INTERNATIONAL STANDARD

**ISO 10838-3**

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# Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels —

## Part 3: Thermoplastics fittings for pipes of nominal outside diameter less than or equal to 63 mm

*Raccords mécaniques pour systèmes de canalisation en polyéthylène destinée à la distribution de combustibles gazeux —*

*Partie 3: Raccords thermoplastiques pour tubes de diamètre extérieur nominal inférieur ou égal à 63 mm*

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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 part of ISO 10838 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10838-3 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 4, *Plastics pipes and fittings for the supply of gaseous fuels*.

ISO 10838 consists of the following parts, under the general title *Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels*:

— *Part 1: Metal fittings for pipes of nominal outside diameter less than or equal to 63 mm*

— *Part 2: Metal fittings for pipes of nominal outside diameter greater than 63 mm*

— *Part 3: Thermoplastics fittings for pipes of nominal outside diameter less than or equal to 63 mm*

Annexes A and B of this part of ISO 10838 are for information only.

# Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels —

# Part 3: Thermoplastics fittings for pipes of nominal outside diameter less than or equal to 63 mm

**WARNING — This part of ISO 10838 does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this part of ISO 10838 to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.**

## 1 Scope

This part of ISO 10838 specifies requirements and test methods for full-end-load-resistant mechanical pipe-jointing systems for connecting, to each other or to a fitting or as a lateral connection to a polyethylene main (branching or lateral connection), polyethylene (PE) pipes, conforming to ISO 4437, of nominal outside diameter smaller than or equal to 63 mm.

In addition, it specifies certain general properties of the material from which these fittings are made.

This part of ISO 10838 specifies dimensional requirements for, and the performance of, such assemblies.

It is applicable to mechanical fittings with thermoplastics and/or reinforced-thermoplastics load-bearing components intended for use with PE pipes designed for the supply of gaseous fuels, to produce either permanent joints or joints which can be dismantled.

If intended for assembly with a metal pipe or fitting, such connections may comprise compression joints or flanged or fused connections.

This part of ISO 10838 is applicable only to mechanical fittings with normal operating-temperature limits between – 20 °C and + 40 °C, unless otherwise agreed between the interested parties.

It is the purpose of this part of ISO 10838 to provide performance requirements that will ensure that mechanical pipe-jointing systems will provide full sealing and full restraint of the PE piping so that the PE piping will yield rather than pull out of the mechanical joint when subjected to tensile forces or pressure.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10838. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10838 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 1167, *Thermoplastics pipes for the conveyance of fluids — Resistance to internal pressure — Test method.*

ISO 3458, *Assembled joints between fittings and polyethylene (PE) pressure pipes — Test of leakproofness under internal pressure.*

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

ISO 4065, *Thermoplastics pipes — Universal wall thickness table.*

ISO 4437, *Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specifications.*

ISO 6447, *Rubber seals — Joint rings used for gas supply pipes and fittings — Specification for material.*

ISO 8085-1, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 1: Fittings for socket fusion using heated tools.*

ISO 8085-2, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 2: Spigot fittings for butt or socket fusion using heated tools and spigot fittings for use with electrofusion fittings.*

ISO 8085-3, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 3: Electrofusion fittings.*

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

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

EN 837-1, *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing.*

EN 12117, *Plastics piping systems — Fittings, valves and ancillaries — Determination of gaseous flow rate/pressure drop relationships.*

## 3 Terms and definitions

For the purposes of this part of ISO 10838, the following terms and definitions apply.

