INTERNATIONAL STANDARD

ISO 6993-3

First edition
2006-06-01

Buried, high-impact poly(vinyl chloride) (PVC-HI) piping systems for the supply of gaseous fuels —

Part 3: Fittings and saddles for a maximum operating pressure of 1 bar (100 kPa)

Systèmes de canalisations enterrées en poly(chlorure de vinyle) à résistance au choc améliorée (PVC-HI) pour réseaux de combustibles gazeux —

Partie 3: Raccords et colliers pour une pression maximale de service de 1 bar (100 kPa)

Reference number
ISO 6993-3:2006(E)

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Published in Switzerland

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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 6993-3 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*.

This first edition of ISO 6993-3, together with ISO 6993-1, ISO 6993-2 and ISO 6993-4, cancels and replaces ISO 6993:2001, of which it constitutes a technical revision.

ISO 6993 consists of the following parts, under the general title *Buried, high-impact poly(vinyl chloride) (PVC-HI) piping systems for the supply of gaseous fuels*:

— *Part 1: Pipes for a maximum operating pressure of 1 bar (100 kPa)*

— *Part 2: Fittings for a maximum operating pressure of 200 mbar (20 kPa)*

— *Part 3: Fittings and saddles for a maximum operating pressure of 1 bar (100 kPa)*

— *Part 4: Code of practice for design, handling and installation*

Buried, high-impact poly(vinyl chloride) (PVC-HI) piping systems for the supply of gaseous fuels —

Part 3: Fittings and saddles for a maximum operating pressure of 1 bar (100 kPa)

1 Scope

This part of ISO 6993 gives the requirements for full-end load-resistant fittings and saddles made of high-impact poly(vinyl chloride) (PVC-HI) intended to be used for the supply of gaseous fuels through buried pipelines having an operating temperature range of 0 °C up to and including +30 °C and a maximum operating pressure of 1 bar (100 kPa) [1)].

It is applicable only to fittings and saddles manufactured from the high-impact PVC materials PVC-A, PVC-CPE and PVC-EPR. It is applicable to joints with elastomeric sealing elements and of the solvent cement type. The fittings and saddles are suitable for those gases not containing potentially damaging components in such concentrations as to impair the properties of the fitting/saddle material.

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 580:2005, *Plastics piping and ducting systems — Injection-moulded thermoplastics fittings — Methods for visually assessing the effects of heating*

ISO 2507-1, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 1: General test method*

ISO 2507-2, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 2: Test conditions for unplasticized poly(vinyl chloride) (PVC-U) or chlorinated poly(vinyl chloride) (PVC-C) pipes and fittings and for high impact resistance poly(vinyl chloride) (PVC-HI) pipes*

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

ISO 3127, *Thermoplastics pipes — Determination of resistance to external blows — Round-the-clock method*

ISO 4422-3:1996, *Pipes and fittings made of unplasticized poly(vinyl chloride) (PVC-U) for water supply — Specifications — Part 3: Fittings and joints*

ISO 6993-1:2006, *Buried, high-impact poly(vinyl chloride) (PVC-HI) piping systems for the supply of gaseous fuels — Part 1: Pipes for a maximum operating pressure of 1 bar (100 kPa)*

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

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

EN 682:2002, *Elastomeric seals — Material requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

EN 922:1994, *Plastics piping and ducting systems — Pipes and fittings of unplasticized poly(vinyl chloride) (PVC-U) — Specimen preparation for determination of the viscosity number and calculation of the K-value*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms, definitions, symbols and abbreviated terms given in ISO 6993-1 and the following terms, definitions and symbols apply.

3.1 Terms and definitions

3.1.1
fitting
component, other than a pipe, used in a pipeline

EXAMPLE Bend, tee, coupler, end cap.

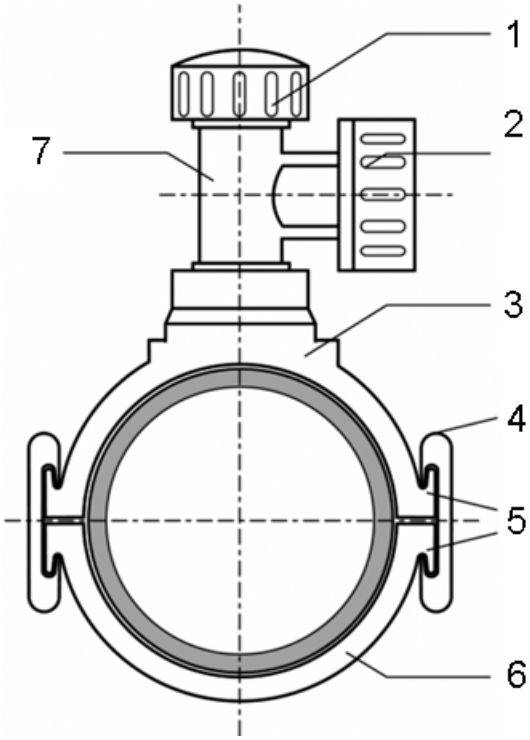
3.1.2
joint
connection between the ends of two components (with smooth spigot-ends and/or sockets)

NOTE In this part of ISO 6993, only solvent weld joints are considered.

