INTERNATIONAL STANDARD

ISO 17484-1

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Plastics piping systems — Multilayer pipe systems for indoor gas installations with a maximum operating pressure up to and including 5 bar (500 kPa) —

Part 1: Specifications for systems

Systèmes de canalisations en matières plastiques — Tubes multicouches et leurs assemblages pour une pression maximale de service inférieure ou égale à 5 bar (500 kPa) destinés à l'alimentation en gaz à l'intérieur des bâtiments —

Partie 1: Spécifications pour les systèmes

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 17484-1 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 17484 consists of the following parts, under the general title *Plastics piping systems — Multilayer pipe systems for indoor gas installations with a maximum operating pressure up to and including 5 bar (500 kPa)*:

— *Part 1: Specifications for systems*

A Part 2 dealing with the code of practice is planned.

Introduction

This part of ISO 17484 was developed in response to worldwide demand for minimum specification for multi-layered pipes for indoor gas applications.

Multi-layered pipes are delivered generally as a complete system. Pipes, fittings, tools, etc., are not compatible with components of another brand, generally. An advantage is that all components are perfectly geared to one another, but for repairing, the lack of compatibility might be problematic in the future.

Fire safety of systems

Depending on the construction of the house, pipework layout and other local circumstances, it is possible that additional safety devices are required to fulfill the demands of fire safety. Safety aspects of the system will be described in the planned Part 2.

Code of practice

The planned second part of ISO 17484 will be the code of practice for installation.

Recommendations on design, construction and protection in case of fire of the gas indoor installation are given in EN 1775).

References to ISO/TC 138/SC5 work

Test methods referred to in this part of ISO 17484 have been developed by SC 5 as far as possible. However, not all test methods needed are in the working programme of SC 5. These test methods are placed in Annexes B to K of this part of ISO 17484. It is planned that these tests will be developed as International Standards in the future.

For multilayer pipe construction, consisting of a layer of a reference standard material, an adhesive and a non-stress-designed layer, procedure l and the relevant product standards are followed for all aspects, excluding the aspects of delamination and, if applicable, oxygen permeation.

For example, layers can have the following purposes:

— ability to withstand the pressure;

— ability to realize interlayer adhesion;

— ability to block or greatly diminish incoming UV and/or sunlight;

— ability to mechanically protect the outside layer;

— ability to control the longitudinal expansion;

— ability to give the multilayer pipe a colour (inside layer or outside layer).

Some characteristics can be combined in one layer.

Plastics piping systems — Multilayer pipe systems for indoor gas installations with a maximum operating pressure up to and including 5 bar (500 kPa) —

Part 1: Specifications for systems

1 Scope

This part of ISO 17484 specifies the general requirements and the performance requirements for multilayer pipe systems based on pipes, fittings and their joints intended to be used for gas supply within buildings.

PE-X and PE pipes composed of one stress-designed layer, adhesive and a barrier layer are also covered by this part of ISO 17484.

This part of ISO 17484 gives guidance for the design of piping systems consisting of multilayer pipes based on thermoplastics, for which at least 60 % of the wall thickness is polymeric material. Polymeric materials intended for stress-designed layers and all inner layers are required to be polyethylene (PE) and/or crosslinked polyethylene (PE-X) in accordance with Annex A of this part of ISO 17484. The outer layer of a metal multilayer is required to be PE or PE-X. PE-RT is considered as PE but with specific properties concerning hoop-stress performance (see 5.4.2).

This part of ISO 17484 applies to systems that operate at temperatures of – 20 °C up to 60 °C.

For the purpose of this part of ISO 17484, crosslinked polyethylene (PE-X) and adhesive layers are considered as thermoplastic materials.

For sizes greater than 63 mm the requirements of ISO 18225 have to be fulfilled in addition.

This part of ISO 17484 is applicable for piping systems used in buildings to supply gas with a maximum operating pressure up to and including 500 kPa (5 bar) [1)].

This standard applies to the following fuels:

— Category D gaseous fuel: natural gas; see ISO 13623;

— Category E gaseous fuel: LPG vapour, and natural gas or LPG vapour; see ISO 13623.

