
**Thermoplastics pipes — Longitudinal
reversion — Test method and
parameters**

*Tubes en matières thermoplastiques — Retrait longitudinal à chaud
— Méthode d'essai et paramètres*

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document 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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 155, *Plastic piping systems and ducting systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 2505:2005), which has been technically revised.

The main changes are as follows:

- the following materials and their respective test requirements have been added: PE 100-RC, PB-H, PB-R, PE-RT, PP-RCT and PE-UHMW;
- a requirement has been added stating that small diameter pipes from coils are to be straightened prior to testing.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Thermoplastics pipes — Longitudinal reversion — Test method and parameters

1 Scope

This document specifies a method for determining the longitudinal reversion of thermoplastics pipes, to be carried out in either a liquid or in air. In case of dispute, heated liquid is used as the reference.

This document is applicable to all thermoplastics pipes with smooth internal and external walls of constant cross-section. It is not applicable to non-smooth structured-wall thermoplastics pipes.

The parameters appropriate to the pipe material and recommendations for the maximum levels of reversion as a function of the pipe material are given in [Annex A](#).

This method is applicable for pipes of wall thickness ≤ 16 mm.

2 Normative references

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.

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

4 Abbreviated terms

For the purposes of this document, the abbreviated terms used for the plastic materials given in ISO 1043-1 and the following apply.

ABS	acrylonitrile/butadiene/styrene
ASA	acrylonitrile/styrene/acrylate
MRS	minimum required strength
PA-U	unplasticized polyamide
PB-H	polybutene homopolymer
PB-R	polybutylene random copolymer
PE 32/40	polyethylene MRS 3,2/4

PE 50/63	polyethylene MRS 5/6,3
PE 80	polyethylene MRS 8
PE 100	polyethylene MRS 10
PE 100-RC	PE 100 with raised crack resistance
PE-RT	polyethylene with raised temperature resistance
PE-UHMW	polyethylene with ultra-high molecular weight
PE-X	cross-linked polyethylene
PP-B	polypropylene block copolymer
PP-H	polypropylene homopolymer
PP-R	polypropylene random copolymer
PP-RCT	polypropylene random copolymer with modified crystallinity
PVC-C	chlorinated poly(vinyl chloride)
PVC-U	unplasticized poly(vinyl chloride)
PVC-HI	high-impact poly(vinyl chloride)
SAN+PVC	styrene/acrylonitrile plus poly(vinyl chloride)

5 Principle

A pipe of specified length is placed in a liquid bath or air oven at a specified temperature for a specified time. A marked length of this portion of pipe is measured, under identical conditions, before and after heating. The reversion is calculated as a percentage of the change in length in relation to the initial length. The surface appearance of the test piece shall not be changed after heating.

6 Apparatus

6.1 Heated liquid bath, thermostatically controlled at the temperature, T_R , as specified in [Table 1](#), unless otherwise specified by a referring standard.

The volume and agitation of the bath shall be such that the temperature remains within the specified temperature range when the test piece is immersed.

The liquid chosen should be stable at the specified temperature and should not otherwise affect the plastics material. Glycerine, glycol, mineral oil free from aromatic hydrocarbons, or a solution of calcium chloride are suitable, but any other liquid in line with these requirements may be used.

6.2 Air oven, thermostatically controlled such that it operates at the temperature, T_R , as specified in [Table 1](#), unless otherwise specified, and capable of re-establishing this temperature within 15 min of the introduction of the test pieces. The oven shall be equipped with a thermostat capable of maintaining T_R to a permissible deviation of ± 2 °C.

6.3 Ancillary equipment

6.3.1 Device, to hold the test piece(s) within the heating bath or oven in accordance with [Clause 7](#).

6.3.2 Thermometer, with an accuracy to within $\pm 0,5$ °C.

6.3.3 Scriber, to trace marks on the pipe in accordance with [Clause 7](#).

6.3.4 Calliper, for measurement with an uncertainty to within $\pm 0,1$ mm.

7 Preparation

7.1 Test piece

Immediately after extrusion, the sample of pipe to be tested shall be stored at (23 ± 2) °C, or conditioning in accordance with [7.2](#) shall commence.

If the test is carried out immediately after production of the pipe, a pessimistic result can be obtained. In case of dispute, carry out the test at least 24 h after production and storage at (23 ± 2) °C.

Take as a test piece a pipe (200 ± 20) mm long.

Using, for example, a scriber, trace on this test piece two circumferential marks approximately 100 mm apart, and approximately equidistant from the pipe ends corresponding to the test area. Alternatively, scribe three or four pairs of axially aligned points on the test pipe, approximately 100 mm apart.

NOTE If pipe is taken from a coil, before marking it is necessary to straighten the pipe. This can be done by inserting a tube into the test pipe.

Prepare a total of three similar test pieces per pipe sample.

For pipes of diameter 250 mm or larger, each test piece may be cut into four even segments.

All 12 segments shall be tested. Each set of four segments shall be treated as one test piece.

Each segment shall be marked to avoid mix up of segments.

