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Metallic industrial piping

Part 6: Additional requirements for buried piping

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National foreword

This British Standard is the UK implementation of EN 13480-6:2012+A1:2016. It supersedes BS EN 13480-6:2012, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PVE/10, Piping systems.

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.

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

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31 October 2014	Implementation of CEN Correction Notice 27 August 2014: Foreword amended and Annexes Y and ZA updated
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31 March 2017	Implementation of CEN Correction Notice 27 July 2016: Pages 2-4 and 35-37 corrected

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

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

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Foreword

This document (EN 13480-6:2012) 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of an identical text or by endorsement, at the latest by December 2012, and conflicting national standards shall be withdrawn at the latest by December 2012.

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

This document 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 document.

This European Standard EN 13480 for metallic industrial piping consists of seven interdependent and not dissociable parts which are:

— *Part 1: General;*

— *Part 2: Materials;*

— *Part 3: Design and calculation;*

— *Part 4: Fabrication and installation;*

— *Part 5: Inspection and testing;*

— *Part 6: Additional requirements for buried piping;*

— *CEN/TR 13480-7, Guidance on the use of conformity assessment procedures;*

— *Part 8: Additional requirements for aluminium and aluminium alloy piping.*

Although these Parts may be obtained separately, it should be recognised that the Parts are inter-dependant. As such the manufacture of metallic industrial piping requires the application of all the relevant Parts in order for the requirements of the Standard to be satisfactorily fulfilled.

This European Standard will be maintained by a Maintenance MHD working group whose scope of working is limited to corrections and interpretations related to EN 13480.

The contact to submit queries can be found at http://www.unm.fr (en13480@unm.fr). A form for submitting questions can be downloaded from the link to the MHD website. After subject experts have agreed an answer, the answer will be communicated to the questioner. Corrected pages will be given specific issue number and issued by CEN according to CEN Rules. Interpretation sheets will be posted on the website of the MHD.

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This document supersedes EN 13480-6:2004+A1:2005. This new edition incorporates the Amendments/the corrigenda which have been approved previously by CEN members, and the corrected pages up to Issue 17 without any further technical change. Annex Y provides details of significant technical changes between this European Standard and the previous edition.

Amendments to this new edition may be issued from time to time and then used immediately as alternatives to rules contained herein. It is intended to deliver a new Issue of EN 13480:2012 each year, consolidating these Amendments and including other identified corrections. Issue 4 (2016-07) includes the corrected pages listed in Annex Y.

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Foreword to amendment A1

This document (EN 13480-6:2012/A1:2016) has been prepared by Technical Committee CEN/TC 267 “Metallic industrial piping”, the secretariat of which is held by AFNOR.

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This document 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 EN 13480-6:2012.

This document includes the text of the amendment itself. The amended/corrected pages of EN 13480-6:2012 will be published in the new Edition 2017 of the European Standard.

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1 Scope

This document specifies requirements for industrial piping either totally buried or partly buried and partly run in sleeves or similar protection. It is used in conjunction with the other six parts of EN 13480.

Where buried piping subject to this standard connects to piping installed under other jurisdiction such as pipelines, the transition should be made at a closing element e.g. an isolating or regulating valve separating the two sections. This should be close to the boundary of the industrial site, but may be inside or outside the boundary.

Operating temperature up to 75 °C.

NOTE For higher temperatures reference should be made to EN 13941+A1:2010, but it should be kept in mind, that CEN/TC 107 only deals with pre-insulated piping with temperatures up to 140 °C and diameters up to 800 mm, which is state of the art for these products.

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 13480-1:2012, *Metallic industrial piping — Part 1: General*

EN 13480-2:2012, *Metallic industrial piping — Part 2: Materials*

EN 13480-3:2012, *Metallic industrial piping — Part 3: Design and calculation*

EN 13480-5:2012, *Metallic industrial piping — Part 5: Inspection and testing*

3 General

3.1 Safety

a) Buried piping within an industrial site presents a potential hazard to site personal, equipment and environment. The sections set out in this document provide guidance as to how the hazard presented by the piping may be assessed, and the integrity of the piping system maintained.

NOTE 1 Attention is drawn to appropriate National or Local regulations.

b) The main factors to be considered are:

- Design including Routing, Layout, Interaction with connecting systems;
- Materials and Construction Specification and Quality Control;
- Operating Procedures and Control;
- Corrosion protection;
- External Impact Protection and Mitigation.

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All of these factors interact.

NOTE 2 It is recommended that all buried piping be subjected to a formal hazard analysis procedure.

NOTE 3 Attention is drawn to appropriate National or Local regulations.

c) Additional safety requirements may be specified for group 1 fluids according to EN 13480-1:2012, including automated means of isolating buried sections of piping.

3.2 Routes

All routes for buried piping shall be agreed with the owner and operator of the site. The site owner shall be required to furnish details of all other actual or planned buried services (including cables) and all roadways or other surface loads within the construction working width or zone of the proposed pipe.

