



**INSTYTUT TECHNIKI BUDOWLANEJ**

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## **NATIONAL TECHNICAL ASSESSMENT ITB-KOT-2020/0803 1<sup>st</sup> Edition**

This National Technical Assessment has been issued in accordance with the Regulation of the Minister of Infrastructure and Construction of November 17, 2016 on national technical assessments (Official Journal of the Republic of Poland (Dz. U.) of 2016, item 1968) by Instytut Techniki Budowlanej (ITB -Building Research Institute) in Warsaw, upon a request of:

**pgb-Polska sp. z o.o.  
ul. Fryderyka Wilhelma Redena 3, 41-807 Zabrze**

The National Technical Assessment ITB-KOT-2020/0803 1<sup>st</sup> Edition is a favourable assessment of the performance properties of the following construction products for their intended use:

### **Plastic-metal fasteners PGB and SMART**

Date of expiry of the National Technical Assessment:

**February 13, 2025**



pp. DIRECTOR  
Deputy Director for Technical  
Assessment and European  
Harmonisation

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The Document of the National Technical Assessment ITB-KOT-2020/0803 1<sup>st</sup> edition, contains 17 pages, including 4 Annexes. The text of this document may only be copied in its entirety. Any publication or dissemination in any other form of excerpts from the text of the National Technical Assessment shall require written agreement with Instytut Techniki Budowlanej. The National Technical Assessment ITB-KOT-2020/0803 1<sup>st</sup> edition refers to the products covered by the Technical Approval ITB AT-15-7074/2012.

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## 1. TECHNICAL DESCRIPTION OF THE PRODUCT

The present National Technical Assessment refers to plastic-metal fasteners PGB and SMART manufactured by pgb-Polska sp. z o.o., ul. Fryderyka Wilhelma Redena 3, 41-807 Zabrze, in a manufacturing plant in Zabrze.

This National Technical Assessment covers the product types defined by the manufacturer resulting from characteristics of performance provided in article 3.

The components of fasteners PGB and SMART are steel expansion elements (screws) and plastic sleeves (according to figures: B1 ÷ B4). Expansion elements can be screws with a countersunk or hexagon head.

The screws are made of carbon steel of class of mechanical properties not lower than 4.8 according to the standard PN-EN ISO 898-1:2013 and electrolytically coated with zinc of thickness not less than 5 µm according to the standard PN-EN ISO 4042:2001.

The plastic sleeves are made:

- for fasteners PGB - of polypropylene (PP) as copolymer EP 548R – a secondary material with properties presented in Annex A,
- for fasteners SMART - of polyamide (PA6) as Tarnamid T-27 – a primary material characterized by differential scanning calorimetry curves (DSC) according to the standard: PN-EN ISO 11357-1:2016, which comply with the standards laid down in the procedure for granting the National Technical Assessment.

Dimensions of the plastic-metal fasteners PGB and SMART are presented in figures: B1 ÷ B5 and provided in tables B1 and B2. An example of a fitting with the fasteners is shown in a figure B5.

Tolerances of the fasteners dimensions correspond to m tolerance class according to the standard PN-EN 22768-1:1999. Visual appearance meets the requirements of the standard: PN-EN 26157-1:1998.

## 2. THE INTENDED USE OF THE PRODUCT

The plastic-metal fasteners PGB and SMART are intended for multi-point fixings of non-structural statically loaded construction elements in substrate of:

- non-cracked or cracked, reinforced or unreinforced concrete of the classes: C20/25 ÷ C50/60 according to the standard PN-EN 206+A1:2016,
- solid ceramic bricks with compressive strength not less than 20 N/m<sup>2</sup> (class not lower than 20) according to the standard PN-EN 771-1+A1:2015 and volumetric density not less than 2000 kg/m<sup>3</sup>,

Due to the corrosive aggressiveness of the environment, steel screws PGB and SMART shall be used in accordance with the standards: PN-EN ISO 12944-2:2018 and PN-EN ISO 9223:2012.

In order to determine the design resistances of fixings with the plastic-metal fasteners PGB and SMART, the characteristic resistances provided in Annex D shall be divided by a partial safety factor equal to:

- 1,8 – when pulled out of the concrete substrate,
- 2,5 – when pulled out of the ceramic substrate
- 1,25 – in the case of shearing.

The installation parameters of plastic-metal fasteners PGB and SMART are given in Annex B, and their layout parameters in the substrate – in Annex C.

The products covered by this National Technical Assessment shall be applied in multi-point fixings. In these fastenings it is assumed that in the case of significant loosening or failure of one of the fasteners, the loads can be transferred to adjacent fasteners without causing substantial changes in the requirements for the fixing in the serviceability and ultimate limit state.

