SLOVENSKI STANDARD
kSIST-TS FprCEN/TS 15223:2015

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Cevni sistemi iz polimernih materialov - Veljavni parametri za načrtovanje plastomernih cevnih sistemov, položenih v zemljo

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

Kunststoff-Rohrleitungssysteme - Gültige Berechnungsparameter von erdverlegten thermoplastischen Rohrleitungssystemen

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

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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 - Gültige Berechnungsparameter von erdverlegten thermoplastischen Rohrleitungssystemen

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

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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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (FprCEN/TS 15223:2015) 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 CEN/TS 15223:2008.

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 three 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 The route is shown in the flowchart given in Figure 1 in 4.1.

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*

FprEN 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)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1
constant load
load on a pipe, e.g. from internal pressure, that is not changing with time

3.1.2
deflection
deviation of the circle cross section of the pipe

Note 1 to entry: Deflection is expressed as percentage [%].

3.1.3
design stress
σ_s
allowable stress for a given application and derived from the MRS by dividing it by the design coefficient C

Note 1 to entry: Design stress is expressed in megapascals [MPa].

3.1.4
minimum required strength
MRS
value of σ_{LPL}, rounded down to the next smaller value of the R10 series or of the R20 series depending on the value of σ_{LPL}

Note 1 to entry: R10 and R20 series are the Renard number series according to ISO 3 [1] and ISO 497 [2].

3.1.5
design coefficient
C
design coefficient with a value greater than one, which takes into consideration service conditions as well as properties of the components of a piping system others than those represented in the lower confidence limit

3.1.6
nominal pressure
PN
numerical designation used for reference purposes related to the mechanical characteristics of the component of a piping system and corresponding to the maximum continuous operating pressure in bars

3.1.7
pipe stiffness
S_p
theoretical pipe stiffness determined with the Young's modulus and the Poisson's ratio

3.1.8
critical buckling pressure
q_{crit}
critical internal pressure causing buckling of the pipe

3.1.9
nominal stiffness
SN
numerical designation of the ring stiffness of a pipe or fitting, which is a convenient round number indicating the minimum required ring stiffness of the pipe or fitting

Note 1 to entry: It is designated by the letters "SN" followed by the appropriate number.

3.1.10
compaction factor
C_f
factor that gives the settlement of the surrounding soil

3.2 Symbols

For the purposes of this document, the following symbols apply.

C	design coefficient
C_{100}	100 year design coefficient
C_{50}	50 year design coefficient
C_f	deflection factor, in percent
d_n	nominal outside diameter of the pipe, in millimetres
d_{em}	mean outside diameter of the pipe, in millimetres
D_m	the midwall diameter, in millimetres
D_u	outside diameter of the pipe, in millimetres
e	wall thickness of the pipe, in millimetres
E_p	the Young's modulus of the pipe, in megapascals
E_t	tangent modulus, in kilopascals
f_a	application rating factor
f_T	temperature rating factor
g	gravity, in m/s^2
K	value of the measured molecular weight
k	absolute roughness, in millimetres
k_{water}	viscosity of water, in m^2/s
q_{crit}	critical buckling pressure, in kilopascals
R	bending radius of the pipe, in millimetres
R_{max}	maximum bending radius of the pipe, in millimetres
S	geometrical pipe characteristic defined as $S = (d_n\ (e) / (2e)$
S_p	pipe stiffness value determined by $(1 - \upsilon^2) / E_p \cdot (d_{em}/e - 2)$, in [MPa^{-1}]
β	deflection correction factor
δ	deflection of the pipe, in millimetres
ε	strain

3.3 Abbreviations

For the purposes of this document, the following abbreviations apply.

HDS	hydrostatic design stress
MRS	minimum required strength
PE	Polyethylene
PEA	allowable site test pressure
PFA	allowable operating pressure
PMA	allowable maximum operating pressure
PN	nominal pressure
PP	polypropylene
PP-MD	polypropylene mineral modified
PVC-O	poly(vinyl chloride) oriented unplasticized
PVC-U	poly(vinyl chloride) unplasticized
SDR	standard dimension ratio

4 Route for structural design

4.1 General

At the start of a project, first the parameters need to be investigated as given in Clause 5.

In general creating a validated structural design of a thermo-plastics pipeline construction by applying analytical or numerical methods is not needed – provided the parameters of the project are within the value range given in Table 1.

