SLOVENSKI STANDARD
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Nepravilnosti v zvarjenih spojih plastomerov - Stopnje kakovosti

Imperfections in thermoplastics welded joints - Quality levels

Unregelmäßigkeiten an Schweißverbindungen von thermoplastischen Kunststoffen - Bewertungsgruppen

Défauts dans les assemblages soudés en thermoplastiques - Niveaux de qualité

Ta slovenski standard je istoveten z: **prEN 16296**

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Imperfections in thermoplastics welded joints - Quality levels

Défauts dans les assemblages soudés en thermoplastiques - Niveaux de qualité

Unregelmäßigkeiten an Schweißverbindungen von thermoplastischen Kunststoffen - Bewertungsgruppen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (prEN 16296:2020) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 16296:2012.

In comparison with the previous edition, the following technical modifications have been made:

— the PA polyamide thermoplastic material has been added in Table 1- Thermoplastic materials;

— in the Tables 3 to 8:

  — the designation 1AAAA of the quality levels for "cracks" has been deleted to be consistent with EN 14728:2019;

  — the numbers and designations have been updated to be aligned with EN 14728:2019 as the texts for the quality levels.

Introduction

This document should be used as a reference in drafting of application codes and/or other application standards. It contains a simplified selection of imperfections based on the designations given in EN 14728, *Imperfections in thermoplastic welds — Classification*.

Some imperfections according to EN 14728 have been used directly and some have been grouped together. The basic numerical referencing system from EN 14728 has been used.

The purpose of this document is to define quality levels based on typical imperfections, which might occur in normal fabrication. It may be used within a quality system for the production of factory welded joints. It provides three sets of dimensional values from which a selection can be made for a particular application. The quality level necessary in each case should be defined by the application standard or the fabricator in conjunction with the user and/or other parties concerned. The level should be prescribed before the start of production, preferably at the enquiry or order stage.

The quality levels given in this document are intended to provide basic reference data and are not specifically related to any particular application. They refer to the types of welded joints in a fabrication and not to the complete product or component itself. It is possible, therefore, that different quality levels are applied to individual welded joints in the same product or component.

The choice of quality level for any application should take account of design considerations, subsequent processing, mode of stressing (e.g. static, dynamic), service conditions (e.g. pressure, temperature, environment) and consequences of failure. Economic factors are also important and should include not only the cost of welding but also of inspection, test and repair.

Although this document includes types of imperfections relevant to the processes given in Clause 1, only those which are applicable to the process and application in question need to be considered.

Imperfections are quoted in terms of their actual dimensions. However, their detection and evaluation may require the use of one or more methods of non-destructive testing. It should be noted that the detection and sizing of imperfections is dependent on the inspection methods and the extent of testing specified in the application standard or contract.

The need for detection is not the subject of this document.

This document is directly applicable to visual examination of welds or test specimens. It does not include details of recommended methods of detection and sizing. The indication provided by non-destructive testing should not be used directly for the evaluation of quality levels. Therefore, it needs to be supplemented by requirements for examinations, inspection and testing.

1 Scope

This document provides quality levels for imperfections in thermoplastics welded joints. It applies to material thickness above 2,0 mm.

Three quality levels are given in order to permit application for a wide range of welded fabrication. They are designated by symbols B, C and D, where B is the most stringent. The quality levels refer to production quality and not to the fitness-for-purpose (see 3.2) of the manufactured product.

This document applies to the following thermoplastic materials in Table 1:

Table 1 — Thermoplastic materials

Abbreviation	Material description
ABS	Acrylonitrile-butadiene-styrene plastic
ECTFE	Ethylene-chlorotrifluoroethylene copolymer
FEP	Fluorinated ethylene propylene
PA-U	Unplasticized Polyamide
PB	Polybutylene
PE	Polyethylene
PFA	Perfluoroalkoxy
PP-B	Polypropylene block copolymer
PP-H	Polypropylene homopolymer
PP-R	Polypropylene random copolymer
PVC-C	Chlorinated polyvinyl chloride
PVC-U	Unplasticized polyvinyl chloride (rigid PVC)
PVDF	Polyvinylidene fluoride

and to the following welding processes:

— heated tool welding;

— electrofusion welding;

— hot gas welding using filler rod only;

— extrusion welding;

— solvent welding of pipes.

2 Normative reference

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14728, *Imperfections in thermoplastic welds — Classification*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
quality level
description of the qualities of a weld on the basis of type and size of selected imperfections

3.2
fitness-for-purpose
ability of a product, process or service to serve a defined purpose under specific conditions

4 Quality levels

4.1 Classification

Three quality levels are defined as B, C and D in order to permit application for a wide range of welded fabrications (see Table 2).

Table 2 — Quality levels for weld imperfections

Symbol	Requirement
B	Stringent
C	Intermediate
D	Moderate

The purpose of this document is to define quality levels based on typical imperfections, which might occur in normal fabrications and are classified in EN 14728. It may be used within a quality system for the production of factory welded joints. It provides three sets of dimensional values from which a selection can be made for a particular application. The quality level necessary in each case should be defined by the application standard or the fabricator in conjunction with the user and/or other parties concerned. The level should be prescribed before the start of production, preferably at the enquiry or order stage.

