
**Plastics pipes and fittings — Mechanical-
joint compression fittings for use with
polyethylene pressure pipes in water
supply systems**

*Tubes et raccords en matières plastiques — Raccords mécaniques à joint
de compression utilisés avec les tubes pression en polyéthylène dans les
systèmes d'adduction d'eau*

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

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

International Standard ISO 14236 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 2, *Plastics pipes and fittings for water supplies*.

Annex A of this International Standard is given for information only.

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Plastics pipes and fittings — Mechanical-joint compression fittings for use with polyethylene pressure pipes in water supply systems

1 Scope

This International Standard specifies the required properties and test methods for mechanical fittings intended to join polyethylene pressure pipes of nominal outside diameters not greater than 160 mm, used in water supply systems conveying potable water and water for general purposes at temperatures up to and including 40 °C. The nominal pressure of the specified mechanical fittings corresponds at least to the PN of the water supply system for which they are designed and is usually of PN 6, PN 10 or PN 16.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 161-1:1996, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameter and nominal pressure — Part 1: Metric series.*

ISO 197-1:1983, *Copper and copper alloys — Terms and definitions — Part 1: Materials.*

ISO 197-4:1983, *Copper and copper alloys — Terms and definitions — Part 4: Castings.*

ISO 228-1:1994, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 426-1:1983, *Wrought copper-zinc alloys — Chemical composition and forms of wrought products — Part 1: Non-lead and special copper-zinc alloys.*

ISO 426-2:1983, *Wrought copper-zinc alloys — Chemical composition and forms of wrought products — Part 2: Lead copper-zinc alloys.*

ISO 427:1983, *Wrought copper-tin alloys — Chemical composition and forms of wrought products.*

ISO 1083:1987, *Spheroidal graphite cast iron — Classification.*

ISO 1167:1996, *Thermoplastics pipes for the conveyance of fluids — Resistance to internal pressure — Test method.*

ISO 3459:1976, *Polyethylene (PE) pressure pipes — Joints assembled with mechanical fittings — Internal under-pressure test method and requirement.*

ISO 3501:1976, *Assembled joints between fittings and polyethylene (PE) pressure pipes — Test of resistance to pull out.*

ISO 3503:1976, *Assembled joints between fittings and polyethylene (PE) pressure pipes — Test of leakproofness under internal pressure when subjected to bending.*

ISO 4427:1996, *Polyethylene (PE) pipes and fittings for water supply — Specifications.*

ISO 5922:1981, *Malleable cast iron.*

ISO 7686:1992, *Plastics pipes and fittings — Opacity — Test method.*

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

ISO 9853:1991, *Injection-moulded unplasticized poly(vinyl chloride) (PVC-U) fittings for pressure pipe systems — Crushing test.*

ISO 12092:—²⁾, *Fittings, valves and other piping system components made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C), acrylonitrile-butadiene-styrene (ABS) and acrylonitrile-styrene-acrylester (ASA) for pipes under pressure — Resistance to internal pressure — Test method.*

ISO 12162:1995, *Thermoplastics materials for pipes and fittings for pressure applications — Classification and designation — Overall service (design) coefficient.*

ISO 15853:1999, *Thermoplastics materials — Preparation of tubular test pieces for the determination of the hydrostatic strength of materials used for injection moulding.*

EN 1254-3:1998, *Copper and copper alloys — Plumbing fittings — Part 3: Fittings with compression ends for use with plastics pipes.*

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3 Terms and definitions

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

3.1 mechanical-joint compression fitting

fitting in which the joint is made by the compression of a ring or sleeve on the outside wall of the pipe, with or without additional sealing elements and with or without internal support

3.2 nominal size

d_n
nominal outside diameter of the pipe which can be connected to the fitting

3.3 nominal pressure PN

maximum working pressure at which a piping component is required to operate under normal service conditions

3.4 design stress

σ_s
allowable stress for a given application

1) To be published. (Revision of ISO/TR 9080:1992)

2) To be published.

