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Plastics piping systems for the supply of gaseous fuels for maximum operating pressures up to and including 2 MPa (20 bar) — Polyamide (PA) —

Part 3: **Fittings**

Systèmes de canalisations en matières plastiques pour la distribution de combustibles gazeux pour des pressions maximales de service inférieures ou égales à 2 MPa (20 bar) — Polyamide (PA) —

Partie 3: Raccords

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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 2.

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.

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 22621-3 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 22621 consists of the following parts, under the general title *Plastics piping systems for the supply of gaseous fuels for maximum operating pressures up to and including 2 MPa (20 bar) — Polyamide (PA)*:

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

Fitness for purpose of the system is to form the subject of a future part 5.

Introduction

As polyamide material is used for piping systems for the supply of gaseous fuels both at low and high pressure, ISO/TC 138/SC 4 experts decided to split the standardization programme into two series of International Standards, with one series covering low pressures up to 0,4 MPa (4 bar), and ISO 22621 high pressures up to 2 MPa (20 bar).

Thin wall thickness pipes and solvent cement joints are used typically for pressures up to 0,4 MPa (4 bar), while thicker wall thickness pipes and butt fusion, electrofusion and mechanical joints are typically used for pressures up to 2 MPa (20 bar). For technical and safety reasons, it is not possible to mix the components of the two types of piping system (thin wall thickness pipes cannot be jointed by butt fusion or mechanical joints and vice versa). In particular, solvent cement joints must not be used for jointing for high pressure piping systems.

NOTE With the publication of ISO 22621-5, performance requirements for joints are to be added to this part of ISO 22621.

Plastics piping systems for the supply of gaseous fuels for maximum operating pressures up to and including 2 MPa (20 bar) — Polyamide (PA) —

Part 3: Fittings

1 Scope

This part of ISO 22621 specifies the physical and mechanical properties of fittings made from polyamide (PA) in accordance with ISO 22621-1, intended to be buried and used for the supply of gaseous fuels at maximum operating pressures (MOP) up to and including 20 bar [1)].

It also specifies the test parameters for the test methods to which it refers.

In addition, it lays down dimensional characteristics and requirements for the marking of fittings.

In conjunction with the other parts of ISO 22621, it is applicable to PA fittings, their joints, to joints with components of PA and to joints with mechanical fittings of other materials, and to the following fitting types:

— fusion fittings — electrofusion fittings and butt fusion fittings;

— transition fittings.

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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 307, *Plastics — Polyamides — Determination of viscosity number*

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 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 4: Preparation of assemblies* [2)]

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

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1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

2) To be published.

ISO 4433-1:1997, *Thermoplastics pipes — Resistance to liquid chemicals — Classification — Part 1: Immersion test method*

ISO 11922-1:1997, *Thermoplastic pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

ISO 13951:2001, *Plastics piping systems — Test method for the resistance of polyolefin pipe/pipe or pipe/fitting assemblies to tensile loading*

ISO 13953:2001, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

ISO 13954, *Plastics pipes and fittings — Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm*

ISO 13955:1997, *Plastics pipes and fittings — Crushing decohesion test for polyethylene (PE) electrofusion assemblies*

ISO 13957:1997, *Plastics pipes and fittings — Polyethylene (PE) tapping tees — Test method for impact resistance*

ISO 22621-1:2007, *Plastics piping systems for the supply of gaseous fuels for maximum operating pressures up to 2 MPa (20 bar) — Polyamide (PA) — Part 1: General*

ISO 22621-2, *Plastics piping systems for the supply of gaseous fuels for maximum operating pressures up to 2 MPa (20 bar) — Polyamide (PA) — Part 2: Pipes*

EN 682, *Elastomeric seals — Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

IEC 60529:2001, *Degree of protection provided by enclosures (IP Code)*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms, definitions, symbols and abbreviated terms given in ISO 22621-1 and the following apply.

3.1
electrofusion socket fitting
polyamide (PA) fitting which contains one or more integral heating elements that are capable of transforming electrical energy into heat to realise a fusion joint with a spigot end and/or a pipe

3.2
electrofusion saddle fitting
polyamide (PA) fitting which contains one or more integral heating elements that are capable of transforming electrical energy into heat to realize fusion onto a pipe

3.3
tapping tee
electrofusion saddle fitting (top loading or wraparound) comprised of one or more integral heating elements and an integral cutter, used to cut through the wall of the main pipe, and holds the coupon inside the cutter

NOTE The cutter remains in the body of the saddle after installation.

