TECHNICAL SPECIFICATION

ISO/TS 26873

First edition
2010-08-15

Plastics pipes and fittings — Definition and construction procedures for reference lines

Tubes et accessoires en plastiques — Définition et procédure de construction des lignes de référence

Reference number
ISO/TS 26873:2010(E)

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Published in Switzerland

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 26873 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*.

Introduction

This Technical Specification gives guidance to the construction of a stress rupture diagram, consisting of reference lines, giving the expected minimum required strength of plastics pipes under internal pressure as a function of time and temperature. Such lines are used for the interpolation and extrapolation of stress rupture properties and for the application of Miner's rule (see ISO 13760) in product standards (see Annex A).

Plastics pipes and fittings — Definition and construction procedures for reference lines

1 Scope

This Technical Specification defines reference lines as the generic representation of the creep rupture properties of pipes made of thermoplastics material and gives procedures for drafting reference lines in a mathematical form.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 9080:—, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*[1)]

3 Terms and definitions

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

3.1
reference line
mathematical description of the stress rupture properties of thermoplastics materials giving the expected hoop strength of the product with a certainty of at least 97,5 % when tested in accordance with ISO 1167-1 and ISO 1167-2

NOTE 1 Reference lines can be used for the calculation of design stress. They begin and end according to limits defined in ISO 9080.

1) Under preparation.

NOTE 2 Reference lines are defined using Equation (1):

$$\log_{10} t = A_i + B_i \frac{\log_{10} \sigma}{T} + \frac{C_i}{T} + D_i \log_{10} \sigma \quad (1)$$

where

t is the expected time to failure, in hours;

σ is the hoop stress, in megapascals;

T is the temperature, in kelvins (°C + 273,15);

A, B, C, D are the parameters used in the model;

i is 1 or 2, in the case of two separate branches (sometimes referred to as brittle and ductile).

NOTE 3 Equation (1) is similar to ISO 9080:—, Equation (A.1), but to avoid confusion, different symbols for the parameters have been used (A to D, instead of c_1 through c_4). This notation is already in general use in several International Standards dealing with reference lines (see Annex A).

NOTE 4 Examples of thermoplastics materials are PE, PB, PE-X, PE-RT, PP, PVC-C, PVC-U, ABS and PVDF.

4 Procedures for drawing reference lines

4.1 General

Depending on the available information, one of the following procedures shall be applied, taking into account the order in which these procedures are given. Lines generated according to these procedures shall not be used as reference lines until approved by ISO TC 138/SC 5.

4.2 Regression method

Reference lines shall be based on the analysis of a set of data points as given in ISO 9080, which is considered representative of the product. Data for at least three temperatures, including 20 °C and at least 10 K apart, shall be used.

The regression (50 %) lines shall be shifted vertically until at least 97,5 % of the failure points are on or above the new line. The shift shall be equal at all temperatures.

In the case of a knee found with ISO 9080, the amount of lowering shall be determined separately for each branch.

4.3 Constructed reference lines

If ISO 9080 is not applicable, develop a 4-parameter model for each branch, in accordance with Equation (1).

Annex A
(informative)

International Standards in which reference lines can be found

Reference lines can be found in the following International Standards:

a) ISO 3213 and ISO 15874-1, ISO 15874-2 and ISO 15874-3 for PP-H, PP-B, PP-R and PP-RCT;

b) ISO 10146 and ISO 15875-1, ISO 15875-2, ISO 15875-3, ISO 15875-5 and ISO 15875-7 for PE-X;

c) ISO 12230 and ISO 15876-1, ISO 15876-2, ISO 15876-3, ISO 15876-5 and ISO 15876-7 for PB;

d) ISO 15494 for PB, PE and PP;

e) ISO 24033 and ISO 22391-1, ISO 22391-2, ISO 22391-3, ISO 22391-5 and ISO/TR 22391-7 for PE-RT;

f) ISO 15877-1, ISO 15877-2 ISO 15877-3, ISO 15877-5 and ISO/TS 15877-7 for PVC-C;

g) ISO 15493 for ABS, PVC-U, PVC-C;

h) ISO 1452-1 for PVC-U;

i) ISO 10931 for PVDF.

Bibliography

[1] ISO 1452-1, *Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: General*

[2] ISO 3213, *Polypropylene (PP) pipes — Effect of time and temperature on the expected strength*

[3] ISO 10146, *Crosslinked polyethylene (PE-X) pipes — Effect of time and temperature on the expected strength*

[4] ISO 10931, *Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF) — Specifications for components and the system*

[5] ISO 12230, *Polybutene (PB) pipes — Effect of time and temperature on the expected strength*

[6] ISO 13760, *Plastics pipes for the conveyance of fluids under pressure — Miner's rule — Calculation method for cumulative damage*

[7] ISO 15493, *Plastics piping systems for industrial applications – Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) – Specifications for components and the system — Metric series*

[8] ISO 15494, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE) and polypropylene (PP) — Specifications for components and the system — Metric series*

[9] ISO 15874-1, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 1: General*

[10] ISO 15874-2, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 2: Pipes*

[11] ISO 15874-3, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 3: Fittings*

[12] ISO 15875-1, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 1: General*

[13] ISO 15875-2, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 2: Pipes*

[14] ISO 15875-3, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 3: Fittings*

[15] ISO 15875-5, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 5: Fitness for purpose of the system*

[16] ISO 15875-7, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 7: Guidance for the assessment of conformity*

[17] ISO 15876-1, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 1: General*

[18] ISO 15876-2, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 2: Pipes*

[19] ISO 15876-3, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 3: Fittings*

[20] ISO 15876-5, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 5: Fitness for purpose of the system*

[21] ISO 15876-7, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 7: Guidance for the assessment of conformity*

[22] ISO 15877-1, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 1: General*

[23] ISO 15877-2, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 2: Pipes*

[24] ISO 15877-3, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 3: Fittings*

[25] ISO 15877-5, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 5: Fitness for purpose of the system*

[26] ISO/TS 15877-7, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 7: Guidance for the assessment of conformity*

[27] ISO 22391-1, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 1: General*

[28] ISO 22391-2, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 2: Pipes*

[29] ISO 22391-3, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 3: Fittings*

[30] ISO 22391-5, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 5: Fitness for purpose of the system*

[31] ISO/TR 22391-7, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 7: Guidance for the assessment of conformity*

[32] ISO 24033, *Polyethylene of raised temperature resistance (PE-RT) pipes — Effect of time and temperature on the expected strength*

ICS 23.040.20; 23.040.45

Price based on 5 pages