[Table 1](#) shows the parameters for determination using a liquid bath or air oven. The values in the third and fourth column ("Duration of exposure" and "Length of test piece") are the same for every thermoplastic material.

Table 1 — Parameters for the determination using a liquid bath or air oven

Thermoplastics material ^a	Temperature of bath or air oven T_R °C	Duration of exposure ^b min.	Length of test piece mm
PVC-U	150 ± 2	For liquid bath: 15 for $e \leq 8$ mm 30 for $8 \text{ mm} < e \leq 16 \text{ mm}$ For air oven: 60 for $e \leq 8$ mm 120 for $8 \text{ mm} < e \leq 16 \text{ mm}$	Minimum 180
PVC-C	150 ± 2		
PVC-HI	150 ± 2		
SAN+PVC	150 ± 2		
PA	150 ± 2 (air oven only)		
PE 32/40	100 ± 2		
PE 50/63	110 ± 2		
PE 80, PE100, PE 100-RC			
Key e is the mean wall thickness, in mm. ^a Symbols in accordance with ISO 1043-1. ^b Tolerance on conditioning time $\pm_0^5$ min.			

Table 1 (continued)

Thermoplastics materi- al ^a	Temperature of bath or air oven T_R °C	Duration of exposure ^b min.	Length of test piece mm
PE-RT		For liquid bath: 15 for $e \leq 8$ mm 30 for $8 \text{ mm} < e \leq 16 \text{ mm}$ For air oven: 60 for $e \leq 8$ mm 120 for $8 \text{ mm} < e \leq 16 \text{ mm}$	Minimum 180
PE-X	120 ± 2		
PE-UHMW	110 ± 2		
PB-R, PB-H	110 ± 2		
PP-H, PP-B	150 ± 2		
PP-R, PP-RCT	135 ± 2		
ASA	135 ± 2		
ABS	110 ± 2		
Key			
e is the mean wall thickness, in mm.			
^a Symbols in accordance with ISO 1043-1.			
^b Tolerance on conditioning time $\pm_0^5$ min.			

7.2 Conditioning

Condition the test pieces at (23 ± 2) °C for a period of time according to the wall thickness of the pipe as follows:

- 1 h for $e \leq 3$ mm;
- 3 h for $3 \text{ mm} < e \leq 8$ mm;
- 6 h for $8 \text{ mm} < e \leq 16$ mm;

where e is the mean wall thickness in millimetres.

8 Procedure

At a temperature of (23 ± 2) °C, measure the distance L_0 between the marks to within 0,25 mm.

Establish the required temperature of the heating bath or air oven to the temperature T_R , as specified in [Table 1](#), unless otherwise specified.

Suspend the test pieces allowing free movement in the heating bath or air oven so that they touch neither the walls nor the base of the bath or oven, and in the case of the bath so that there is a minimum distance of 30 mm between the upper boundary of the test area (see [6.1](#)) and the fluid–air interface. Alternatively, the test piece may be supported providing this does not inhibit reversion.

NOTE Talc or a PTFE foil on a horizontal support can be used to allow free movement of the test piece.

Leave the test pieces for the duration specified in [Table 1](#), unless otherwise specified. Allow the bath or oven to re-establish the specified temperature, and count only the time tested at this temperature. Maintain the specified test temperature in the zone between the circumferential marks on the test piece.

Remove the test pieces from the bath or oven and allow them to cool down in the same position as in the oven or bath.

After they have naturally cooled to $(23 \pm 2) ^\circ\text{C}$, wait at least another hour and then measure the maximum and minimum distance, L_i , between marks (diametrically opposed), following any curvature of the marked surfaces.

9 Expression of results

For each test piece, calculate the longitudinal reversion, $R_{L,i}$, as a percentage, using [Formula \(1\)](#):

$$R_{L,i} = \frac{\Delta L}{L_0} \times 100 \quad (1)$$

where

$$\Delta L = L_0 - L_i$$

L_0 is the distance between the marks before the immersion, in mm;

L_i is the distance between the marks after the immersion, measured along the generatrices, in mm.

Choose those measurements of L_i which give the greatest value of ΔL , with ΔL being either positive or negative.

When the test piece has been cut into four even segments (see [7.1](#)), the longitudinal reversion of each test piece, $R_{L,i}$, is calculated as the highest value of the four segments.

Calculate, as the value for the longitudinal reversion of the pipe, $R_{L,I}$, the arithmetic mean of the values obtained for each of the three test pieces to one decimal place.

10 Test report

The test report shall include at least the following information:

- a) a reference to this document, i.e. ISO 2505:2023;
- b) full identification of the pipe;
- c) details of how the test pieces were prepared;
- d) the nature of the heating fluid used;
- e) the duration of the test and the temperature, T_R , of the bath or oven;
- f) the change in length of each test pipe, ΔL , indicating whether it is positive or negative;
- g) any change in the appearance of the test pieces during the immersion, or immediately afterwards, for example, bubbles or cracking;
- h) the value of the longitudinal reversion, $R_{L,i}$, of the pipe, calculated in accordance with [Clause 9](#);
- i) all operating details not specified in this method, as well as any incidents likely to have influenced the results and any unusual features observed;
- j) the date of the test.