1) 1 bar = 0,1 MPa = 105 Pa; 1 MPa = 1 N/mm^2

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 3:1973, *Preferred numbers — Series of preferred numbers*

ISO 161-1, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*

ISO 497:1973, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

ISO 1167 (all parts), *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure*

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

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

ISO 8085-3:2001, *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 10838 (all parts), *Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time*

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

ISO 13480, *Polyethylene pipes — Resistance to slow crack growth — Cone test method*

ISO 13623:2000, *Petroleum and natural gas industries — Pipeline transportation systems*

ISO 14531-1, *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 1: Pipes*

ISO 17454:2006, *Plastics piping systems — Multilayer pipes — Test method for the adhesion of the different layers using a pulling rig*

ISO 17456:—, *Plastics piping systems — Multilayer pipes — Determination of long-term strength*

ISO 18225, *Plastic piping systems — Multilayer piping systems for outdoor gas installations — Specifications for systems*

EN 713, *Plastics piping systems — Mechanical joints between fittings and polyolefin pressure pipes — Test method for leaktightness under internal pressure of assemblies subjected to bending*

EN 1555-3, *Plastics piping systems for the supply of gaseous fuels — Polyethylene(PE) — Part 3: Fittings*

3 Terms, definitions and symbols

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

3.1 Structural definitions

3.1.1
construction group A
group composed of multilayer pipes in which all the layers considered to be designed for stress bearing are made of polymeric materials selected from the list of reference product standards (see Annex A)

3.1.2
construction group B
group composed of multilayer pipes in which all the layers considered to be designed for stress bearing are made of polymeric materials selected from the list of reference product standards (see Annex A) and including a stress bearing metallic layer

3.1.3
multilayer pipe
pipe comprising of several stress-designed layers

3.1.4
multilayer M-pipe
multilayer pipe comprising of polymers and one metallic layer of which thickness of the pipe consists of at least 60 % of polymer layers

3.1.5
multilayer P-pipe
pipe comprised of more than one stress-designed polymeric layer (e.g. PE/PE-X)

3.1.6
layer
homogeneous circumferential section of pipe wall that has chemical and/or mechanical and/or physical characteristics different from those of its immediate neighbours

3.1.7
inner layer
layer in contact with the conveyed fluid

3.1.8
outer layer
layer exposed to the external environment

3.2 Geometrical definitions

3.2.1
nominal diameter
d_n
specified diameter, assigned to a nominal size (DN/OD or DN/ID)

NOTE The nominal diameter is expressed in units of millimetres.

3.2.2
outside diameter
d_e
diameter, measured through its cross section at any point of a pipe or the fitting end of a fitting, rounded to the next greater 0,1 mm

3.2.3
mean outside diameter
measured length of the outer circumference of the pipe divided by π, rounded up to the nearest 0,1 mm

NOTE The value for π is taken to be 3,142.

3.2.4
inside diameter
value of the measurement of the diameter through its cross section at any point of a pipe, rounded to the next greater 0,1 mm

3.2.5
SDR_m
metal layer standard dimension ratio, the nominal outside diameter (DN or OD) divided by the nominal wall thickness of the metal layer

3.2.6
wall thickness
difference between the pipe outside diameter used for joining and the pipe bore divided by 2

3.2.7
nominal wall thickness
e_n
wall thickness, corresponding to the minimum wall thickness at any point

NOTE The nominal wall thickness is expressed in units of millimetres.

3.2.8
mean wall thickness
e_m

arithmetic mean of at least four measurements regularly spaced around the same cross-sectional plane of the pipe, including the measured minimum and maximum values obtained, rounded up to the nearest 0,1 mm

3.3 Definitions related to pressure

3.3.1
design pressure
p_D
highest pressure related to the circumstances for which the system has been designed and intended to be used

3.3.2
predicted design pressure
p_{CD}
pressure that represents the predicted design pressure after a lifetime of 50 years, using the 97,5 % reference line

NOTE The predicted design pressure is expressed in units of kilopascals (bars).

