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Specification

ISO/PAS 22101-3

**Polyethylene reinforced with short
glass fibres (PE-sGF) piping systems
for industrial applications —**

**Part 3:
Fittings**

*Systèmes de canalisations en polyéthylène renforcé de fibres de
verre courtes (PE-sGF) pour les applications industrielles —*

Partie 3: Raccords

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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).

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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 3, *Plastics pipes and fittings for industrial applications*.

A list of all parts in the ISO 22101 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.

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Introduction

Polyethylene reinforced with short glass fibres (PE-sGF) piping systems are pipe systems which consist of fittings produced by adding short glass fibres into high density polyethylene resins. Their physical and mechanical properties are influenced by short glass fibre orientation.

For the material subject of this document, the mechanical performances are obtained on the basis of standards dedicated to thermoplastics. The geometrical characteristics are defined for this material in line with ISO 3 and ISO 4065.

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Polyethylene reinforced with short glass fibres (PE-sGF) piping systems for industrial applications —

Part 3: Fittings

1 Scope

This document specifies the fittings made from short glass fibre reinforced polyethylene (PE-sGF) manufactured by the spiral cross winding method used below ground for the conveyance of fluids in the following industrial and agricultural contexts:

- chemical plants;
- industrial sewerage engineering;
- power engineering (cooling and general-purpose water supply);
- agricultural production plants;
- water treatment;
- small hydraulic power plants (general-purpose water supply).

This document also specifies the test parameters for the test methods it references.

In conjunction with the other parts of the ISO 22101 series, this document is applicable to PE-sGF fittings, and to joints with components of PE-sGF or other materials, intended to be used under the following conditions:

- a) a maximum allowable operating pressure (PFA) up to and including 25 bar;¹⁾
- b) an operating temperature of 20 °C as the reference temperature.

NOTE 1 For other operating temperatures, guidance is given in ISO/PAS 22101-1:2022, Annex A.

This document covers a range of maximum allowable operating pressures and gives requirements concerning colours and additives.

NOTE 2 It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national guidance or regulations and installation practices or codes.

This document is applicable to fittings of the following types:

- electrofusion socket fittings;
- loose backing flanges and flange adapters;
- fabricated fittings (see [Annex A](#)).

1) 1 bar = 0,1 MPa = 105 Pa; 1 MPa = 1 N/mm².

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 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

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 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*

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

ISO 4427-2, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 2: Pipes*

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

ISO 4433-2, *Thermoplastics pipes — Resistance to liquid chemicals — Classification — Part 2: Polyolefin pipes*

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

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/PAS 22101-1, *Polyethylene reinforced with short glass fibres (PE-sGF) piping systems for industrial applications — Part 1: General*

ISO/PAS 22101-2, *Polyethylene reinforced with short glass fibres (PE-sGF) piping systems for industrial applications — Part 2: Pipes*

ISO/PAS 22101-5, *Polyethylene reinforced with short glass fibres (PE-sGF) piping systems for industrial applications — Part 5: Fitness for purpose of the system*

3 Terms and definitions

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

PE-sGF 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 pigot end or pipe

3.2

mechanical fitting

fitting that generally includes a compression part to provide pressure integrity, leak tightness and resistance to end loads for assembling PE-sGF pipe to another PE-sGF pipe or any other element of the piping system

Note 1 to entry: The fitting can allow either a dismountable or permanently assembled joint.

Note 2 to entry: The fitting can be supplied for field assembly or pre-assembled by the manufacturer.

3.3

fabricated fitting

fitting produced from pipe conforming to ISO/PAS 22101-2 or the spiral cross winding process in accordance with this document, or both

4 Material

4.1 PE compound

The PE compound from which the fitting is made shall conform to ISO/PAS 22101-1.

4.2 PE-sGF compound

The PE-sGF compound from which the fittings are made shall conform to ISO/PAS 22101-1.

4.3 Material for non-polyethylene-based parts

4.3.1 General

The materials and constituent elements used in making the fitting (including any metal parts) shall be as resistant to the external and internal environments as the other elements of the piping system and shall have a life expectancy under the following conditions at least equal to that of the PE-sGF pipe conforming to ISO/PAS 22101-2 with which they are intended to be used:

- a) during storage;
- b) under the effect of the fluids being conveyed;
- c) with respect to the service environment and operating conditions.

4.3.2 Metal parts

All parts susceptible to corrosion shall be adequately protected, provided this is necessary for durability and function of the system. When dissimilar metallic parts are used which can potentially be in contact with moisture, appropriate actions shall be taken to avoid galvanic corrosion.