Piping in category III according to EN 13480-1:2012 shall be separated from any other pipe or service by a minimum distance of 0,25 m unless it can be demonstrated that a smaller distance is acceptable.

3.3 Depth of installation

In the absence of special protection (e.g. concrete slabs) buried piping shall be provided with a minimum cover of 0,8 m.

The designer shall consider increasing the extent of cover above the minimum where penetrating cold or frost heave of the ground is likely, or where damage from excavation activities is a possibility.

3.4 Pipes marking and recording

Buried pipes shall be marked by a continuous tape or other agreed means placed directly above the pipe and no closer than 0,3 m.

All buried pipes shall be identified on as-installed drawings which accurately locate the route relative to structures or other permanent features. The site owner may require the route to be physically marked by the use of identification posts or cover slabs at appropriate intervals.

3.5 Internal inspection provisions

Where periodic internal inspection of buried piping is anticipated, and the specification identifies the method proposed, the designer shall incorporate appropriate means of introducing and removing the inspection devices. Such closures, and openings for inspection shall be designed in accordance with EN 13480-3:2012.

3.6 Contents removal

The design of the piping system shall make allowance for the safe filling and removal of the contents. This shall include vent and drain points or falls as required, and the selection of appropriate bends and fittings.

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3.7 Trench drainage

The designer shall recognize that pipe trenches for buried piping can act as channels for ground water. Appropriate means shall be employed to ensure that the bottom of the trench has sufficient slope to soak-aways or sumps to prevent accumulation of water around the piping. Where such measures are not possible, the designer shall include the possibility of flotation in the design calculations.

In addition, the drainage arrangements shall dispose of the hydrostatic test water. Care shall be exercised during this operation to ensure that washout of bedding material does not occur.

4 Materials

Materials shall conform to the requirements of EN 13480-2:2012 except that the value for the specified minimum elongation after fracture for the longitudinal direction (see EN 13480-2:2012, 4.1.4.) shall be 20 %.

Materials with elongation values less than 20 % shall be avoided, and shall only be used subject to agreement between the purchaser and the designer.

5 Design and calculation

5.1 Minimum wall thickness for buried piping

Unless the pressure design calculations lead to a greater thickness, the wall thickness of the pipe shall not be lower than the value given in Table 1.

Table 1 — Minimum wall thickness for buried piping

Nominal size (DN)	Minimum thickness mm
DN ≤ 80	3,2
80 < DN ≤ 150	4,7
150 < DN ≤ 450	6,35
450 < DN ≤ 600	7,9
600 < DN ≤ 950	9,5
950 < DN	1 % DN

5.2 Design

5.2.1 A simple single dimensional model linking buried pipes and the surrounding ground may be sufficient for piping designed in accordance with EN 13480-3:2012. More complex analysis of pipe to soil interaction may be used where sufficient accurate geo-mechanical data is available, or where the conditions of this annex cannot be met.

NOTE It is assumed that the loads imposed by the piping on the soil do not exceed its load bearing capacity.

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5.2.2 The designer shall include in the calculations the weight of soil or backfill above the pipe and the maximum predicted value of traffic or other static and dynamic loads imposed on the ground above the pipe. With a minimum immediate (first) cover to the pipe of 150 mm of sand, or similar free-flowing material, the forces may be considered as acting over the entire 180° of the upper pipe surface.

5.2.3 In addition to calculations at the design pressure, the loadings on the unpressurized system shall be calculated.

5.2.4 Pipe movement will be significantly restrained by the frictional force at the interface with the surrounding soil, and may be effectively prevented at buried bends and large branches. Unless specific measures are incorporated to permit relative movement, buried pipes shall be considered as fully restrained axially for calculation purposes.

The axial stress due to combined pressure and temperature change effects shall be calculated as follows:

$$S_L = \nu \, S_p - E_\alpha \, (\Delta T) \qquad (1)$$

where

S_L is the longitudinal stress ≤ 0,90 x yield strength at design temperature;

S_p is the circumferential stress due to pressure alone;

ΔT is the maximum temperature range;

ν is Poisson's ratio.

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 13480-3:2012 supplemented by Annex A (normative).

5.2.6 Where seismic events are to be considered, the pipe shall be treated as if rigidly connected to the ground and following the imposed displacements. Dynamic amplification may be ignored.

NOTE The surrounding soil can be considered to effectively dampen all harmonic excitations of the pipe.

5.2.7 The designer shall consider the interface between buried and above ground sections of the piping for all design conditions.

For the static analysis, the buried part shall be considered as clamped for thermal expansion, and it shall be ensured that the flexibility of the above ground part is sufficient in order to limit the loads at the connection of the two parts to acceptable values.

The designer shall analyse the effects of any anticipated settlement of the buried piping relative to the connected piping overground or in ducts, and shall ensure compliance with the requirements of this document.

NOTE When gaseous fluids are carried by the piping, the designer should note the likely rise in temperature in the discharge lines of a compressor and corresponding reduction at the outflow from pressure reducing equipment.

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Where such in-line items are close to a buried section, the designer shall consider the effects of the temperature change.

