



**FINAL DRAFT**  
**International**  
**Standard**

**ISO/FDIS 16486-3**

**Plastics piping systems for  
the supply of gaseous fuels —  
Unplasticized polyamide (PA-U)  
piping systems with fusion jointing  
and mechanical jointing —**

**Part 3:  
Fittings**

*Systèmes de canalisations en matières plastiques pour la  
distribution de combustibles gazeux — Systèmes de canalisations  
en polyamide non plastifié (PA-U) avec assemblages par soudage  
et assemblages mécaniques —*

*Partie 3: Raccords*

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CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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This document 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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 16486-3:2020), which has been technically revised.

The main changes are as follows:

- the references in the Introduction have been updated;
- a Note has been added in the Introduction for information related to the suitability of PA-U pipe systems for 100 % hydrogen and its admixtures with natural gas;
- ISO 3183 has been added to the normative references;
- in [Table 3](#), row “315”, cut back length, the value “758” has been corrected to “75”;
- a Note has been added in [7.4](#) for the testing of leaktightness under pressure with air/nitrogen, appropriate for all gaseous fuels (e.g. methane and hydrogen);
- the Note in [11.3](#) concerning coding of traceability data has been changed and in [11.4](#), reference to ISO 12176-5 has been made;
- in [Figure A.1](#), the illustration is replaced by a sketch that shows the value  $h_2$  (= height of the active part).

A list of all parts in the ISO 16486 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document specifies the requirements for a piping system and its components made from unplasticized polyamide (PA-U), which is intended to be used for the supply of gaseous fuels.

NOTE 1 Additional information about the suitability of PA-U pipe systems for hydrogen and its admixtures is given in ISO 16486-1:2023, Annex D.

Requirements and test methods for material and components of the piping system, are specified in ISO 16486-1, ISO 16486-2 and ISO 16486-4.

Characteristics for fitness for purpose of the system and generic fusion parameters are covered in ISO 16486-5.

Recommended practice for installation is given in ISO 16486-6, which will not be implemented as a European Standard under the Vienna Agreement.

NOTE 2 Recommended practice for installation is also given in CEN/TS 12007-6,<sup>[3]</sup> which has been prepared by Technical Committee CEN/TC 234, *Gas infrastructure*.

Assessment of conformity of the system is covered in ISO/TS 16486-7 .

ISO 16486-1, ISO 16486-2, ISO 16486-3, ISO 16486-5, ISO 16486-6, ISO/TS 16486-7 and ISO/TS 16486-8 have been prepared by ISO/TC 138/SC 4. ISO 16486-4 has been prepared by ISO/TC 138/SC 7.

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# Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing —

## Part 3: Fittings

### 1 Scope

This document specifies the physical and mechanical properties of fittings made from unplasticized polyamide (PA-U) in accordance with ISO 16486-1, intended to be buried and used for the supply of gaseous fuels.

It also specifies the test parameters for the test methods to which it refers.

The ISO 16486 series is applicable to PA-U piping systems, the components of which are connected by fusion jointing and/or mechanical jointing.

In particular, this document lays down dimensional characteristics and requirements for the marking of fittings.

In conjunction with the other parts of the ISO 16486 series, this document is applicable to PA-U fittings, their joints, joints with components of PA-U and joints with mechanical fittings of other materials, and to the following fitting types:

- fusion fittings (electrofusion fittings and butt fusion fittings), and
- transition fittings.

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### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 307, *Plastics — Polyamides — Determination of viscosity number*

ISO 1133-2, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 2: Method for materials sensitive to time-temperature history and/or moisture*

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 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 4: Preparation of assemblies*

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

ISO 3183, *Petroleum and natural gas industries — Steel pipe for pipeline transportation systems*

ISO 4433-1, *Thermoplastics pipes — Resistance to liquid chemicals — Classification — Part 1: Immersion test method*

- ISO 11922-1, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*
- ISO 13950, *Plastics pipes and fittings — Automatic recognition systems for electrofusion joints*
- ISO 13951, *Plastics piping systems — Test method for the resistance of plastic pipe/pipe or pipe/fitting assemblies to tensile loading*
- ISO 13953, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*
- 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 13956, *Plastics pipes and fittings — Decohesion test of polyethylene (PE) saddle fusion joints — Evaluation of ductility of fusion joint interface by tear test*
- ISO 13957, *Plastics pipes and fittings — Polyethylene (PE) tapping tees — Test method for impact resistance*
- ISO 16486-1, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 1: General*
- ISO 16486-2, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 2: Pipes*
- ISO 16486-5, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 5: Fitness for purpose of the system*
- ISO 17778, *Plastics piping systems — Fittings, valves and ancillaries — Determination of gaseous flow rate/pressure drop relationships*
- ISO 17885, *Plastics piping systems — Mechanical fittings for pressure piping systems — Specifications*
- EN 682, *Elastomeric seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*
- IEC 60529, *Degrees of protection provided by enclosures (IP Code)*
- API 5L, *Specification for Line Pipe*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16486-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