3.1.3
socket
end of the fitting into which a smooth spigot-end can be inserted and joined by the solvent weld process

3.1.4
tapping saddle
component, including the necessary parts such as wedges and connector, used to make branches from a main pipeline to a service pipeline of polyethylene (PE) with a maximum d_n of 63

See Figure 1.



Key

1 cap
2 end trust joint
3 upper saddle half
4 clamp
5 wedge
6 lower saddle half
7 tapping tee

Figure 1 — Tapping saddle

3.1.5
bag stopper saddle
component, including the necessary parts such as wedges and balloon entry equipment, used to introduce a balloon into a pipeline in order to temporarily interrupt the gas flow

See Figure 2.

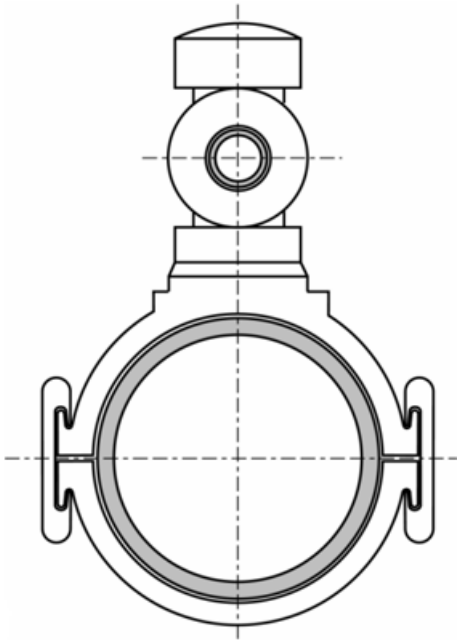


Figure 2 — Bag stopper saddle

3.2 Symbols

d depth/total depth of cracks, delaminations, blisters, or open yield seam, as applicable

L crack/blister length

l key-way length

4 Material

4.1 Material for fittings/saddles

4.1.1 Composition

The fittings and saddles shall be made of high-impact PVC, to which only such additives are added that are necessary to facilitate conformity of the components to this part of ISO 6993.

The impact-resistant modified PVC shall be one of the following compositions:

a) a mixture based on PVC;

b) a blend based on PVC;

c) a copolymer based on PVC;

d) a combination of these types.

The proportion of the impact modifier in the composition shall be at least 7 % by mass.

4.1.2 Long-term strength

The MRS value of the injection-moulding material shall be at least 14 MPa. Conformity to this requirement shall be proven using a long-term evaluation in accordance with ISO 9080. Testing is to be carried out at 20 °C, 40 °C and 60 °C, for periods up to 10 000 h. At 60 °C no knee shall occur before 5 000 h.

For injection-moulding compounds, this test shall be carried out on test pieces in the form of an injection moulded or extruded sample in solid wall pipe form made from the relevant injection-moulding material.

NOTE The MRS evaluation is used for a material qualification and is not intended to be used for a pressure rating.

4.1.3 Vicat softening temperature

The Vicat softening temperature of the injection-moulding material shall be not less than 74 °C when determined in accordance with ISO 2507-1 and ISO 2507-2.

4.1.4 K-value

The K-value of the unplasticized polyvinyl chloride (PVC-U) resin in the injection-moulding material shall exceed 57, when measured in accordance with EN 922.

4.2 Material for elastomeric sealing elements

The material of the elastomeric sealing elements shall conform to EN 682:2002, type G.

The elastomeric sealing element shall have no detrimental effects on the properties of the components.

5 General characteristics of fittings/saddles

5.1 Contaminants

The material of the fitting or saddle shall not be shown to contain any contaminants, such as inorganic particles or agglomerations thereof, exceeding 50 µm in size, when measured in accordance with 11.1 and 11.2.

5.2 Appearance and finish

The appearance and finish of the fitting/saddle shall be examined visually without magnification.

Internal and external surfaces shall be free from grooves, pits, blisters, indications of burning, an unacceptable form of cold-flow and other irregularities that could have a detrimental effect on the mechanical properties of the material and/or on the functional quality of the component.

Transitions in the form shall be smooth, in order to avoid notch influence. The corners in the grooves, in particular for the fixing of the elastomeric sealing elements, shall be rounded.

6 Geometrical characteristics

6.1 Measurements

All dimensions shall be measured in accordance with ISO 3126.

6.2 Fittings

6.2.1 Spigot ends on moulded fittings

The dimensions of spigot ends on moulded fittings shall meet the outside diameter requirements of ISO 6993-1:2006, Table 1.

6.2.2 Sockets on moulded fittings

The geometrical characteristics of fittings for solvent cementing shall be in accordance with ISO 4422-3:1996, 6.1.