**3.1**
**maximum operating pressure**
maximum pressure at which a system can be operated continuously under normal conditions

**3.2**
**mechanical fitting**
fitting for assembling PE pipes with each other or with a metal pipe or fitting, which includes one or more compression zones to provide pressure integrity, leaktightness and resistance to end loads

**3.3**
**full-end-load resistance**
combination of component and joint design and characteristics such that under any load condition the pipe will fail first

**3.4**
**mechanical tapping tee**
fitting designed primarily to provide a lateral connection to a PE gas main

**3.5**
**stiffener insert**
rigid internal tubular stiffener that provides a permanent support for the PE pipe to prevent creep in the pipe wall under radial compressive forces

**3.6**
**grip ring**
ring that holds the PE pipe in place and prevents pull-out from the fitting

NOTE In some cases, the stiffener insert also constitutes a grip ring.

**3.7**
**batch of fittings**
specified and marked quantity of fittings of given type and dimensions

**3.8**
**initial type test**
test performed to prove that the material, a component or an assembly, after it has been designed or the design modified, conforms to the requirements given in a standard

**3.9**
**minimum bore**
smallest internal diameter, $d_i$, measured at any cross-section of the fitting assembly

**3.10**
**fitting assembly**
complete joint assembly, consisting of a PE pipe jointed, by means of a mechanical pipe-jointing system, to another PE pipe or to a metal pipe or fitting

**3.11**
**virgin material**
thermoplastics material in form of granules or powder which has not been previously processed other than for compounding and to which no reprocessable or recyclable materials have been added

**3.12**
**reprocessable material**
thermoplastics material prepared from clean unused rejected pipes, fittings or valves, produced in a manufacturer's plant by a process such as injection-moulding or extrusion, which will be reprocessed in the same plant

NOTE Such material may include trimmings from the production of such pipes, fittings and valves.

**3.13**
**accuracy class**
⟨pressure gauge⟩ maximum permissible error of the gauge, expressed as a percentage of the measurement range

## 4 Symbols and abbreviated terms

CTL constant tensile load

$d_i$ the minimum inside diameter of a fitting assembly

MOP maximum operating pressure

MRS minimum required strength (ISO 12162)

PE polyethylene

$S$ the cross-sectional area of a pipe wall, in square millimetres, calculated using the measured average outside diameter and the minimum wall thickness

SDR standard dimension ratio (ISO 4065)

$T_{max}$ the maximum temperature to which a fitting and pipe may be exposed during normal operation

$T_{min}$ the minimum temperature to which a fitting and pipe may be exposed during normal operation

$\sigma$ the stress in the wall of a pipe

# 5 Materials

## 5.1 General

The materials from which the fitting components are made shall be such that the level of performance of these components shall at least be equal to that specified for the PE pipe connected to the fitting. Materials in contact with the PE pipe shall not prevent the pipe from conforming to its specification (e.g. ISO 4437).

All load-bearing components shall be made from thermoplastics or reinforced thermoplastics.

Components exposed to corrosive conditions shall be of corrosion-resistant material or protected against corrosion.

Annex A provides examples of specific requirements for a non-restrictive list of thermoplastics materials which can be used for components conforming to this part of ISO 10838.

If a lubricant has to be used for assembly, it is recommended that the material supplier be consulted on the suitability of lubricants for assembly. In contact with such a lubricant, the assembly shall conform to the requirements of this part of ISO 10838, and to ISO 4437 for the PE pipes used.

## 5.2 Metal components

Metal components shall conform to the relevant ISO standards. Other standards may be used in cases where suitable ISO standards do not exist. In all cases, fitness for purpose of the components shall be established.

## 5.3 Plastics materials

### 5.3.1 General

Determination of a long-term hydrostatic strength is critical in the selection of plastics materials as it is the first step in designing plastic fittings that will last the lifetime of PE piping that they connect.

Plastics materials for components intended to be pressure-containing and subject to continuous stress, either in hoop or tension, shall have an ISO material classification. The classification of thermoplastics materials shall be determined in accordance with ISO 12162; the extrapolation method for the long-term hydrostatic strength is given in ISO 9080. The classification of other plastics materials shall be obtained with the same extrapolation method, except that failure data may be obtained from tensile bars, plane-strain specimen and actual fitting specimens.

