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Plastics piping systems — Multilayer piping systems for outdoor gas installations — Specifications for systems

Systèmes de canalisations en plastique — Tubes multicouches destinés à l'alimentation en gaz à l'extérieur des bâtiments — Spécifications pour les systèmes

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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 18225 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*.

Introduction

The test methods used in this International Standard have been developed by ISO TC 138/SC 5 as far as possible. However, not all the required methods were in the SC 5 standards development work programme at the time of publication of this International Standard, so they have been placed in its annexes. When those methods are developed for other International Standards, these annexes will be redundant.

For multilayer pipe construction — consisting of a layer of a reference standard material, an adhesive and a non-stress designed layer — Procedure I and the relevant product standards are required to be followed for all aspects, excepting for those of delamination and — if applicable — oxygen permeation.

For example, layers can have the following purposes:

— the ability to withstand pressure;

— the ability to realize interlayer adhesion;

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

— the ability to mechanically protect the outside layer;

— the ability to control longitudinal expansion;

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

Moreover, some characteristics can be combined in one layer.

Plastics piping systems — Multilayer piping systems for outdoor gas installations — Specifications for systems

1 Scope

This International Standard specifies general and performance requirements for multilayer pipe systems based on pipes made from thermoplastics and intended to be used for gas supply.

It gives requirements for the design of pipe systems consisting of multilayer pipes based on thermoplastics and for which at least 60 % of the wall thickness is of a polymeric material. The polymeric material used for stress design layers and all inner layers must be polyethylene (PE) and/or crosslinked polyethylene (PE-X), in accordance with Annex A. The outer layers of metal multilayer pipes must be of either PE or PE-X.

NOTE For the purposes of this International Standard, PE-RT is considered as PE, while PE-X and adhesive layers are considered as thermoplastics materials.

This International Standard is applicable to systems intended to be operated at temperatures ranging from −20 °C to 40 °C. It is applicable to pipes in these systems having a nominal diameter up to and including 630 mm, and to the supply of gaseous fuels of categories D (natural gas) and E (LPG vapour and natural gas or LPG vapour) (see ISO 13623).

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

ISO 497, *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 pipes — Measurement of dimensions*

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 8085-3, *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 9969, *Thermoplastics pipes — Determination of ring stiffness*

ISO 10146, *Crosslinked polyethylene (PE-X) pipes — Effect of time and temperature on the expected strength*

ISO 10838-1, *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*

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

ISO 13968, *Plastics piping and ducting systems — Thermoplastics pipes — Determination of ring flexibility*

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 14531-2, *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 2: Fittings for heat-fusion jointing*

ISO 14531-3. *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 3: Fittings for mechanical jointing (including PE-X/metal transitions)*

ISO 16871, *Plastics piping and ducting systems — Plastics pipes and fittings — Method for exposure to direct (natural) weathering*

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

ISO 17456:2006, *Plastics piping systems — Multilayer pipes — Determination of long-term strength*

ISO 24033:2006, *Pipes made of raised-temperature-resistance polyethylene (PE-RT) — Effect of time and temperature on the expected strength*

EN 573-3, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition*

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 document, the following terms and definitions apply.

3.1 Structural definitions

3.1.1 Construction groups

3.1.1.1
construction group A
group comprising 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

NOTE 1 See Annex A for the list of reference product standards.

NOTE 2 For this definition, adhesives are not considered as stress-designed layers.

3.1.1.2
construction group B
group comprising 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 and which include a stress bearing metallic layer

NOTE 1 See Annex A for the list of reference product standards.

NOTE 2 For this definition, adhesives are not considered as stress-designed layers.

3.1.2
multilayer pipe
pipe comprised of several stress-designed layers

3.1.3
multilayer M pipe
multilayer pipe comprised of polymers and one metallic layer, whose pipe wall thickness consists of at least 60 % of polymer layers

3.1.4
multilayer P pipe
pipe comprised of more than one stress-designed polymeric layer

EXAMPLE PE/PE-X.

3.1.5
layer
homogeneous circumferential section of pipe wall that has chemical and/or mechanical and/or physical characteristics different from those of its immediate neighbours

3.1.6
inner layer
layer in contact with the conveyed fluid

3.1.7
outer layer
layer exposed to the outer environment

3.1.8
embedded layer
layer between the outer and inner layer

3.2 Geometrical definitions

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

3.2.2
outside diameter
d_e
outside 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
d_{em}
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
d_i
value of the measurement of the inside diameter through its cross-section at any point of a pipe, rounded to the next greater 0,1 mm

3.2.5
mean inside diameter
d_{im}
average value of a number of equally spaced measurements of inside diameter in the same cross-section of the pipe, rounded to the next greater 0,1 mm

3.2.6
metal layer standard dimension ratio
SDR_m
nominal outside diameter of the metal layer of the pipe divided by the nominal wall thickness of the metal layer (DN or OD/$e_{n,m}$)

3.2.7
wall thickness
difference between the pipe outside diameter and the pipe inside diameter divided by two

3.2.8
nominal wall thickness
e_n
wall thickness corresponding to the minimum wall thickness at any point

3.2.9
total wall thickness
e
measured total wall thickness at any point around the circumference of the component, rounded up to the nearest 0,1 mm

3.2.10
layer wall thickness
e_l
measured wall thickness of the layer at any point around the circumference of the component, rounded up to the nearest 0,1 mm

3.2.11
minimum layer wall thickness
e_{lmin}
minimum value of the measured wall thickness of a layer at any point around the circumference of the component, 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

3.4 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 will 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 ISO/TC 138/SC 4, applicable for non-multilayer pipes, to which this International Standard can refer for clauses related to the materials, components (e.g. fittings), and fitness for purpose of the system

3.5 Definitions related to material characteristics

3.5.1
lower confidence limit of the predicted hydrostatic strength
σ_{LPL}
quantity, with the dimensions of stress, expressed in megapascals (MPa), which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength for a single value at a temperature, T, and time, t, and which is expressed as

$$\sigma_{LPL} = \sigma_{(T,t,0,975)}$$

3.5.2
minimum required strength
MRS
value of σ_{LPL} at a temperature 20 °C and a time 50 years [$\sigma_{(20,50years,0,975)}$], rounded down to the next smaller value of the R10 series or of the R20 series conforming to ISO 3, ISO 497 and ISO 12162, depending on the value of σ_{LPL}

3.5.3
lower confidence limit of the predicted hydrostatic pressure
P_{LPL}
quantity with the dimension of pressure that represents the 97,5 % (one-sided) lower confidence limit of the predicted hydrostatic pressure at a temperature, T, and time, t

3.5.4
minimum required pressure
MRP
value of P_{LPL} of a pipe at a temperature of 20 °C and a time 50 years, rounded to the nearest lower value of the R10 series conforming to ISO 3 and ISO 497

3.5.5
overall service coefficient
overall design coefficient
C
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 For gas systems, a minimum C value of 2,0 is allocated by this International Standard for the calculation, see 4.2.3.

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 1 bar

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

3.6.2
category D gaseous fuel
category of gaseous fuel, as defined in ISO 13623, corresponding to natural gas