SLOVENSKI STANDARD
SIST EN 1610:1998

01-april-1998

Gradnja cevovodov za odvod odpadne vode in kanalizacijo

Construction and testing of drains and sewers

Verlegung und Prüfung von Abwasserleitungen und -kanälen

Mise en oeuvre et essai des branchements et collecteurs d'assainissement

Ta slovenski standard je istoveten z: **EN 1610:1997**

ICS:

13.060.30	Odpadna voda	Sewage water
93.030	Zunanji sistemi za odpadno vodo	External sewage systems

SIST EN 1610:1998 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1610

September 1997

ICS 13.060.30

Descriptors: sanitation, pipelines, buried pipes, pressure pipes, junctions, definitions, materials, earthworks, coating processes, implementation, tests

English version

Construction and testing of drains and sewers

Mise en oeuvre et essai des branchements et collecteurs d'assainissement

Verlegung und Prüfung von Abwasserleitungen und -kanälen

This European Standard was approved by CEN on 18 May 1997.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Content

Foreword

This European Standard 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of an identical text or by endorsement, at the latest by March 1998, and conflicting national standards shall be withdrawn at the latest by March 1998.

Annexes A, B and C are informative.

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

1 Scope

This European Standard is applicable to the construction and testing of drains and sewers normally buried in the ground and normally operating under gravity.

The construction of pipelines operating under pressure is covered by this European Standard together with prEN 805 as appropriate.

This European Standard is applicable to drains and sewers laid in trenches, under embankments or above ground. Trenchless construction will be covered in prEN 12889. Additionally other local or national regulations should be taken into account, e.g. concerning health and safety, pavement reinstatement and requirements for leaktightness testing etc.

2 Normative References

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 476
General requirements for components used in discharge pipes, drains and sewers for gravity systems

EN 752-3
Drain and sewer systems outside buildings – Part 3: Planning

prEN 805
Water supply – Requirements for external systems and components

EN 1295-1
Structural design of buried pipelines under various conditions of loading – Part 1: General requirement

prEN 12889
Trenchless construction and testing of drains and sewers

3 Definitions

For the purposes of this standard the following definitions including figure 1 apply:

3.1 bedding: Part of the construction which supports the pipe between the trench bottom and the sidefill or initial backfill. The bedding consists of upper and lower bedding. In the case of the pipe laid on natural trench bottom, the trench bottom is the lower bedding.

3.2 compaction layer thickness: Thickness of each new layer of fill material prior to its compaction.

3.3 depth of cover: Vertical distance from the top of the pipe barrel to the surface.

3.4 embedment: Fill around the pipe including bedding, sidefill and initial backfill.

3.5 initial backfill: Layer of fill material immediately above the crown of the pipe.

3.6 main backfill: Fill between the top of the embedment and the level of the ground, top of embankment or, when applicable, the bottom of the road or railway construction.

3.7 minimum trench width: Minimum distance needed for safety and construction between the trench walls at the top of the lower bedding or when applicable between the trench supports at any level.

3.8 native soil: Soil from the excavation of the trench.

3.9 nominal size (DN): Numerical designation of size of component, which is a convenient integer approximately equal to a manufacturing dimension in mm. This may apply to either the internal diameter (DN/ID) or the external diameter (DN/OD). (EN 476)

3.10 pipeline: Assembly of pipes, fittings and joints between manholes or other structures.

3.11 prefabricated component: Product manufactured separately from the installation process, generally in circumstances where a product standard applies and/or a manufacturer's quality control is in place.

3.12 sidefill: Material between bedding and initial backfill.

3.13 trench depth: Vertical distance from the bottom of the trench to the surface.

1 Surface

2 Bottom of road or railway construction, if any

3 Trench walls

4 Main backfill (3.6)

5 Initial backfill (3.5)

6 Sidefill (3.12)

7 Upper bedding

8 Lower bedding

9 Trench bottom

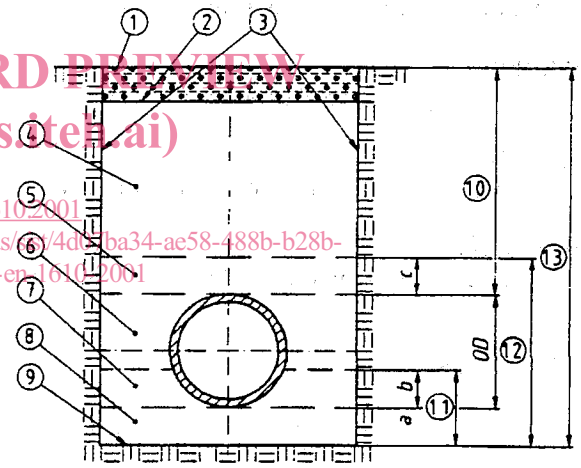
10 Depth of cover (3.3)

11 Depth of bedding (3.1)

12 Depth of embedment (3.4)

13 Trench depth (3.13)

a *Depth of lower bedding*
b *Depth of upper bedding*
c *Depth of initial backfill*



$b = k \times OD$ (see clause 7)

where:

k is a dimensionless factor relating the upper bedding thickness, b, to OD
OD is the outside diameter of pipe in mm

NOTE 1: For minimum values of a and c see clause 7.

