SLOVENSKI STANDARD
SIST EN 13480-6:2004/A1:2006

01-marec-2006

Kovinski industrijski cevovodi – 6. del: Dodatne zahteve za vkopane cevovode

Metallic industrial piping - Part 6: Additional requirements for buried piping

Metallische industrielle Rohrleitungen - Teil 6: Zusätzliche Anforderungen an erdgedeckte Rohrleitungen

Tuyauteries industrielles métalliques - Partie 6 : Exigences complémentaires relatives aux tuyauteries enterrées

Ta slovenski standard je istoveten z: **EN 13480-6:2004/A1:2005**

ICS:

77.140.75	Jeklene cevi in cevni profili za posebne namene	Steel pipes and tubes for specific use

SIST EN 13480-6:2004/A1:2006 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13480-6:2004/A1

December 2005

ICS 23.040.01

English Version

Metallic industrial piping - Part 6: Additional requirements for buried piping

Tuyauteries industrielles métalliques - Partie 6 : Exigences complémentaires relatives aux tuyauteries enterrées

Metallische industrielle Rohrleitungen - Teil 6: Zusätzliche Anforderungen an erdgedeckte Rohrleitungen

This amendment A1 modifies the European Standard EN 13480-6:2004; it was approved by CEN on 22 September 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant 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 amendment 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

Page

Foreword

This European Standard (EN 13480-6:2004/A1:2005) has been prepared by Technical Committee CEN/TC 267 “Industrial piping and pipelines”, the secretariat of which is held by AFNOR.

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 June 2006, and conflicting national standards shall be withdrawn at the latest by June 2006.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this European Standard.

This European Standard contains the Annex A (normative) to be added in EN 13480-6:2004, and the Annex ZA updated to replace the current Annex ZA in EN 13480-6:2004.

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

5 Design and calculation

Replace title of 5.2 by:

5.2 Design

Replace 5.2.5 by:

5.2.5 Where no detailed analysis is undertaken, the maximum temperature range (including the installation temperature) shall not exceed 35 °C, and restraining features such as buried bends and tees shall have a separation of not less than 5 DN. Where detailed analysis is undertaken, it shall be in accordance with EN 13480-3 supplemented by Annex A (normative).

Annex A
(normative)

Calculations for buried piping

A.1 General

This annex describes the applicable requirements for buried piping, supplementing those of EN 13480-3 and EN 13480-6.

Thus, it is proposed to deal with the calculations for buried piping taking account of the following:

— weight of the soil or backfill above the pipe according to the different types of installation;

— static and dynamic loads imposed on the ground above the pipe (e.g. traffic loads);

— flexibility and stability of the piping subjected to combined pressure and temperature change effects.

A.2 Materials

The requirements specified in EN 13480-2 apply without any restriction.

However, one shall remind that the corrosion phenomena occurring in the case of buried piping may be significantly different from those to which piping above-ground, in ducts or tunnels are subjected.

A.3 Design and calculation

A.3.1 Calculation procedure

a) Determination of the required thicknesses from the equations given in EN 13480-3 when the piping is subjected only to internal pressure;

b) determination of the loads due to backfill (A.3.2) and to live loads (A.3.3);

c) checking of the thicknesses defined in *a*) for the different operating conditions under which the loads defined in b) are applicable (A.3.4);

d) checking of the global stability of the buried piping system.

A.3.2 Determination of the loads due to backfill

A.3.2.1 General

The installation methods for buried piping covered are as follows:

— piping in narrow trench;

— piping in wide trench or in positive projecting embankment condition.

