrete C20/25 ⁽¹⁾	13.0
26			Full solid bricks ⁽²⁾ , class 20	12.0
27	A / AG / KARS 16	HS 12	Normal concrete C20/25 ⁽¹⁾	3.5
28			Full solid bricks ⁽²⁾ , class 20	3.5
29	AT / AGT 6	WKN / WKF / WASL / WT / WS / HK / HS / SDD / SDG / WR4	Normal concrete C20/25 ⁽¹⁾	0.2
30			Full solid bricks ⁽²⁾ , class 20	0.2
31	AT / AGT 8	WKN / WKF / WASL / WT / WS / HK / HS / SDD / SDG / WR5	Normal concrete C20/25 ⁽¹⁾	0.3
32			Full solid bricks ⁽²⁾ , class 20	0.2
33	AT / AGT 10	WKN / WKF / WASL / WT / WS / HK / HS / WSK / HZ / SDD / SDG / WR 6	Normal concrete C20/25 ⁽¹⁾	0.1
34			Full solid bricks ⁽²⁾ , class 20	0.2
35	AT / AGT 12	WKN / WKF / WASL / WT / WS / HK / HB / SDD / SDG / WR8	Normal concrete C20/25 ⁽¹⁾	1.5
36			Full solid bricks ⁽²⁾ , class 20	3.5
37	AT / AGT 12	HS / HZ 8	Normal concrete C20/25 ⁽¹⁾	1.5
38			Full solid bricks ⁽²⁾ , class 20	1.5
39	AT / AGT 14	WKN / WKF / WASL / WT / WS / HZ / HB / SDD / SDG / HK / WR 10	Normal concrete C20/25 ⁽¹⁾	1.5
40			Full solid bricks ⁽²⁾ , class 20	3.0
41	AT / AGT 14	HS 10	Normal concrete C20/25 ⁽¹⁾	1.5
42			Full solid bricks ⁽²⁾ , class 20	2.5
43	AT / AGT 14	HO 10	Normal concrete C20/25 ⁽¹⁾	1.5
44			Full solid bricks ⁽²⁾ , class 20	2.5
45	A / AG / KARS 14	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HB / WR / SDD / SDG 10	Normal concrete C20/25 ⁽¹⁾	4.0
46			Full solid bricks ⁽²⁾ , class 20	8.0
47	A / AG / KARS 14	HK 10	Normal concrete C20/25 ⁽¹⁾	4.0
48			Full solid bricks ⁽²⁾ , class 20	6.0
49	A / AG / KARS 14	HS / HO10	Normal concrete C20/25 ⁽¹⁾	2.5
50			Full solid bricks ⁽²⁾ , class 20	2.5



51	A / AG / KARS 14	HZ 10	Normal concrete C20/25 ⁽¹⁾	3.0
52			Full solid bricks ⁽²⁾ , class 20	3.0
53	A / AG / KARS 14	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / WR / SDD / SDG 12	Normal concrete C20/25 ⁽¹⁾	12.0
54			Full solid bricks ⁽²⁾ , class 20	11.0
55	A / AG / KARS 14	HS 12	Normal concrete C20/25 ⁽¹⁾	3.5
56			Full solid bricks ⁽²⁾ , class 20	3.5
57	A / AG / KARS 8	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HKR / SDD / SDG 5,5	Normal concrete C20/25 ⁽¹⁾	1.5
58			Full solid bricks ⁽²⁾ , class 20	1.5
59	A / AG / KARS 10	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HKR / SDD / SDG 7	Normal concrete C20/25 ⁽¹⁾	0.9
60			Full solid bricks ⁽²⁾ , class 20	2.0
61	A / AG / KARS 10	HSR 7	Normal concrete C20/25 ⁽¹⁾	0.9
62			Full solid bricks ⁽²⁾ , class 20	0.9
63			Full solid bricks ⁽²⁾ , class 20	0.9
64	AL / KARL 8	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HKR / SDD / SDG 5.5	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	0.6
65			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	0.6
66	AL / KARL 8	HSR 5.5	Full solid bricks ⁽²⁾ , class 20	0.4
67			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	0.4
68			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	0.4
69	AL / KARL 8	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / SDD / SDG 6	Full solid bricks ⁽²⁾ , class 20	1.5
70			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	0.6
71			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	0.6
72	AL / KARL 8	HS 5	Full solid bricks ⁽²⁾ , class 20	0.6
73			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	0.5
74			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	0.6
75	AL / KARL 8	HS 6	Full solid bricks ⁽²⁾ , class 20	1.0
76			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	0.6
77			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	0.6
78	AL / KARL 8	HZ 6	Full solid bricks ⁽²⁾ , class 20	0.6
79			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	0.6
80			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	0.6
81	AL / KARL 10	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HKR / HSR / SDD / SDG7	Full solid bricks ⁽²⁾ , class 20	0.9
82			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	0.4
83			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	0.75
84	AL / KARL 12	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / SDD / SDG 9	Full solid bricks ⁽²⁾ , class 20	10.0
85			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	1.5
86			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	2.0
87	AL / KARL 12	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / HB / WR / SDD / SDG 10	Full solid bricks ⁽²⁾ , class 20	5.5
88			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	1.5
89			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	2.0
90	AL / KARL 12	HS / HO 10	Full solid bricks ⁽²⁾ , class 20	2.5
91			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	1.5
92			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	2.0
93	AL / KARL 12	HZ 10	Full solid bricks ⁽²⁾ , class 20	3.0
94			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	1.5
95			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥350 kg/m ³	2.0
96	AL / KARL 14	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / HKR / HS / HSR /	Full solid bricks ⁽²⁾ , class 20	2.0
97			Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥10 mm	1.2





98		HO / HOR / HZ / HZR / HB / WR / SDD / SDG 10	Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	1.5
99			Full solid bricks ⁽²⁾ , class 20	7.5
100	AL / KARL 16	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / WR / SDD / SDG 12	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥ 10 mm	1.5
101			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	1.5
102			Full solid bricks ⁽²⁾ , class 20	3.5
103	16	HS 12	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥ 10 mm	1.5
104			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	1.5
105			Full solid bricks ⁽²⁾ , class 20	0.4
106	AL / KARL 6	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / HS / SDD / SDG 4	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥ 10 mm	0.2
107			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	0.3
108			Full solid bricks ⁽²⁾ , class 20	0.9
109	AL / KARL 8	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / SDD / SDG 5	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥ 10 mm	0.5
110			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	0.6
111			Full solid bricks ⁽²⁾ , class 20	0.5
112	AL / KARL 10	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / HS / HZ / SDD / SDG 6	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥ 10 mm	0.2
113			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	0.6
114			Full solid bricks ⁽²⁾ , class 20	3.0
115	AL / KARL 12	WSK / WSKT / WS / WSR / WASL / WKN / WKF / WT / WAST / HK / HB / WR / SDD / SDG 8	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥ 10 mm	0.9
116			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	0.9
117			Full solid bricks ⁽²⁾ , class 20	1.5
118	AL / KARL 12	HS / HZ 8	Ceramic hollow bricks ⁽²⁾ , class 15, wall thickness ≥ 10 mm	0.9
119			Autoclaved aerated concrete ⁽³⁾ , class 2, density ≥ 350 kg/m ³	0.9

(1) – according to PN-EN 206+A1:2016
 (2) – according to PN-EN 771-1+A1:2015
 (3) – according to PN-EN 771-4+A1:2015



I, Magdalena Owsiany-Sidor, a certified translator of the English language, certify that the foregoing is a complete, true and accurate translation of the document submitted to me.

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