Materials in long-term contact with natural gas of line quality and/or LPG vapour shall conform to the requirements of this part of ISO 10838.

Materials shall have a demonstrated resistance to environmental stress cracking when exposed, under stress, to chemical compounds encountered in, or external to, gas piping systems, and a demonstrated resistance to bacteriological decomposition. Such compounds include, but are not limited to, ice-thawing chemicals, fertilizers, insecticides, herbicides, leak-detection fluids, acids, bases and antifreeze solutions used to thaw frozen lines. Liquids such as antifreeze agents, odorants and hydrocarbons are known to have deleterious effects on some plastics, particularly under service conditions.

Pressure-bearing components shall be produced from virgin materials, reprocessable material or a combination of virgin and reprocessable material. Only clean reprocessable material generated from a manufacturer's own production of fittings to this part of ISO 10838 may be used.

### 5.3.2 Polyethylene materials

Extruded polyethylene parts of jointing systems shall conform to the requirements of ISO 4437. The PE material shall have a minimum classification of MRS 8.

Injection-moulded polyethylene parts of jointing systems shall conform to the requirements of ISO 8085-1, ISO 8085-2 or ISO 8085-3, as applicable. The PE material shall have a minimum classification of MRS 8.

### 5.4 Elastomers

Elastomeric sealing components shall conform to the requirements of ISO 6447.

### 5.5 Other materials

Other materials, not covered by 5.2, 5.3 and 5.4, conforming to 5.1 may be used, provided that the fittings conform to this part of ISO 10838.

## 6 Individual fittings

### 6.1 Design and construction

The fitting shall be pre-assembled or capable of field assembly on a PE pipe conforming to ISO 4437 within a temperature range of – 5 °C to + 40 °C. If special mechanical assembly tools are required, they shall be supplied by the manufacturer of the fitting.

NOTE The fitting should have sufficiently large bearing surfaces to avoid deformation during assembly. The fitting and tools should be designed to avoid any weakening which influences the performance of the joint assembly.

The fitting assembled with PE pipes conforming to ISO 4437 shall meet the requirements of this part of ISO 10838, irrespective of the pipe material and the pipe dimension tolerances, if they are within the tolerance range given in ISO 4437.

A stiffener insert, which shall be rigid and shall not be a split tube, shall be used in conjunction with the fitting.

Except for pre-assembled fittings, this stiffener shall be provided with a means to control its position in the pipe.

The stiffener shall provide support over the entire compression area and there shall be no longitudinal displacement of the stiffener after assembly. A fitting shall have only one stiffener insert for each combination of diameter and SDR series of the pipe with which it is assembled.

The pressure drop across the fitting shall be kept to a minimum.

The fitting shall not induce twisting of the PE pipe during assembly.

The fitting shall include, if required by design, a means for anchoring an anti-shear sleeve.

PE pipes shall not be machined (e.g. for threading or grooving purposes).

### 6.2 Appearance

Fitting components shall not show any signs of surface defects or inclusions that would prevent conformity to this part of ISO 10838.

### 6.3 Fittings with socket fusion ends

Socket fusion ends shall conform to ISO 8085-1.

### 6.4 Fittings with spigot ends

PE spigot ends shall conform to ISO 8085-2.

### 6.5 Fittings with electrofusion sockets

PE electrofusion sockets shall conform to ISO 8085-3.

### 6.6 Minimum wall thickness of body

The minimum wall thickness of any hoop-stress-bearing plastics body part shall be such that the performance of the fitting is equivalent to that of the PE pipes with which the fitting is designed to be used.

### 6.7 Minimum bore

The minimum internal bore diameter, $d_i$, shall be stated by the manufacturer in his technical data sheet.

## 7 Test pieces

The tests specified in this part of ISO 10838 shall be carried out on fitting assemblies constructed by the fitting manufacturer or assembled by the user in accordance with the manufacturer's written assembly instructions, including lubricants if required in the manufacturer's instructions.

