SLOVENSKI STANDARD
kSIST prEN 1796:2012

01-oktober-2012

Cevni sistemi iz polimernih materialov za oskrbo z vodo, s tlakom ali brez njega - S steklenimi vlakni ojačeni duromerni materiali (GRP), ki temeljijo na nenasičeni poliestrski smoli (UP)

Plastics piping systems for water supply with or without pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)

Kunststoff-Rohrleitungssysteme für die Wasserversorgung mit oder ohne Druck - Glasfaserverstärkte duroplastische Kunststoffe (GFK) auf der Basis von ungesättigtem Polyesterharz (UP)

Systèmes de canalisations en plastiques pour l'alimentation en eau avec ou sans pression - Plastiques thermodurcissables renforcés de verre (PRV) à base de résine polyester non saturé (UP)

Ta slovenski standard je istoveten z: **FprEN 1796:2012**

ICS:

23.040.20	Cevi iz polimernih materialov	Plastics pipes
83.120	Ojačani polimeri	Reinforced plastics
91.140.60	Sistemi za oskrbo z vodo	Water supply systems

kSIST prEN 1796:2012 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

FINAL DRAFT
FprEN 1796

September 2012

ICS 23.040.01

Will supersede EN 1796:2006+A1:2008

English Version

Plastics piping systems for water supply with or without pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)

Systèmes de canalisations en plastiques pour l'alimentation en eau avec ou sans pression - Plastiques thermodurcissables renforcés de verre (PRV) à base de résine polyester non saturé (UP)

Kunststoff-Rohrleitungssysteme für die Wasserversorgung mit oder ohne Druck - Glasfaserverstärkte duroplastische Kunststoffe (GFK) auf der Basis von ungesättigtem Polyesterharz (UP)

This draft European Standard is submitted to CEN members for formal vote. It has been drawn up by the Technical Committee CEN/TC 155.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword ... **5**

Introduction ... **6**

1 Scope ... **7**

2 Normative references ... **8**

3 Terms and definitions and symbols ... **9**

4 General requirements ... **16**

4.1 Classification ... 16
4.1.1 Categories ... 16
4.1.2 Nominal size ... 16
4.1.3 Nominal stiffness ... 16
4.1.4 Nominal pressure ... 16
4.2 Materials ... 17
4.2.1 General ... 17
4.2.2 Reinforcement ... 17
4.2.3 Resin ... 17
4.2.4 Aggregates and fillers ... 17
4.2.5 Elastomers ... 18
4.2.6 Metals ... 18
4.3 Wall construction ... 18
4.3.1 Inner layer ... 18
4.3.2 Structural layer ... 18
4.3.3 Outer layer ... 18
4.4 Appearance ... 18
4.5 Reference conditions for testing ... 19
4.5.1 Temperature ... 19
4.5.2 Properties of water for testing ... 19
4.5.3 Loading conditions ... 19
4.5.4 Preconditioning ... 19
4.5.5 Measurement of dimensions ... 19
4.6 Elapsed time for determination of long-term properties, (x) ... 19
4.7 Joints ... 19
4.7.1 General ... 19
4.7.2 Types of joint ... 19
4.7.3 Flexibility of the jointing system ... 19
4.7.4 Sealing ring ... 20
4.7.5 Adhesives ... 20

5 Pipes ... **20**

5.1 Geometrical characteristics ... 20
5.1.1 Diameter ... 20
5.1.2 Wall thickness ... 25
5.1.3 Length ... 25
5.2 Mechanical characteristics ... 26
5.2.1 Initial specific ring stiffness ... 26
5.2.2 Long-term specific ring stiffness under wet conditions ... 27
5.2.3 Initial resistance to failure in a deflected condition ... 27
5.2.4 Ultimate long-term resistance to failure in a deflected condition ... 29
5.2.5 Initial specific longitudinal tensile strength ... 30
5.2.6 Initial failure and design pressures for pressure pipes ... 32
5.2.7 Long-term failure pressure ... 34

