SLOVENSKI STANDARD

SIST EN 1796:2006+A1:2009

01-januar-2009

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: EN 1796:2006+A1:2008

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EUROPEAN STANDARD
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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)

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This European Standard was approved by CEN on 21 December 2005 and includes Amendment 1 approved by CEN on 2 October 2008.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 1796:2006+A1:2008) has been prepared by CEN /TC 155, "Plastics piping systems and ducting systems", the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2009, and conflicting national standards shall be withdrawn at the latest by May 2009.

This document includes Amendment 1 approved by CEN on 2008-10-02.

This document supersedes EN 1796:2006.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This 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.

This European Standard results from merging and revising (by 155 resolution 537/1997) of the following CEN enquiry drafts: prEN 1796-1:1995, prEN 1796-2:1995, prEN 1796-3:1995 and prEN 1796-5:1995.

EN 1796 consists of the following main clauses:

- Clause 1: Scope
- Clause 2: Normative references
- Clause 3: Definitions and symbols
- Clause 4: General
- Clause 5: Pipes
- Clause 6: Fittings
- Clause 7: Joint performance

NOTE Separate CEN/Technical Specifications are published covering practices for installation CEN/TS 14578 [1], and assessment of conformity CEN/TS 14632 [2].

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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 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 standard.

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.

NOTE 1 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 regulations and installation practices or codes.

This standard is applicable to GRP-UP, with flexible or rigid joints (see 3.37 and 3.38), primarily intended for use in buried installations.

NOTE 2 Piping systems conforming to this standard can also be used for non-buried applications provided that the influence of the environment 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 3000, which are intended to be used for the conveyance of water at temperatures up to 50 °C, with or without pressure.

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

Clause 4 specifies the general aspects of GRP-UP piping system intended to be used in the field of water supply with or without pressure.

NOTE 3 Attention is drawn to the national requirements, in the country of installation, for the effects on water quality applicable to pipes intended for use in possible contact with drinking water.

Clause 5 specifies the characteristics of pipes made from GRP-UP with or without aggregates and/or fillers. The pipes can have a thermosetting or thermoplastics liner. Clause 5 also specifies the test parameters for the test methods referred to in this standard.

Clause 6 specifies the characteristics of fittings made from GRP-UP with either a thermosetting or thermoplastics liner intended to be used in the field of water supply. Clause 6 specifies the dimensional and performance requirements for bends, branches, reducers, saddles and flanged adaptors and it also specifies the test parameters for the test methods referred to in this standard.

Clause 6 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.

Clause 7 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. This specification 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. Clause 7 specifies type test performance requirements for the following joints as a function of the declared nominal pressure rating of the pipeline or system:

a) socket-and-spigot or mechanical joint;

b) locked socket-and-spigot joint;

c) cemented or wrapped joint;

d) bolted flange joint.

2 Normative reference(s)

The following referenced documents are indispensable for the application of this European Standard. 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 705:1994, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Methods for regression analysis and their use*

ENV 1046, *Plastics piping and ducting systems — Systems outside building structures for the conveyance of water or sewage — Practices for installation above and below ground*

EN 1119, *Plastics piping systems — Joints for glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods for leaktightness and resistance to damage of flexible and reduced-articulation joints*

EN 1226, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Test method to prove the resistance to initial ring deflection*

EN 1228, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of initial specific ring stiffness*

EN 1393:1996, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of initial longitudinal tensile properties*

EN 1394:1996, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the apparent initial circumferential tensile strength*

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

EN 1452-3, *Plastics piping systems for water supply - Unplasticized poly (vinyl chloride) (PVC-U) - Part 3: Fittings*

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 527-4:1997)*

EN ISO 527-5, *Plastics - Determination of tensile properties - Part 5: Test conditions for unidirectional fibre-reinforced plastic composites (ISO 527-5:1997)*

EN ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions (ISO 3126:2005)*

ISO 2531, *Ductile iron pipes, fittings, accessories and their joints for water or gas applications*

ISO 4200, *Plain end steel tubes, welded and seamless - General tables of dimensions and masses per unit length*

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 8483, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of bolted flange joints*

ISO 8533, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of cemented or wrapped joints*

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 the long-term ultimate relative ring deflection under wet conditions*

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

ISO 14828, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term specific ring relaxation stiffness under wet conditions and calculation of the wet relaxation factor*

3 Terms, definitions and symbols

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

3.1
nominal size
DN
alphanumerical designation of size, which is common to all components in a piping system. It is a convenient round number for reference purposes and is related to the internal diameter when expressed in millimetres

NOTE The designation for reference or marking purposes consists of the letters DN plus a number.

3.2
declared diameter
diameter which a manufacturer states to be the mean internal or external diameter produced in respect of a particular nominal size DN

3.3
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) (see 4.1.3)

NOTE The designation for reference or marking purposes consists of the letters SN plus a number.