If the mechanical fitting has to be assembled by the user, the test piece shall be assembled at – 5 °C and at + 40 °C, in accordance with the manufacturer's instructions. Half of the fitting assemblies shall be assembled at – 5 °C, the other half at + 40 °C. Each half of the fitting assemblies shall undergo the test cycles described in 8.1 to 8.4.

## 8 Test requirements

### 8.1 Leaktightness test

When a fitting assembly, assembled in accordance with clause 7, is tested in accordance with 9.1, it shall be leaktight.

### 8.2 Leaktightness with bending and temperature cycling

The fitting shall be assembled in accordance with clause 7.

When tested in accordance with 9.2, the assembly shall not leak either before or after the test.

### 8.3 Leaktightness after tensile testing

**8.3.1** When a fitting assembly, assembled in accordance with clause 7, is tested in accordance with 9.3.1, none of the following shall occur:

a) damage or permanent deformation of the fitting assembly to an extent which would prevent conformity to this part of ISO 10838;

b) pull-out of the pipe;

c) leakage during a leaktightness test after the tensile test [see 9.3.1.3.3, item d)].

**8.3.2** When a fitting assembly, assembled in accordance with clause 7, is tested in accordance with 9.3.2, none of the following shall occur:

a) damage or permanent deformation of the fitting assembly to an extent which would prevent conformity to this part of ISO 10838;

b) pull-out of the pipe;

c) leakage during a leaktightness test after the tensile test (see 9.3.2).

Displacement of trapped air from the free space within the fitting assembly, i.e. seal burping, shall not be considered leakage.

If some components of the fitting cannot be tested at 80 °C, another temperature level shall be chosen, taking into account the long-term hydrostatic regression curves (e.g. ISO 9080 for the temperature chosen).

### 8.4 Hydrostatic strength

When assembled in accordance with clause 7 and tested in accordance with 9.4, the assembly shall not leak.

### 8.5 Determination of gas flow rate/pressure drop relationship

The air flow rate at ambient temperature corresponding to a pressure drop across the fitting of 0,5 mbar[1)], as measured when the fitting assembly is tested in accordance with 9.5, shall be declared in the technical data sheet.

## 9 Test methods

### 9.1 Leaktightness testing

Leaktightness testing shall be carried out in conformity with ISO 3458 with the exception that air or an inert gas shall be used as the pressurizing fluid instead of water. Testing shall be carried out at a temperature of (23 ± 2) °C in the following sequence: a test at a pressure of 25 mbar and a second test at a pressure corresponding to 1,5 MOP as declared by the manufacturer in the technical data sheet but a minimum of 6 bar.

### 9.2 Leaktightness with bending and temperature cycling

The test procedure shall be as follows:

a) Carry out a test in accordance with ISO 3503 on a fitting that has been completely mounted on straight PE pipes (the fitting assembly shall fulfil the requirements given in 8.1).

b) Subject the fitting assembly, under an internal pressure of 6 bar, to 10 successive complete temperature cycles. Use one of the following cycles:

   1) Two temperature-regulated chambers:

      i) place the fitting assembly in the first chamber at $T_{max}$ and leave it there for at least 2,5 h;

      ii) transfer the fitting assembly to the second chamber at $T_{min}$; the minimum transfer time shall be 0,5 h and the maximum 1 h;

      iii) leave the fitting assembly in the second chamber at $T_{min}$ for at least 2,5 h;

      iv) transfer the fitting assembly to the first chamber at $T_{max}$; the minimum transfer time shall be 0,5 h and the maximum 1 h;

      v) return to i).

1) 1 bar = $10^5$ N/$m^2$ = 0,1 MPa

2) One temperature-regulated chamber:

   i) increase the temperature of the chamber to $T_{max}$ at a minimum rate of 1 °C/min;

   ii) maintain at $T_{max}$ for at least 2 h;

   iii) reduce the temperature to $T_{min}$ at a minimum rate of 1 °C/min;

   iv) maintain at $T_{min}$ for at least 2 h;

   v) return to i).