A.3.2.2 Notations

For the purposes of this annex the following notations shall apply:

C_{tass} = Settlement ratio (see A.3.2.5.1 b));

C_{dyn} = Coefficient for taking into account the dynamic effect of the live loads;

D_o = External piping diameter. For standardized tubes, D_o is the theoretical external diameter, tolerances excluded;

e_{ord} = Ordered wall thickness;

E_t = Backfill material modulus;

E = Modulus of elasticity for the piping material (see EN 13480-3);

H_t = Total height from the top of the piping to natural ground surface (cover);

H_e = Distance from the plane of equal settlement to the top of pipe;

k = Ratio of lateral pressure to vertical pressure for the backfill material (Rankine coefficient):

$$k = \left\{ \tan\left(\frac{\pi}{4} - \frac{\varphi}{2} \right) \right\}^2$$

L_t = Width of the trench in the horizontal plane containing the top of the piping;

γ_t = Unit weight of backfill material;

φ = Angle of internal friction for the material used to fill the trench;

μ = Coefficient of internal friction of backfill material;

μ' = Coefficient of sliding friction between the backfill material and the trench walls;

μ' is always less than or equal to μ and μ' may be taken as μ provided that backfilling material of proper quality (homogeneity) is used;

F = Load per unit length.

A.3.2.3 Soil properties

In the absence of specific data, the values given in the table hereafter may be used for the design and calculation of buried piping.

Table A.3.2.3 – Soil properties and backfill material

Type of soil	Density daN/m^3	φ °	μ = tan (φ)	k	μ' = tan (φ')	k μ	k μ'
Topsoil [a]	1 450	22	0,404			0,184	0,184
Partially compacted (moist) topsoil [b]	1 440			0,330	0,500		0,165
Saturated topsoil [b]	1 760			0,370	0,400		0,150
Sandy clay [c]		25		0,406			
Clay [c]		22					
Silty clay [a]	2 000	20	0,364			0,178	0,178
Plastic clay – Sandy clay [a]	1 800	14	0,249			0,152	0,152
Moist clay [a]	2 000	12	0,213			0,139	0,139
Yellow clay, moist and partially compacted [b]	1 600			0,330	0,400		0,130
Saturated yellow clay or loam [b]	2 080			0,370	0,300		0,110
Coarse – gravely sand [c]		43					
Medium sand [c]		40					
Fine sand [c]		38					
Silty sand [c]		36					
Uncompacted sand [a]	1 700	31	0,601			0,192	0,192
Sand - Gravel [a]	2 000	33	0,649			0,191	0,191
Clayey sand [a]	1 800	22	0,404			0,184	0,184
Saturated clayey sand [b]	2 110			0,350	0,400		0,140
Dry sand [b]	1 600			0,330	0,500		0,165
Moist sand [b]	1 920			0,330	0,500		0,165
Sludge [c]		18					
Marshy ground – Peat [a]	1 700	12	0,213			0,139	0,139

(Continued)

Table A.3.2.3 (*concluded*)

Type of soil	Density daN/m^3	φ °	μ = tan (φ)	k	μ' = tan (φ')	k μ	k μ'
Loamy loess (alluvial deposits) [a]	2 100	18	0,325			0,172	0,172
Loam – Marl – poor clay [a]	2 100	22	0,404			0,184	0,184
Sandy silt [a]	1 800	25	0,466			0,189	0,189
Gravel – Pebbles [a]	1 900	37	0,754			0,187	0,187
Loose – gravelly backfilling material [b]	1 700			0,330	0,580		0,192
Stony-sandy backfilling material [b]	1 900			0,330	0,500		0,165
Moist-loamy backfilling material [b]	2 000			0,330	0,450		0,150

a Calcul des sollicitations extérieures agissant sur les conduites enterrées (*Calculation of external loadings acting on buried pipings*) - CERIB 1970.

b The theory of external loads on closed conduits in the light of the latest experiments - MARSTON 1930.

c Stabilité des canalisations enterrées (*Stability of buried pipelines*) - E.M.YASSINE et V.I. TCHERNIKINE - Moscow 1968.