3.4
branch saddle
electrofusion saddle fitting (top loading or wraparound) comprised of one or more integral heating elements, which requires an ancillary cutting tool for drilling the hole in the main pipe

3.5
spigot end fitting
polyamide (PA) fitting where the outside diameter of the spigot length is equal to the nominal outside diameter, d_n, of the corresponding pipe

3.6
mechanical fitting
fitting for assembling a polyamide (PA) pipe to another PA pipe or any other element of the piping system

NOTE 1 The mechanical fitting can be supplied for field assembly or pre-assembled by the manufacturer and generally includes a compression part to provide pressure integrity, leak-tightness and resistance to end loads. A support sleeve inserted into the pipe bore provides a permanent support for the PA pipe to prevent creep in the pipe wall under radial compressive forces.

NOTE 2 The metallic parts of the fitting may be assembled to metallic pipes by screw threads, compression joints, welded or flanged connections. The fitting can allow for either a dismountable or permanently assembled joint. In some cases, the supporting ring may also act as a grip ring.

3.7
voltage regulation
control of energy supplied, during the fusion process of an electrofusion fitting, by means of the voltage parameter

4 Material

4.1 PA compound

The fittings shall be made from virgin material.

The compound from which the fittings are made shall be in accordance with ISO 22621-1.

4.2 Material for non-polyamide parts

4.2.1 General

The materials and constituent elements used in making the fitting shall be resistant to the external and internal environments in which they are intended to be used:

a) during storage;

b) under the effect of the fluids being conveyed;

c) taking account of the service environment and operating conditions.

Fittings materials, including elastomers, greases and lubricants in contact with the PA pipe, shall not adversely affect pipe performance or initiate stress cracking.

4.2.2 Metal parts

All parts susceptible to corrosion shall be adequately protected.

When dissimilar metallic materials are used which may be in contact with moisture, steps shall be taken to avoid galvanic corrosion.

Metals and materials produced by corrosion shall not affect the long-term performance of the pipe/fitting.

4.2.3 Elastomers

Elastomeric materials used for the manufacture of seals shall be in accordance with EN 682.

4.2.4 Other materials

Greases or lubricants shall not exude on to the fusion areas, and shall not affect the long-term performance of the pipe/fitting.

5 General characteristics

5.1 Appearance

When viewed without magnification, the internal and external surfaces of the fitting shall be smooth, clean and free from scoring, cavities and other surface defects such as would prevent conformity of the fitting to this part of ISO 22621.

5.2 Design

The design of the fitting shall be such that, when assembling the fitting onto the pipe, spigot ends or other components, the electrical coils and/or seals and other functional parts (e.g. grippers) are not displaced.

5.3 Colour

The fitting shall be either black or yellow.

5.4 Electrical characteristics for electrofusion fittings

The electrical protection to be provided by the system depends on the voltage and the current used and on the characteristics of the electric power.

For voltages greater than 25 V, direct human contact with the energized parts shall not be possible when the fitting is in the fusion cycle during assembly in accordance with the instructions of the manufacturer of the fittings and the assembly equipment, as applicable.

NOTE 1 This type of fitting is part of an electrical system as defined in IEC 60335-1, IEC 60364-1 and IEC 60449. Protection against direct contact with active parts (live conductors) is required for conformity with IEC 60529. This protection is a function of the work site conditions.

NOTE 2 See Annex A for examples of typical electrofusion terminal connectors.

The surface finish of the terminal pins shall allow a minimum contact resistance in order to satisfy the resistance tolerance requirements (nominal value ± 10 %).

5.5 Appearance of factory-made joints

The following requirements apply only to joints and fittings made or assembled in the factory.

The internal and external surfaces of the pipe and fitting after fusion jointing, examined visually without magnification, shall be free from melt exudation outside the confines of the fitting apart from that which may be declared acceptable by the fitting manufacturer or used as a fusion marker.

Any melt exudation shall not cause wire movement in electrofusion fittings leading to short circuiting when jointed in accordance with the manufacturer's instructions. There shall be no excessive creasing of the internal surfaces of the adjoining pipes.

