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**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**

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*Tubes et raccords en matières plastiques — Systèmes de tubes en  
polyéthylène réticulé (PE-X) pour le transport de combustibles  
gazeux — Série métrique — Spécifications —*

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**Partie 2. Raccords pour assemblage par fusion**



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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 14531-2 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 14531 consists of the following parts, under the general title *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications*:

- Part 1: Pipes [ISO 14531-2:2004](https://standards.iteh.ai/catalog/standards/sist/cdfb578c-55fb-4437-b43c-f600adbc6434/iso-14531-2-2004)
- Part 2: Fittings for heat-fusion jointing <https://standards.iteh.ai/catalog/standards/sist/cdfb578c-55fb-4437-b43c-f600adbc6434/iso-14531-2-2004>
- Part 3: Fittings for mechanical jointing (including PE-X/mechanical transitions)
- Part 4: System design and installation guidelines

## Introduction

Further to the publication of International Standards for crosslinked polyethylene (PE-X) hot-water pipes, it has become evident that the properties of PE-X, in particular its high fracture resistance and a recently established socket and saddle fusion jointing capability, render it suitable for use in high-performance gas distribution systems. The philosophy of ISO 14531 is to provide the basis for the introduction of PE-X gas pipe systems by the specification of a performance range beyond that covered by existing PE standards in order to take its application into regimes of higher operating pressures and extremes of operating temperature.

ISO 14531-2 is therefore one part of a four-part system standard covering pipes, fittings for heat-fusion jointing, fittings for mechanical jointing and design and installation guidelines. The content is suitable for use by procurement authorities and distribution engineers responsible for the design, installation and operation of pipeline systems.

ISO 14531-2 is structured to provide for the supply of heat-fusion fittings with an associated heating method (e.g. electrofusion and induction fusion) that enables pipes and fittings to be pre-assembled in a separate operation prior to the commencement of the fusion-jointing process.

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# 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

### 1 Scope

This part of ISO 14531 specifies the physical properties and mechanical performance requirements of crosslinked polyethylene (PE-X) and polyethylene (PE) socket, saddle and spigot fittings for the connection by socket or saddle heat-fusion jointing techniques of PE-X pipes manufactured in accordance with ISO 14531-1. In addition, it lays down dimensional requirements and specifies some general material properties (including chemical stability) together with a classification scheme for PE-X fitting base materials produced in the form of pipe.

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This part, when used in conjunction with the other parts of ISO 14531, provides the basis for the design, manufacture and installation of PE-X piping systems (PE-X pipes, PE-X fusion fittings and mechanical fittings) for the supply of category D and category E gaseous fuels (see ISO 13623) at:

- a) maximum operating pressures (MOP) up to and including 16 bar<sup>1)</sup>;
- b) a maximum operating temperature of + 60 °C;
- c) a minimum operating temperature of
  - i) – 50 °C
  - ii) – 35 °C
  - iii) – 20 °C.

Conformity to this part of ISO 14531 of PE fittings for heat-fusion jointing produced in accordance with ISO 8085-3 may be claimed subject to the satisfactory conclusion of the tests listed in 5.11 and an end use restriction on operating temperature of from – 20 °C to + 40 °C with a maximum operating pressure as determined by ISO 8085-3.

**NOTE** Provision is made in ISO 14531-4 for the use on a restricted temperature basis of ISO 8085 fittings conforming to 5.11 in conjunction with PE-X pipe conforming to ISO 14531-1. The technical file of the fitting manufacturer should also be consulted for relevant supporting information.

For installation purposes, this part of ISO 14531 provides for the jointing of heat-fusion fittings to PE-X pipes within the temperature range – 5 °C to + 40 °C.

