



Technical delivery conditions
Plastic components used in permanent way construction

DBS
918 280

Supersedes BN 918280, edition 05/2000

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Foreword

This DB standard was drawn up by DB Systemtechnik - VTZ 115 - Permanent Way Technology in collaboration VTZ 35 - Non-metallic Materials and the Quality Assurance department (VQB) on the basis of the railway standard BN 918 280 issued in the May 2000. It represents the interests of Deutsche Bahn AG. The following revisions were made:

- Editorial and structural revision
- Adjusted in line with international regulations

Annexes A to G (normative) contain the required details for verification of product conformity and are an integral part of this DB standard.

Introduction

The purpose of this DB standard is to set out rules for qualification and quality assurance with respect to plastic permanent way components. It complements the performance requirements for rail fastening systems described in DIN EN 13481 series of standards "Railway applications - Track, performance requirements for fastening systems".

1. Scope

This DB standard is to be applied during product qualification (approval of new plastic components or changes to already qualified plastic components) and in connection with verifications of conformity regarding: materials (moulding materials) already in use and new materials; manufacturing; product tests in the context of quality assurance.

In the following text, plastic components used in permanent way construction are referred to as "products" (note: as per DIN 7708-1 "Plastic moulding materials; plastic products; concepts", the products in question are moulded parts).

2. Normative references

This DB standard contains stipulations from other publications in the form of dated or undated references. These normative references are quoted in the respective positions in the text and the names of the publications are stated thereafter. In the case of dated references, subsequent amendments or revisions to these publications only belong to this standard if they have been incorporated by means of amendment or revision. In the case of undated references, the latest version of the referenced publication applies (including amendments).

| | |
|------------------|--|
| DIN EN ISO 179-1 | Plastics - Determination of Charpy impact properties - Part 1: Non-instrumented impact test |
| DIN EN ISO 307 | Plastics - Polyamides - Determination of viscosity number |
| DIN EN ISO 472 | Draft version: Plastics - Vocabulary |
| DIN EN ISO 527-2 | Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics |
| DIN EN ISO 868 | Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness) |
| DIN EN ISO 1133 | Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics |

| | |
|-----------------------------|---|
| DIN EN ISO 1172 | Textile-glass-reinforced plastics - Prepregs, moulding compounds and laminates - Determination of the textile-glass and mineral-filler content; calcination methods |
| DIN EN ISO 1183-1 | Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pycnometer method and titration method |
| DIN EN ISO 1872-1 | Plastics - Polyethylene (PE) moulding and extrusion materials - Part 1: Designation system and basis for specifications |
| DIN EN ISO 1874-1 | Plastics - Polyamide (PA) moulding and extrusion materials - Part 1: Designation |
| DIN EN ISO 2039-1 | Plastics - Determination of hardness - Part 1: Ball indentation method |
| DIN EN ISO 2818 | Plastics - Preparation of test specimens by machining |
| DIN EN ISO 3451-4 | Plastics - Determination of ash - Part 4: Polyamides |
| DIN EN ISO 4613-1 | Plastics - Ethylene/vinyl acetate (E/VAC) moulding and extrusion materials Part 1: Designation system and basis for specifications |
| DIN 7708 Part 1 | Plastic moulding materials, plastic products, concepts |
| DIN EN ISO 8985 | Plastics - Ethylene/vinyl acetate copolymer (EVAC) thermoplastics - Determination of vinyl acetate content |
| DIN EN ISO 11469 | Plastics - Generic identification and marking of plastics products |
| DIN EN ISO 11357-1 | Plastics - Differential scanning calorimetry (DSC), Part 1: General principles |
| ISO 11357-3 | Differential scanning calorimetry (DSC) |
| DIN EN ISO 11358 | Plastics - Thermogravimetry (TG) of polymers, general principles |
| DIN EN ISO 14021 | Environmental labels and declarations, self-declared environmental claims (Type II environmental labelling) |
| DIN EN 13146 | Series of standards Parts 1 to 8, Railway applications - Track -. Test methods for fastening systems |
| DIN EN 13481 | Series of standards Parts 1 to 7, Railway applications - Track - Performance requirements for fastening systems |
| DIN EN 15347 | Plastics - Recycled plastics - Characterisation of plastics waste |
| DIN EN 15343 | Plastics - Recycled Plastics - Plastics recycling traceability and assessment of conformity and recycled content |
| DIN 53765 DIN IEC 600 93 | Testing of plastics and elastomers; thermal analysis; DSC-method Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials |

Deutsche Bahn guidelines:

| | |
|-------------|--|
| 201.0240V02 | Supplementary Contractual Terms of DB AG and its Affiliated Companies for Quality Assurance in Procurement |
| 120.0381V15 | List of permanent-way products subject to quality inspection ("Güteprüfungspflichtige Produkte Oberbaumaterial") |

3. Terms:

- **Qualification test:**
Contains the criteria demanded by this DBS and is to be implemented with respect to the specific moulding material for each product prior to initial delivery to DB AG. If the raw material supplier is changed, written notification and verification of compliance with the requirements shall be required.
- **Quality assurance plan:**
Binding description of the type, scope and frequency of tests, the assignment of responsibility and of the measures to be taken in the event of non-conformance.