In cases of dispute, the two-chamber cycle shall be used.

c) After the test, check the fitting assembly for leaks at (23 ± 2) °C (see 8.1).

## 9.3 Leaktightness after tensile testing

### 9.3.1 Tensile testing under constant load, followed by tensile testing at constant speed at 23 °C

#### 9.3.1.1 Principle

A fitting assembly is first subjected to a specified longitudinal stress by the application of a constant load, and subsequently to extension at a specified constant speed until the pipe yields. The leaktightness is verified at the end of the test.

#### 9.3.1.2 Apparatus

a) A room which can be maintained at (23 ± 2) °C.

b) A tensile-testing machine or other equipment sufficiently powerful to allow tests to be carried out up to the yield point of the PE pipe. The machine shall be capable of sustaining, between its clamping jaws, a constant force with a maximum variation of 2 % and a constant speed of 25 mm/min.

c) Devices for clamping a fitting assembly in place.

d) A force-measurement device capable of checking conformity to item b).

e) A stopwatch or similar timing device.

f) A class 1,6 recording manometer (0 mbar to 60 mbar) as specified in EN 837-1, or a contacting manometer.

g) A compressed-air supply (50 mbar).

h) A set of pipes equipped with valves which can be used to connect the fitting assembly to the manometer and the pressure supply or to isolate the fitting assembly/manometer unit from the pressure supply.

#### 9.3.1.3 Procedure

##### 9.3.1.3.1 Procedure for in-line connections

For each fitting, use PE pipe of length (not counting the fitting and the clamping jaws) equivalent to at least two times the nominal outside diameter of the pipe, but a maximum of 250 mm.

Reinforce by means of a stiffener insert the free ends of the pipes that are to be clamped in the jaws of the tensile-testing machine.

Attach seals to the free ends of the pipes so that the fitting assembly will remain leaktight at a pressure of 25 mbar. It shall be possible to connect one of these ends to the pressure supply.

Condition the fitting assembly for 4 h at (23 ± 2) °C.

Clamp the ends of the fitting assembly in the jaws of the tensile-testing machine such that the line of action of the force is along the axis of the pipe.

Connect the fitting assembly to the pressure supply and introduce a pressure of 25 mbar into the assembly.

Isolate the fitting assembly from the pressure supply and check the leaktightness of the assembly.

Load the test assembly as specified in 9.3.1.3.3.

#### 9.3.1.3.2 Procedure for lateral connections (mechanical tapping tees)

For each fitting, use lateral pipe of length (not counting the fitting and the clamping jaws), equivalent to at least five times the nominal outside diameter of the pipe, but a maximum of 250 mm.

Reinforce by means of a stiffener insert the free end of the lateral pipe, and by external means the main pipe.

Attach seals to the free ends of the pipes so that the fitting assembly will remain leaktight at a pressure of 25 mbar. It shall be possible to connect one of these ends to the pressure supply.

Condition the fitting assembly for 4 h at (23 ± 2) °C.

Clamp the ends of the fitting assembly in the jaws of the tensile-testing machine such that the line of action of the force is along the axis of the lateral pipe. The main pipe shall be restrained externally to allow the lateral pipe to remain on-centre (see annex B, Figure B.1).

Connect the fitting assembly to the pressure supply and introduce a pressure of 25 mbar into the assembly.

Isolate the fitting assembly from the pressure supply and check the leaktightness of the assembly.

Load the test assembly as specified in 9.3.1.3.3.

#### 9.3.1.3.3 Testing

Load the test assembly as follows:

a) Apply gradually, within a time period of (5 ± 1) min, a tensile force to the fitting assembly until the force $F$ corresponding to a stress of 12 MPa in the wall of the pipe has been obtained, $F$ being calculated, in newtons, using the following equation:

$$F = S\sigma$$

where

$\sigma$ is the stress (12 MPa);

$S$ is the cross-sectional area of the pipe wall, in square millimetres, calculated using the measured average outside diameter and the minimum wall thickness.

b) Leave the fitting assembly under this force, kept constant to within ± 2 %, for 1 h.