6 Installation

6.1 Trenches

6.1.1 The normal method of installation shall be by the excavation of trenches. Alternatively, sections of underground pipe installed by thrust boring or similar trenchless methods shall be set in casings.

6.1.2 The bottom of the trench shall be consolidated and free from sharp objects, rocks or stones. The trench shall be made with sufficient slope to provide drainage for the pipe to minimise flotation and corrosion. Where necessary, soak-aways or sumps shall be provided.

The piping shall be laid on an even bed of sand or similar material and consequently the longitudinal bending stress due to weight may be discounted.

6.1.3 A bedding base of free-flowing material such as rounded sand or fine gravel shall be provided with sufficient depth to support the pipe and assist drainage.

6.2 Pipe laying

6.2.1 The trench shall be substantially free of water before the pipe is placed in position.

6.2.2 Provision shall be made for sufficient access to joints to permit proper examination during hydrostatic or other testing operations, and to wrap or otherwise protect pipe joints in the trench. Adequate means shall be provided for removing the hydrostatic test water from the pipe and trench.

6.2.3 The bore of the piping shall be clean to the required standard before laying in the trench.

6.2.4 All practical means shall be taken to prevent damage to the pipe and its coatings in storage and during pipe laying. Wire ropes and chains shall not be used for lifting. Protective pipe coatings shall be visual examined or high voltage tested after the pipe is laid and prior to back filling the excavation.

6.3 Back filling

6.3.1 All tie and examination operations shall be completed before backfilling.

6.3.2 The first cover of the piping shall be made using free-flowing materials to a minimum depth of 150 mm, ensuring that the whole circumference of the pipe is in contact with the filling.

6.3.3 The remaining backfilling shall be the same material that was excavated to form the trench or of similar characteristics. No vegetable or waste matter shall be incorporated. Compacting shall not commence before a cover of 0,3 m has been achieved.

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7 Sleeves or casings

Where buried piping is subjected to frequent overhead traffic or occasional heavy loads, consideration shall be given to providing the pipe with an external protective sleeve or casing. These shall also be employed for sections installed by thrust boring or similar means.

Casings shall be of steel, concrete or plastic composition with a diameter providing a minimum of 100 mm clearance from the carrier pipe.

They shall be constructed to carry all likely external loads, without consideration of the carrier pipe and any internal supports. The thicknesses of steel tubing shall not be less than the values required by EN 13480-3:2012 according to the loads applied (with a minimum of 9,5 mm).

Not less than 3 supporting centralising spacers shall be installed around the pipe at intervals not exceeding the span requirements with a maximum of 4 m.

Casings shall be sealed at their ends to prevent the ingress of water or other foreign matter. If the annulus between carrier and sleeve pipes is to be filled with a fluid, the seal need only be sufficient to withstand the pressure of the filler unless, otherwise specified by the purchaser.

8 Corrosion protection

8.1 General

Buried piping shall be protected from external corrosion which can arise from water and ground contaminants, and the effects of stray earth electrical currents. Protection shall be provided by a combination of coating the pipe surface and cathodic electrical protection.

It is normal for the piping specification to identify the necessary requirements for corrosion protection of buried pipes. These shall be in the form of preparation, coating and cathodic protection specifications.

All appropriate information in respect of the corrosion hazards likely to be encountered on site shall be provided.

8.2 Coatings

All coatings shall be suitable for the underground environment and have mechanical and electrical properties to suit the specified conditions.

In the absence of any other specification, the manufacturer shall consider the relevant European Standards for the selection of suitable coatings.

Coatings shall bond strongly to the pipe surface and be resistant to loss of bonding at geometrical discontinuities and damaged sites areas exposed to external impact.

Offsite coating shall be maximised to ensure application under the most favourable conditions. Site coating may use alternative methods to achieve the requisite protection, e.g. tape wrapping of joints or similar small areas. Care shall be taken to select a method which will bond adequately with the coating of the main pipe body and is appropriate for the installation conditions.

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8.3 Cathodic protection

Cathodic protection of buried piping shall be applied to reduce the risk of aggressive localised corrosion at points where the protective coating is or could become defective.

Protection shall be either by the connection of sacrificial anodes or the use of an impressed current. Protection shall be applied as soon as practicable after installation.

Attention shall be given to the risks of pick up from stray earth currents in complex industrial sites, and the designer of the protection system shall consider the possible interaction with other local electrical networks.

The designer shall ensure that electrical continuity is in place for all buried piping.

NOTE Flanges and other in line components may require specific continuity connections.

Electrical connections to piping shall be through the use of fully welded pads compatible with the material of the pressure shell. Direct connection to the pipe wall shall not be permitted.

Buried piping shall be electrically isolated from above ground sections through the use of isolating flanges or similar arrangements.

9 Examination and testing

Buried piping shall be examined and tested in accordance with EN 13480-5:2012.

Wherever practical, buried sections of piping shall be pressure tested prior to laying in the trench, and all final connections subjected to leak test or other recognized non-destructive testing methods.

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