Fixing of the fasteners is performed by placing the plastic sleeve in the hole drilled in the substrate, and then by screwing the expansion element into the sleeve. The hole in the substrate shall be drilled perpendicularly to the surface of the substrate. When screwing in, the expansion element expands the expansion part of the sleeve, causing it to be pressed against the side of the hole drilled in the substrate.

The plastic-metal fasteners PGB and SMART shall be used in accordance with the technical design, developed for a particular facility taking into account:

- the Polish construction standards and regulations, in particular of the Regulation of Minister of Infrastructure of April 12, 2002 on the technical conditions to be satisfied by buildings and their location (Journal of Laws of the Republic of Poland (Dz. U.) of 2019, item 1065),
- the findings of this National Technical Assessment,
- the manufacturer's instructions provided to the customers concerning the conditions of performing the fixings with the above specified fasteners.

### **3. PERFORMANCE PROPERTIES OF THE PRODUCT AND METHODS APPLIED TO ASSESS THE PROPERTIES**

#### **3.1 Performance properties of the product**

**3.1.1. Characteristic resistances of fastener fixings.** Characteristic tension resistance and characteristic shear resistance of fixings with the plastic-metal fasteners PGB and SMART are given in Annex D.

**3.1.2. Working life of the fasteners.** Zinc coating with a thickness of not less than 5 µm shall ensure working life of the fasteners in the scope resulting from article 2.

#### **3.2. Methods used for performance assessment**

**3.2.1. Characteristic resistances of fixings with the fasteners.** Characteristic resistances of fixings with the fasteners shall be tested in compliance with ETAG 020:2012 on fasteners anchored in substrates according to article 2. The force shall be measured by means of a device with a range chosen to match the expected value of the destructive force, enabling a constant and gradual increase in force until the destruction occurs. The measurement error shall not exceed 3% over the entire measurement range.

**3.2.2. Durability of the fasteners.** Test of zinc coating thickness shall be carried out in compliance with the standard PN-EN ISO 2178:2016 or PN-EN ISO 3497:2004.

#### **4. PACKAGING, TRANSPORT AND STORAGE AND MARKING OF THE PRODUCT**

The plastic-metal fasteners PGB and SMART shall be delivered in sets, in the manufacturer's own packaging and stored and transported in a way that ensures that their technical properties remain unchanged.

The method of marking the products with a construction mark shall be in accordance with the Regulation of the Minister of Infrastructure and Construction of November 17, 2016 on the method of declaring the performance of construction products and the method of marking them with a construction mark (Journal of Laws of the Republic of Poland (Dz. U.) of 2016, item 1966, as later amended).

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

- the last two digits of the year in which the construction mark was first placed on the construction product;
- the name and address of the manufacturer's registered office or an identification mark allowing explicit identification of the name and address of the manufacturer's registered office;
- the name and type designation of the construction product;
- the number and year of issue of the National Technical Assessment, which served as the basis for the declaration of performance; (ITB-KOT-2020/0803 1<sup>st</sup> edition);
- the number of the national declaration of performance;
- the level or class of the declared performance;
- the name of the certification body that has 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 on that website.

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

Moreover, the marking of a construction product, being a hazardous mixture according to the REACH regulation, shall comply with the requirements of Regulation (EC) No. 1272/2008 of the European Parliament and of the Council on Classification, Labelling and Packaging of Substances and Mixtures (CLP), amending and repealing Directives: 67/548/EEC and 1999/45/EC, as well as amending Regulation (EC) No. 1907/2006.

#### **5. ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE (AVCP)**

##### **5.1. National system for the assessment and verification of the constancy of performance properties**

In accordance with the Regulation of the Minister of Infrastructure and Construction of November 17, 2016 on the method of declaring the performance of construction products and the method of marking them with a construction mark (Journal of Laws of the Republic of Poland (Dz. U.) of 2016, item 1966, as later amended) the System 2+ of AVCP shall be applicable.

## 5.2. Type testing

The performance characteristics assessed in article 3 constitute the product-type testing, unless raw materials, components, production line or manufacturing plant have been changed.

## 5.3. Factory production control

In the manufacturing plant the manufacturer shall have implemented a factory production control system. All the elements, requirements and provisions adopted by the manufacturer for the system shall be documented methodically in the form of written policies and procedures, including test records. The factory production control shall be adapted to the manufacturing processes and ensure the achievement of the declared performance of the product in series production.

The factory production control includes the specification and verification of raw materials and components, inspections and in-process tests and control tests (following article 5.4) carried out by the manufacturer in accordance with the prescribed test plan and according to the principles and procedures laid down in the documentation of the factory production control.