For pressure pipe systems, it is recommended that at least level B be chosen.

For specific applications, additional requirements not covered by this standard may need to be prescribed. These additional requirements shall be defined as quality level A.

4.2 Choice of quality level

For the choice of the quality level, the following factors, among others, shall be taken into account:

— mechanical loading (static, dynamic);

— environment (media, temperature);

— material properties (ductile, brittle);

— manufacturing conditions (workshop, construction site, welding in constrained condition);

— operating conditions;

— potential danger in the vent of failure.

5 Requirements for welded joints

The requirements for the above mentioned quality levels (B, C and D) are listed as follows:

— heated tool butt welds: Table 3;

— heated tool socket welds: Table 4;

— electrofusion socket welds: Table 5;

— hot gas welds: Table 6;

— extrusion welds: Table 7;

— solvent socket welds : Table 8.

Different types of imperfection occurring simultaneously at any cross-section of the joint may need special consideration and advice should be sought from the product manufacturer.

Any two adjacent imperfections separated by a distance smaller than the major dimension of the smaller imperfection shall be considered as a single imperfection.

In certain circumstances, it is necessary to machine the completed weld. In this case, the weld shall be examined both before and after machining.

Table 3 — Definition of quality levels for heated tool butt welds

Number	Designations	Level B	Level C	Level D
2BAAA	Gas cavity inside of fusion zone	Isolated cavities permissible if diameter ≤ 5 % of wall thickness	Permissible if diameter of largest cavity ≤ 10 % of wall thickness	Permissible if diameter of largest cavity ≤ 15 % of wall thickness
2CAAI	Shrinkage cavity	Isolated cavities permissible if diameter ≤ 5 % of wall thickness	Permissible if diameter of largest cavity ≤ 10 % of wall thickness	Permissible if diameter of largest cavity ≤ 15 % of wall thickness
2MAAA	Surface bubble	Permissible if, when the weld bead is removed, there is no evidence of gas cavities at the weld interface	Permissible if, when the weld bead is removed, there is no evidence of gas cavities at the weld interface	Permissible if, when the weld bead is removed, there is no evidence of gas cavities at the weld interface
3AAAA	Particulate inclusion	Isolated inclusion permissible if maximum dimension ≤ 5 % of wall thickness	Isolated and rows of inclusions permissible if maximum dimension ≤ 10 % of wall thickness	Isolated and rows of inclusions permissible if maximum dimension ≤ 15 % of wall thickness
3JAAI	Parent material inclusion	Not permissible	Not permissible	Not permissible
3KAAA	Degraded polymer	Not permissible	Not permissible	Not permissible
4BAAA	Lack of fusion	Not permissible	Not permissible	Not permissible
4QBAF	Groove in upset or reinforcement	Not permissible if below surface of parent material	Not permissible if below surface of parent material	Not permissible if below surface of parent material
4WAAA	Cold fusion	Not permissible	Not permissible	Not permissible
5CAAA	Deviation of the specified shape of the weld bead	Mechanical testing of sample welds is recommended	Mechanical testing of sample welds is recommended	Mechanical testing of sample welds is recommended
5EIAA[b]	Linear misalignment	Permissible if misalignment is not greater than 10 % of the wall thickness	Permissible if misalignment is not greater than 15 % of the wall thickness	Permissible if misalignment is not greater than 20 % of the wall thickness

Number	Designations	Level B	Level C	Level D
5EJAA[b]	Angular misalignment	Permissible if misalignment is not greater than 1,0°	Permissible if misalignment is not greater than 1,5°	Permissible if misalignment is not greater than 2,0°
5GAAA	Irregular width	To be agreed between contracting parties	To be agreed between contracting parties	To be agreed between contracting parties
6DAAA	Excessive width	To be agreed between contracting parties	To be agreed between contracting parties	To be agreed between contracting parties
6HAAA[a]	Excessive asymmetry of welds	Permissible if smaller half of weld bead is not less than 70 % of larger half of weld bead at any point around the circumference	Permissible if smaller half of weld bead is not less than 60 % of larger half of weld bead at any point around the circumference	Permissible if smaller half of weld bead is not less than 50 % of larger half of weld bead at any point around the circumference
6MAAA	Insufficient upset material	To be agreed between contracting parties	To be agreed between contracting parties	To be agreed between contracting parties
7BAAA	Thermal damage outside of welding	Not permissible	Not permissible	Not permissible
7VAAA	Excessive toe in	To be agreed between contracting parties	To be agreed between contracting parties	To be agreed between contracting parties
9CAAA	Tool mark	Locally permissible if the notch depth is less than 10 % of the wall thickness	Locally permissible if the notch depth is less than 10 % of the wall thickness	Locally permissible if the notch depth is less than 15 % of the wall thickness
[a] To be agreed between contracting parties when welding materials with different MFRs. [b] For mitred joints the requirements should be agreed between the contracting parties.				
NOTE Some of the data in this table can also be found in DVS 2202 [1].				