Any calculated prediction of the pipe behaviour and reality is strongly dependent on the conditions used for the calculation being the same as used for the installation. Therefore, it is important that effort is put into controlling the input values by extensive soil surveys and monitoring the installation. In many cases, practical and/or reference information is available and results in a sound prediction of the pipe performance.

The flowchart in Figure 1 provides the necessary steps to establish the structural design of a pipeline.

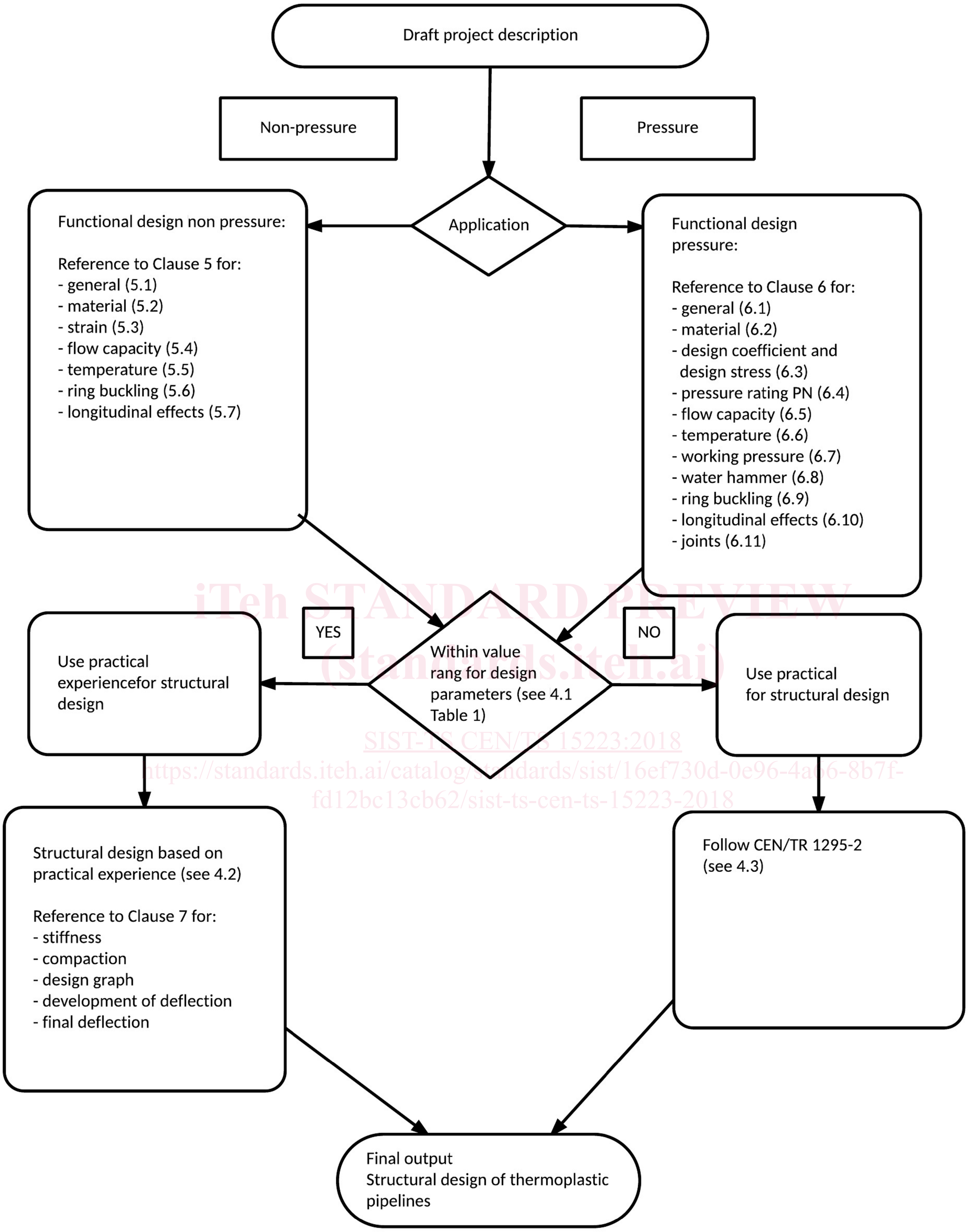

Figure 1 — Flowchart for structural design of a pipeline