The results of production control shall be recorded on a regular basis. The records of the register shall prove that the products have satisfied the criteria of the assessment and verification of the constancy of performance. Individual products or batches of the products and related manufacturing details shall be fully identifiable and traceable.

## 5.4. Control tests

**5.4.1. Test plan.** The test plan shall include:

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

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

- a) for the fasteners PGB:
  - the fasteners in terms of:
    - the shape and dimensions,
    - the thickness of zinc coating,
  - for plastic of the fasteners in terms of:
    - the melt mass-flow rate MFR,
    - density,
    - tensile strength,
    - modulus of elasticity in tension,
- b) for the fasteners SMART
  - the shape and dimensions,
  - the thickness of zinc coating.

**5.4.3. Periodic tests.** Periodic tests shall include the verification of characteristic resistances of fixings with the fasteners.

### **5.5. Frequency of tests**

The ongoing tests shall be conducted:

- a) for the fasteners PGB:
  - in terms of properties of plastic for the fasteners: in compliance with the prescribed test plan, however not less frequently than for each delivered batch of the raw material,
  - in terms of a shape and dimensions as well as thickness of zinc coating of the fasteners: in compliance with the prescribed test plan, however not less frequently than for delivery of each batch of the products,
- b) for the fasteners SMART – in compliance with the prescribed test plan, however not less frequently than for delivery of each batch of the products.

The size of the batch of the products shall be specified in the documentation of factory production control.

The periodic tests shall be performed at least once every 3 years.

## **6. INSTRUCTIONS**

**6.1.** The National Technical Assessment ITB-KOT-2020/0803 1<sup>st</sup> edition is a favourable assessment of the performance of those essential characteristics of the plastic-metal fasteners PGB and SMART, which, in accordance with the intended use, resulting from the provisions of the Assessment, have an impact on the fulfilment of basic requirements by the construction structures in which the product will be used.

**6.2.** The National Technical Assessment ITB-KOT-2020/0803 1<sup>st</sup> edition is not a document authorizing to mark the construction product with a construction mark.

Pursuant to the Act on Construction Products of April 16, 2004 (Journal of Laws of the Republic of Poland: Dz. U. of 2019, item 266, as later amended) the products to which this National Technical Assessment refers may be launched or made available on the domestic market, if the manufacturer has assessed and verified the constancy of performance, drawn up a national declaration of performance in accordance with the National Technical Assessment ITB-KOT-2020/0803 1<sup>st</sup> edition and marked the products with the construction mark in compliance with the applicable regulations.

**6.3.** The National Technical Assessment ITB-KOT-2020/0803 1<sup>st</sup> edition does not infringe the rights resulting from the provisions on industrial property protection, and in particular the Act of 30<sup>th</sup> June, 2000 – the Industrial Property Law (Journal of Laws of the Republic of Poland: Dz. U. of 2017, item 776, as later amended). Ensuring these rights is the responsibility of the users of this National Technical Assessment, by ITB.

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

**6.5.** The National Technical Assessment does not release the manufacturer of products from responsibility for their proper quality, and the contractors of construction works from responsibility for their proper use.

**6.6.** The validity of the National Technical Assessment may be extended for further periods, however not exceeding 5 years.

## 7. A LIST OF DOCUMENTS USED IN THE PROCEEDINGS

### 7.1. Reports, test reports, evaluations, classifications

- 1) LZK00-06026/19/R46NZK. Test report, Plastic-metal fasteners PGB and SMART, Building Structures and Geotechnics Plant of the Building Research Institute (ITB), Katowice, 2019.
- 2) LZK00-06026/18/R44NZK. Test report, Plastic-metal fasteners PGB and SMART, Building Structures and Geotechnics Plant of the Building Research Institute (ITB), Katowice, 2018.
- 3) 51/2018, Test report – DSC (Differential Scanning Calorimetry) Analysis, the Institute for Engineering of Polymer Materials & Dyes, Toruń 2018.