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1) 1 bar = 10<sup>5</sup> N/m<sup>2</sup> = 100 kPa

## 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, *Preferred numbers — Series of preferred numbers*

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

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

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

ISO 3458, *Assembled joints between fittings and polyethylene (PE) pressure pipes — Test of leakproofness under internal pressure*

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 9356, *Polyolefin pipe assemblies with or without jointed fittings — Resistance to internal pressure — Test method*

ISO 9624, *Thermoplastics pipes for fluids under pressure — Mating dimensions of flange adapters and loose backing flanges*

ISO 10147, *Pipes and fittings made of crosslinked polyethylene (PE-X) — Estimation of the degree of crosslinking by determination of the gel content*

ISO/TR 10837, *Determination of the thermal stability of polyethylene (PE) for use in gas pipes and fittings*

ISO 10838-1:2000, *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/TS 10839, *Polyethylene pipes and fittings for the supply of gaseous fuels — Code of practice for design, handling and installation*

ISO 11413, *Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting*

ISO 12092<sup>2)</sup>, *Fittings, valves and other piping system components made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C), acrylonitrile-butadiene-styrene (ABS) and acrylonitrile-styrene-acrylester (ASA) for pipes under pressure — Resistance to internal pressure — Test method*

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2) Under revision as ISO 1167-3.



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

ISO 13479, *Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes (notch test)*

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

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

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

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 14531-3, *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 14531-4, *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 4: System design and installation guidelines*

ISO 18553, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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### 3 Terms and definitions

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

#### 3.1 Fitting types

##### 3.1.1

##### **socket fitting**

fitting with one or more cylindrical sockets into which pipes or fitting spigots can be inserted to form an assembly for subsequent jointing by heat fusion and the creation of an integral pipe/fitting connection

##### 3.1.2

##### **spigot fitting**

fitting with one or more tubular ends capable of insertion into a socket fitting to form an assembly for subsequent jointing by heat fusion and the creation of an integral pipe-to-fitting connection

##### 3.1.3

##### **saddle fitting**

fitting for placement on or around the outer surface of a pipe to form a saddle assembly for subsequent jointing by heat fusion and the creation of an integral pipe-to-fitting connection

##### 3.1.4

##### **tapping tee**

saddle fitting, with various outlet configurations, containing an intrinsic tool designed to perforate the wall of the pipe whilst the pipe is under internal pressure

### 3.1.5

#### branch saddle

saddle fitting, with various outlet configurations, with provision made for the location of a separate tool designed to perforate the wall of the pipe whilst the pipe is under internal pressure or in a non-pressurised state

## 3.2 Terms relating to the geometry

### 3.2.1

#### nominal outside diameter

$d_n$

numerical designation of the pipe 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 used for reference purposes.

### 3.2.2

#### mean outside diameter

$d_e$

(pipe) quotient of the outer circumference of the pipe measured at any cross-section and  $\pi^3$ , rounded up to the nearest 0,1 mm

### 3.2.3

#### mean outside diameter

$D_{1,sp}$

(spigot fitting) quotient of the outer circumference of a tubular spigot, measured in any radial plane over a distance extending up to  $L_{1,sp}$  from its leading face, and  $\pi^4$ , rounded up to the nearest 0,1 mm

### 3.2.4

#### minimum mean outside diameter

$d_{e,min}$

minimum value of the mean outside diameter of a pipe, specified for a given nominal outside diameter  $d_n$

See ISO 14531-1.

### 3.2.5

#### wall thickness

$e_y$

(pipe) value of the measured wall thickness at any point around the circumference of a pipe, rounded up to the nearest 0,1 mm

### 3.2.6

#### wall thickness

$E_y$

(fitting) value of the measured wall thickness at any point around the circumference of a socket, spigot or saddle fitting that is exposed to internal pressure, rounded up to the nearest 0,1 mm

### 3.2.7

#### minimum wall thickness

$e_{y,min}$

(pipe) minimum permissible value of the wall thickness  $e_y$  at any point around the circumference of a pipe

See ISO 14531-1.

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3) Taken to be 3,141 592 6..., as specified in ISO 31-11.