4. Technical requirements

4.1 General

Only such products may be supplied for which there are verifications of compliance with the applicable performance requirements for rail fastenings as specified in the DIN EN 13481 series of standards (e.g. type approval tests according to DIN EN 13481-2). Where the materials (raw materials or moulding materials as per DIN 7708 Part 1) used in products are from other suppliers and differ from those used in the type tests, this shall not be deemed to constitute a change of material in terms of Section 6 (Test specimens) of DIN EN 13481-2 if they correspond to the associated datasheet in this DBS. The manufacturer or system supplier shall notify DB AG of the use of such substances, thereby attaching the datasheet for the moulding material and the first article inspection report including any material tests (see Section 5.1). Before using such materials for the first time, the manufacturer or system supplier shall also provide verification to the effect that the materials comply with the requirements according to the corresponding datasheet.

Tests on the rail fastening systems shall be conducted according to the DIN EN 13146 series of standards.

Status protection for already approved moulding materials will remain in place until the end of 2013.

The material approved for the respective product (see Section 4.2) is to be found in the corresponding standard drawings in connection with the datasheets. If necessary, additional product-specific requirements can be included on the standard drawing.

Applications with a temperature range from -30°C to +80°C are to be assumed when selecting the material for products.

No harmful substances may be released during handling - e.g. installation and storage - or when the product is used as intended.

4.2 Material

The requirements contained in the annexes (datasheets) to this DB standard - in combination with the standard drawings - apply to materials (plastics, moulding material, mould material) used in the products.

Additives (stabilisers, auxiliary materials, plasticisers, fillers, reinforcements, dyestuff, etc.) must be distributed throughout the material. Production-related fluctuations and orientations in material quality are permitted as long as the functional capability of the products is not impaired. Functional capability shall generally be considered to be given if the quality tests were passed.

Material mixtures of PA 6 and PA 66 are not permitted.

4.3 Manufacturing

The manufacture and any required subsequent treatment (e.g. hot storage, conditioning) of the products must comply with the applicable rules of engineering (guidelines issued by the Association of German Engineers (VDI), raw material manufacturer's processing rules).

4.4 Form and dimensions

See the corresponding DB AG standard drawings for the form, dimensions and permissible tolerances of the products.

4.5 Weight/mass

The weight or mass of each product must be checked during production.

4.6 Surface condition and structure

The surface quality (smoothness, roughness) must correspond to the agreements, specifications and any retained samples. The products may not display any burrs or weld lines that impair their function. Sufficient and functionally reliable material strength must be ensured especially in the proximity of weld lines.

The material shall always have a dense, even structure. Voids may not have a negative impact on the function of the moulded parts. The required quality shall be verified by means of a visual inspection on the cut-open moulded part. An assessment shall be made based on a reference sample. The producer shall provide the reference sample with the involvement of the client.

4.7 Samples

Upon request, DB AG shall be provided with samples.

4.8 Marking

During manufacturing, each product shall be permanently marked with the company logo, month and year of manufacture as well as the product and plastic type (observe DIN EN ISO 11469). See the corresponding standard drawings for the position of the marking.

5. Qualification and quality assurance

5.1 Qualification of the product

Prior to the first delivery to DB AG, every product must undergo a qualification test.

During the qualification test, each of the requirements described in Section 4 must be verified on at least three products or on the number of products that enables execution of the tests or the taking of the required number of test specimens according to the test standard. The test results for each single tested product must meet the requirements.

The unit responsible for technical aspects at DB AG (see cover sheet) may determine additional requirements and tests. DB AG may waive tests if, for example, product properties do not require certain tests or if material properties are already well known. This applies, for example, to already qualified or approved moulding materials used for the first time by the product manufacturer.

Tests will be conducted at the applicant's expense and – insofar as they concern material, component and system tests – may only be conducted by accredited testing centres or at a testing institute to be agreed with the DB AG Technology department.

Once all qualification tests have been successfully conducted, the unit responsible for technical aspects at DB AG may demand field testing on a specified line for a period of one year, but with a traffic load of at least 20 million metric load tons. In the event of minor product changes that do not affect ageing resistance, the unit responsible for technical aspects at DB AG may waive field testing.

5.2 Qualification of the manufacturer

For certain products (cf. List of permanent-way products subject to quality inspection), the manufacturer's capability to manufacture a product as specified in the contract shall be verified prior to the first delivery to DB AG. This shall take the form of a "manufacturer-related product qualification". One component of the manufacturer-related product qualification is the qualification testing according to Section 5.1. The manufacturer-related product qualification shall be carried out by DB AG's Quality Assurance department (VQB) with the involvement of the Technology department (VTZ 115). The manufacturer/supplier shall bear the cost of the manufacturer-related product qualification.