3.4 Materials definitions

3.4.1
virgin material
material in a form such as granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no reprocessable or recyclable material has been added

3.4.2
own reprocessable material
material prepared from rejected unused pipes and fittings, including trimmings from the production of pipes and fittings that can be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation is known

3.4.3
reference product standard
International Standard or draft International Standard prepared by Technical Committee ISO/TC 138/SC 4, applicable for non-multilayer pipes, to which this part of ISO 17484 can refer for clauses related to the materials, components (e.g. fittings), and fitness for purpose of the system

3.4.4
stress-designed layer
plastics materials used for layers intended to be stress bearing shall be restricted to the reference material standards

3.5 Definitions related to material characteristics

3.5.1
long-term hydrostatic strength
long-term pressure strength
quantity with the dimensions of stress, which represents the predicted mean strength at a temperature T and a time t

NOTE The long-term hydrostatic strength is expressed in units of megapascals.

3.5.2
P_{LPL}

lower confidence limit of the predicted hydrostatic pressure, which represents the 97,5 % (one-sided) lower confidence limit of the predicted hydrostatic pressure at a temperature T and a time t

NOTE The lower confidence limit of the predicted hydrostatic pressure is expressed in units of kilopascals (bars).

3.5.3
MRP
minimum required pressure, equal to the estimated long-term pressure resistance of a pipe at a temperature of 20 °C and a time 50 years, rounded to the nearest lower value of the R10 series of ISO 3:1973 and ISO 497:1973

3.5.4
overall service (design) coefficient
C factor
overall coefficient with a value greater than 1, which takes into consideration service conditions as well as properties of the components of a piping system other than those represented in the lower confidence limit

NOTE The minimum value of C for various materials is given in 5.2.3.

3.6 Terms related to service conditions

3.6.1
gaseous fuel
any fuel which is in the gaseous state at a temperature of 15 °C and a pressure of 100 kPa (1 bar)

3.6.2
category D gaseous fuels
natural gas

NOTE Categories of gaseous fuels and liquid fuel are defined in detail in ISO 13623:2000.

3.6.3
category E gaseous fuels
LPG vapour

NOTE Categories of gaseous fuels and liquid fuel are defined in detail in ISO 13623:2000.

3.6.4
maximum operating pressure
MOP
maximum pressure at which a system can be operated continuously under normal conditions

4 Requirements for the system

4.1 Pressure drop

The manufacturer shall provide information on the pressure drop in the system.

4.2 Bending

Special attention shall be paid to the pressure drop of bends. Bending properties of the pipe shall be stated by the manufacturer.

4.3 Corrosive conditions

Components exposed to corrosive conditions shall be manufactured from a corrosion-resistant material or protected against corrosion.

5 Pipes

5.1 Material

5.1.1 General

All stress-designed and polymeric inner layers shall be composed of reference materials in accordance with the reference product standards specified in Annex A. It is not necessary for the outer layer to be made of a reference material.

Materials intended for the stress-bearing layers shall conform to the material requirements of the reference product standard(s) specified in Annex A. The pipe manufacturer shall declare the reference material standard applicable to his product, as listed in Annex A.

5.1.2 Reprocessable materials

Clean own reprocessable material (except PE-X) of the same polymer type from products manufactured to the reference product standard may be added to the virgin material.

5.1.3 Metallic materials

Aluminium materials used shall be in accordance with EN 573-3.

5.1.4 Product classification and construction group

Multilayer pipes may include polymeric or metallic layers that have several purposes, including the ability to withstand the pressure.

For the purpose of this part of ISO 17484, multilayer pipes are classified in two groups: construction group A and construction group B as defined in 3.1. For these definitions, adhesives are not considered as stress-bearing layers.

The pipe manufacturer shall declare the construction group of the multilayer pipe.

5.2 General characteristics

5.2.1 General

When viewed without magnification, the internal and external surfaces of pipes shall be smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformance with this part of ISO 17484. The ends of the pipe shall be cut cleanly and square to the axis of the pipe.

The following information shall be provided:

— outside diameter;

— wall thickness;

— thickness of the inner layer;

— thickness of the metal layer;

— thickness of the outer layer;

— tolerances.

Dimensions shall be measured in accordance with ISO 3126.

5.2.2 Multilayer pipe construction

The joint line of the metallic layer shall be continuously welded.

5.2.3 Minimum overall service (design) coefficient

The minimum overall service (design) coefficient (C factor) is 2, as used to calculate the design pressure, p_D, taking into account the maximum operating temperature.

5.3 Dimensions of pipes

The outside diameter shall be accordance with ISO 161-1.

All layers shall be of sufficient thickness so that the composite pipe fulfills the requirements of this part of ISO 17484.