A.3.2.4 Piping in narrow-trench condition

A.3.2.4.1 Definition

A piping is considered as piping in narrow-trench condition (Figures A.3.2.4.1-1 to A.3.2.4.1-4) if one of the following conditions is satisfied:

$$\frac{L_t}{D_0} < 2 \text{ and } \frac{H_t}{L_t} \geq 1{,}5$$

or

$$2 \leq \frac{L_t}{D_0} \leq 3 \text{ and } \frac{H_t}{L_t} \geq 3{,}5$$

If neither of these conditions is satisfied, the piping is considered as piping in wide-trench condition.

A.3.2.4.2 Calculation of the load due to backfill

The load per unit length the piping is subjected to is given by the Equations A.3.2.4.1-1 and -2:

$$F_1 = C_1 \gamma_t L_t H_t \qquad \text{(A.3.2.4.2-1)}$$

$$C_1 = \frac{L_t}{2\,k\,\mu'\,H_t}\left\{1 - e^{\left(\frac{-2\,k\,\mu'\,H_t}{L_t}\right)}\right\} \qquad \text{(A.3.2.4.2-2)}$$

The value of C_1 may be derived directly from Figure A.3.2.4.2 as a function of the ratio H_t / L_t and of the product $k\mu'$.

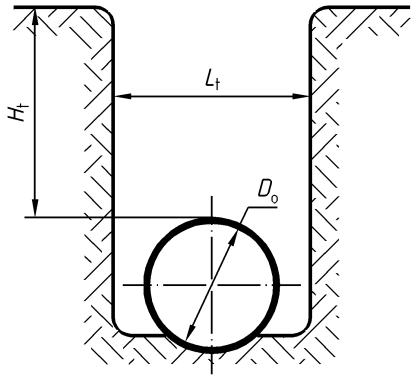

Figure A.3.2.4.1-1

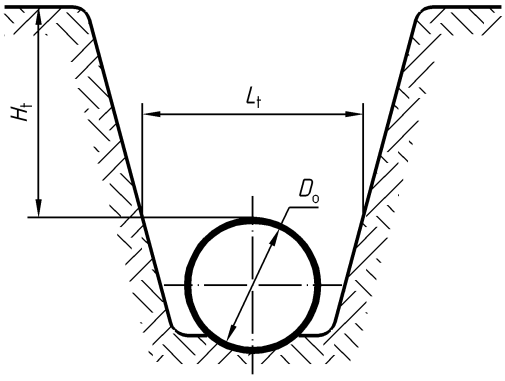

Figure A.3.2.4.1-2

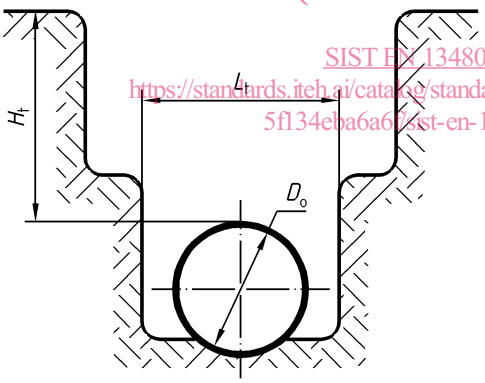

Figure A.3.2.4.1-3

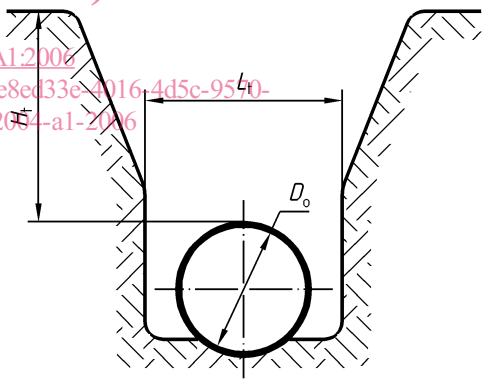

Figure A.3.2.4.1-4

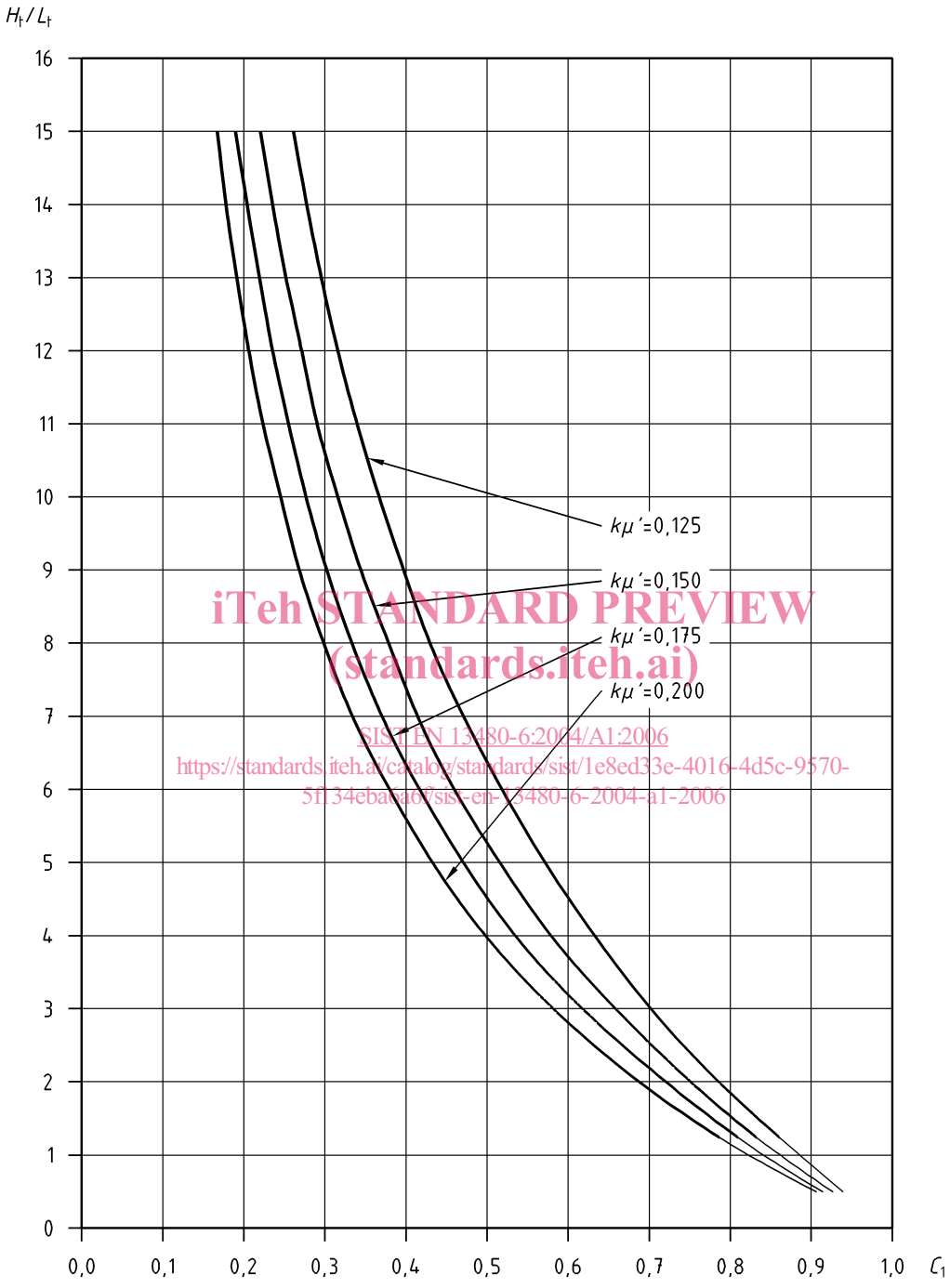

Figure A.3.2.4.2 – Determination of C_1