**3.2.8****minimum wall thickness** $E_{y,\min}$ 

⟨fitting⟩ minimum permissible value, defined by the manufacturer, of the wall thickness  $E_y$  at any point around the circumference of a socket, spigot or saddle fitting that is exposed to internal pressure

**3.2.9****penetration length** $L_{1,\text{so}}$ 

length from the entry face of a socket to the face of an inserted pipe or fitting spigot, selected as the basis for the fitting design

**3.2.10****fusion length** $L_{2,\text{so}}$ 

nominal length of the fusion zone between a pipe or fitting spigot and a fitting socket

**3.2.11****entry length** $L_{3,\text{so}}$ 

nominal length from the entry face of a socket to the beginning of the fusion zone

**3.2.12****mean inside diameter** $D_{1,\text{so}}$ 

arithmetic mean of at least two measured inside diameters of a socket perpendicular to each other in a plane parallel to the plane of the entry face, at a distance of  $L_{3,\text{so}} + 0.5L_{2,\text{so}}$  from that face

**3.2.13****minimum bore** $D_{2,\text{so}}$ 

⟨socket fitting⟩ minimum diameter of the flow channel through the bore of a socket fitting

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**3.2.14****minimum bore** $D_{2,\text{sp}}$ 

⟨spigot fitting⟩ minimum diameter of the flow channel through the bore of a spigot fitting

**3.2.15****out-of-roundness**

⟨socket fitting⟩ difference between the maximum inside diameter and minimum inside diameter in any radial cross-section of a socket fitting

NOTE In the context of this part of ISO 14531, out-of-roundness is measured in millimetres.

**3.2.16****out-of-roundness**

⟨spigot fitting⟩ difference between the maximum outside diameter and minimum outside diameter in any radial cross-section of a spigot fitting

NOTE In the context of this part of ISO 14531, out-of-roundness is measured in millimetres.

**3.2.17****tubular length** $L_{1,\text{sp}}$ 

length of tubular spigot designed to fit within a socket fitting

### 3.3 Terms relating to fuel and service conditions

#### 3.3.1

##### **gaseous fuel**

fuel which is in the gaseous state at a temperature of + 15 °C and at a pressure of 1 bar

#### 3.3.2

##### **category D gaseous fuel**

natural gas

NOTE Categories of gaseous fuel are defined in detail in ISO 13623.

#### 3.3.3

##### **category E gaseous fuel**

LPG vapour; natural gas or LPG vapour conveyed in association with intrinsic liquid condensates

NOTE Categories of gaseous fuel are defined in detail in ISO 13623.

#### 3.3.4

##### **fitting design pressure**

$DP_F$

pressure on which design calculations are based

#### 3.3.5

##### **pipeline operator**

private or public organisation authorised to design, construct and/or operate and maintain a gas supply system

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### 3.4 Terms relating to materials

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#### 3.4.1

##### **crosslinked polyethylene PE-X**

polyethylene structure within which the polymer chains are interconnected by chemical bonds to create a three-dimensional polymer network

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NOTE The properties of the three-dimensional structure ensure that it is not possible to melt or dissolve the polymer. The extent of crosslinking is related to the mass of insoluble material remaining following solvent extraction and can be determined by measurement of the gel content.

#### 3.4.2

##### **base material**

physical blend of non-crosslinked polyethylene(s) and additives formulated to facilitate conversion to PE-X during the production of fittings to conform to this part of ISO 14531

#### 3.4.3

##### **lower confidence limit of the predicted hydrostatic strength**

$\sigma_{LPL}$

quantity, with the dimensions of stress, which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength at a temperature  $\theta$  and time  $t$  in water

NOTE It is denoted by  $\sigma_{LPL} = \sigma_{(\theta, t, 0,975)}$ .

#### 3.4.4

##### **overall service (design) coefficient**

$C$

overall coefficient, with a value greater than 1,0, that takes into consideration service conditions as well as properties of the components of a piping system other than those represented in  $\sigma_{LPL}$