5.3 Marking ...35

6 Fittings ...36

6.1 General ...36
6.1.1 Diameter series...36
6.1.2 Nominal pressure (PN) ...36
6.1.3 Nominal stiffness (SN) ...36
6.1.4 Joint type...36
6.1.5 Pipe type ...36
6.1.6 Mechanical characteristics of fittings ...36
6.1.7 Installed leak-tightness of fittings...37
6.1.8 Dimensions ...37
6.2 Bends...37
6.2.1 Classification of bends...37
6.2.2 Dimensions and tolerances of bends ...37
6.3 Branches...41
6.3.1 Classification of branches...41
6.3.2 Dimensions and tolerances of branches ...42
6.4 Reducers ...44
6.4.1 Classification of reducers...44
6.4.2 Dimensions and tolerances of reducers ...44
6.4.3 Mechanical characteristics of tapered section laminate ...46
6.5 Non Pressure Saddles...46
6.5.1 Classification of saddles ...46
6.5.2 Dimensions and tolerances of saddles...47
6.6 Flanges ...48
6.6.1 Classification of flanges ...48
6.6.2 Dimensions and tolerances for flanged adaptors ...49
6.7 Marking ...51

7 Joint performance...51

7.1 General ...51
7.1.1 Interchangeability...51
7.1.2 Test temperature ...52
7.1.3 Non-pressure piping ...52
7.2 Dimensions ...52
7.3 Non-end-load-bearing flexible joints with elastomeric sealing rings...52
7.3.1 General ...52
7.3.2 Requirements ...52
7.3.3 Number of test pieces for type test purposes...53
7.3.4 Test pieces...53
7.4 End-load-bearing flexible joints with elastomeric sealing rings ...54
7.4.1 General ...54
7.4.2 Performance requirements for locked-socket-and-spigot joints with elastomeric sealing rings54
7.5 Wrapped or cemented joints...56
7.5.1 General ...56
7.5.2 Performance requirements ...56
7.5.3 Number of test pieces for type test purposes...57
7.5.4 Test pieces...57
7.6 Bolted flange joints ...58
7.6.1 General ...58
7.6.2 Performance requirements ...58
7.6.3 Number of test pieces for type test purposes...59
7.6.4 Test pieces...59
7.6.5 Joint assembly details...59
7.6.6 Torque resistance ...59

Annex A (normative) Test method for the resistance to bending and pressure of end-thrust loaded joints in pipe systems 61
A.1 Principle 61
A.2 Apparatus 61
A.3 Test pieces 61
A.4 Test temperature 62
A.5 Calculation of the bending load F 62
A.5.1 General 62
A.5.2 Calculation of F, if applied in the horizontal plane 62
A.5.3 Calculation of F, if applied in the vertical plane 62
A.6 Procedure 63
A.7 Test report 64
Bibliography 65

Foreword

This document (FprEN 1796:2012) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

This document is currently submitted to the Formal Vote.

This document will supersede EN 1796:2006+A1:2008.

This European Standard is a system standard for plastics piping systems using glass-reinforced thermosetting plastics based on polyester resin (GRP-UP), for water supply with or without pressure.

System standards are based on the results of the work being undertaken in ISO/TC 138 "Plastics pipes, fittings and valves for the transport of fluids", which is a Technical Committee of the International Organization for Standardization (ISO). They are supported by separate standards on test methods, to which references are made throughout the system standard.

System standards are consistent with standards on general functional requirements.

The following is a list of significant technical changes since the previous edition:

— changes to many test method references to the more up to date ISO methods;
— extension of the diameter range to 4000 mm;
— completion of the axial strength tables for all PN classes;
— restructure of the fittings section to be more practical;
— update of the joint testing criteria.

Introduction

This system standard specifies the properties of a piping system and its components when made from glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) intended to be used for water supply with or without pressure.

