SLOVENSKI STANDARD
SIST EN 1295-1:2019

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Projektiranje vkopanih cevovodov pri različnih pogojih obremenitve - 1. del: Splošne zahteve

Structural design of buried pipelines under various conditions of loading - Part 1: General requirements

Statische Berechnung von erdverlegten Rohrleitungen unter verschiedenen Belastungsbedingungen - Teil 1: Allgemeine Anforderungen

Calcul de résistance mécanique des canalisations enterrées sous diverses conditions de charge - Partie 1: Prescriptions générales

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ICS:

93.025	Zunanji sistemi za prevajanje vode	External water conveyance systems
93.030	Zunanji sistemi za odpadno vodo	External sewage systems

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EUROPEAN STANDARD

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English Version

Structural design of buried pipelines under various conditions of loading - Part 1: General requirements

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This European Standard was approved by CEN on 14 January 2019.

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This European Standard exists 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.

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

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Contents

European foreword

This document (EN 1295-1:2019) has been prepared by Technical Committee CEN/TC 165 “Waste water engineering”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2019, and conflicting national standards shall be withdrawn at the latest by October 2019.

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 EN 1295-1:1997.

The principal change in this revision is the following:

a) Annex B “Nationally established methods of design” has been updated.

This standard is intended for use in conjunction with the series of product standards covering pipes of various materials for the water industry.

This standard comprises two parts:

— Part 1, General requirements: it deals with the requirements for structural design of pipelines and gives the basic principles of the nationally established methods of design;

— Part 2, Summary of the nationally established methods of design: it gives an overview of these methods as prepared by the various countries where they are in use.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: 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

The structural design of buried pipelines constitutes a wide ranging and complex field of engineering, which has been the subject of extensive study and research, in many countries over a period of very many years.

Whilst many common features exist between the design methods which have been developed and established in the various member countries of CEN, there are also differences reflecting such matters as geological and climatic variations, as well as different installation and working practices.

In view of these differences, and of the time required to develop a common design method which would fully reflect the various considerations identified in particular national methods, a two stage approach has been adopted for the development of this European Standard.

In accordance with this two stage approach, the Joint Working Group, at its initial meeting, resolved "first to produce an EN giving guidance on the application of nationally established methods of structural design of buried pipelines under various conditions of loading, whilst working towards a common method of structural design". This standard represents the implementation of the first part of that resolution.

1 Scope

This document specifies the requirements for the structural design of water supply pipelines, drains and sewers, and other water industry pipelines, whether operating at atmospheric, greater or lesser pressure.

In addition, this document gives guidance on the application of the nationally established methods of design declared by and used in CEN member countries at the time of preparation of this document.

This guidance is an important source of design expertise, but it cannot include all possible special cases, in which extensions or restrictions to the basic design methods may apply.

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 engineer. In this connection the guide can only provide general indications and advice.

This document specifies the requirements for structural design and indicates the references and the basic principles of the nationally established methods of design (see Annexes A and B).

2 Normative references

There are no normative references in this document.

3 Terms and definitions

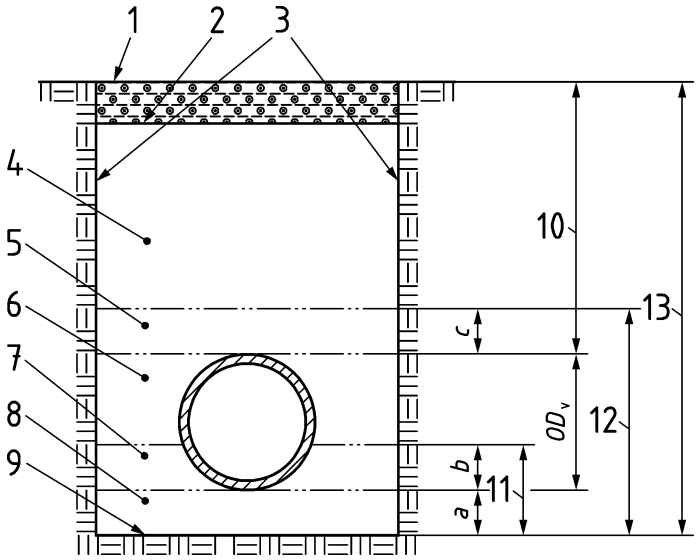
For the purposes of this document, the following terms and definitions apply (see also Annex A).

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Installation terms

The same définitions apply for trenches with vertical or sloping sides and pipes laid below embankements. Some of these terms are illustrated in Figure 1.



