INTERNATIONAL STANDARD

ISO 6993-4

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

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

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

Partie 4: Code de pratique pour la conception, la manutention et l'installation

Reference number
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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 6993-4 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 6993-4, together with ISO 6993-1, ISO 6993-2 and ISO 6993-3, 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*

Introduction

This part of ISO 6993 addresses the common basic principles for gas supply systems. Its users need to be aware that more detailed national standards and/or codes of practice might exist in the ISO member countries and that these will take precedence over this part of ISO 6993, which is intended to be applied in association with those national standards and/or codes of practice related to the above-mentioned basic principles.

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

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

1 Scope

This part of ISO 6993 specifies a code of practice for the design, handling and installation of high-impact poly(vinyl chloride) (PVC-HI) pipes and fittings 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).

The code of practice covers mains and service lines, and gives provisions for the design, installation, storage, handling, transportation and quality control of PVC-HI pipes and fittings up to and including an outside diameter of 400 mm, as well as backfilling, pipe system testing and commissioning.

The pipes and fittings are suitable for those gases which do not contain potentially damaging components in such concentrations as to impair the properties of the pipe/fitting 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 4437:1997, *Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specifications*

ISO 6993-1, *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)*

ISO 6993-3, *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)*

ISO 7005 (all parts), *Metallic flanges*

ISO 7387-1:1983; *Adhesives with solvents for assembly of PVC-U pipe elements — Characterization — Part 1: Basic test methods*

ISO 8085 (all parts), *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications*

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

EN 12327:2000, *Gas supply systems — Pressure testing, commissioning and decommissioning procedures — Functional requirements*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions and symbols apply.

3.1
clearance
shortest distance between the outer limits of two objects

3.2
design pressure
pressure on which design calculations are based

3.3
gas supply system
pipeline systems, including pipe work and their associated stations or plants, for the transmission and distribution of gas

3.4
nominal outside diameter
d_n
numerical designation of size which is common to all components in a thermoplastics piping system other than flanges and components designated by thread size

NOTE It is a convenient round number for reference purposes.

NOTE For metric pipes conforming to ISO 161-1, the nominal outside diameter, expressed in millimetres, is the minimum mean outside diameter $d_{em,min}$.

3.5
nominal wall thickness
e_n
numerical designation of the wall thickness of a component, approximately equal to the manufacturing dimension

NOTE 1 It is a convenient round number for reference purposes.

NOTE 2 It is expressed in millimetres (mm).

3.6
main
pipework in a gas supply system to which a number of gas consumers are connected via service lines

3.7
out-of-roundness
difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross-sectional plane of the pipe

3.8
maximum operating pressure
MOP
maximum effective pressure of the gas in a piping system, expressed in bars, which is allowed in continuous use

NOTE 1 It takes into account the physical and the mechanical characteristics of the components of the piping system.

NOTE 2 The MOP is given by the equation:

$$\text{MOP} = \frac{20 \times \text{MRS}}{C \times (\text{SDR} - 1)}$$

where

MRS is the minimum required strength (see ISO 6993-1);

SDR is the standard dimension ratio.

3.9
standard dimension ratio
SDR
numerical designation of a pipe series, which is approximately equal to the ratio of the nominal outside diameter, d_n, to the nominal wall thickness, e_n:

$$SDR = \frac{d_n}{e_n}$$

NOTE It is a convenient round number for reference purposes.

3.10
pipeline components
elements from which a pipeline is constructed including, in PVC-HI pipeline systems, the distinct elements of straight pipes, fittings and ancillaries

EXAMPLE 1 Fittings: socket joint, saddle, reducer, tee, factory-made bend/elbow, end-cap.

EXAMPLE 2 Ancillaries: valve, flange.

3.11
installer
trained person authorized by the pipeline operator to assemble PVC-HI systems from pipes and fittings, based on a written procedure agreed by the pipeline operator

3.12
overall service [design] coefficient
C
overall coefficient with a value greater than 1, which takes into consideration service conditions as well as properties of the pipeline components

3.13
pipeline operator
private or public organization responsible for the design, construction, operation and maintenance of a gas supply system

3.14
service line
pipework in a gas supply system that connects a gas consumer with a main

3.15
depth of cover
vertical distance between the top of a buried pipe and the normal surface after finishing work

3.16
high-impact poly(vinyl chloride)
PVC-HI
mixture of unplasticized PVC and an impact-resistance modifier

4 Design

4.1 General

Written laying procedures, authorized by the pipeline operator, shall be made available prior to the construction of a pipeline. The laying procedure shall include specification of the pipe and fitting materials to be used, the trenching and backfilling requirements, the pressure testing and commissioning procedures.

The selection of materials, SDR series, dimensions and assembly techniques shall be the responsibility of the pipeline operator.

It is an established practice in PVC-HI distribution systems to construct service lines in polyethylene in order to take advantage of the natural flexibility of this material.

4.2 Materials and components

The maximum operating pressure (MOP) for PVC-HI gas supply systems is 1 bar (100 kPa). Pipes shall meet the requirements of ISO 6993-1. The most commonly used SDR values are 41 and 33. For specific applications, other SDR values can be taken from all series stated in ISO 4065 and ISO 161-1.

Assembly techniques in systems with a MOP above 200 mbar (20 kPa) and up to and including 1 bar (100 kPa) shall be of the end thrust type in accordance with ISO 6993-3.