The working group responsible for this European Standard is currently working on a test method and requirements for assessing resistance to impact damage. When this work is completed, it may result in additional requirements being incorporated into this European Standard.

This European Standard was prepared recognising the guidelines of EN 476 [1]

1 Scope

This European Standard specifies the required properties of the piping system and its components made from glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) intended to be used for water supply (drinking or raw) with or without pressure. In a pipework system, pipes and fittings of different nominal pressure and stiffness ratings may be used together.

It is the responsibility of the purchaser or specifier to make the appropriate selections taking into account their particular requirements and any relevant national regulations and installation practices or codes.

This European Standard is applicable to GRP-UP, with flexible or rigid joints (see 3.33 and 3.34), primarily intended for use in buried installations.

NOTE Piping systems conforming to this European Standard can also be used for non-buried applications provided that the influence of the environment, e.g. from UV-radiation, and the supports are considered in the design of the pipes, fittings and joints.

It is applicable to pipes, fittings and their joints of nominal sizes from DN 100 to DN 4000, which are intended to be used for the conveyance of water at temperatures up to 50 °C, with or without pressure.

This European Standard covers a range of nominal sizes, nominal stiffnesses and nominal pressures.

This European Standard is applicable to fittings made using any of the following techniques:

a) fabricated from straight pipe;

b) moulded by

   1) filament winding;

   2) tape winding;

   3) contact moulding;

   4) hot or cold press moulding.

This European Standard is applicable to the joints to be used in GRP-UP piping systems to be used for the conveyance of water, both buried and non-buried. It is applicable to joints, which are or are not intended to be resistant to axial loading. It covers requirements to prove the design of the joint. It specifies type test performance requirements for the following joints as a function of the declared nominal pressure rating of the pipeline or system:

c) socket-and-spigot (either integral with pipe or sleeve coupling) or mechanical joint;

d) locked socket-and-spigot joint;

e) cemented or wrapped joint;

f) bolted flange joint.

Recommended practices for the installation of buried pipes made in accordance with this standard is addressed in CEN TS 14578. Guidelines for the structural analysis of buried GRP-UP pipelines are addressed in CEN TS 14807.

Guidance for the Assessment of Conformity of products made in accordance with this standard is addressed in CEN TS 14632.

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.

EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanised rubber*

EN 1119, *Plastics piping systems — Joints for glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods for leaktightness and resistance to damage of non-thrust resistant flexible joints with elastomeric sealing elements*

EN 1447, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of long-term resistance to internal pressure*

EN ISO 75-2:2004, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics, ebonite and long-fibre-reinforced composites (ISO 75-2:2004)*

EN ISO 527-4, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites (ISO 527-4)*

EN ISO 527-5, *Plastics — Determination of tensile properties — Part 5: Test conditions for unidirectional fibre-reinforced plastic composites (ISO 527-5)*

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

ISO 7432, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of locked socket-and-spigot joints, including double-socket joints, with elastomeric seals*

ISO 7685, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the initial specific ring stiffness*

ISO 8483, *Plastics piping systems for pressure and non-pressure drainage and sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin — Test methods to prove the design of bolted flange joints*

ISO 8513:2000, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of longitudinal tensile properties*

ISO 8521:2009, *Plastic piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Test methods for the determination of the apparent initial circumferential tensile strength*

ISO 8533, Plastics piping systems for pressure and non-pressure drainage and sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin — Test methods to prove the design of cemented or wrapped joints

ISO/TR 10465-3, *Underground installation of flexible glass-reinforced pipes based on unsaturated polyester resin (GRP-UP) — Part 3 Installation parameters and application limits.*

ISO 10466, *Plastics piping systems — 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 long-term specific ring creep stiffness under wet conditions and calculation of the wet creep factor*

ISO 10471, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term ultimate bending strain and 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*

3 Terms and definitions and symbols

For the purposes of this document the following terms, definitions and symbols apply.