5.3 Quality assurance at the manufacturer's site

Incoming goods inspection: The manufacturer shall conduct and document an appropriate incoming inspection on all raw material used in the manufacture of the products (moulding material as per DIN 7708). The type, scope and frequency of incoming goods inspections shall be determined in the manufacturer's quality assurance plan.

As part of the quality assurance procedure, the manufacturer shall carry out a first article inspection to verify that products meet the quality requirements in the drawings and specification as well as in any approvals by the Federal Railway Authority. Such a first article inspection (FAI) is necessary when using new moulds, when a mould is modified, when there is a change of loca-

tion, lengthy downtimes (> 1 year for series production) and when new moulding materials are used for the first time. The initial inspection of a product during the qualification test also counts as an FAI.

All quality features concerning dimension, material and surface finish agreed by means of a drawing or specification are to be inspected. The results shall be presented in a first article inspection report and submitted to DB AG.

The manufacturer shall also ensure the quality of the products by means of a factory production control (FPC) procedure on the basis of appropriate statistical process control. Compliance with the requirements demanded by this DB standard shall be assured by means of test schedules and/or test plans (quality assurance plan) and presented to DB AG upon request.

In addition to the manufacturer's FPC procedure, DB AG reserves the right to check to what extent the products to be manufactured/that have been manufactured or the services to be rendered/that have been rendered fulfil contractual obligations in terms of quality and also reserves the right to intervene if necessary. Furthermore, DB AG reserves the right to review the quality assurance measures put in place by the contractor. These rights shall apply at all times and at all locations where products are produced or services rendered. The scope of these measures is based on the "List of permanent-way products subject to quality inspection" as well as on the "Supplementary contractual terms regarding quality assurance in procurement" (EVB- Qualitätssicherung Beschaffung). The scope is specified by the DB AG Quality Assurance department. The test includes the entire process workflow as well as the qualification tests.

5.4 Tests

The following test methods or stipulations are to be applied to verify compliance with the technical requirements placed on the products according to datasheets, drawings, etc. Use of comparable methods requires agreement.

Test specimens are to be taken from suitable areas of the finished products if no other areas are specified and no other stipulations made in the standard drawings, for example. DIN EN ISO 2818 is to be observed when preparing the test specimens from the products. The test specimens can be prepared by milling and planing or by punching and sawing.

The \geq values must be reached as a minimum for the requirements. The tolerance range is to be observed.

Test methods:

| No. | Property/requirement | Test conditions/test methods |
|------------|--|--|
| 1 | Appearance, surface, marking | Visual inspection, assessment according to drawing, possibly on retained samples |
| 2 | Dimensions | Measuring instrument, drawings |
| 3 | Weight/mass | Use of scales with an accuracy of 0.1 g |
| 4 | Voids/pores | Slicing the product in several planes - if necessary grinding the cut surfaces - then visual assessment of the cut surfaces with reference/retained sample. In the example, the dowels are to be cut open longitudinally through the rotation protection and the procedure is to be repeated after turning the dowel through 90°. |
| 5 | Chemical origin/composition, type of plastic | Thermal analysis according to DIN 53765, infrared spectroscopy, gas chromatography |
| 6 | Melting temperature | Thermal analysis according to DIN 53765 or ISO 11357-3 (heating rate 20 K/min analysis during 2nd heating; sample mass 20 mg) |
| 7 | Moisture content | The moisture content is determined by weighing the product before and after conditioning. Determining the moisture content by drying in a vacuum furnace shall be either for 96 hours at an air pressure of 250 mbar at 110°C or for 24 hours at 120°C. In case of disputes, 96 hours at 110°C is required. The moisture content shall be measured in terms of the percentage loss of mass. |
| 8 | Density | Test according to DIN EN ISO 1183-1 immersion method |
| 9 | Glass fibre content | Test according to DIN EN ISO 1172 or, in exceptional cases, according to ISO 11358 if only small quantities of specimens are available or according to DIN EN ISO 3451-4 |
| 10 | Viscosity number | Test according to DIN EN 307, solvents sulphuric acid |
| 11 | Melt mass-flow rate (MFR) | Test according to DIN EN ISO 1133 |
| 12 | Modulus of elasticity from tensile strength test | Test according to DIN EN ISO 527-2 |
| 13 | Tensile stress at break | Test according to DIN EN ISO 527-2 |
| 14 | Impact strength, Charpy impact strength | Test according to DIN EN ISO 179-1 |
| 15 | Hardness | Test of Shore D hardness according to DIN EN ISO 868 Test of ball indentation hardness according to DIN EN ISO 2039-1 |
| 16 | Volume resistivity | Test according to DIN IEC 60093 |
| 17 | Strength on moulded part (finished part) | Stipulations on test in datasheet |

5.5 Scope of testing

Compliance with the requirements demanded of the moulding material shall be verified for each delivery by means of inspection certificate 3.1 according to DIN EN 10 204. Any missing details shall be verified by tests in the context of the incoming goods inspection on the premises of the processing company. The density, MFR for EVA and PE as well as the melting temperature und viscosity number for PA are to be verified as a minimum.