The interface of the butt fusion joints shall be perpendicular to the pipe and/or spigot end axis.

5.6 Fusion compatibility

Components made from PA 11 shall be heat fusion jointed only to components made from PA 11.

Components made from PA 12 shall be heat fusion jointed only to components made from PA 12.

Components made from polyamide are not fusion compatible with components made from other polymers.

6 Geometrical characteristics

6.1 Measurement of dimensions

The dimensions of the fittings shall be measured in accordance with ISO 3126. In case of dispute, the measurement of dimensions shall be made not less than 24 h after manufacture and after conditioning for at least 4 h at (23 ± 2) °C.

6.2 Dimensions of electrofusion sockets

6.2.1 Diameters and lengths of electrofusion sockets

When measured in accordance with 6.1, the diameters and lengths of electrofusion sockets (see Figure 1) shall be in accordance with Table 1.

The mean inside diameter of the fitting in the middle of the fusion zone, D_1, shown in Figure 1, shall not be less than d_n. The manufacturer shall declare the actual maximum and minimum values of D_1 and L_1 for determining suitability for clamping and joint assembly.

In the case of a fitting having sockets of differing sizes, each socket shall conform to the requirements for the corresponding nominal diameter.

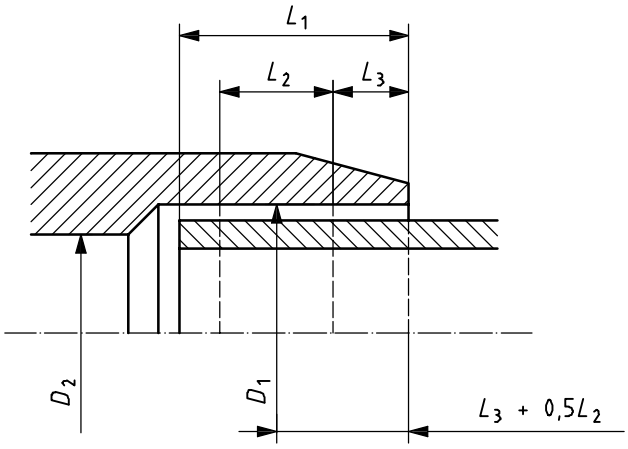
6.2.2 Wall thickness

In order to prevent stress concentrations, any changes in wall thickness of the fitting body shall be gradual.

a) The wall thickness of the body of the fitting at any point, E, shall be greater than or equal to e_{min} for the corresponding pipe at any part of the fitting located at a distance beyond a maximum of $2L_1/3$ from all entrance faces if the fitting and the corresponding pipe are made from a polyamide having the same MRS.

   If the fitting is produced from a polyamide having an MRS that is different from that of the corresponding pipe, the relationship between the wall thickness of the fitting, E, and the pipe, e_{min}, shall be in accordance with Table 2.

b) In the case of a wall thickness design different from that according to a), fittings and associated fusion joints shall additionally meet the performance requirements given in Table 3.



Key

D_1 mean inside diameter in fusion zone [a]

D_2 bore that is minimum diameter of flow channel through body of fitting [b]

L_1 depth of penetration of pipe or male end of spigot fitting [c]

L_2 heated length within socket [d]

L_3 distance between mouth of fitting and start of fusion zone [e]

[a] D_1 is measured in a plane parallel to the plane of the mouth at a distance of $L_3 + 0{,}5L_2$.

[b] $D_2 \geqslant (d_n - 2e_{min})$.

[c] In the case of a coupling without a stop, it is not greater than half the total length of the fitting.

[d] As declared by the manufacturer to be the nominal length of the fusion zone.

[e] As declared by the manufacturer to be the nominal unheated entrance length of the fitting, L_3 shall be $\geqslant$ 5 mm.

Figure 1 — Dimensions of electrofusion sockets

Table 1 — Electrofusion socket dimensions

Dimensions in millimetres

Intensity regulation	Voltage regulation		Fusion zone
d_n	$L_{1,min}$	$L_{1,max}$	$L_{2,min}$
20	25	41	10
25	25	41	10
32	25	44	10
40	25	49	12
50	28	55	15
63	31	63	19
75	35	70	22
90	40	79	26
110	53	82	32
125	58	87	36
140	62	92	40
160	68	98	46
180	74	105	52
200	80	112	57
225	88	120	64
250	95	129	71