3.5**test stress** σ_T

stress for the relevant test period and temperature

4 Classification

For the purposes of this International Standard, mechanical fittings shall be classified as follows:

- a) according to the connecting system, as follows:
- type 1: external-grip fittings (compression-type fittings), which grip the pipe only at its outer surface,
 - type 2: internal/external-grip fittings, which grip or support the pipe both at the inner and outer surface of the pipe;
- b) according to the resistance of the fitting to the longitudinal forces which develop as a result of the internal pressure, as follows:
- class 1: end-load-bearing compression fittings,
 - class 2: non-end-load-bearing compression fittings.

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5 Material**5.1 General**

The material of the fitting components which are in contact with the water should conform to relevant national standards, where applicable, and shall not contain toxic additives.

NOTE Attention is drawn to the need to comply with national regulations concerning the effects of materials in contact with water for the purposes of water supply.

5.2 Plastics

The fitting body shall be opaque. When measured in accordance with ISO 7686, the percentage of light which passes through the wall of the fitting shall be less than or equal to 0,2 %.

The composition of the plastics parts of the fitting exposed to ultra-violet radiation shall include a UV stabilizer.

The body should preferably be made from one or more of the types of material listed in Table 1.

Table 1 — Plastics fitting materials

Fitting material	MRS	Specified design stress, σ_s
	MPa	MPa
PVC-U	<25	10
PP-H	10	6,3
PP-B, PP-R	8	6,3
POM homopolymer	10	6,3
POM copolymer	10	6,3
ABS	12,5	8

5.3 Metals

Metal fittings should preferably be made from one or more of the materials listed in Table 2. The materials shall be corrosion-resistant or shall be protected against corrosion.

NOTE Some grades of stainless steel and mild steel are also suitable.

Table 2 — Metallic fitting materials

Material designation symbol	Relevant ISO standard
Copper: Cu-DHP	ISO 197-1
Copper alloys, e.g. CuSn ₅ Zn ₅ Pb ₅ -C	ISO 427, ISO 197-4
CuZn ₃₉ Pb ₃	ISO 426-2, ISO 197-4
CuZn ₃₆ Pb ₂ As	ISO 426-2, ISO 197-4
CuZn ₃₃ Pb ₂ -C	ISO 426-2, ISO 197-4
CuZn ₁₅ As-C	ISO 426-1, ISO 197-4
Ductile cast iron	ISO 1083
Malleable cast iron	ISO 5922

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6 Workmanship and appearance

6.1 Plastics materials

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The internal and external surfaces of fittings made of plastics materials shall be clean and free from grooves, pinholes, voids and other features likely to cause the fittings to fail to conform to any requirement of this International Standard.

6.2 Metal or metal-alloy materials

6.2.1 Castings

Castings shall in all respects be sound and free from laps, blowholes and pitting, and both the external and the internal surfaces shall be clean, smooth and free from sand.

6.2.2 Manufactured fittings

Manufactured fittings shall be sound in all respects. In particular, they shall be free from laps, blowholes and pitting, and both the external and internal surfaces shall be clean and smooth.

6.2.3 Fittings made by other processes

Fittings made by other processes shall be sound in all respects and, in particular, free from laminations.

7 Geometrical characteristics

7.1 General

Fittings shall be designed with due regard to good practice in relation to their hydrodynamic characteristics. They shall be manufactured with such dimensions and within such tolerances as will permit their use with polyethylene pipes conforming to ISO 161-1 and ISO 4427.

The dimensions shall be such that joints with pipes conform to the requirements of clause 8.

7.2 Minimum bore diameter

The minimum bore diameter of pre-assembled pipe/fitting assemblies shall be as stated by the manufacturer in his technical specifications.

7.3 Minimum wall thickness of metal fittings

The minimum wall thickness of the fitting body shall conform to Table 3 for castings, stampings and fittings made from rods.

The minimum wall thickness specified shall not apply along the cone angle or at the point of minimum thickness of the loose ring or sleeve where such a ring or sleeve has been deformed to form a seal. It shall also not apply to internal pipe supports.

7.4 Fitting threads

The size and length of jointing threads for connections with the water supply system shall conform to ISO 7-1. Fastening threads shall conform to ISO 228-1.