During the factory production control (FPC) procedure, the manufacturer shall ensure that product realisation complies with this DB Standard and the product specification. To do so, the manufacturer shall determine the scope of testing, test method and acceptance criteria for each product in the quality assurance plan and retain the records of the results as verification of monitoring. In the event of deviations from the target values, the necessary action shall be defined and persons appointed who are responsible for their implementation.

The FPC tests stated in the datasheets shall be conducted weekly per machine shot during on-going production (series production) or according to the supplements on the datasheet (column: FPC). With regard to small quantities, the scope of testing shall be determined depending on the product requirement in the quality assurance plan.

The viscosity number of PA products shall be determined as an indication of process reliability. The waste between moulding material and moulded part may not exceed 10%.

The type, scope and frequency of tests stated according to this DB standard shall be considered minimum requirements. Deutsche Bahn AG may decide on deviations on a case-by-case basis.

6. Storage

See datasheets!

7. Furnishing proof

The contractor shall retain the test reports for a minimum of 10 years unless other periods are stipulated in the master agreements.

Annex A (normative): Datasheet no. 1:

Moulding material with designation according to DIN EN ISO 4613 Part 1:

Ethylene/vinyl acetate copolymer, black, stabilised with 1 to 2% fine-particle soot

Thermoplastic ISO 4613 - E/VAC13, ML, D045, 1-2% fine-particle soot for stabilisation

The addition of up to 10% recyclate of the same moulding material from the same manufacturer is permitted in the processing of the moulding material.

Requirements and test plan for the moulded part (finished part):

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory production control FPC |
|---|--|-------------------------------|--------------------------|---|-----------------------------------|
| Colour, colour shade | Drawing, reference sample | Compliant | X | X | X |
| Surface | Drawing, reference sample | Compliant | X | X | X |
| Dimensions | Drawing | Compliant | X | X | |
| Functional dimensions | Drawing or specify in QM plan | Compliant | X | X | X |
| Weight | Drawing with the manufacturer's specific details | Compliant | X | X | X |
| Voids | Reference sample | Compliant | X | X | |
| Density (1 part per shot) | DIN EN ISO 1183-1 | 0.930-0.962 g/cm ³ | X | X | X |
| Percentage of soot | ISO 11358 | 1-2 % | X | | |
| Vinyl acetate content | DIN EN ISO 8985 | 10-15 % | X | | |
| Melt mass-flow rate - MFR) - (MFR 190/2,16) | DIN EN ISO 1133 | ≤6 g/10 min | X | X | X |
| Shore D hardness | DIN EN ISO 868 | 32-42 | X | X | X |
| Volume resistivity | DIN IEC 60093 | ≥10 ⁸ Ω cm | X | | |

¹⁾ If FAI is also the QT, the QT test plan applies

Further information:

In the FPC and in additional quality tests conducted by DB AG, the values determined should be at the level of those determined for the properties in the qualification tests or FAI. Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818.

Annex B (normative): Datasheet no. 1a:

Moulding material with designation according to DIN EN ISO 4613 Part 1:

Ethylene/vinyl acetate copolymer, black, stabilised with 1 to 2% fine-particle soot

Thermoplastic ISO 4613 - E/VAC08, ML, D045, 1-2% fine-particle soot for stabilisation

The addition of up to 10% recyclate of the same moulding material from the same manufacturer is permitted in the processing of the moulding material.

Requirements and test plan for the moulded part (finished part):

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory production control FPC |
|---|--|-------------------------------|--------------------------|---|-----------------------------------|
| Colour, colour shade | Drawing, reference sample | Compliant | X | X | X |
| Surface | Drawing, reference sample | Compliant | X | X | X |
| Dimensions | Drawing | Compliant | X | X | |
| Functional dimensions | Drawing or specify in QM plan | Compliant | X | X | X |
| Weight | Drawing with the manufacturer's specific details | Compliant | X | X | X |
| Voids | Reference sample | Compliant | X | X | |
| Density (1 part per shot) | DIN EN ISO 1183-1 | 0.920-0.962 g/cm ³ | X | X | X |
| Percentage of soot | ISO 11358 | 1-2 % | X | | |
| Vinyl acetate content | DIN EN ISO 8985 | 5-10% | X | | |
| Melt mass-flow rate - MFR) - (MFR 190/2,16) | DIN EN ISO 1133 | ≤4.0 g/10 min | X | X | X |
| Shore D hardness | DIN EN ISO 868 | 37-47 | X | X | X |
| Volume resistivity | DIN IEC 60093 | ≥10 ⁸ Ωcm | X | | |

¹⁾ If FAI is also the QT, the QT test plan applies

Further information:

In the FPC and in additional quality tests conducted by DB AG, the values determined should be at the level of those determined for the properties in the qualification tests or FAI.

Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818.

Annex C (normative): Datasheet no. 2:

Moulding material with designation according to DIN EN ISO 1872 Part 1:

High-density polyethylene, natural colour or dyed yellow

Thermoplastic ISO 1872-PE, M, 57-G022 or thermoplastic ISO 1872-PE, MC, 57-G022

Requirements and test plan for the moulded part (finished part):

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory produc- tion control FPC |
|---|---|--------------------------|-----------------------------|--|--|
| Colour, colour shade | Drawing, reference sample | Compliant | X | X | X |
| Surface | Drawing, reference sample | Compliant | X | X | X |
| Dimensions | Drawing | Compliant | X | X | |
| Functional di- mensions | Drawing or specify in QM plan | Compliant | X | X | X |
| Weight | Drawing with the manufacturer's specific details | Compliant | X | X | X |
| Voids | Reference sample | Compliant | X | X | X |
| Density (1 part per shot) | DIN EN ISO 1183-1 | ≥0.950 g/cm ³ | X | X | X |
| Thermogram of the DSC analysis | ISO 11357-3 Range of melting peak temperature | 125-140°C | X | X | |
| Melt mass-flow rate - MFR) - (MFR 190/21.6) | DIN EN ISO 1133 | ≤2.3 g/10 min | X | X | X |
| Shore D hardness | Based on DIN EN ISO 868 | 60-70 | X | X | X |
| Bending strength on moulded part | <u>For corrugated dowel only:</u> each half of the dowel is cut into three strips Each strip is then bent approx. 120° through a radius of approx. 50 mm. | No cracks may occur | X | X | X |
| Volume resistivity | DIN IEC 60093 | ≥10 ⁸ Ωcm | X | | |

¹⁾ If FAI is also the QT, the QT test plan applies

Further information:

In the FPC and in additional quality tests conducted by DB AG, the values determined should be at the level of those determined for the properties in the qualification tests or FAI. Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818.

Annex D (normative): Datasheet no. 3:

Moulding material with designation according to DIN EN ISO 1872 Part 1:

High-density polyethylene, stabilised with approx. 0.5% fine-particle soot, black

Thermoplastic ISO 1872-PE, MC, 57-G022

Requirements and test plan for the moulded part (finished part):

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory pro- duction con- trol FPC |
|---|--|--------------------------|-----------------------------|--|---|
| Colour, colour shade | Drawing, reference sample | Compliant | X | X | X |
| Surface | Drawing, reference sample | Compliant | X | X | X |
| Dimensions | Drawing | Compliant | X | X | |
| Functional di- mensions | Drawing or specify in QM plan | Compliant | X | X | X |
| Weight | Drawing with the manufacturer's specific details | Compliant | X | X | X |
| Voids | Reference sample | Compliant | X | X | X |
| Density (1 part per shot) | DIN EN ISO 1183-1 | ≥0.950 g/cm ³ | X | X | X |
| Thermogram of the DSC analysis | ISO 11357-3 Range of melting peak temperature | 125-140°C | X | X | |
| Melt mass-flow rate - MFR) - (MFR 190/21.6) | DIN EN ISO 1133 | ≤2.3 g/10 min | X | X | X |
| Shore D hardness | Based on DIN EN ISO 868 | 60-70 | X | X | X |
| Volume resistivity | DIN IEC 60093 | ≥10 ⁸ Ωcm | X | | |

¹⁾ If FAI is also the QT, the QT test plan applies

Further information:

In the FPC and in additional quality tests conducted by DB AG, the values determined should be at the level of those determined for the properties in the qualification tests or FAI.

Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818.

Annex E (normative): Datasheet no. 6:

Moulding material with designation according to DIN EN ISO 1874 Part 1:

Polyamide 6 or polyamide 66 stabilised with approx. 30% glass fibre and 0.5 to 1.0% fine-particle soot

Thermoplastic ISO 1874 – PA 6, ML, 14-090 (minimum class), GF30, 0.5 - 1.0% soot

Thermoplastic ISO 1874 – PA 66, ML, 14-090 (minimum class), GF30, 0.5 - 1.0% soot

Requirements and test plan for the moulded part (finished part):