3.1
nominal size
DN
alphanumerical designation of size of component, which is a convenient integer approximately equal to a manufacturing dimension in mm and which can apply to either the internal diameter (DN-ID) or the external diameter (DN-OD)

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

3.2
nominal stiffness
SN
alphanumerical designation for stiffness classification purposes, which has the same numerical value as the minimum initial specific ring stiffness value required, when expressed in Newtons per square metre (N/m^2)

Note 1 to entry: The designation for reference or marking purposes consists of the letters SN plus a number (see 4.1.3)

3.3
specific ring stiffness
S
physical characteristic of the pipe, expressed in Newtons per square metre (N/m^2) which is a measure of the resistance to ring deflection per metre length under external load and is defined by Formula (1):

$$S = \frac{E \times I}{d_m{}^3} \tag{1}$$

where

E is the apparent modulus of elasticity, which can be derived from the result of the ring stiffness test, i.e. ISO 7685, expressed in Newtons per square metre (N/m^2);

d_m is the mean diameter of the pipe, in metres (m) (see 3.4);

I is the second moment of area in the longitudinal direction per metre length, in metres to the fourth power per metre, (m^4/m) (see Formula (2)).

$$I = \frac{e^3}{12} \tag{2}$$

where

e is the wall thickness, in metres (m).

3.4
mean diameter
d_m
diameter of the circle corresponding with the middle of the pipe wall cross section which is expressed in metres (m), by either Formula (3) or (4):

$$d_m = d_i + e \quad (3)$$

$$d_m = d_e - e \quad (4)$$

where

d_i is the internal diameter, in metres (m);

d_e is the external diameter, in metres (m);

e is the wall thickness of the pipe, in metres (m).

3.5
initial specific ring stiffness
S_0
value of S obtained when tested in accordance with ISO 7685, in Newtons per square metre (N/m^2)

3.6
wet creep factor
$\alpha_{x,\text{creep,wet}}$
ratio of the long-term specific ring stiffness, $S_{x,\text{wet}}$ at x years determined under sustained loading in wet conditions when tested in accordance with ISO 10468, to the initial specific ring stiffness, S_0 is given by Formula (5)

$$\alpha_{x,\text{creep,wet}} = \frac{S_{x,\text{wet}}}{S_0} \quad (5)$$

3.7
calculated long-term specific ring stiffness
$S_{x,\text{wet}}$
calculated value of S at *x* years (see 4.6), obtained by Formula (6)

$$S_{x,\text{wet}} = S_0 \times \alpha_{x,\text{wet}} \quad (6)$$

where

x is the elapsed time in years specified in this European Standard

$\alpha_{x,\text{wet}}$ is the wet creep factor (see 3.6) ;

S_0 is the initial specific ring stiffness, in Newtons per square metre (N/m^2)

Note 1 to entry: See 3.5 and 4.6

3.8
rerating 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 (R.H.)

3.9
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, when expressed in bars[1]

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

3.10
type tests
tests carried out to prove that a material, component, joint or assembly is capable of conforming to the relevant requirement

3.11
quality control tests
tests carried out for the purpose of process control and/or release of product

3.12
nominal length
numerical designation of a pipe length which is equal to the pipe's laying length (see 3.14), expressed in metres (m), rounded to the nearest whole number

Note 1 to entry: See 3.14

3.13
total length
distance between two planes normal to the pipe axis and passing through the extreme end points of the pipe including, where applicable, the affixed sockets; expressed in metres (m)

3.14
laying length
total length of a pipe minus, where applicable, the manufacturer's recommended insertion depth of the spigot(s) in the socket; expressed in metres (m)

3.15
normal service conditions
conveyance of surface water or sewage, in the temperature range 2 °C to 50 °C, with or without pressure, for 50 years

3.16
minimum initial design pressure
$P_{0,d}$
least value for mean short term burst test failure pressure, which is evaluated in accordance with the procedures described in ISO 10928 and used to design the pipe, expressed in bars

[1] 1 bar = 10^5 N/m^2 = 0,1 MPa.