### 7.2. Related standards and documents

PN-EN 206+A1:2016	<i>Beton – Wymagania, właściwości, produkcja i zgodność Concrete – Requirements , properties, production and compliance</i>
PN-EN ISO 527-2:2012	<i>Tworzywa sztuczne. Oznaczanie właściwości mechanicznych przy statycznym rozciąganiu – Część 2: Warunki badań tworzyw sztucznych przeznaczonych do różnych technik formowania. Plastics – Determination of mechanical properties – Part 2: Test conditions of plastics for different moulding techniques</i>
PN-EN 771-1+A1:2015	<i>Wymagania dotyczące elementów murowych - Część 1: Elementy murowe ceramiczne Specification for masonry units – Part 1: Clay masonry units.</i>
PN-EN ISO 898-1:2013	<i>Własności mechaniczne części złącznych wykonanych ze stali węglowej i stopowej – Śruby i śruby dwustronne Mechanical properties of fasteners made of carbon steel and alloy steel – Screws and studs</i>
PN-EN 1133-1:2011	<i>Tworzywa sztuczne. Oznaczanie masowego wskaźnika szybkości płynięcia (MFR) i objętościowego wskaźnika szybkości płynięcia (MVR) tworzyw termoplastycznych – Część 1: Metoda standardowa Plastics – Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics – Part 1: Standard method</i>
PN-EN 1183-1:2013	<i>Tworzywa sztuczne – Metody oznaczania gęstości tworzyw sztucznych nieporowatych – Część 1: Metoda zanurzeniowa, Metoda piknometru cieczowego i Metoda miareczkowa Plastics – Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method</i>
PN-EN ISO 2178:2016	<i>Powłoki niemagnetyczne na podłożu magnetycznym. Pomiar grubości powłok. Metoda magnetyczna. Non-magnetic coatings on magnetic substrates. Measurement of coating thickness. Magnetic method.</i>
PN-EN ISO 3497:2004	<i>Powłoki metalowe. Pomiar grubości powłok. Metody spektrometrii</i>



	<i>rentgenowskiej.</i>
	<i>Metallic coatings. Measurement of coating thickness. X-ray spectrometric methods</i>
PN-EN ISO 4042:2001	<i>Części złączne. Powłoki elektrolityczne</i> <i>Fasteners. Electrolytic coatings</i>
PN-EN ISO 9223:2012	<i>Korozja metali i stopów – Korozyjność atmosfer – Klasyfikacja, określanie i ocena.</i> <i>Corrosion of metals and alloys – Corrosivity of atmospheres – Classification, determination and assessment.</i>
PN-EN ISO 11357-1:2016	<i>Tworzywa sztuczne. Różnicowa kalorymetria skaningowa (DSC) – Część 1: Zasady ogólne.</i> <i>Plastics. Differential scanning calorimetry (DSC) – Part 1: General principles</i>
PN-EN ISO 12944-2:2018	<i>Farby i lakiery – Ochrona przed korozją konstrukcji stalowych za pomocą ochronnych systemów malarskich – Część 2: Klasyfikacja środowisk</i> <i>Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments</i>
PN-EN 26157-1:1998	<i>Części złączne – Nieciągłości powierzchni – Śruby, wkręty i śruby dwustronne ogólnego stosowania</i> <i>Fasteners – Surface discontinuities – Bolts, screws and studs for general requirements</i>
AT-15-7074/2012	<i>Łączniki tworzywowo-metalowe PGB i SMART do wielopunktowych zamocowań niekonstrukcyjnych</i> <i>Plastic-metal fasteners PGB and SMART for non-structural multi-point fixings</i>