3.4
specific ring stiffness
S
physical characteristic of the pipe, expressed in newtons per square metre (N/m^2). It is a measure of the resistance to ring deflection per metre length under external load and is defined by Equation (1):

$$S = \frac{E \times I}{d_{\mathrm{m}}^{3}} \qquad \ldots(1)$$

where:

E is the apparent modulus of elasticity, which can be derived from the result of the ring stiffness test, i.e. EN 1228, expressed in newtons per square metre (N/m^2);

d_{m} is the mean diameter of the pipe, in metres (m) (see 3.5);

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 Equation (2)]

$$I=\frac{e^3}{12} \quad (2)$$

where:

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

3.5
mean diameter
d_m
diameter of the circle corresponding with the middle of the pipe wall cross section. It is given, in metres (m), by either Equation (3) or (4)

$$d_m = d_i + e \quad \text{…(3)}$$

$$d_m = d_e - e \quad \text{…(4)}$$

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).

3.6
initial specific ring stiffness
S_0
value of S obtained when tested in accordance with EN 1228, in newtons per square metre (N/m^2)

3.7
wet creep factor
$\alpha_{x,\text{creep,wet}}$
ratio of the long-term specific ring stiffness, $S_{x,\text{wet}}$ at x years (see 4.6), determined under sustained loading in wet conditions when tested in accordance with ISO 10468, to the initial specific ring stiffness, S_0. It is given by Equation (5)

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

3.8
wet relaxation factor
$\alpha_{x,\text{relax,wet}}$
ratio of the long-term specific ring stiffness, $S_{x,\text{wet}}$ at x years (see 4.6), determined under sustained deflection in wet conditions when tested in accordance with ISO 14828, to the initial specific ring stiffness, S_0. It is given by Equation (6)

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

3.9
calculated long-term specific ring stiffness
$S_{x,\mathrm{wet}}$
calculated value of S at x years (see 4.6), obtained by Equation (7)

$$S_{x,\mathrm{wet}} = S_0 \times \alpha_{x,\mathrm{wet}} \qquad \ldots(7)$$

where:

x is the elapsed time in years specified in this standard (see 4.6);

$\alpha_{x,\mathrm{wet}}$ is either the wet creep factor (see 3.7) or the wet relaxation factor (see 3.8);

S_0 is the initial specific ring stiffness, in newtons per square metre (N/m^2) (see 3.6).

3.10
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.)

3.11
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 The designation for reference or marking purposes consists of the letters PN plus a number.

3.12
type tests
tests carried out to prove that a material, component, joint or assembly is capable of conforming to the relevant requirement

3.13
quality control tests
tests carried out for the purpose of process control and/or release of product

3.14
nominal length
numerical designation of a pipe length which is equal to the pipe's laying length (see 3.16), expressed in metres (m), rounded to the nearest whole number

3.15
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)

3.16
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)

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

3.17
normal service conditions
conveyance of water, both raw and drinking, in the temperature range 2 °C to 50 °C, with or without pressure, for 50 years

3.18
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 EN 705 and used to design the pipe. It is expressed in bars.

3.19
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 EN 705, expressed in bars.

3.20
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 EN 705 and includes a design factor of safety, FS_d. It is one of the parameters used to determine the minimum initial design pressure.

3.21
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 EN 705 and includes a factor of safety, FS_{min}. It is one parameter used to determine the minimum initial design pressure.

3.22
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 Equation (8) as follows:

$$R_{R,P} = \frac{P_{x,\text{mean}}}{P_{6\,\text{min, mean}}} \qquad \ldots(8)$$

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.

3.23
break
condition where a test piece can no longer carry load

3.24
non-pressure pipe or fitting
pipe or fitting, subject at its top to an internal pressure not greater than 1 bar

3.25
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

3.26
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

3.27
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

3.28
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

3.29
design service temperature
maximum sustained temperature at which the system is expected to operate, expressed in degrees Celsius (°C)

3.30
relative ring deflection
y/d_m
ratio of the change in diameter of a pipe, y, in metres, to its mean diameter, d_m (see 3.5)

It is derived as a percentage, %, when using Equation (9).

$$\text{relative ring deflection} = \frac{y}{d_m} \times 100 \qquad \ldots(9)$$

3.31
projected initial relative ultimate ring deflection
y_2/d_m
projected value, at 2 min, expressed as a percentage, derived from the ultimate relative ring deflection regression line obtained from long-term ultimate relative ring deflection tests performed in accordance with ISO 10471

3.32
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 EN 1226

3.33
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 EN 1226

3.34
extrapolated long-term ultimate relative ring deflection
$y_{u,wet,x}/d_m$
value, expressed as a percentage (%), at x years (see 4.6), derived from the ultimate relative ring deflection regression line, obtained from long-term deflection tests performed under wet conditions in accordance with ISO 10471

3.35
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

3.36
ultimate deflection regression ratio
$R_{R,dv}$
ratio of the extrapolated long-term ultimate relative ring deflection, at x years (see 4.6), $y_{u,wet,x}/d_m$ (see 3.34), to the projected initial ultimate relative ring deflection, y_2/d_m (see 3.31), (see Equation (10)

$$R_{R,dv} = \frac{y_{u,wet,x} / d_m}{y_2 / d_m} \qquad \text{...(10)}$$

3.37
flexible joint
joint which allows relative movement between the pipes being joined

Examples of this type of joint are:

a) socket-and-spigot joint with an elastomeric sealing element (including double socket designs);

b) locked socket-and-spigot joint with an elastomeric sealing element (including double socket designs);

c) mechanical clamped joint, e.g. bolted coupling including joints made from materials other than GRP.