If during this period the pipe yields, repeat the test, using a new assembly if necessary.

c) Increase the tensile force using a cross-head speed of (25 ± 1) mm/min until yield of the PE pipe occurs, unless the free PE pipe length is greater than twice the nominal outside diameter, in which case increase the cross-head speed proportionally.

d) Reduce the tensile force to zero, and then pressurize the assembly to 25 mbar air pressure and check the leaktightness of the assembly.

#### 9.3.2 Tensile testing under constant load at 80 °C

For each fitting, use PE pipe of length (not counting the fitting and the clamping jaws) equivalent to at least two times the nominal outside diameter of the pipe, but a maximum of 250 mm.

Mount the fitting assembly in a fixture capable of applying a constant longitudinal tensile force to the pipe(s) and fitting. The fitting shall be held in such a way that no distortion or support of any of the fitting components can occur.

Suspend the fitting assembly, subject to a longitudinal force (end load) in accordance with Table 1 for SDR 11 and SDR 17,6 pipes at (80 ± 5) °C applied gradually within a time period of (5 ± 1) min and then maintained for 500 h.

After completion of the 500 h constant tensile load (CTL) test, condition the fitting assembly for 24 h at (23 ± 2) °C, then conduct a leaktightness test in accordance with 8.1 at a pressure of 25 mbar for 24 h followed by a further 24 h at 6 bar.

**Table 1 — End loads for SDR 11 and SDR 17,6 pipes**

| Size mm | End load N | |
|---|---|---|
| | SDR 17,6 | SDR 11 |
| 16 | 350 | 430 |
| 20 | 450 | 560 |
| 25 | 570 | 730 |
| 32 | 750 | 960 |
| 40 | 950 | 1 480 |
| 50 | 1 500 | 2 300 |
| 63 | 2 350 | 3 650 |
| NOTE End load values are approximately half of the yield strength of the pipe at 80 °C. | | |

### 9.4 Hydrostatic strength at 80 °C

Conduct the test in accordance with ISO 1167 using a test temperature of (80 ± 1) °C and with the fitting assembly unrestrained during the test.

Apply a hydraulic pressure corresponding to a pipe wall stress of 4 MPa (PE 80) or 5 MPa (PE 100) to the fitting assembly for 1 000 h.

Monitor the tightness of the assembly during this period.

Displacement of trapped air from the free space within the fitting assembly, i.e. seal burping, shall not be considered leakage.

If some components of the fitting cannot be tested at 80 °C, another temperature level shall be chosen, taking into account the long-term hydrostatic regression curves (e.g. ISO 9080 method for the temperature chosen).

### 9.5 Determination of gas flow rate/pressure drop relationship

Conduct the test in accordance with EN 12117.

# 10 Marking

## 10.1 General

The body of the fitting shall carry permanent markings, e.g. produced by moulding or indent marking, which shall remain visible after assembly and shall include the minimum information specified in 10.2 and 10.3.

## 10.2 Permanent marking (e.g. by moulding or indent marking on the body of the fitting)

a) the manufacturer's name and/or trademark;

b) the manufacturing batch number and/or date;

c) manufacturer’s information for providing traceability;

d) identification of the moulder.

The marking shall not affect the part to an extent that would prevent conformity of the fitting to this part of 10838.

## 10.3 Permanent marking on the fitting or on a label

a) a traceability code in accordance with the relevant standards;

b) the size of PE pipe to which the fitting is designed to be connected, its material properties and its dimensions;

c) the assembly torque (if specified);

d) the size of metal pipe to which the fitting is designed to be connected (DN);

e) the designation of the plastics material, if necessary;

f) any other useful information for assembly of the fitting.