##### **electrofusion socket fitting**

polyamide (PA-U) fitting which contains one or more integral heating elements that are capable of transforming electrical energy into heat to realize a fusion joint with a spigot end and/or a pipe

#### 3.2

##### **electrofusion saddle fitting**

unplasticized polyamide (PA-U) fitting which contains one or more integral heating elements that are capable of transforming electrical energy into heat to realize fusion onto a pipe



**3.3****tapping tee**

*electrofusion saddle fitting* (3.2) (top loading or wraparound) which contains an integral cutter, used to cut through the wall of the main pipe, and which holds the coupon inside the cutter

Note 1 to entry: The cutter remains in the body of the saddle after installation.

**3.4****spigot end fitting**

unplasticized polyamide (PA-U) fitting where the outside diameter of the spigot length is equal to the nominal outside diameter,  $d_n$ , of the corresponding pipe

**3.5****transition fitting**

factory made fitting that makes a transition joint between an unplasticized polyamide (PA-U) piping and a metallic pipe

Note 1 to entry: The metallic parts of the fitting may be assembled to metallic pipes by screw threads, compression joints, welded or flanged connections. The fitting can allow for either a dismantable or permanently assembled joint. In some cases, the supporting ring can also act as a grip ring.

**4 Material****4.1 PA-U compound**

The fittings shall be made from virgin material.

The compound from which the fittings are made shall be in accordance with ISO 16486-1.

**4.2 Material for non-unplasticized polyamide parts****4.2.1 General**

The materials and constituent elements used in making the fitting shall be resistant to the external and internal environments in which they are intended to be used:

- 1) during storage;
- 2) under the effect of the gaseous fuels being conveyed; and
- 3) taking account of the service environment and operating conditions.

Fittings materials, including elastomers, greases and lubricants in contact with the PA-U pipe, shall not adversely affect pipe performance or initiate stress cracking.

In all cases, fitness for purpose of the system of the components shall be demonstrated.

**4.2.2 Metal parts**

All parts susceptible to corrosion shall be adequately protected.

When dissimilar metallic materials are used which can be in contact with moisture, steps shall be taken to avoid galvanic corrosion.

Metals and materials produced by corrosion shall not affect the long-term performance of the pipe/fitting.

**4.2.3 Elastomers**

Elastomeric materials used for the manufacture of seals shall be in accordance with EN 682.

#### 4.2.4 Other materials

Greases or lubricants shall not exude on to the fusion areas, and shall not affect the long-term performance of the pipe/fitting.

## 5 General characteristics

### 5.1 Appearance

When viewed without magnification, the internal and external surfaces of the fitting shall be smooth, clean and free from scoring, cavities and other surface defects such as would prevent conformity of the fitting to this document.

No component of the fitting shall show any signs of damage, scratches, pitting, bubbles, blisters, inclusions or cracks to an extent that would prevent conformity of the fittings to the requirements of this document.

### 5.2 Design

The design of the fitting shall be such that, when assembling the fitting onto the pipe, spigot ends or other components, the electrical coils and/or seals and other functional parts (e.g. grippers) are not displaced.

### 5.3 Colour

The colour of fittings shall be yellow or black.

### 5.4 Electrical characteristics for electrofusion fittings

The electrical protection to be provided by the system depends on the voltage and the current used and on the characteristics of the electric power.

For voltages greater than 25 V, direct human contact with the energized parts shall not be possible when the fitting is in the fusion cycle during assembly in accordance with the instructions of the manufacturer of the fittings and the assembly equipment, as applicable.

This type of fitting is part of an electrical system as specified by IEC 60335-1,<sup>[4]</sup> IEC 60364-1<sup>[5]</sup> and IEC 60449.<sup>[6]</sup> Protection against direct contact with active parts (live conductors) shall be required in accordance with IEC 60529. This protection is a function of the work site conditions.

NOTE See [Annex A](#) for examples of typical electrofusion terminal connectors.

The surface finish of the terminal pins shall allow a minimum contact resistance in order to satisfy the resistance tolerance requirements (nominal value  $\pm 10\%$ ).

### 5.5 Appearance of factory-made fusion joints

The following requirements apply only to joints and fittings made or assembled in the factory.

The internal and external surfaces of the pipe and fitting after fusion jointing, examined visually without magnification, shall be free from melt exudation outside the confines of the fitting apart from that which may be declared acceptable by the fitting manufacturer or used as a fusion marker.

Any melt exudation shall not cause wire movement in electrofusion fittings leading to short-circuiting when jointed in accordance with the manufacturer's instructions. There shall be no excessive creasing of the internal surfaces of the adjoining pipes.

The interface of the butt fusion joints shall be perpendicular to the pipe and/or spigot end axis.