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BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 25780

Plastics piping systems for pressure and non-pressure water supply, drainage or sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin — Pipes with flexible joints intended to be installed using jacking techniques

ICS: 91.140.60; 91.140.80; 93.030; 23.040.20

ISO/TC 138/SC 6

Secretariat: **ASI**

Voting begins on:
2025-06-24

Voting terminates on:
2025-09-16

This document is circulated as received from the committee secretariat.

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CP 401 • Ch. de Blandonnet 8
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Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: 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 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO *had not* received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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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 ISO/TC 138, Plastics pipes, fittings and valves for the transport of fluids, Subcommittee SC 6, Reinforced plastics pipes and fittings for all applications.

This second edition cancels and replaces the first edition (ISO 25780:2011), which has been technically revised.

The main changes are as follows:

The document was thoroughly revised, and many inconsistencies and errors corrected in all chapters. Several parameters which were not considered useful were deleted. Some new parameters, such as partial factors, were added.

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.

Plastics piping systems for pressure and non-pressure water supply, drainage or sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin — Pipes with flexible joints intended to be installed using jacking techniques

1 Scope

This document specifies the properties of the piping system and its components made from glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP). It is suited for all types of water supply, drainage and sewerage with or without pressure. Types of water supply include, but are not limited to, raw water, irrigation, cooling water, potable water, salt water, sea water, penstocks in power plants, processing plants and other water-based applications.

This document is applicable to GRP-UP piping systems, with flexible joints, intended to be installed using jacking techniques. It specifies the characteristics of pipes made from GRP-UP, with or without aggregates or fillers and also specifies the test parameters for the test methods referred to in this document.

The requirements for the hydrostatic pressure design of pipes referring to this document meet the requirements of ISO/TS 20656-1 and the general principle for the reliability of structures detailed in ISO 2394 and in EN 1990. These documents provide procedures for the harmonization of design practices and address the probability of failure, as well as possible consequences of failures. The design practices are based on a partial safety factor concept, as well as on risk management engineering.

This document is applicable to circular pipes and joints with a size range from DN 100 to DN 4000 at normal service conditions.

It covers requirements to prove the design of the joint and specifies type test performance requirements for the joints as a function of the declared nominal pressure rating of the pipeline system and the required joint deflection capability of the system.

GRP-fittings, used between pipe systems covered by this document, shall be in accordance with ISO 23856. In a pipe-work system, pipes of different nominal pressure and stiffness ratings may be used together.

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 75-2, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite*

ISO 604, *Plastics — Determination of compressive properties*

ISO 2078, *Textile glass — Yarns — Designation*

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

ISO 4633, *Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials*

ISO 7685, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of initial ring stiffness*

ISO 8521, *Glass-reinforced thermosetting plastic (GRP) pipes — Test methods for the determination of the initial circumferential tensile wall strength*

ISO 8639, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods for leaktightness and proof of structural design of flexible joints*

ISO 10466, *Glass-reinforced thermosetting plastics (GRP) pipes — Test method to prove the resistance to initial ring deflection*

ISO 10468, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the ring creep properties under wet or dry conditions*

ISO 10471, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term ultimate bending strain and the long-term ultimate relative ring deflection under wet conditions*

ISO 10928, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Methods for regression analysis and their use*

ISO 10952, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Determination of the resistance to chemical attack for the inside of a section in a deflected condition*

ISO 23856, *Plastics piping systems for pressure and non-pressure water supply, drainage or sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin*

CEN/TS 14632, *Plastics piping systems for drainage, sewerage and water supply, pressure and non-pressure — Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) — Guidance for the assessment of conformity*

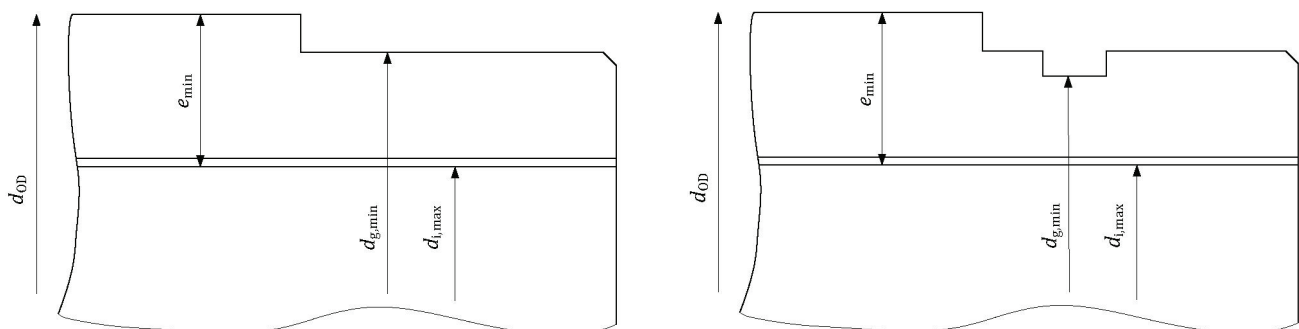
3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the following terms, definitions, symbols and abbreviated terms 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 Design values declared by the manufacturer