# 11 Packaging and storage

Fittings shall be packaged in bulk, or individually protected where necessary in order to prevent deterioration.

The stiffener insert shall be secured in the package to the main body of the fitting.

Where necessary, fittings shall be packaged in plastic bags and placed in cardboard boxes or cartons.

The plastic bags and/or cardboard boxes or cartons shall bear at least one label with the following information:

a) the manufacturer's name;

b) the type of fitting and its dimensions;

c) the date of manufacture;

d) the number of units in the box;

e) any special storage conditions and storage-time limits.

The manufacturer’s written assembly instructions shall be included in the package.

# Annex A
(informative)

# Material specifications for mechanical fittings

**Table A.1 — Material: polyamide (PA 11, PA 12)**

| Property | Units | Requirement | Test parameters | Test method |
|---|---|---|---|---|
| MRS (long-term hydrostatic strength at 20 °C) | MPa | $\geqslant$ 15,1 | $\sigma_{lcl}$ 20 °C | ASTM D 2837<br>AS 2943 |
| Density at 23 °C | kg/m$^3$ | 1 020 to 1 050 | 23 °C | ISO 1183 |
| Viscosity | ml/g | $\geqslant$ 1,8 | 23 °C | ISO 307 |
| Hydrostatic strength | h | Failure time $\geqslant$ 44 | 80 °C/11,5 MPa | ISO 1167 |
| Elongation at break | % | $\geqslant$ 300 | 50 mm/min | ISO 6259 |
| Changes in properties after artificial weathering | % | $\leqslant$ 20 | Determine decrease in elongation at break and in yield strength. Test parameters to be agreed between the interested parties. | ISO 4892-2 |
| Yield strength | MPa | $\geqslant$ 40 | 23 °C | ASTM D 638 |
| Moisture content | % | $\leqslant$ 0,10 | | ISO 960 |

**Table A.2 — Material: polyacetal (polyoxymethylene, POM) 11110**

| Property | Units | Requirement | Test parameters | Test method |
|---|---|---|---|---|
| MRS (long-term hydrostatic strength at 23°C) | MPa | $\geqslant$ 14 | PPI TR3 | ASTM D 2837<br>PPI TR4 |
| Density at 23 °C | kg/m$^3$ | 1,39 to 1,44 | 23 °C | ASTM D 792 |
| Melt flow rate | g/10 min | 0 to 4 | | ASTM D 1238 |
| Melting point | °C | $\geqslant$ 172 | | ASTM D 3418 |
| Tensile strength | MPa | $\geqslant$ 62 | | ASTM D 638 |
| Flexural modulus | MPa | $\geqslant$ 2 400 | | ASTM D 790 |
| Izod impact | J/m | $\geqslant$ 110 | | ASTM D 256 |
| Deflection temperature | °C | $\geqslant$ 115 | | ASTM D 648 |

