PUBLICLY AVAILABLE SPECIFICATION

**ISO/PAS 22101-2**

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

## Part 2: Pipes



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

*Partie 2: Tubes*



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# Foreword

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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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.



This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 3, *Polyethylene reinforced with short glass fibres (PE-sGF) piping systems 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.

# Introduction

Polyethylene reinforced with short glass fibres (PE-sGF) piping systems are pipe systems which consist of pipes 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 International Standards dedicated to thermoplastics. The geometrical characteristics are defined for this material in line with ISO 3 and ISO 4065.

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

# Part 2: Pipes

## 1 Scope

This document is applicable to short glass fibre reinforced polyethylene (PE-sGF) pipes manufactured by the spiral cross winding method, which are used below ground for the conveyance of liquid fluids for the following industrial and agricultural uses:

— 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);



In conjunction with the other parts of the ISO 22101 series, this document applies to PE-sGF pipes, fittings and their joints with each other, with other PE-sGF components, and to components from other materials intended for use under the following conditions:



a) allowable operating pressure (PFA) up to and including 25 bar[1)];

b) operating temperature of 20 °C as the reference temperature.

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

Other application areas differing from those listed in the scope can be permitted if the requirements of this document and/or relevant national requirements are taken into account. Drinking water applications are outside the scope of this document.

This document is applicable to pipes with an inside diameter of 200 mm to 1 000 mm with integrated socket and spigot fusion joint.

Components conforming to any of the documents listed in the Bibliography or to national standards, as applicable, can be used with components conforming to this document, provided that they conform to the requirements for joint dimensions and to the relevant requirements of this document.

## 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*

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

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

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 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 11922-1, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

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:—[2)], *Polyethylene reinforced with short glass fibres (PE-sGF) piping systems for industrial applications — Part 1: General*



## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/PAS 22101-1 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**
**out-of-roundness**
difference between the maximum and the minimum inside diameters in the same cross-section of a pipe or spigot

**3.2**
**electrofusion socket end**
glass fibre reinforced polyethylene (PE-sGF) pipe socket 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

**3.3**
**spigot end**
glass fibre reinforced polyethylene (PE-sGF) pipe end where the outside diameter of the spigot length is equal to the socket inside diameter, $d_{im}$, of the corresponding pipe

2) Under preparation. Under preparation. Stage at the time of publication: ISO/PAS PRF 22101-1:2022

**3.4**
**tolerance**
permissible variation of the specified value of a quantity expressed as the difference between the permissible maximum and permissible minimum values

## 4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/PAS 22101-1 apply.

## 5 Material

The material from which the pipe is made shall be in accordance with ISO/PAS 22101-1.

## 6 General characteristics

### 6.1 Appearance

When viewed without magnification the internal surfaces of pipes, sockets and spigots shall be smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformity of the pipe to this document. When applicable, the pipe ends shall be cut cleanly and square to the axis of the pipe.



### 6.2 Colour

The pipes shall be black.

## 7 Geometrical characteristics



### 7.1 Measurements

The dimensions of the pipe, of the socket length of the pipe for welding, and of the integrated spigot length shall be measured in accordance with ISO 3126, where applicable. In case of dispute, the measurements of dimensions shall be made not less than 24 h after manufacture, after being conditioned for at least 4 h at (23 ± 2) °C.

### 7.2 Mean inside diameter and out-of-roundness (ovality)

The nominal inside diameter, $d_{in}$, the mean inside diameters, $d_{im}$, and the out-of-roundness (ovality) shall be in accordance with Table 1.