End-load-bearing flexible joints have resistance to axial loading.

3.38
rigid joint
joint which does not allow relative movement between the pipes being joined

Examples of this type of joint are:

a) flanged joint, including integral and loose flanges;

b) wrapped or cemented joint;

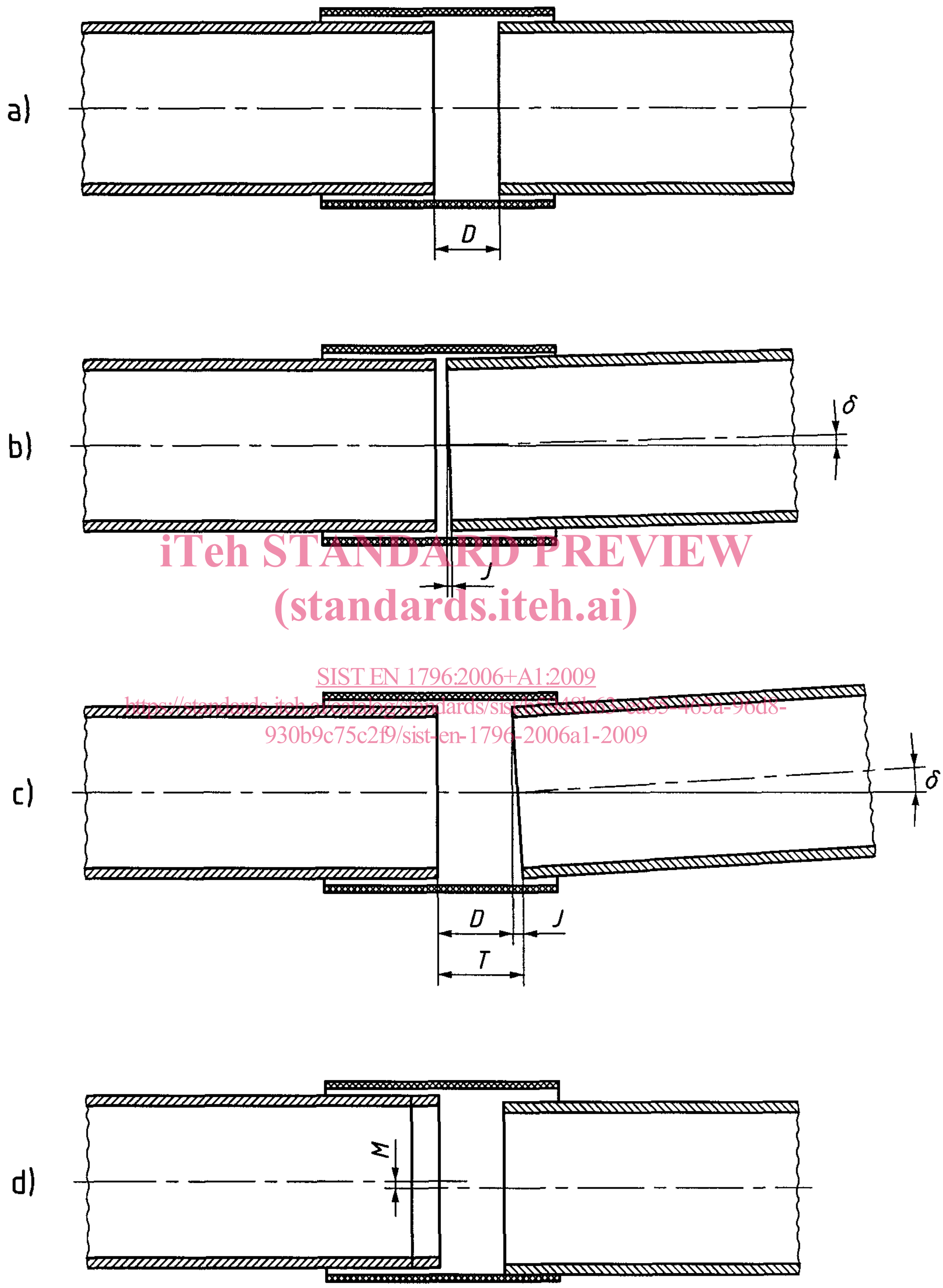
Non-end-load-bearing rigid joints do not have resistance to axial loading.

3.39
angular deflection
δ
angle between the axis of two adjacent pipes (see Figure 1), expressed in degrees (°)

3.40
draw
D
longitudinal movement of a joint (see Figure 1), is expressed in millimetres (mm)

3.41
total draw
T
sum of the draw, D, and the additional longitudinal movement, J, due to the presence of angular deflection (see Figure 1), expressed in millimetres (mm)

3.42
misalignment
M
amount by which the centrelines of adjacent pipes fail to coincide (see Figure 1)



Key

D	Draw
J	Longitudinal movement arising from angular deflection
δ	Angular deflection
T	Total draw
M	Misalignment

Figure 1 — Joint movements