a) Section through a rebated un-grooved spigot

b) Section through a rebated grooved spigot

Key

- | | | | |
|-------------|--|-----------|---------------------------------------|
| d_{OD} | pipe outside diameter, in mm | e_{min} | minimum wall thickness of pipe, in mm |
| $d_{i,max}$ | maximum spigot inside diameter, in mm | | |
| $d_{g,min}$ | minimum spigot or groove diameter, in mm | | |

Figure 1 — Diameters declared by the manufacturer

3.1.1**pipe outside diameter****jacking diameter** d_{OD}

maximum external diameter of the pipe barrel declared by the manufacturer

Note 1 to entry: The pipe outside diameter is expressed in millimetres (mm).

Note 2 to entry: See [Figure 1](#).**3.1.2****maximum spigot inside diameter** $d_{i,max}$

maximum internal diameter of the pipe spigot, at the groove location where applicable, as declared by the manufacturer

Note 1 to entry: Note to entry: See [Figure 1](#).**3.1.3****minimum spigot or groove diameter** $d_{g,min}$ minimum external diameter of the spigot [see [Figure 1](#) a) diameter], or in the groove of the spigot [see [Figure 1](#) b) diameter, if applicable], declared by the manufacturer

Note 1 to entry: Spigot or groove diameter is expressed in millimetres (mm).

Note 2 to entry: See [Figure 1](#).**3.1.4****minimum wall thickness** e_{min}

minimum wall thickness of the pipe barrel declared by the manufacturer

Note 1 to entry: The minimum wall thickness is expressed in millimetres (mm).

Note 2 to entry: See [Figure 1](#).**3.1.5****minimum cross-sectional area at the spigot** A_s

minimum area of the cross-section of the pipe at the spigot, or in the groove of the spigot, if applicable

Note 1 to entry: Minimum cross-sectional area at the spigot is derived using the following formula and is expressed in square millimetres (mm²)

$$A_s = \pi \left[(0,5d_{g,min})^2 - (0,5d_{i,max})^2 \right]$$

Note 2 to entry: See [Figure 1](#).**3.1.6****cross-sectional area at the barrel** A_b

area of the cross-section of the pipe barrel

Note 1 to entry: The cross-sectional area at the pipe barrel is derived using the following formula and is expressed in square millimetres (mm²)

$$A_b = \pi \left[(0,5d_{OD})^2 - (0,5d_{i,max})^2 \right]$$

Note 2 to entry: See [Figure 1](#).

3.1.7

minimum initial longitudinal compressive stress at break

σ_b
manufacturer's declared minimum value, derived from tests, for the initial longitudinal compressive stress at break of the pipe

Note 1 to entry: When tested in accordance with [Annex A](#) or [Annex B](#), the minimum initial longitudinal compressive stress at break is expressed in megapascals (MPa).

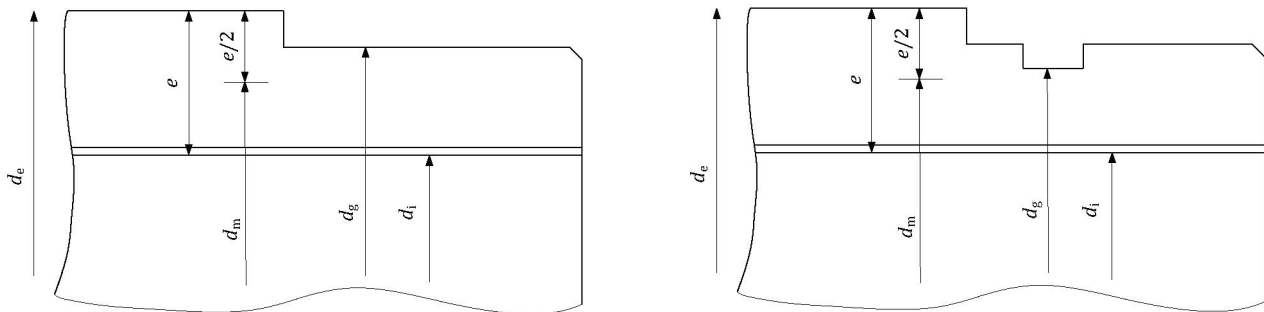
3.1.8

declared initial longitudinal compressive modulus

E_c
manufacturer's declared value, derived from tests, for the initial longitudinal compressive modulus $E_{c,m}$