NOTE 2: k x OD replaces the designation of bedding angle in some existing national standards. The bedding angle is not the bedding reaction angle used in structural design.

Figure 1: Illustration of definitions

The same definitions apply for trenches with sloping sides and for embankments where appropriate.

4 General

4.1 Concepts

Pipelines and manholes are essentially engineering structures in which the combined performance of construction components, bedding, and fill constitute the basis for stability and safety in operation. The pipes, fittings and joint materials supplied, together with the work carried out at site, such as the pipe bedding, the jointing of pipes, the sidefilling and backfilling are all important factors in achieving a structure with adequate performance.

4.2 Safeguarding design assumptions

The strength of a pipeline shall be determined, decided or specified before construction work is undertaken in accordance with EN 752-3 and EN 1295-1.

In the execution of the work it should be ensured that the assumptions made in the design are safeguarded or adapted to changed conditions.

The design assumptions are affected in particular by any variation of the following:

- trench width compared to the design width;
- trench depth compared to the design depth;
- trench support system and the effect of its removal;
- degree of compaction of the embedment;
- degree of compaction of main backfill;
- pipe support and trench bottom conditions;
- construction traffic and temporary loads;
- soil types and soil parameters (e. g. subsoil, trench walls, backfill);
- shape of trench (e. g. stepped trench, trench with sloping walls);
- ground and soil condition (e. g. frost and thaw, rain, snow, flooding);
- ground water table;
- additional pipelines in the same trench.

NOTE: The above list is not exhaustive.

5 Construction components and materials

5.1 General

Construction components and materials shall conform to national standards, transposing European Standards as available, or to European technical approvals or in the absence of these the components and materials shall comply with the requirements of the specifier.

5.2 Construction components

Construction components shall comply with 5.1.

Any supplementary instructions of the manufacturer shall be observed.

5.3 Materials used for embedment

5.3.1 General

The materials used for embedment shall comply with the appropriate subclauses of 5.3 in order to be capable of providing permanent stability and load bearing capacity for the pipeline buried in the ground. Such materials shall not be detrimental to the pipe or pipe materials or the groundwater.

Frozen materials shall not be used.

Materials used for embedment shall conform with the design requirements. The materials may either be native soil (see 5.3.2) if proved to be suitable or imported materials (see 5.3.3). Materials for bedding should contain no particles with sizes above

- 22 mm for DN $\leq$ 200,
- 40 mm for DN $>$ 200 up to DN $\leq$ 600.

5.3.2 Native soil

Requirements for re-use of native soil are:

- conformity with design requirements;
- compactability if specified;
- freedom from materials detrimental to the pipe (e. g. "oversized" particles – depending on pipe material, wall thickness and diameter –, tree roots, rubbish, organic material, clay lumps > 75 mm, snow and ice).

Native soil meeting the requirements of 5.3.3.1 or 5.3.3.3 is considered suitable.

5.3.3 Imported materials

The following materials which may include recycled materials are suitable.

5.3.3.1 Granular materials

Granular materials include:

- single size granular material;
- graded granular material;
- sand;
- all-in aggregates;
- crushed aggregates.

Guidance on granular materials is given in annex B.

5.3.3.2 Hydraulically bonded materials

Hydraulically bonded materials include:

- soil cement;
- light weight concrete;
- lean concrete;
- unreinforced concrete;
- reinforced concrete.

They shall be as specified in the design.

5.3.3.3 Other materials

Materials other than those described in 5.3.3.1 to 5.3.3.2 may be used for embedment if their suitability as defined under 5.3.1 is proved. Natural or artificial substances which may cause damage to the pipeline and manholes are unsuitable.

Environmental consequences should be considered.

5.4 Materials used for main backfill

Materials used for main backfill shall conform with the design requirements.

Materials specified in 5.3 may be used for main backfill.

The maximum size of stones in excavated material used for backfill should be 300 mm or the thickness of the initial backfill or half of the compaction layer thickness, whichever is the smallest. The maximum size may be further limited depending on soil conditions, groundwater and pipe material. Special conditions may be specified for rocky areas.

6 Excavation

6.1 Trenches

Trenches shall be designed and excavated in such a way as to ensure correct and safe installation of pipelines.

If construction access is required to the outside face of underground structures, e. g. manholes, a protected minimum working space 0,50 m wide shall be provided.