## ANNEXES

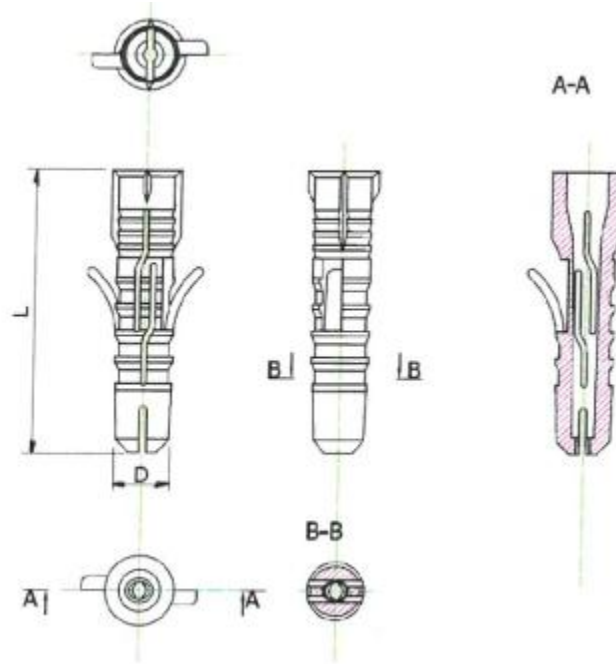
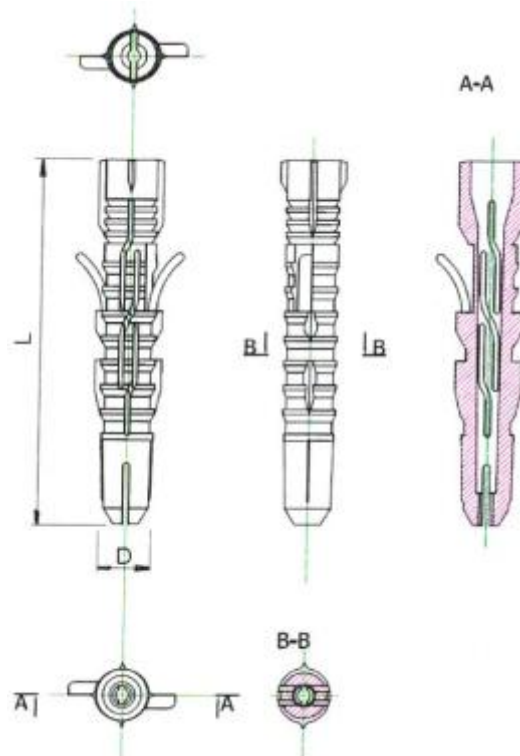
<b>Annex A.</b> Sleeve material of fastener PGB .....	10
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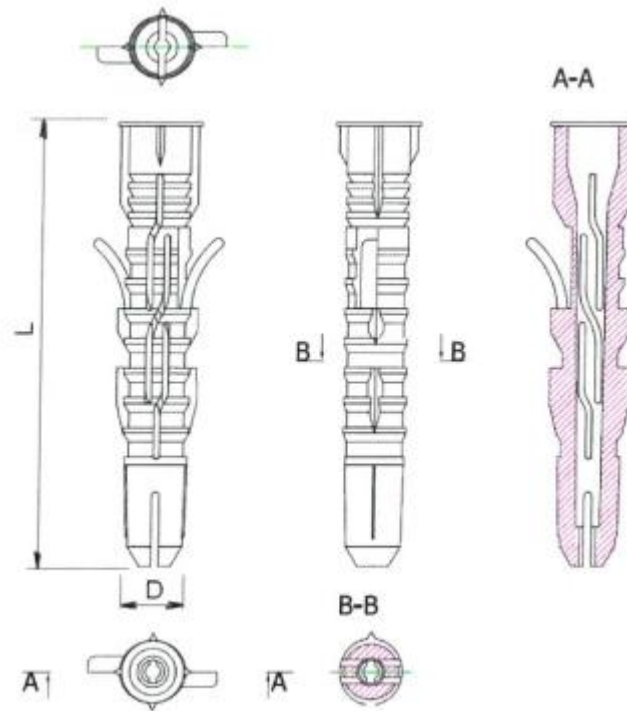
**Annex A.**

Polypropylene (PP) as granulate copolymer EP 548R (secondary material) shall be used for the sleeves for the plastic-metal fasteners PGB. The required material properties are given in Table A1.

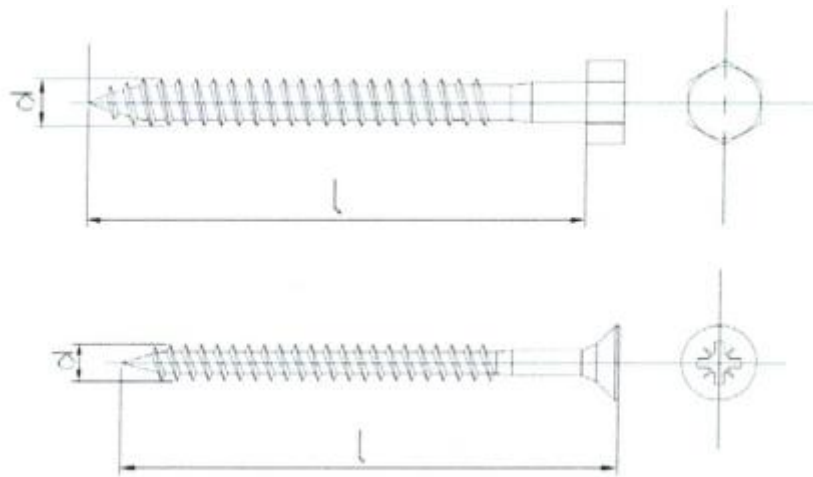
**Table A1**

Item	Properties	Requirements	Methods for testing
1	Melt mass-flow rate MFR (275°C; 5 kg), g/10 min.	5 ÷ 9	PN-EN ISO 1133-1:2011
2	Density, g/cm <sup>3</sup>	0,96 ± 10%	PN-EN ISO 1183-1:2013
3	Tensile strength, MPa	≥ 20	PN-EN ISO 527-2:2012
4	Modulus of elasticity in tension, MPa	≥ 1400	
5	Relative elongation at break, %	≥ 70	

