



BSI Standards Publication

**Plastics piping systems - Validated design
parameters of buried thermoplastics piping systems**

National foreword

This Published Document is the UK implementation of CEN/TS 15223:2017.

The UK participation in its preparation was entrusted to Technical Committee PRI/88, Plastics piping systems.

A number of errors and omissions have been detected in this document. Until these can be addressed by CEN/TC 155, the following clarifications have been provided by BSI committee PRI/88, Plastics piping systems, for the guidance of readers.

Clause 3.1.6: q_{crit} should refer to the critical external pressure causing buckling of the pipe.

Figure 1: The middle box on the right-hand side of the flow chart should state 'Use calculation for structural design' rather than 'Use practical for structural design'.

Clause 5.3: It is the view of the UK committee that the cited Reference [4] is not the source of the statements on strain limits in this subclause. Readers are guided to reference [17], which together with the subsequent book by the same author, listed below as additional reference [20], makes clear that the cited conclusion from research studies that 'for all practical purposes these [thermoplastics] materials are not strain limited' applies only to solid wall pipes. For structured wall plastics pipes, the strain limits specified in Table 3 can prove critical in structural design.

The statement in the second paragraph that "Passing this [EN ISO 13968 ring flexibility] test ensures stability against buckling." should refer to local buckling stability of structured wall pipes only.

Clause 5.6: It is the view of the UK committee that the cited Reference [9] is not the source of Formula (1) and Formula (2). Readers are guided to additional Reference [20], which advises that Formula (1) is amended in the case of soft soils, with the long-term ring stiffness S_L of the pipe replacing the short-term ring stiffness expressed by SN. For clarification, E_t refers to the soil tangent modulus.

Clause 5.6, EXAMPLE: Readers are guided to additional Reference [20], which for deep burial with sustained groundwater head advises the use of an amended Formula (1), with the long-term ring stiffness S_L of the pipe replacing the short-term ring stiffness expressed by SN.

Clause 6.7.1: The second paragraph of Clause 6.7.1 should relate to the free creeping design condition for positive internal pressure resistance described in Clause 6.7.2.

Clause 6.10: The UK committee draws attention to the need to consider the additional longitudinal stresses and strains arising from any internal pressurization, due to the Poisson effect and/or any unrestrained changes in pipe alignment. These can particularly impact the design or selection of suitable joints and connection fittings.

The following additional reference, cited above, provides essential background to the document:

[20] Janson, L.E. (1999). *Plastics pipes for water supply and sewage disposal*. 3rd ed. Stockholm: Borealis.

Readers are also referred to BS 9295:2010 *Guide to the structural design of buried pipelines*, which is currently being revised and updated to reflect the current state of the art of design of buried thermoplastics pipes of both solid and structured wall profile.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 87507 6

ICS 23.040.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 May 2018.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

TECHNICAL SPECIFICATION
SPÉCIFICATION TECHNIQUE
TECHNISCHE SPEZIFIKATION

CEN/TS 15223

November 2017

ICS 23.040.01

Supersedes CEN/TS 15223:2008

English Version

**Plastics piping systems - Validated design parameters of
buried thermoplastics piping systems**

Systèmes de canalisations en matières plastiques -
Paramètres de calcul validés pour les systèmes
enterrés de canalisations en matières
thermoplastiques

Kunststoff-Rohrleitungssysteme - Bestätigte
Berechnungsparameter von erdverlegten
thermoplastischen Rohrleitungssystemen