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 which would prevent conformity of the fitting to this document.

5.2 Design

The design of the fitting shall be such that, when assembling the fitting onto the pipe or other components in accordance with the manufacturer's recommendations, the electrical coils are not displaced.

The electrofusion fitting body shall be made with PE-sGF. Electrofusion fitting sockets shall have an internal layer in PE. Heating wires shall be placed in the internal PE layer. The outer surface shall have a protective PE layer.

Flange adapters shall be made from PE-sGF.

Loose backing flanges shall be made from metal.

Fabricated fittings shall be designed in accordance with [Annex A](#).

5.3 Colour

The colour of the PE-sGF parts of the fitting shall be black.

5.4 Electrical characteristics for electrofusion fittings

The electrical protection that shall be provided by the fusion process depends on the voltage and the current used, and on the characteristics of the electricity power source.

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

NOTE 1 The fitting during the fusion process is part of an electrical system as defined in EN 60335-1,^[7] HD 60364-1,^[8] and IEC 60449.^[6]

The specified electrical resistances of the fitting at 23 °C shall be stated by the manufacturer and its tolerance shall be between nominal resistance ($\pm 5\% \Omega$).

NOTE 2 0,1 Ω is the assumed value of the contact resistance.

The surface finish of the terminal pins shall allow a minimum contact resistance in order to satisfy the resistance tolerance requirements.

5.5 Appearance of factory-made joints

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.

There shall be no wire movement leading to short circuiting when the electrofusion fitting is jointed in accordance with the manufacturer's instructions. There shall be no excessive creasing of the internal surfaces of the adjoining pipes or spigots.

6 Geometrical characteristics

6.1 Measurement of dimensions

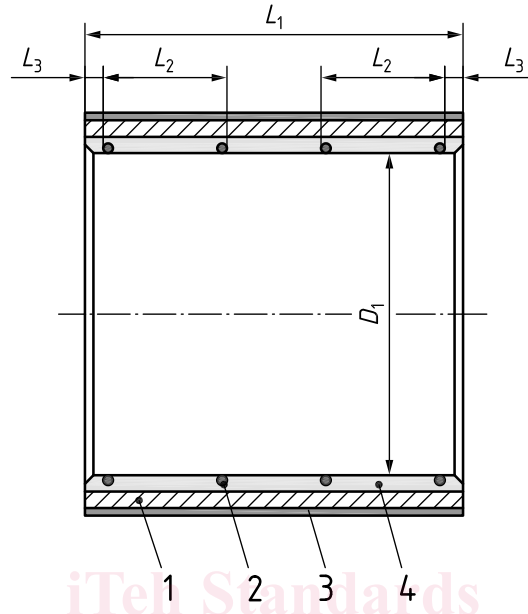
The dimensions of the fittings shall be measured in accordance with ISO 3126. In case of dispute, the measurement of dimensions shall be made not less than 24 h after manufacture and after conditioning for at least 4 h at (23 ± 2) °C.

Indirect measurement at the stage of production is permitted after shorter time periods, provided that evidence is shown of correlation.

6.2 Dimensions of electrofusion socket

6.2.1 Diameters and lengths of electrofusion socket fitting

When measured in accordance with 7.1, the diameters and lengths of electrofusion sockets as shown in Figure 1 shall conform to ISO/PAS 22101-2. L_3 shall be at least 20 mm. The thickness of the non-glass filled layer of inner polyethylene shall be at least 1,5 mm for electrofusion socket fittings.



Key

- D_1 mean inside diameter in the fusion zone, measured in a plane parallel to the plane of the mouth at a distance of $L_3 + 0,5 L_2$
- L_1 socket depth corresponding to the maximum spigot insertion
- L_2 heated length within a coupler as declared by the manufacturer to be the nominal length of the fusion zone
- L_3 distance between the mouth of the fitting and the start of the fusion zone
- 1 glass-filled layer of electrofusion socket fitting
- 2 electrical oils
- 3 non-glass-filled layer of electrofusion socket fitting
- 4 non-glass-filled layer of electrofusion socket fitting

Figure 1 — Dimensions of electrofusion socket fitting

In the case of a fitting having sockets of different sizes, each one shall conform to the requirements for the corresponding nominal diameter.

The connection of two pipes of different materials (e.g. PE to PE-sGF) and thicknesses is allowed by the fitting.

6.2.2 Wall thickness of the fitting body

The wall thickness, E , of the fitting body measured at any point, shall be at least equal to the nominal wall thickness, e_n , of the pipe.

Any changes in wall thickness inside the body of the fitting shall be gradual in order to prevent stress concentrations.