Note 1 to entry: When tested in accordance with [Annex A](#) or [Annex B](#), the declared initial longitudinal compressive modulus is expressed in megapascals (MPa).

3.2 Measured values



a) Section through a rebated un-grooved spigot

b) Section through a rebated grooved spigot

Key

- d_e measured external diameter, in mm
- d_i measured spigot inside diameter, in mm
- d_g measured spigot or groove diameter, in mm
- d_m mean diameter, in mm
- e measured wall thickness of pipe, in mm

Figure 2 — Measured diameters

3.2.1

mean diameter

d_m
diameter of the circle corresponding to the middle of the pipe wall cross-section and given by the following formula:

$$d_m = d_e - e$$

where

- d_e is the measured external diameter, in mm;
- e is the measured wall thickness of the pipe, in mm.

Note 1 to entry: It is expressed in millimetres (mm).

[SOURCE: ISO 23856:2021, amended by “measured”]

Note 2 to entry: If measured values are not available (e.g. for design purposes) declared values may be used.

Note 3 to entry: See [Figure 2](#).

3.3

jacking

trenchless construction method which installs a pipeline by inserting pipes one by one under the ground by pressing with one or more hydraulic jacks, while the excavated ground is simultaneously evacuated from the cutting head

3.4

nominal length

pipe length without tolerance

Note 1 to entry: It is expressed in metres (m).

3.5

de-rating factor

f_s
factor correcting for the relationship between compression test results obtained on spool test pieces and results obtained using prism test pieces with the unrebrated spigot geometry

Note 1 to entry: de-rating factor is determined using the following formula and is a dimensionless number

$$f_s = \sigma_{b,s} / \sigma_{b,p,ITT}$$

where

$\sigma_{b,s}$ is the initial longitudinal compressive stress at break (spool test pieces) according to [5.4.2](#), in MPa;

$\sigma_{b,p,ITT}$ is the initial longitudinal compressive stress at break (prism test pieces) for initial type tests, according to [5.4.3](#), in MPa.

3.6

initial longitudinal compressive modulus

$E_{c,p}$
ratio of the applied stress to the resulting strain below the elastic limit, both measured concurrently during a short-term compression test with prism

3.7

$E_{c,s}$
ratio of the applied stress to the resulting strain below the elastic limit, both measured concurrently during a short-term compression test with spool

Note 1 to entry: When tested in accordance with [Annex A](#) or [Annex B](#), the initial longitudinal compressive modulus is expressed in megapascals (MPa).

3.8

design longitudinal load

F_d
design value of the concentric longitudinal load that the pipe withstands taking into account the material partial factor

Note 1 to entry: The ultimate longitudinal load is determined using the following formula and is expressed in kilonewtons (kN)

$$F_d = \sigma_b \cdot A_s \cdot \frac{1}{1000} \cdot \frac{1}{\gamma_M}$$

where

σ_b is the declared minimum initial compressive stress at break, in MPa;

A_s is the minimum pipe cross-sectional area at the spigot, in mm²;

γ_M material partial factor, $\gamma_M = 1,37$; see also [Table C.1](#).

3.9 design jacking load

$F_{j,d}$
longitudinal compressive load that a pipe can withstand during a jacking operation, taking into account installation partial factor and the stress eccentricity dependence factor

Note 1 to entry: Design jacking load is determined using the following formula and is expressed in kilonewtons (kN)

$$F_{j,d} = \frac{F_d}{S_\sigma \cdot \gamma_i}$$

where

F_d is the design longitudinal load, in kN;

S_σ is the stress eccentricity dependence factor, with $S_\sigma \geq 2$;

γ_i is the installation partial factor, see [Table C.1](#).

Note 2 to entry: For the design jacking load for closed joint (considering full contact between the spigots) the stress eccentricity dependence factor $S_\sigma = 2$.