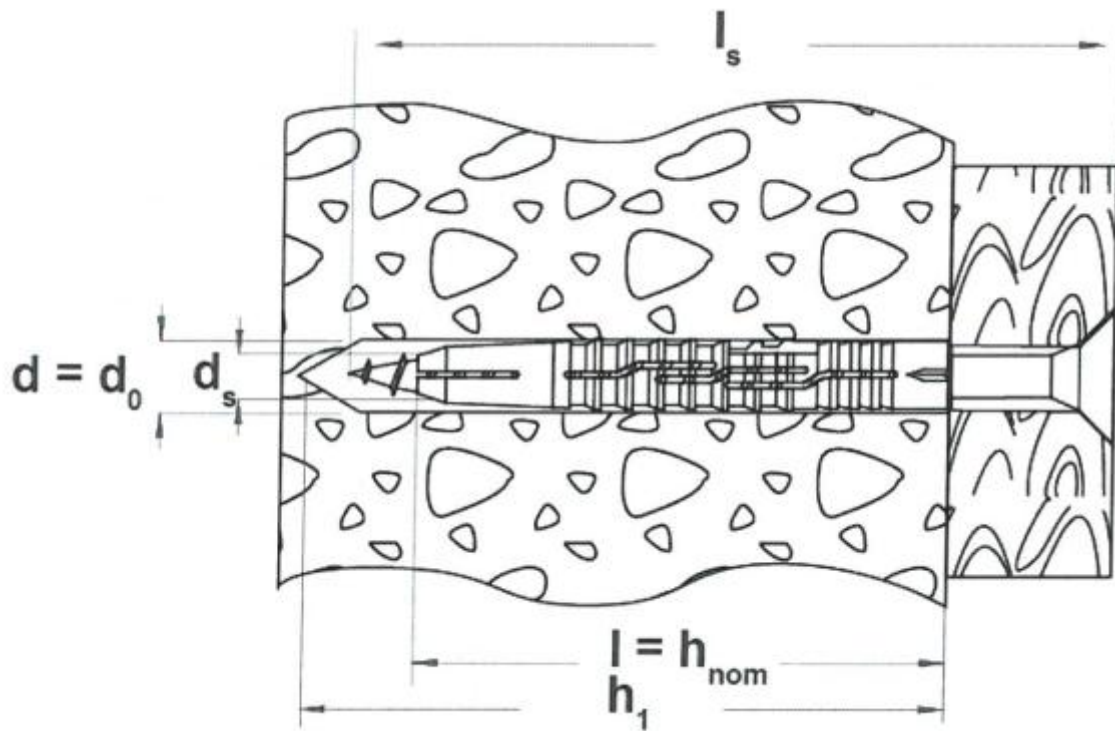
**Annex B.**

**Figure B1.** Plastic sleeve for fasteners PGB and SMART – type 1

**Figure B2.** Plastic sleeve for fasteners PGB and SMART – type 2



**Figure B3.** Plastic sleeve for fasteners PGB and SMART – type 3



**Figure B4.** Steel expansion elements for fasteners PGB and SMART



$d$	diameter of plastic sleeve
$l$	length of plastic sleeve
$d_c$	nominal diameter of drill bit
$h_1$	depth of drilled hole
$h_{nom} = h_{ef}$	total anchorage depth
$d_s$	diameter of expansion element
$l_s$	length of expansion element

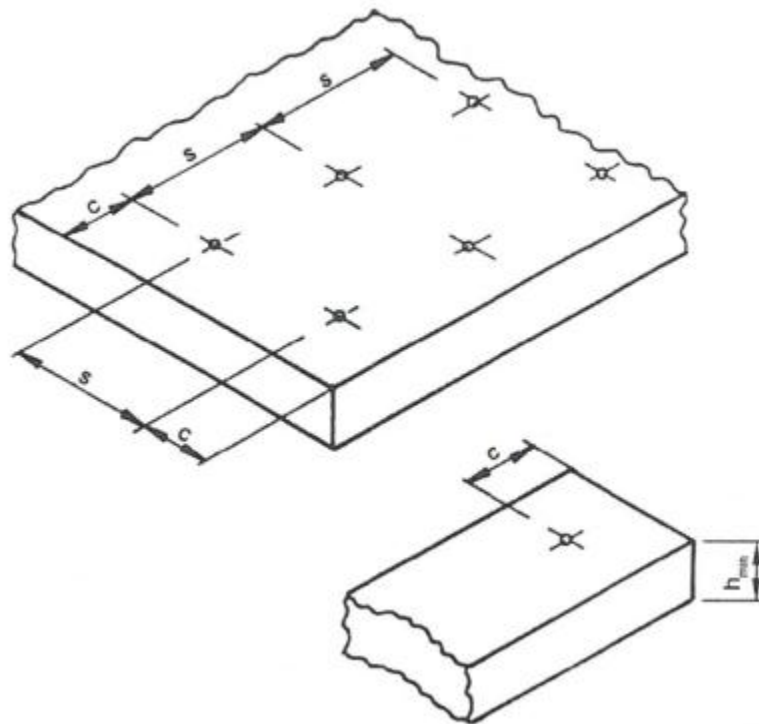
**Figure B5.** Example of fixing and installation parameters of fasteners PGB and SMART