Where two or more pipes are being laid in the same trench or embankment, a minimum horizontal working space shall be observed for the distance between the pipelines. If not otherwise specified it shall be: 0,35 m for pipes up to and including DN 700 and 0,50 m for pipes greater than DN 700.

Where necessary appropriate safety measures for other supply pipelines, drains and sewers, constructions or surfaces shall be observed to protect these against detrimental effects.

6.2 Trench width

6.2.1 Maximum trench width

The trench width shall not exceed the maximum width specified in the structural design.

If this is not possible, the matter shall be referred to the designer.

6.2.2 Minimum trench width

The minimum trench width shall be the greater of the values taken from tables 1 and 2, except as provided in 6.2.3.

Table 1: Minimum trench width in relation to nominal size DN

DN	Minimum trench width (OD + x) m		
	Supported trench	Unsupported trench	
		$\beta > 60°$	$\beta \leq 60°$
≤ 225	OD + 0,40	OD + 0,40	
> 225 to ≤ 350	OD + 0,50	OD + 0,50	OD + 0,40
> 350 to ≤ 700	OD + 0,70	OD + 0,70	OD + 0,40
> 700 to ≤ 1200	OD + 0,85	OD + 0,85	OD + 0,40
> 1200	OD + 1,00	OD + 1,00	OD + 0,40

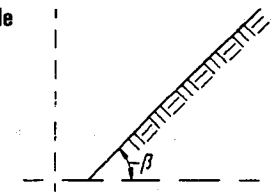
In the values OD + x, x/2 equals the minimum working space between the pipe and the trench wall or support.

Where:
OD is the external diameter, in metres
β is the angle of unsupported trench side measured to the horizontal (see figure 2)

Table 2: Minimum trench width in relation to trench depth

Trench depth m	Minimum trench width m
< 1,00	no minimum width required
≥ 1,00 ≤ 1,75	0,80
> 1,75 ≤ 4,00	0,90
> 4,00	1,00

Figure 2: Angle β of unsupported trench wall



6.2.3 Exceptions to minimum trench width

The minimum width of trench obtained from tables 1 and 2 may be modified in the following circumstances:

- where personnel will never be required to enter the trench, e. g. automated laying techniques;
- where personnel will never be required to enter between pipeline and trench wall;
- in unavoidable constricted situations.

In each of these cases special measures will be required in design and construction.

6.3 Trench stability

Trench stability shall be ensured either by means of a trench support system, by battering the trench sides or by other suitable means. Trench support systems shall be removed in accordance with the assumptions in the structural design in such a way that the pipeline is not moved or damaged.

6.4 Trench bottom

The gradient of the trench bottom and the trench bottom material shall comply with the design specifications. Trench bottom material should not be disturbed. If it is disturbed, its original bearing capacity shall be restored by some suitable means.

Where pipes are to be laid on the trench bottom, this shall be trimmed to the required gradient and shape to provide support to the barrel of the pipe. Socket holes shall be provided in the lower bedding or trench bottom as appropriate.

In freezing conditions it may be necessary to protect the trench bottom so that frozen layers are not left under or around the pipeline.

Where the trench bottom is unstable or the soil has low bearing capacity, suitable precautions shall be taken (see 7.1 and 7.3).

6.5 Dewatering

During installation work, excavations should be kept free from water, e. g. rainwater, seepage water, spring water or water from leaks from pipelines. Methods of dewatering shall not affect embedments and pipelines (see also annex A).

Precautions shall be taken to prevent loss of fine material during dewatering.

The influence of dewatering on groundwater movement and stability of surrounding area shall be taken into account.

On completion of dewatering, any temporary drains shall be adequately sealed.

7 Embedment and support

7.1 General

Materials, bedding, support and embedment layer thickness shall be in accordance with the design requirements. Materials in accordance with 5.3.2 and 5.3.3 should be chosen. The embedment material and its grading together with any support shall be selected with regard to the:

- size of the pipe;
- pipe material and pipe wall thickness;
- nature of the soil.

The width of the bedding shall be the width of the trench unless otherwise specified. For pipelines laid within embankments the width of the bedding shall be four times OD unless otherwise specified.

Minimum thickness *c* (see figure 1) of the initial backfill shall be 150 mm above barrel and 100 mm above joint. When using materials described in 5.3.3.2 and 5.3.3.3, *c* shall be as specified in the design.

Any localised quantity of soft ground below trench bottom shall be removed and replaced with suitable bedding material. If more extensive quantities are encountered a re-evaluation of the structural design should be undertaken.

7.2 Bedding construction types

7.2.1 Bedding construction type 1

Bedding construction type 1 (figure 3) may be used in any case of embedment, providing support for the pipes over their whole barrel length, using the layer thickness requirements for *a* and *b*. This includes any size and