Key

1	surface	10	depth of cover
2	bottom of road or railway construction, if any	11	depth of bedding
3	trench walls	12	depth of embedment
4	main backfill	13	trench depth
5	initial backfill		
6	sidefill	*a*	*thickness of lower bedding*
7	upper bedding	*b*	*thickness of upper bedding*
8	lower bedding	*c*	*thickness of initial backfill*
9	trench bottom	OD_V	is the vertical outside diameter

NOTE The terms in Figure 1 are the same as in EN 1610.

Figure 1 — Trench installation

3.1.1
compaction
deliberate densification of soil during the construction process

3.1.2
consolidation
time-dependent densification of soil by processes other than those deliberately applied during construction

3.1.3
embedment
fill around the pipe including bedding, sidefill and initial backfill

Note 1 to entry: it is the part of the trench which contributes to the structural performance of the buried pipeline.

3.2 Design terms

3.2.1
bedding factor
ratio of the maximum design load for the pipe, when installed with a particular embedment, to the test load which produces the same maximum bending moment

3.2.2
design pressure
DP
maximum operating internal pressure of the system or of the pressure zone fixed by the designer considering future developments but excluding surge

3.2.3
load bearing capacity
load per unit length that a particular combination of pipe and embedment can sustain without exceeding a limit state

3.2.4
maximum design pressure
MDP
maximum operating internal pressure of the system or of the pressure zone fixed by the designer considering future developments and including surge, where:

— MDP is designated MDPa when there is a fixed allowance for surge;

— MDP is designated MDPc when the surge is calculated

3.2.5
silo effect
effect whereby lateral earth pressure in trench backfill causes friction at the trench wall to carry part of the weight of the backfill

3.2.6
soil-structure interaction
process whereby the deformations of soil and/or pipe caused by the contact and reaction pressures between a pipe and the surrounding soil distribute the pressures to achieve equilibrium

3.2.7
system test pressure
STP
hydrostatic pressure applied to a newly laid pipeline in order to ensure its integrity and tightness

4 Requirements

4.1 All pipelines shall be designed to withstand the various loadings to which they are expected to be subjected, during construction and operation, without detriment to their function and to the environment.

4.2 The future owner of the pipeline is free to specify the appropriate method of design to be adopted.

4.3 The designer shall determine whether or not the pipeline comes within the scope of the methods covered by this European Standard.

4.4 The design adopted shall be such that construction may be carried out safely and so as to ensure that the design assumptions regarding the influence of construction procedures and soil characteristics will be satisfied.

4.5 Subject to the other requirements of Clause 4, design should be carried out preferably using in its entirety one of the methods in Annex B of this European Standard.

4.6 Methods of design, in accordance with Annex B, when presented in the form of tables, charts or computer programmes shall be deemed equivalent to a full calculation, provided that any simplification does not reduce the level of safety below that which would be obtained by full design. Outputs from computer programmes shall be capable of verification.

4.7 Whichever the design method used, the designer shall satisfy himself that the method constitutes a coherent system and provides the accepted level of safety.

4.8 Account shall be taken of the probable consequences of pipeline failure in establishing the acceptable level of safety.

4.9 The values adopted for all variables, including factors of safety, shall be in accordance with the method used.

5 Basis of design procedures

5.1 General

Whilst there are differences between some of the established national design procedures, there are no differences in respect of the fundamental basis of design, which is the interactive system consisting of the pipe and the surrounding soil.

The external loadings to be considered shall include that due to the backfill, that due to the most severe surface surcharge or traffic loading likely to occur, and those due to any other causes, producing a loading of significant magnitude such as self-weight of the pipe and water weight, as appropriate. The internal pressure in the pipeline, if different from atmospheric, shall also be treated as a loading.

The design of the pipeline, and its embedment, shall provide an adequate level of safety against the appropriate ultimate limit state being exceeded. In addition, the design loading shall not result in any appropriate serviceability limit state being exceeded.

5.2 External loads

Account shall be taken of the effect of the stiffness of the pipe and the stiffness of the surrounding soil.

Where appropriate, account shall be taken of the effects of trench construction, of groundwater and of time dependent influences. The design should take into consideration, however, the possible effect on trench conditions of any further planned works.

The effective pressure due to the backfill and any distributed surface loads shall be calculated on the basis of the principles of soil-structure interaction.

The pressure exerted on pipelines by concentrated surface surcharges, such as vehicle wheels, shall be calculated in accordance with a method based on Boussinesq, and account shall be taken of impact.