**Table B1.** Installation dimensions and parameters of plastic-metal fasteners PGB

Pos.	Designation of the fastener	Type of the fastener	Name of the used sleeve	Expansion element	Sleeve dimensions, mm		Screw dimensions, mm		Installation parameters			
					d	l	d <sub>s</sub>	l <sub>s</sub>	d <sub>o</sub> / d <sub>nom</sub> , mm	h <sub>1</sub> , mm	h <sub>ef</sub> / h <sub>nom</sub> , mm	
1	2	3	4	5	6	7	8	9	10	11	12	
1	SMRTS/04030 PP	PGB 5	type 1	countersunk or hexagon head screw	5	25	4	40	5	35	25	
2	SMRTS/04035 PP	PGB 6	type 1		6	6	30	4	35	6	40	30
3	SMRTS/04050 PP		type 1				30	4	50			
4	SMRTS/05035 PP		type 1				30	5	35			
5	SMRTS/05060 PP		type 2				50	5	60			
6	SMRTS/05045 PP		PGB 8				type 1	8	8			
7	SMRTS/05050 PP	type 1			40	5	50					
8	SMRTS/05060 PP	type 1			40	5	60					
9	SMRTS/06050 PP	type 1			40	6	50					
10	SMRTS/06060APP	type 1			40	6	60					
11	SMRLS/06070 PP	type 2			60	6	70					
12	SMRTS/06060 PP SMRTZ/06060 PP	PGB10	type 1		10	10	50	6	60	10	60	50
13	SMRTS/06080 PP SMRTZ/06080 PP		type 1				50	6	80			
14	SMRTZ/06100 PP		type 1				50	6	100			
15	SMRTZ/08060APP		type 1				50	8	60			
16	SMRTZ/08080APP		type 1				50	8	80			
17	SMRTZ/08100APP		type 1				50	8	100			
18	SMRLZ/08080 PP		type 2				70	8	80			
19	SMRTZ/08080 PP	PGB12	type 1		12	12	60	8	80	12	70	60
20	SMRTZ/08100 PP		type 1				60	8	100			
21	SMRTZ/08120 PP		type 1				60	8	120			
22	SMRTZ/10100APP		type 1				60	10	100			
23	SMRTZ/10120APP		type 1				60	10	120			
24	SMRTZ/10080 PP	PGB14	type 1		14	14	70	10	80	14	80	70
25	SMRTZ/10100 PP		type 1				70	10	100			
26	SMRTZ/10120 PP		type 1				70	10	120			