**Table 1 — Mean inside diameter and out-of-roundness (ovality)**

Dimensions in millimetres

| Nominal size DN/ID | Nominal inside diameter | Mean inside diameter | | Maximum out-of-roundness (ovality)[b] |
|---|---|---|---|---|
| | $d_{in}$ | $d_{im,min}$ | $d_{im,max}$[a] | |
| 200 | 200 | 200 | 208 | 8 |
| 300 | 300 | 300 | 308 | 10 |
| 400 | 400 | 400 | 408 | 14 |
| 500 | 500 | 500 | 508 | 17 |
| 600 | 600 | 600 | 610 | 21 |
| 700 | 700 | 700 | 711 | 24 |
| 800 | 800 | 800 | 813 | 28 |
| 900 | 900 | 900 | 915 | 31 |
| 1 000 | 1 000 | 1 000 | 1 017 | 35 |

[a] Tolerances for grass-filled layer are calculated based on the following formula, rounding calculated values down to the nearest 1 mm: $d_{im,max}=d_{in}+(d_{in} \cdot 0{,}017)$, but $\geqq d_{in}+8$ mm.

[b] Out of roundness (ovality) is calculated in accordance with ISO 11922-1.

## 7.3 Wall thicknesses and their tolerances

Table 2 provides maximum allowable pressure (PS) values for pipes with and without integral socket. Pipes with integral sockets are derated to account for the socket strength. Minimum wall thicknesses shall be in accordance with Table 2. Values shown in Table 2 do not include a non-glass-filled layer of outer and inner polyethylene, minimum 1,5 mm each, for protecting against UV and chemical degradation (see also Annex C).

Alternatively, other diameters and pressures may be used; the corresponding wall thickness is then calculated according to the national requirements.

The PS values in Table 2 are based on the value $C$ = 1,60, where $C$ is the design coefficient. Higher design coefficients may be agreed upon between the manufacturer and the purchaser. See Annex A.

**Table 2 — Pressure rating and wall thickness**

Dimensions in millimetres

| | Pipe series | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SIDR 9<br>$S_i$ 5 | | SIDR 11<br>$S_i$ 6 | | SIDR 14<br>$S_i$ 7,5 | | SIDR 21<br>$S_i$ 10 | |
| | Nominal pressure, PS in bar[d] | | | | | | | |
| **Pipes without socket** | PS 25 | | PS 20 | | PS 16 | | PS 11 | |
| **Pipe with socket** | PS 16 | | PS 13 | | PS 10 | | PS 8 | |
| **Nominal size** | Wall thicknesses[a,b,c] | | | | | | | |
| DN/ID | $e_{min}$ | $e_{max}$ | $e_{min}$ | $e_{max}$ | $e_{min}$ | $e_{max}$ | $e_{min}$ | $e_{max}$ |
| **200** | 22,6 | 27,9 | 18,5 | 23,4 | 14,5 | 19,1 | 10,7 | 14,9 |
| **300** | 33,9 | 40,4 | 27,7 | 33,6 | 21,8 | 27,1 | 16,1 | 20,8 |
| **400** | 45,0 | 52,6 | 36,8 | 43,6 | 28,9 | 34,9 | 21,3 | 26,5 |
| **500** | 56,1 | 64,8 | 45,9 | 53,6 | 36,1 | 42,8 | 26,6 | 32,3 |
| **600** | 67,8 | 77,7 | 55,5 | 64,1 | 43,6 | 51,0 | 32,1 | 38,4 |
| **700** | 78,9 | 89,9 | 64,5 | 74,1 | 50,7 | 58,9 | 37,4 | 44,2 |
| **800** | 90,0 | 102,1 | 73,6 | 84,1 | 57,9 | 66,7 | 42,6 | 50,0 |
| **900** | 101,1 | 114,3 | 82,7 | 94,1 | 65,0 | 74,6 | 47,9 | 55,8 |
| **1 000** | 112,8 | 127,2 | 92,3 | 104,6 | 72,5 | 82,9 | 53,4 | 61,9 |

[a] Minimum wall thicknesses are calculated based on SIDR values that are derived from Renard Series R20 according to ISO 3, where possible.

[b] Tolerances in accordance with grade V of ISO 11922-1.

[c] See Annex A for actual calculated values.

[d] 1 bar = 0,1 MPa = $10^5$ Pa; 1 MPa = 1 N/mm$^2$.