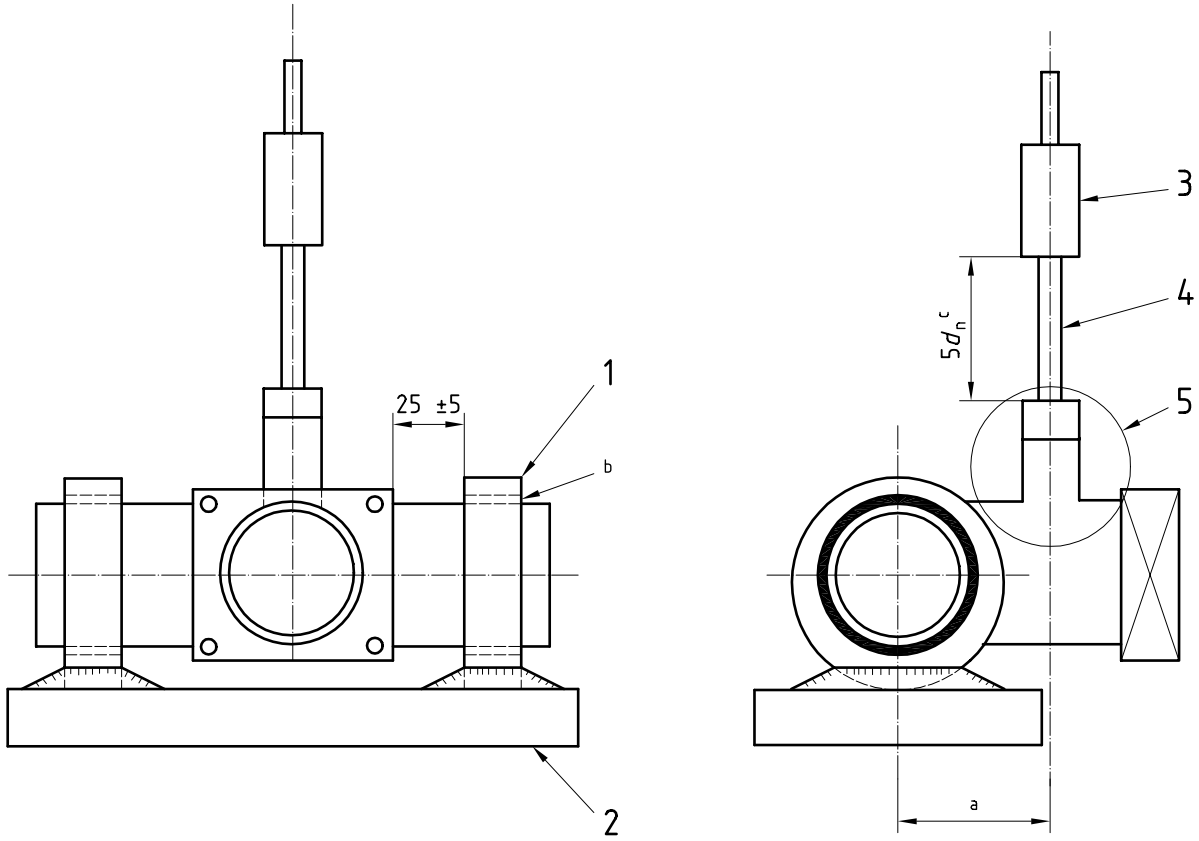
**Table A.3 — Material type: polyacetal (polyoxymethylene, POM) 21110**

| Property | Units | Requirement | Test parameters | Test method |
|---|---|---|---|---|
| MRS (long-term hydrostatic strength at 23 °C) | MPa | ⩾ 14 | PPI TR3 | ASTM D 2837<br>PPI TR4 |
| Density at 23 °C | kg/m$^3$ | 1,38 to 1,42 | 23 °C | ASTM D 792 |
| Melt flow rate | g/10 min | 0 to 4 | | ASTM D 1238 |
| Melting point | °C | ⩾ 160 | | ASTM D 3418 |
| Tensile strength | MPa | ⩾ 55 | | ASTM D 638 |
| Flexural modulus | MPa | ⩾ 2 270 | | ASTM D 790 |
| Izod impact | J/m | ⩾ 48 | | ASTM D 256 |
| Deflection temperature | °C | ⩾ 105 | | ASTM D 648 |

# Annex B
(informative)

# Typical arrangement for applying a tensile force to a lateral connection

Dimensions in millimetres




**Key**

1 Steel rings attached to steel base
2 Steel plate mounted in tensile-testing machine
3 Crosshead of tensile-testing machine
4 Lateral PE pipe
5 Tee under test

a Offset from lateral centreline to centre of main pipe
b Gap to allow tee and pipe to rotate
c Nominal outside diameter

**Figure B.1 — Typical arrangement for applying a tensile force to a lateral connection (see 9.3.1.3.2)**

**ICS 75.200; 83.140.30**

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