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Table 3 — Minimum wall thicknesses of metallic fittings

Nominal outside diameter of pipe, d_n	Copper and copper alloys ^a		Ductile and malleable cast iron
	Stampings, or fittings made from rods	Castings	
mm	mm	mm	mm
16	1,2	1,2	Due to limitations in casting techniques, the wall thickness is always greater than that required by the design strength.
20	1,4	1,4	
25	1,4	1,6	
32	1,6	1,8	
40	1,8	2,0	
50	1,9	2,3	
63	2,0	2,4	
75	2,6	2,8	
90	2,9	3,1	
110	3,3	3,5	

^a The minimum wall thicknesses are in conformity with EN 1254-3.

8 Mechanical and hydraulic characteristics

8.1 General

If the fittings are tested, the tests specified in this International Standard shall be used. For this purpose, the fittings shall be joined to polyethylene pipes conforming to ISO 4427. The nominal pressure of the pipes used in the tests shall be equivalent to the nominal pressure of the fittings.

Test methods and requirements for fittings made from metals or metal alloys are given in 8.2.

Test methods and requirements for fittings made from plastics materials are given in 8.3.

8.2 Test methods and requirements for fittings made of metal or metal alloy

8.2.1 Leaktightness under internal pressure when subjected to bending

When a straight fitting (coupling) assembly is tested in accordance with ISO 3503, it shall conform to the requirement given in Table 4.

Table 4 — Performance requirements for metal fittings — Leaktightness when subjected to bending

Pipe material	Test temperature °C	Test duration h	Test stress, σ_T MPa	Test pressure, p_T bar	Requirement
PE 63	20 ± 5	1	9,0	1,8 × PN	No leakage during test
PE 80	20 ± 5	1	11,4	1,8 × PN	
PE 100	20 ± 5	1	14,4	1,8 × PN	

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For class 2 fittings, a fitting assembly capable of sustaining the longitudinal forces generated by the internal water pressure shall be used.

The test pressure shall be calculated, in bars, from the equation

$$p_T = \frac{\sigma_T}{\sigma_s} \times PN$$

where

σ_T is the applicable test stress given in Table 4 (MPa);

σ_s is the design stress in accordance with ISO 4427;

PN is the nominal pressure.

NOTE 1 1 bar = 0,1 MPa.

NOTE 2 For diameters larger than 63 mm, the use of special equipment might be necessary to create the bending radius required for the pipe under test.

8.2.2 Resistance to pull-out (only for class 1 fittings)

When a fitting assembly is tested in accordance with ISO 3501, it shall conform to the requirement given in Table 5, the test force F_T being calculated, in newtons, from the following equation:

$$F_T = 1,5 \sigma_T \pi e_n (d_n - e_n)$$

where

σ_T is the applicable test stress given in Table 5 (MPa);

e_n is the wall thickness of the pipe (mm);

d_n is the nominal outside diameter of the pipe (mm).

NOTE For diameters larger than 63 mm, the use of special equipment, such as hydraulic rams, might be necessary to produce the force required. See also testing in ISO 10838-2:2000, *Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels — Part 2: Metal fittings for pipes of nominal outside diameter greater than 63 mm*.

Table 5 — Performance requirements for metal fittings — Pull-out test

Pipe material	Test temperature °C	Test duration h	Test stress, σ_T^a MPa	Requirement
PE 63	20 ± 5	1	4,5	Displacement of pipe during test does not affect leaktightness of joint
PE 80	20 ± 5	1	5,7	
PE 100	20 ± 5	1	7,2	

^a These are longitudinal stresses, and their values are therefore half those of the circumferential stresses given as test stresses in Table 4.

8.2.3 Leaktightness under internal vacuum

When a fitting assembly is tested at two pressures in accordance with ISO 3459, it shall conform to the requirement given in Table 6.

Table 6 — Performance requirements for metal fittings — Leaktightness under vacuum

Pipe material	Test temperature °C	Test duration (two periods)	Test pressure bar	Requirement
PE 63	20 ± 5	1 h at	0,1 ^{+0,05} ₀	No leakage during either test period
PE 80		followed by		
PE 100		1 h at	0,8 ^{+0,05} ₀	