3.17
minimum initial failure pressure
$P_{0,\min}$
least value for short term burst test failure pressure, which is evaluated in accordance with the procedures described in ISO 10928, expressed in bars

3.18
minimum long-term design pressure
$P_{x,d}$
least value for mean long-term burst failure pressure, expressed in bars, which is evaluated in accordance with the procedures described in ISO 10928 and includes a design factor of safety, FS_d.

Note 1 to entry: It is one of the parameters used to determine the minimum initial design pressure.

3.19
minimum long-term failure pressure
$P_{x,\min}$
least value for long-term burst failure pressure, expressed in bars, which is evaluated in accordance with the procedures described in ISO 10928 and includes a factor of safety, $FS_{\min}$

Note 1 to entry: It is one of the parameters used to determine the minimum initial design pressure.

3.20
pressure regression ratio
R_{RP}
relationship between the extrapolated mean failure pressure at 50 years to the extrapolated mean failure pressure at 6 min derived using Formula (7) as follows:

$$R_{R,P} = \frac{P_{x,\text{mean}}}{P_{6\,\text{min},\text{mean}}} \quad (7)$$

where

$P_{x,\text{mean}}$ is the extrapolated long-term (50 year) mean failure pressure;

$P_{6\,\text{min,mean}}$ is the extrapolated short-term (6 min) mean failure pressure

3.21
break
condition where a test piece can no longer carry load

3.22
non-pressure pipe or fitting
pipe or fitting, subject at its top to an internal pressure not greater than 1 bar

3.23
pressure pipe or fitting
pipe or fitting having a nominal pressure classification which is 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

3.24
buried pipeline
pipeline, which is subjected to the external pressure, transmitted from soil loading, including traffic and superimposed loads and, possibly, the pressure of a head of water

3.25
non-buried pipeline
pipeline subject only to forces resulting from its supports and environmental conditions, including, where applicable, internal negative and positive pressures, snow and wind

3.26
sub-aqueous pipeline
pipeline which is subjected to an external pressure arising from a head of water and may be subject to conditions such as drag and lift caused by current and wave action

3.27
design service temperature
maximum sustained temperature at which the system is expected to operate, expressed in degrees Celsius (°C)

3.28
relative ring deflection
y/d_m
ratio of the change in diameter of a pipe, y, in metres, to its mean diameter, d_m derived as a percentage (%) when using Formula (8):

$$\text{relative ring deflection} = \frac{y}{d_m} \times 100 \quad (8)$$

Note 1 to entry: See 3.4

3.29
minimum initial relative specific ring deflection before bore cracking occurs
$(y_{2,bore}/d_m)_{min}$

initial relative specific ring deflection, expressed as a percentage (%), at 2 min, which a test piece is required to pass without bore cracking when tested in accordance with ISO 10466

3.30
minimum initial relative specific ring deflection before structural failure occurs
$(y_{2,struct}/d_m)_{min}$
initial relative specific ring deflection, expressed as a percentage (%), at 2 min, which a test piece is required to pass without structural failure when tested in accordance with ISO 10466

3.31
extrapolated long-term ultimate relative ring deflection
$y_{u,wet,x}/d_m$
value, expressed as a percentage (%), at x years, derived from the ultimate relative ring deflection regression line, obtained from long-term deflection tests performed under wet conditions in accordance with ISO 10471

Note 1 to entry: See 4.6

3.32
minimum long-term ultimate relative ring deflection
$(y_{u,wet,x}/d_m)_{min}$
required minimum extrapolated value, expressed as a percentage (%), at x years (see 4.6), derived from the ultimate relative ring deflection regression line obtained from long-term ultimate ring deflection tests performed under wet conditions in accordance with ISO 10471