For systems with a MOP up to and including 200 mbar (20 kPa) both the end thrust type assembly or the push-in type of fittings in accordance with ISO 6993-2 may be used.

Rubber parts for other components shall be in accordance with EN 682:2002, type G. Polyethylene service line materials shall be in accordance with ISO 4437 and the relevant part of ISO 8085.

Other components not covered by the above-mentioned International Standards shall conform to the relevant International Standards or national standards, and/or national or international specifications.

4.3 Assembly techniques

4.3.1 Slip-on socket joints (for gas supply systems with MOP $\leqslant$ 20 kPa)

Because of the relatively low operating pressure, the joints in PVC-HI gas supply systems with a MOP up to and including 200 mbar (20 kPa) do not normally need to be tensile-resistant. In special situations, provision shall be made to prevent pipes from sliding out of the sockets by using external clamps or anchors.

Socket joints consist of a spigot (end) and a PVC-HI socket, in which gas tightness is achieved by the use of a rubber ring, tightened between the spigot and the socket. Distinction is made between sockets with, and those without, a stop shoulder or dead stop (see Figure 1).

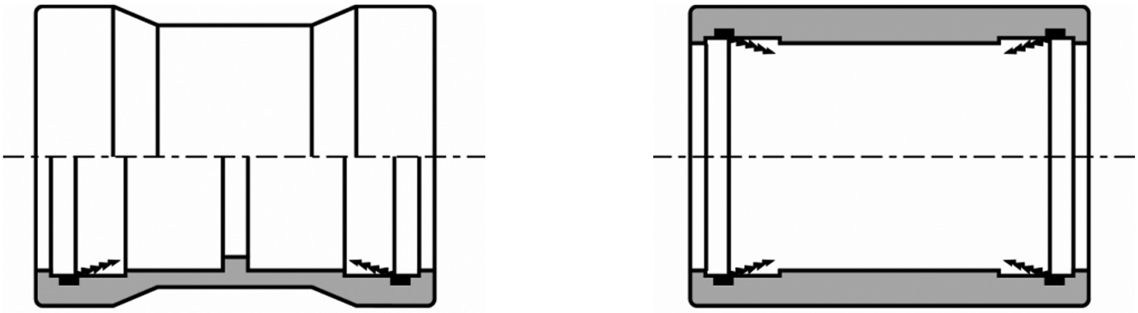
Tees, reducers and elbows also may bear socket joints or have spigot ends.

4.3.2 Solvent-cement socket joints

Solvent cement is used to effect a seal between close-fitting spigots and sockets. The resulting joint is end-load bearing.

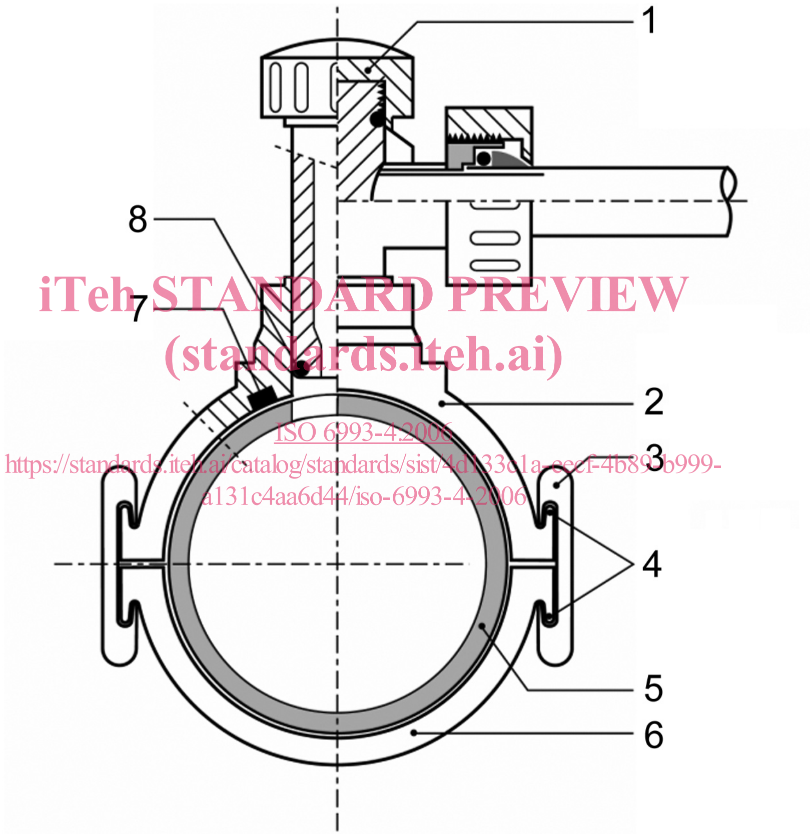
4.3.3 Tapping saddles

Tapping saddles are used for connecting service lines to a main (see Figure 2).



a) Socket joint **b) Sleeve joint**

Figure 1 — Straight socket joints



Key

1 sealing cap
2 upper half of saddle
3 clamp
4 wedge
5 main
6 lower half of saddle
7 rubber seal
8 O-ring

Figure 2 — Tapping saddle with PE service line

4.3.4 Bag stopper saddles

Bags stoppers are used for temporarily stopping the gas stream, thereby making it possible to work on the pipe system without gas pressure. A bag is inserted in the pipe via a bag stopper saddle, and then inflated by means of a hand pump (see Figure 3). When the work is done, the bag stopper is deflated and removed, after which the saddle is sealed with a cap.