**Table B2.** Installation dimensions and parameters of plastic-metal fasteners SMART

Pos.	Designation of the fastener	Type of the fastener	Name of the used sleeve	Expansion element	Sleeve dimensions, mm		Screw dimensions, mm		Installation parameters		
					d	l	d <sub>s</sub>	l <sub>s</sub>	d <sub>o</sub> / d <sub>nom</sub> , mm	h <sub>1</sub> , mm	h <sub>ef</sub> / h <sub>nom</sub> , mm
1	2	3	4	5	6	7	8	9	10	11	12
1	SMPUS/03030 NZN	SMART 5	type 1	countersunk or hexagon head screw	5	25	3	30	5	35	25
2	SMPUS/04030 NZN		type 1			25	4	30			
3	SMPUS/04035 NZN	SMART 6	type 1		6	30	4	35	6	40	30
4	SMPUS/04050 NZN		type 1			30	4	50			
5	SMPUS/05045 NZN	SMART 8	type 1		8	40	5	45	8	50	40
6	SMPUS/05060 NZN		type 1			40	5	60			
7	SMLPS/06070 NZN		type 3			60	6	70			
8	SMLPS/06080 NZN		type 3			60	6	80			
9	SMLPS/06090 NZN		type 3			60	6	90			
10	SMLPS/06100 NZN		type 3			60	6	100			
11	SMLPS/06120 NZN		type 3			60	6	120			
12	SMPUS/06060 NZN		SMART 10			type 1	10	50			
13	SMPZS/08060 NZN	type 1			50	8		60			
14	SMPUS/06080 NZN SMPZS/06080 NZN	type 1			50	6		80			
15	SMPZS/06100 NZN	type 1			50	6		100			
16	SMLPZ/08080 NZN	type 3			70	8		80			
17	SMLPZ/08090 NZN	type 3			70	8		90			
18	SMLPZ/08100 NZN	type 3			70	8		100			
19	SMLPZ/08120 NZN	type 3			70	8		120			
20	SMLPZ/08140 NZN	type 3			70	8		140			
21	SMLPZ/08160 NZN	type 3			70	8		160			
22	SMPZS/08070 NZN	SMART 12			type 1	12		60	8	70	12
23	SMPZS/08080 NZN		type 1		60		8	80			
24	SMPZS/08090 NZN		type 1		60		8	90			
25	SMPZS/08100 NZN		type 1		60		8	100			
26	SMPZS/08120 NZN		type 1		60		8	120			
27	SMPZS/08140 NZN		type 1		60		8	140			
28	SMPZS/08160 NZN		type 1		60		8	160			
29	SMPZS/10080 NZN	SMART 14	type 1		14	70	10	80	14	80	70
30	SMPZS/10100 NZN		type 1			70	10	100			
31	SMPZS/10120 NZN		type 1			70	10	120			
32	SMPZS/10140 NZN		type 1			70	10	140			
33	SMPZS/10160 NZN		type 1			70	10	160			
34	SMPZS/10180 NZN		type 1			70	10	180			
35	SMPZS/10200 NZN		type 1			70	10	200			

**Annex C.**


s – axial spacing of fasteners, c – distance between the fastener and substrate edge,  
 $h_{min}$  – minimal thickness of substrate

**Figure C1.** Layout parameters of the steel screws PGB and SMART in substrate

**Table C1.** Layout parameters of the plastic-metal fasteners PGB and SMART in substrate

Pos.	Layout parameter	Distance, mm
1	2	3
1	Minimal spacing of fasteners s, mm	$2 \times h_{ef}^{1)} / 3 \times h_{ef}^{2)}$
2	Minimal distance between the fastener and substrate edge c, mm	$2 \times h_{ef}$
3	Minimal thickness of substrate h, mm	$1,5 \times h_{ef}$ , but not less than $80^{3)}$
<sup>1)</sup> for concrete substrate <sup>2)</sup> for other substrates <sup>3)</sup> according to ETAG 020:2012, article 2.1.3		



**Annex D.**
**Table D1.** Characteristic tension resistance ( $N_{R,k}$ ) and characteristic shear resistance ( $V_{R,k}$ ) of fixings with plastic-metal fasteners PGB and SMART

Pos.	Fastener type	Name of used sleeve	Screw diameter, $d_s$	Effective depth of anchorage $h_{ef}$ , mm	Characteristic tension resistance ( $N_{R,k}$ ) and characteristic shear resistance ( $V_{R,k}$ ), kN	
					concrete <sup>1)</sup>	solid ceramic brick <sup>2)</sup>
1	2	3	4	5	6	7
1	PGB 5	type 1	4	25	0,10	0,10
2	PGB 6	type 1	4	30	0,10	0,10
3		type 1	5		0,10	0,10
4		type 2	5		0,15	0,15
5	PGB 8	type 1	5	40	0,15	0,15
6		type 1	6		0,15	0,15
7		type 2	6		0,15	0,15
8	PGB 10	type 1	6	50	0,20	0,15
9		type 1	8		0,20	0,15
10		type 2	8		0,20	0,15
11	PGB 12	type 1	8	60	0,65	0,95
12		type 1	10		0,65	0,95
13	PGB 14	type 1	10	70	1,30	2,00
14	SMART 5	type 1	3	25	0,15	0,10
15		type 1	4		0,15	0,10
16	SMART 6	type 1	4	30	0,15	0,20
17	SMART 8	type 1	5	40	0,25	0,25
18		type 3	6		0,25	0,25
19	SMART 10	type 1	6	50	0,70	1,10
20		type 1	8		0,70	1,10
21		type 3	8		0,70	1,40
22	SMART 12	type 1	8	60	2,00	2,50
23	SMART 14	type 1	10	70	4,00	4,50

<sup>1)</sup> reinforced or unreinforced concrete of the classes: C20/25 ÷ C50/60 according to the standard PN- EN 206+A1:2016

<sup>2)</sup> solid ceramic brick of the class 20 according to the standard PN-EN 771-1+A1:2015