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

### Part 2: Pipes

ICS: 23.040.01

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[ISO/DTS 22101-2.3](#)

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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 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](http://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](http://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](http://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 03, *Plastics pipes and fittings for industrial applications*.

ISO 22101 consists of the following parts, under the general title *Polyethylene reinforced with short glass fibres (PE-sGF) piping systems for industrial applications*:

*Part 1: General*

*Part 2: Pipes*

*Part 3: Fittings*

*Part 5: Fitness for purpose of the system*

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

The pipe systems which consist of pipes produced by adding short glass fibres into high density polyethylene resins are called polyethylene reinforced with short glass fibres (PE-sGF) piping systems. The physical and mechanical properties are influenced by short glass fibre orientation. This document is applicable to pipe inside diameter from 200 mm to 2000 mm with integrated socket and spigot fusion joint. The PE-sGF system is intended to be used for general purpose fluids supply (e.g.: chemical plants, industrial sewerage engineering, power plants, agricultural production plants, water treatment).

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 exclusively for this material in analogy to ISO 4065<sup>[1]</sup>.

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

## Part 2: Pipes

### 1 Scope

This International Standard is applicable to polyethylene reinforced with short glass fibre [PE-sGF] pipes manufactured by spiral cross winding method used in above and below ground for the conveyance of liquid fluids as well as solid matter in fluids for industrial applications such as the following:

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

In conjunction with the other parts of ISO 22101, it applies to PE-sGF pipes, 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 (PEA) up to and including 25 bar ;
- b) operating temperature of 20 °C as the reference temperature

NOTE 1 For other operation temperatures, guidance is given in ISO/CD 22101-1: Annex B.

NOTE 2 If needed, national regulations for specific applications (e.g. water treatment) apply. This standard is not applicable to drinking water application.

Other application areas are permitted if the requirements of this International Standard and applicable national requirements are fulfilled.

National regulations in respect of fire behaviour and explosion risk are applicable.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 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 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 6259-1, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

ISO 6259-3, *Thermoplastics pipes — Determination of tensile properties — Part 3: Polyolefin pipes*

ISO 9969, *Thermoplastics pipes — Determination of ring stiffness*

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 15494, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE), polyethylene of raised temperature resistance (PE-RT), crosslinked polyethylene (PE-X), polypropylene (PP) — Metric series for specifications for components and the system*

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

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

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### 3 Terms and definitions

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For the purposes of this document, the terms and definitions given in ISO/CD 22101-1:2019 and the following apply.

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

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

#### 3.1 electrofusion socket fitting

glass fibre reinforced polyethylene (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 spigot end or a pipe

#### 3.2 spigot end fitting

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

#### 3.3 voltage regulation

control of energy supplied during the fusion process of an electrofusion fitting by means of the voltage parameter

#### 3.4 intensity regulation

control of energy supplied during the fusion process of an electrofusion fitting by means of the current parameter



## 4 Symbols and abbreviated terms

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

## 5 Material

The material from which the pipe is made shall be in accordance with ISO/CD 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 standard. 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 the 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  $(23 \pm 2)$  °C.

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

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 millimeters

Nominal size DN/ID	Nominal inside Diameter	Mean inside diameter		Maximum out-of-roundness (ovality) <sup>b</sup>
		$d_{in}$	$D_{im,min}$	
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
1000	1000	1000	1017	35
1100	1100	1100	1119	38
1200	1200	1200	1220	42
1300	1300	1300	1322	45
1400	1400	1400	1423	49
1500	1500	1500	1525	53
1600	1600	1600	1627	56
1800	1800	1800	1830	63
2000	2000	2000	2034	70

<sup>a</sup> Tolerances for intermediate 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  $\geq d_{in} + 8$  mm.

<sup>b</sup> Out of roundness (ovality) is calculated according to ISO 11922-1.

### 7.3 Wall thicknesses and their tolerances

Minimum wall thicknesses, listed in [Table 2](#), are not including non-structural layer of outer and inner polyethylene, minimum 1,5 mm each for colouring, protection against UV and chemical degradation.

Alternatively other diameters and pressures may be used; the corresponding wall thickness is then calculated according to the applicable formula.

The PN values in [Table 2](#) are based on C=1,60. Higher safety coefficients may be agreed upon between the manufacturer and the purchaser, see also [Annex B](#).

Table 2 — Pressure rating and wall thickness

Dimensions in millimetres

	Pipe series							
	SIDR 9 S <sub>i</sub> 5		SIDR 10 S <sub>i</sub> 5,5		SIDR 11 S <sub>i</sub> 6		SIDR 12 S <sub>i</sub> 6,5	
	Nominal pressure, PN in bar							
PE-sGF 200/20	PN 25		PN 23		PN 21		PN 19	
Nominal size DN/ID	Wall thicknesses <sup>a, b, c, d</sup>							
	<i>e</i> <sub>min</sub>	<i>e</i> <sub>max</sub>	<i>e</i> <sub>min</sub>	<i>e</i> <sub>max</sub>	<i>e</i> <sub>min</sub>	<i>e</i> <sub>max</sub>	<i>e</i> <sub>min</sub>	<i>e</i> <sub>max</sub>
200	22,6	27,9	20,3	25,4	18,5	23,4	16,9	21,7
300	33,9	40,4	30,5	36,7	27,7	33,6	25,4	31,1
400	45,0	52,6	40,5	47,7	36,8	43,6	33,8	40,2
500	56,1	64,8	50,5	58,7	45,9	53,6	42,1	49,4
600	67,8	77,7	61,0	70,2	55,5	64,1	50,8	59,0
700	78,9	89,9	71,0	81,2	64,5	74,1	59,2	68,2
800	90,0	102,1	81,0	92,2	73,6	84,1	67,5	77,4
900	101,1	114,3	91,0	114,8	82,7	94,1	75,8	86,5
1000	112,8	127,2	101,5	125,8	92,3	104,6	84,6	96,1
1100	123,9	139,4	111,5	136,8	101,4	114,6	92,9	105,3
1200	135,0	151,6	121,5	147,8	110,5	124,6	101,3	114,5
1300	146,1	163,8	131,5	159,3	119,5	134,6	109,6	123,6
1400	161,0	171,9	142,0	170,3	129,1	145,1	118,3	133,3
1500	168,9	188,9	152,0	181,3	138,2	155,1	126,7	142,4
1600	180,0	201,1	162,0	203,9	147,3	165,1	135,0	151,6
1800	202,8	226,2	182,5	225,9	165,9	185,6	152,1	170,4
2000	225,0	250,6	202,5	242,3	184,1	205,6	168,8	188,7

<sup>a</sup> Minimum wall thicknesses are calculated based on SIDR values that are derived from Renard Series R20 according to ISO 3.

<sup>b</sup> Tolerances in accordance with grade V of ISO 11922-1.

<sup>c</sup> For practical reasons, a minimum wall thickness of 3,9 mm included non-structural layer is recommended for electrofusion jointing and lining applications.

<sup>d</sup> See also [Annex B](#) for actual calculated values.