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory production control FPC |
|--|--|---|--------------------------|---|---|
| Colour, colour shade | Drawing, reference sample | Compliant | X | X | X |
| Surface | Drawing, reference sample | Compliant | X | X | X |
| Dimensions | Drawing | Compliant Conditioned | X | X | |
| Functional dimensions | Drawing or specify in QM plan | Compliant Conditioned | X | X | X |
| Weight | Drawing with the manufacturer's specific details | Compliant | X | X | X |
| Voids | Reference sample | Compliant | X | X | X |
| Density (1 part per shot) | DIN EN ISO 1183-1 | PA6: 1.300–1.420 g/cm ³ PA66: 1.300–1.420 g/cm ³ | X | X | X |
| Glass content | DIN EN ISO 1172 | 30 ±3% w/w | X | | |
| Percentage of soot | ISO 11358 (TGA) | 0.5-1.0% | X | | |
| Viscosity number | DIN EN ISO 307 | ≥130 ml/g max. deviation -10% from moulding material to moulded part | X | X | Monthly per component group and alternately per production facility |
| Thermogram of the DSC analysis | ISO 11357-3 | PA6: 215–225°C PA66: 255–265°C | X | X | 1 x per batch of moulding material |
| Modulus of elasticity from tensile strength test | DIN EN ISO 527-2 | ≥6000 MPa | X | | |
| Impact strength | Based on DIN EN ISO 179-1 eU | >40 kJ/m ² (A and B specimen) | X | X | 1 unit per week and mould with changing mould cavity |
| Moisture content | See section 5.4 for test method | 1-2.5% | X | X | X |

| Type of test | Specification Test specifica- tion | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory produc- tion control FPC |
|---|--|-------------------------------------|-----------------------------|--|--|
| Breaking force in bending test on finished part | Bending test with round bar steel Figure 2. Test speed 5 mm/min Abrasive cloth on a backing (fabric-based), P 240 with a mean grain diameter 58 µm according to the Fepa 43-D-1984 standard | ≥15 kN (angle guide plate 3, 14) | X | X | 3 tests per moulded part per quarter |
| Volume resistivity | DIN IEC 60093 | ≥10 ⁸ Ωcm | X | | |

¹⁾ If FAI is also the QT, the QT test plan applies

Further information:

In the FPC and in additional quality tests conducted by DB AG, the values determined should be at the level of those determined for the properties in the qualification tests or FAI. Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818.

Conditioned products shall be used for determining the moisture content and for the bending test on the finished product (angle guide pate).

The impact strength values shall be determined and the tensile test (modulus of elasticity) conducted in a dry state (as-moulded or drying as specified in the "Test methods" section no. 7).

The test specimens for the impact strength and tensile test (modulus of elasticity) shall be removed according to the relevant DB drawing. If these do not contain any corresponding details, the test specimens are to be taken from the angle guide plates according to Figure 1 below.

Test specimens for impact strength (angle guide plate): based on test specimen type 1eU, l > 80 mm, b = 10 mm, h = 10 mm.

Test specimens for tensile test: test specimen 1BA, l₃ ≥ 75 mm, b₁ = 5 mm, h = 5 mm

Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818. The test specimens shall be stored in a desiccator between preparation of the test specimens and execution of the test.

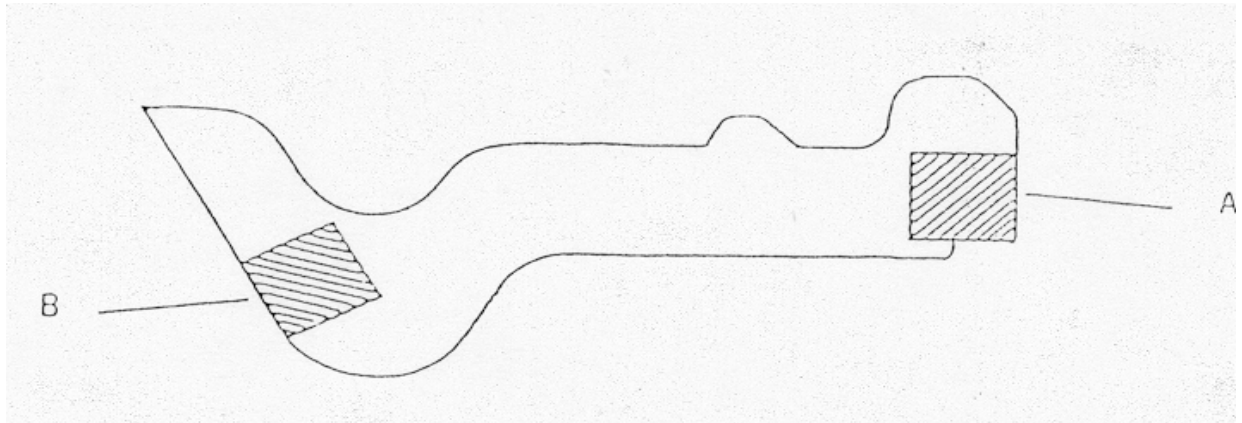


Figure 1: Angle guide plate: removal positions A and B for test specimens for the impact strength test (DIN EN ISO 179-1). When performing the test, the unmachined side of the test specimens is to be placed in the tensile zone. The test specimens for the test of tensile modulus of elasticity shall also be taken from the areas around A and B (DIN EN 527-2)