This Technical Specification (CEN/TS) was approved by CEN on 4 September 2017 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
European foreword.....	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms, definitions, symbols and abbreviations.....	7
3.1 Terms and definitions	7
3.2 Symbols.....	8
3.3 Abbreviations	9
4 Route for structural design.....	9
4.1 General.....	9
4.2 Structural design based on practical experience	12
4.3 Structural design based on design calculations.....	13
5 Functional design non-pressure	13
5.1 General.....	13
5.2 Material.....	13
5.3 Strain	14
5.4 Flow capacity	14
5.5 Temperature.....	15
5.6 Ring buckling.....	15
5.7 Longitudinal effects.....	16
5.7.1 General.....	16
5.7.2 Axial bending.....	17
5.7.3 Allowable cold bending.....	17
6 Functional design pressure	17
6.1 General.....	17
6.2 Material.....	17
6.3 Design coefficient.....	18
6.4 Pressure rating PN	18
6.5 Flow capacity	18
6.6 Temperature.....	19
6.6.1 Temperature dependence of the nominal working pressure of PE piping systems.....	19
6.6.2 Temperature dependence of the nominal working pressure of PVC piping systems.....	19
6.7 Working pressure	20
6.7.1 Buckling resistance for negative pressure applications.....	20
6.7.2 PFA, PMA and PEA.....	20
6.8 Water hammer	20
6.9 Ring buckling.....	21
6.10 Longitudinal effects.....	22
6.10.1 Axial bending.....	22
6.10.2 Cold bending limits.....	22
6.11 Joints	23
7 Structural design	23
7.1 General.....	23
7.2 Behaviour of installed plastic pipes in soil	24

7.3	Structural design based on practical experience	25
7.3.1	General	25
7.3.2	Values for installation phase	26
7.3.3	Values for final deflection.....	27
7.4	Structural design based on a design calculations	28
8	Guidance for verification of installation	28
9	Commissioning	29
9.1	General	29
9.2	Non pressure pipe	29
9.3	Pressure pipe	29
Annex A (informative)	Time dependency of stress and strain in buried flexible piping systems.....	30
Annex B (informative)	Soil / pipe behaviour.....	31
Annex C (informative)	Verification against limit states for non-pressure pipes.....	33
Annex D (informative)	Flow capacity charts (non-pressure).....	34
Bibliography	36

European foreword

This document (CEN/TS 15223:2017) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 15223:2008.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

In Europe, several design methods exist and some are still under development. The plastics pipes industry has carried out a lot of research with full-scale trials. From these researches, graphs have been made that show the deflection in the pipes immediately after installation. In addition, the so-called settlement period is measured. This settlement will always take place. In case that heavy traffic is present, the final deflection will be reached faster.

It is strongly advised to check any calculated deflection with the values in the two design graphs.

The information compiled is meant to be used by designers. The values given are meant for general guidance.

For the purpose of design using simple methods, two compactible soil groups are used, granular and cohesive.

If applicable, reference is made to EN 1295-1, EN 1610, CEN/TR 1046 and national practices.

1 Scope

This Technical Specification covers validated design parameters of buried thermoplastics piping systems for functional and structural design for the following applications:

- pressure (excluding piping systems for gaseous fluids and industrial applications);
- non-pressure.

The functional design is based on relevant standards and commonly used practices.

Depending on the project parameters, the route for structural design can be

- either established by long term experience (within certain limitations),
- or calculated according to CEN/TR 1295-2 [8] by using thermoplastic pipe material related properties and design criteria.

NOTE 1 The route for the structural design is shown in the flowchart given in Figure 1 in 4.1.

NOTE 2 Industrial applications also includes district heating

Since in practice precise details of types of soil and installation conditions are not always available at the design stage, the choice of design assumptions is left to the judgement of the designer/specifier. In this connection, this guide can only provide general indications and advice.

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 476, *General requirements for components used in drains and sewers*

EN 805, *Water supply - Requirements for systems and components outside buildings*

EN 1295-1, *Structural design of buried pipelines under various conditions of loading - Part 1: General requirements*

EN 1610:2015, *Construction and testing of drains and sewers*

CEN/TR 1046:2013, *Thermoplastics piping and ducting systems - Systems outside building structures for the conveyance of water or sewage - Practices for underground installation*

EN ISO 9969, *Thermoplastics pipes - Determination of ring stiffness (ISO 9969)*

EN ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications - Classification, designation and design coefficient (ISO 12162)*

EN ISO 13968, *Plastics piping and ducting systems - Thermoplastics pipes - Determination of ring flexibility (ISO 13968)*