Note 3 to entry: For the design jacking load for open joint (considering incomplete contact between the spigots) the stress eccentricity dependence factor $S_\sigma > 2$. For the determination of S_σ see [C.2.5](#).

3.10 nominal stiffness

SN
alphanumeric designation for stiffness classification purposes, which has the same numerical value as the minimum initial value required, when expressed in newtons per square metre (N/m²)

Note 1 to entry: The designation for reference or marking purposes consists of the letters SN plus a number.

[SOURCE: ISO 23856:2022, 3.8]

3.11 ring stiffness

S
physical characteristic of the pipe which is a measure of the resistance to ring deflection per metre length under external load

Note 1 to entry: ring stiffness is determined using the following formula and is expressed in newtons per square metre (N/m²)

$$S = \frac{E \cdot I}{d_m^3}$$

where

E is the apparent modulus of elasticity, which can be derived from the result of the ring stiffness test, i.e. ISO 7685, in N/m²;

d_m is the mean diameter, in m;

I is the second moment of area in the longitudinal direction per metre length, in m⁴/m;

$$I = \frac{e^3}{12} \quad (6)$$

where e is the measured wall thickness of pipe, in m.

3.12 initial ring stiffness

S_0
value of ring stiffness, S , obtained when tested in accordance with ISO 7685

The initial stiffness shall be computed by:

$$S_0 = \frac{\left\{ 1\,860 + \left(2\,500 \frac{y}{d_m} \right) \right\} \cdot 10^{-5}}{\frac{L_R \cdot y}{F_R} - 0,3927 \cdot \frac{k \cdot d_m}{G \cdot e}}$$

where

y is the measured deflection, in m;

d_m is the mean diameter, in m;

L_R is the length of the specimen, in m;

F_R is the measured load, in N;

k is a shape factor for the wall cross section, can be assumed to be equal to 1.2, dimensionless;

G is the shear modulus, in N/m².

Note 1 to entry: The shear modulus to be used in the calculation can be determined through calibration between measured and computed values on various products, or other suitable means.

Note 2 to entry: Initial ring stiffness is expressed in newtons per square metre (N/m²).

Note 3 to entry: The test shall be performed at relative deflection, y/d_m calculated by:

$$y/d_m (\%) = \frac{65}{\sqrt[3]{SN}}$$

3.13 calculated long-term ring creep stiffness

S_x
calculated value of ring creep stiffness, S , at x years

Note 1 to entry: Long-term ring creep stiffness is obtained using the following formula

$$S_x = S_{0,1} \cdot \alpha_{x,\text{creep}}$$

where

- x is the elapsed time in years specified in this document (see 4.6);
- $\alpha_{x,\text{creep}}$ is the creep factor at x years, determined according to ISO 10468 under wet conditions;
- $S_{0,1}$ is the ring stiffness at position 1 at 0,1 hour.

3.14

pressure pipe

pipe having a *nominal pressure* (PN) classification greater than 1 bar and which is intended to be used with the internal pressure equal to or less than its nominal pressure when expressed in bars

3.15

non-pressure pipe

pipe subjected to an internal pressure not greater than 1 bar

3.16

nominal pressure

PN
alphanumeric designation for pressure classification purposes, which has a numerical value equal to the resistance of a component of a piping system to internal pressure

Note 1 to entry: Nominal pressure is a designation for reference or marking purposes that consists of the letters PN plus a number which is related to a component's pressure rating in bars.

3.17

normal service conditions

conveyance of water or sewage, in the temperature range 2 °C to 50 °C, with or without pressure, for 50 years

3.18

service temperature

maximum sustained temperature, at which the system is expected to operate continuously

Note 1 to entry: Service temperature is expressed in degrees Celsius (°C).

3.19

normalizing factor

R_{RF}
multiplication factor that quantifies the relation between a mechanical, physical or chemical property at the service condition compared to the respective value at 23 °C and 50 % relative humidity (RH)

3.20

relative ring deflection

y/d_m
ratio of the change in diameter of a pipe, y , in metres, to its mean diameter, d_m , in metres

Note 1 to entry: Relative ring deflection is derived as a percentage, %, i.e.:

$$\left(\frac{y}{d_m} \right) \cdot 100$$

3.21

type test

tests carried out in order to assess the fitness for purpose of a product or assembly of components to fulfil its or their function(s) in accordance with this document

3.22

flexible joint

joint which allows relative movement between components being joined