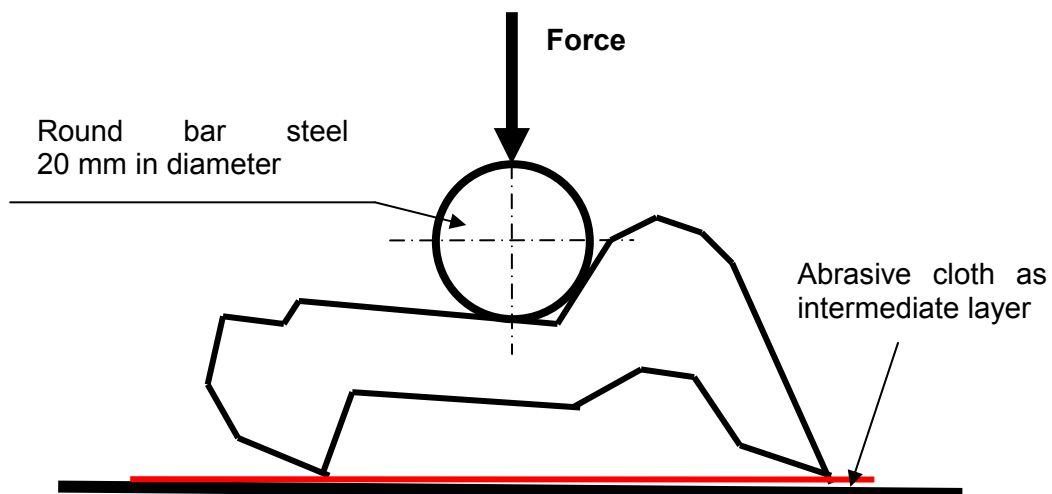


Figure 2: Angle guide plate: principle of the bending test on the finished part

Annex F (normative): Datasheet no. 9:

Moulding material with designation according to DIN EN ISO 1874 Part 1:

Polyamide 6 or polyamide 66 natural or stabilised with 0.5 to 1.0% fine-particle soot (black), depending on the stipulations on the drawing.

Thermoplastic ISO 1874 – PA 6, MNH, 14-030 (minimum class)

Thermoplastic ISO 1874 – PA 6, MC2H, 14-030 (minimum class), 0.5 - 1.0% soot

Thermoplastic ISO 1874 – PA 66, MNH, 14-030 (minimum class)

Thermoplastic ISO 1874 – PA 66, MC2H, 14-030 (minimum class), 0.5 - 1.0% soot

Requirements and test plan for the moulded part (finished part):

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory production control FPC |
|--|--|---|--------------------------|---|---|
| Colour, colour shade | Drawing, reference sample | Compliant | X | X | X |
| Surface | Drawing, reference sample | Compliant | X | X | X |
| Dimensions | Drawing | Compliant For insulating angles and joint pads: Conditioned | X | X | |
| Functional dimensions | Drawing or specify in QM plan | Compliant For insulating angles and joint pads: conditioned | X | X | X |
| Weight | Drawing with the manufacturer's specific details | Compliant | X | X | X |
| Voids | Reference sample | Compliant | X | X | X |
| Density (1 part per shot) | DIN EN ISO 1183-1 | PA6: 1.120-1.140 g/cm ³ PA66: 1.130-1.150 g/cm ³ | X | X | X |
| Percentage of soot | ISO 11358 (TGA) | 0.5-1.0% | X | | |
| Viscosity number | DIN EN ISO 307 | ≥130 ml/g max. deviation - 10% from moulding material to moulded part | X | X | Monthly per component group and alternately per production facility |
| Thermogram of the DSC analysis | ISO 11357-3 | PA6: 215-225°C PA66: 255-265°C | X | X | 1 x per batch of moulding material |
| Modulus of elasticity from tensile strength test | DIN EN ISO 527-2 | ≥2000 MPa | X | | |
| Impact strength | DIN EN ISO 179-1 eU | Only for joint pads at 23°C: no break | X | X | X |
| Charpy impact strength | DIN EN ISO 179-1 eA | See "Further information" for require- | X | X | X |

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory production control FPC |
|--------------------------------|---|---|--------------------------|---|-----------------------------------|
| Moisture content | See section 5.4 for test method | Only for joint pads: 2-3% Only for insulating angles: 2.5-3.5% | X | X | X |
| Rupture force on finished part | Only for screwed insert 25 /27: 5 kN (?) Methodology/ regulation in preparation | Yet to be determined | X | X | |
| Volume resistivity | DIN IEC 60093 | $\geq 10^8 \Omega\text{cm}$ | X | | |

¹⁾ If FAI is also the QT, the QT test plan applies

Further information:

In the FPC and in additional quality tests conducted by DB AG, the values determined should be at the level of those determined for the properties in the qualification tests or FAI.