6.3 Saddles

6.3.1 General

The dimensions and the admissible tolerances of the saddles shall be in accordance with the values declared by the manufacturer.

6.3.2 Wall thickness and cross-section area

The wall thickness and the cross-section area of those parts of the saddles subject to tangential stresses due to the clamp force of the pipe shall be in accordance with Table 1, for every cross section perpendicular to the direction of the stress.

Table 1 — Wall thickness and cross-section area of saddles

Nominal outside diameter of main pipe d_n	Saddle	
	Minimum wall thickness mm	Minimum cross-section area mm^2
50	4,3	300
63	4,3	325
75	4,3	325
90	4,8	360
110	5,1	450
125	5,5	450
140	5,7	500
160	6,0	560
180	6,4	600
200	6,8	650
225	7,4	800
250	8,1	950
280	8,7	1 025
315	9,4	1 100
355	10,1	1 200
400	11,0	1 300

7 Physical characteristics

When tested in accordance with 11.1 and 11.3 at 150 °C (oven test), injection moulded fittings and saddles shall meet the following requirements (see Figures 3 and 4).

The depth, d, of all cracks, delaminations or blisters occurring within a distance of 1,5 times the wall thickness measured at the injection point, with a minimum of 20 mm, shall not be greater then 30 % of the wall thickness at that point.

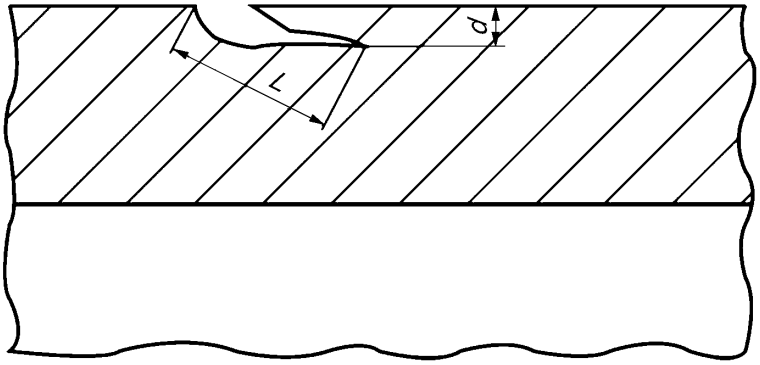
For diaphragm-gated injection moulded fittings or saddles, the depth, d, of all cracks, delaminations or blisters occurring within a distance of 1,0 times the wall thickness of the diaphragm zone shall not be greater than 30 % of the wall thickness at that point.

For ring-injected fittings or saddles, the depth, d, of all cracks, delaminations or blisters occurring within a distance of 1,0 times the wall thickness at the ring gate zone shall not be greater than 30 % of the wall thickness at that point.

For fittings or saddles with a yield seam, the total depth, d, of the opened yield seam shall not be greater than 10 % of the wall thickness at that point.

For all other parts of the surface outside the injection zone, the total depth, d, of cracks or delaminations shall not be greater than 10 % of the wall thickness at that point.

Blisters in the wall shall not be longer than twice the wall thickness at that point, with a maximum length, L, of 20 mm (see Figure 4).



d shall be a maximum of 30 % of the wall thickness.

Figure 3 — Maximum allowable crack depth

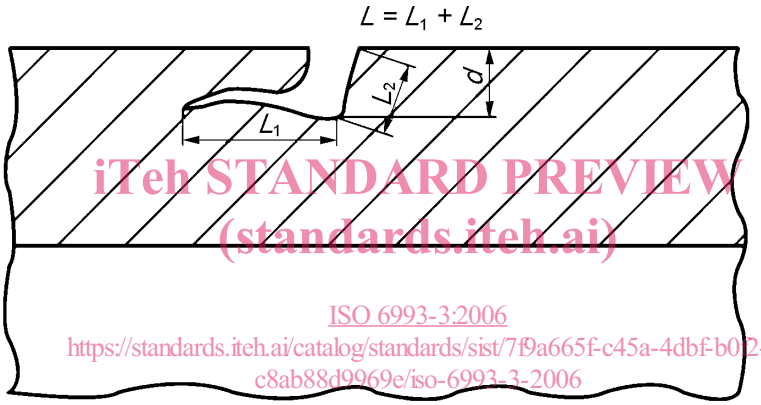


Figure 4 — Maximum allowable crack/blister length

8 Mechanical characteristics

8.1 Fittings

Fittings shall be tested against their resistance to external blows at 0 °C in accordance with 11.1 and Annex A. They shall have a true impact rate (TIR) of no more than 5 % under the test conditions according to Table 2.

8.2 Saddles

Saddles shall be tested against their resistance to external blows at 0 °C in accordance with 11.1 and Annex B. No failure in the saddle or leakage in the connection part shall occur.

Failure is considered to have occurred when there is fracture, cracking or leakage.