The impact strength values and Charpy impact strength values shall be determined and the tensile test (modulus of elasticity) shall be conducted in a dry state (as-moulded or drying as specified in the "Test methods" section no. 7).

The test specimens for the impact strength and Charpy impact strength tests as well as for the tensile test (modulus of elasticity) shall be removed according to the relevant DB drawing or agreement

Test specimens for impact strength and Charpy impact strength: based on test specimen type 1eU, $l > 80 \text{ mm}$, $b = 10 \text{ mm}$, $h = 4 \text{ mm to } 10.2 \text{ mm}$ depending on thickness of moulded part and on agreement. In the Charpy impact test: notch in the unmachined side.

Test specimens for tensile test: test specimen 1BA, $l_3 \geq 75 \text{ mm}$, $b_1 = 5 \text{ mm}$, $h = 2 \text{ to } 5 \text{ mm}$ (agreement). With small finished parts test specimen 1BB is permissible: $l_3 \geq 30 \text{ mm}$, $b_1 = 2 \text{ mm}$,
 $h \geq 2 \text{ mm}$ (agreement)

Specific agreements are to be made if no standard-compliant test specimens can be taken from the products (finished parts).

Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818. The test specimens shall be stored in a desiccator between preparation of the test specimens and execution of the test.

Storage of the screwed inserts and joint pads:
the moulded parts must be protected from splash water when stored between manufacture and use.

Upon corresponding agreement, determination of the density can also be calculated from the volume and mass of finished parts.

Annex G (normative): Datasheet no. 14:

Moulding material with designation according to DIN EN ISO 1874 Part 1:

Polyamide 6 with 35% glass fibres/glass beads

Thermoplastic ISO 1874 – PA 6, MHR, 14-060 (minimum class), GF/GK35

Requirements and test plan for the moulded part (finished part):

| Type of test | Specification Test specification | Requirement | Qualification test QT | First article inspection FAI ¹⁾ | Factory produc- tion control FPC |
|--|--|---|-----------------------------|--|---|
| Colour, colour shade | Drawing, reference sample | Compliant | X | X | X |
| Surface | Drawing, reference sample | Compliant | X | X | X |
| Dimensions | Drawing | Compliant Conditioned | X | X | |
| Functional di- mensions | Drawing or speci- fy in QM plan | Compliant Conditioned | X | X | X |
| Weight | Drawing with the manufacturer's specific details | Compliant | X | X | X |
| Voids | Reference sam- ple | Compliant | X | X | X |
| Density (1 part per shot) | DIN EN ISO 1183-1 | 1.300-1.420 g/cm ³ | X | X | X |
| Glass content | DIN EN ISO 1172 | 35 ± 3% w/w | X | | |
| Viscosity number | DIN EN ISO 307 | ≥130 ml/g max. deviation - 10% from mould- ing material to moulded part | X | X | Monthly per component group and alter- nately per pro- duction facility |
| Thermogram of the DSC analysis | ISO 11357-3 | 215-225°C | X | X | 1 x per batch of moulding materi- al |
| Modulus of elas- ticity from tensile strength test | DIN EN ISO 527- 2 | ≥6000 MPa | X | | |
| Impact strength | DIN EN ISO 179- 1 eU | >40 kJ/m ² | X | X | X |
| Moisture content | See section 5.4 for test method | 1-2.5% | X | X | X |
| Volume resistivity | DIN IEC 60093 | ≥10 ⁸ Ωcm | X | | |

¹⁾ If FAI is also the QT, the QT test plan applies

Further information:

In the FPC and in additional quality tests conducted by DB AG, the values determined should be at the level of those determined for the properties in the qualification tests or FAI. Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818.

The impact strength values shall be determined and the tensile test (modulus of elasticity) conducted in a dried state (as-moulded or drying as specified in the "Test methods" section no. 7).

The test specimens for the impact strength and tensile test (modulus of elasticity) shall be removed according to the relevant DB drawing or agreement.

Test specimens for impact strength: based on test specimen type 1eU, $l > 80$ mm, $b = 10$ mm, $h = 4$ mm to 10.2 mm depending on thickness of moulded part and on agreement.

Test specimens for tensile test: test specimen 1BA, $l_3 \geq 75$ mm, $b_1 = 5$ mm, $h = 2$ to 5 mm (agreement). With small finished parts test specimen 1BB is permissible: $l_3 \geq 30$ mm, $b_1 = 2$ mm, $h \geq 2$ mm (agreement)

Specific agreements are to be made if no standard-compliant test specimens can be taken from the products (finished parts).

Preparing test specimens and requirements placed on machined surfaces according to DIN EN ISO 2818. The test specimens shall be stored in a desiccator between preparation of the test specimens and execution of the test.

Storage of the joint pads:

the moulded parts must be protected from splash water when stored between manufacture and use.

Upon corresponding agreement, determination of the density can also be calculated from the volume and mass of finished parts.