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EUROCODE 3: DESIGN OF STEEL STRUCTURES - PART 4-3: SILOS, TANKS AND PIPELINES - PIPELINES

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EUROPEAN PRESTANDARD
PRÉNORME EUROPÉENNE
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English version

Eurocode 3: Design of steel structures - Part 4-3: Silos, tanks and pipelines - Pipelines

Eurocode 3: Calcul des structures en acier - Partie 4-3: Silos, réservoirs et canalisations - Canalisations

Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 4-3: Silos, Tankbauwerke und Rohrleitungen - Rohrleitungen

This European Prestandard (ENV) was approved by CEN on 25 December 1998 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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

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Contents

Foreword

Objectives of the Eurocodes

(1) The "Structural Eurocodes" comprise a group of standards for the structural and geotechnical design of buildings and civil engineering works.

(2) They cover execution and control only to the extent that is necessary to indicate the quality of the construction products, and the standard of the workmanship, needed to comply with the assumptions of the design rules.

(3) Until the necessary set of harmonised technical specifications for products and for methods of testing their performance is available, some of the Structural Eurocodes cover some of these aspects in informative annexes.

Background to the Eurocode programme

(4) The Commission of the European Communities (CEC) initiated the work of establishing a set of harmonized technical rules for the design of building works and civil engineering works which would initially serve as an alternative to the different rules in force in the various Member States and would ultimately replace them. These technical rules became known as the 'Structural Eurocodes'.

(5) In 1990, after consulting their respective Member States, the CEC transferred the work of further development, issue and updating of the Structural Eurocodes to CEN, and the EFTA Secretariat agreed to support the CEN work.

(6) CEN Technical Committee CEN/TC 250 is responsible for all Structural Eurocodes.

Eurocode programme

(7) Work is in hand on the following Structural Eurocodes, each generally consisting of a number of parts:

EN 1991 Eurocode 1 Basis of design and actions on structures;

EN 1992 Eurocode 2 Design of concrete structures;

EN 1993 Eurocode 3 Design of steel structures;

EN 1994 Eurocode 4 Design of composite steel and concrete structures;

EN 1995 Eurocode 5 Design of timber structures;

EN 1996 Eurocode 6 Design of masonry structures;

EN 1997 Eurocode 7 Geotechnical design;

EN 1998 Eurocode 8 Design provisions for earthquake resistance of structures;

EN 1999 Eurocode 9 Design of aluminium structures.

(8) Separate sub-committees have been formed by CEN/TC 250 for the various Eurocodes listed above.

(9) This Part 4-3 of ENV 1993 is being published by CEN as a European Prestandard (ENV) with an initial life of three years.

(10) This Prestandard is intended for experimental application and for the submission of comments.

(11) After approximately two years CEN members will be invited to submit formal comments on this Prestandard to be taken into account in determining future actions.

(12) Meanwhile feedback and comments on this Prestandard should be sent to the Secretariat of Sub-committee CEN/TC 250/SC 3 at the following address:

BSI Standards

British Standards House

389 Chiswick High Road

London W4 4AL

England

or to your national standards organisation.

National Application Documents (NADs)

(13) In view of the responsibilities of the authorities in member countries for safety, health and other matters covered by the essential requirements of the Construction Products Directive (CPD), certain safety elements in this ENV have been assigned indicative values which are identified by ☐ ("boxed values"). The authorities in each member country are expected to review the "boxed values" and may substitute alternative definitive values for these safety elements for use in national application.

(14) Some of the necessary supporting European or International Standards might not be available by the time this Prestandard is issued. It is therefore anticipated that a National Application Document (NAD) giving any substitute definitive values for safety elements, referencing compatible supporting Standards and providing guidance on the national application of this Prestandard, will be issued by each member country or its Standards Organisation.

(15) It is intended that this Prestandard is used in conjunction with the NAD valid in the country in which the building or civil engineering work is located.

Matters specific to this Prestandard

(16) The list of parts of ENV 1993 that are currently envisaged is:

ENV 1993-1-1 General rules and rules for buildings;

ENV 1993-1-2 Supplementary rules for structural fire design;

ENV 1993-1-3 Supplementary rules for cold formed thin gauge members and sheeting;

ENV 1993-1-4 Supplementary rules for stainless steels;

ENV 1993-1-5 Supplementary rules for the strength and stability of planar plated structures without transverse loads;

ENV 1993-1-6 Supplementary rules for the strength and stability of shell structures;

ENV 1993-1-7 Supplementary rules for the strength and stability of planar plated structures with transverse loads;

ENV 1993-2 Steel bridges;

ENV 1993-3-1 Towers and masts;

ENV 1993-3-2 Chimneys;

ENV 1993-4-1 Silos;

ENV 1993-4-2 Tanks;

ENV 1993-4-3 Pipelines;

ENV 1993-5 Piling;

ENV 1993-6 Crane supporting structures;

ENV 1993-7 Marine and maritime structures;

ENV 1993-8 Agricultural structures.

(17) This Prestandard provides strain based limit state structural design methods for pipelines in accordance with the principles adopted by CEN/TC250.

(18) According to CEN Resolution BTS1 11/1992 - Revision 1995, CEN/TC250 has overall responsibility for structural design rules in the building and civil engineering fields.

(19) In preparing this Prestandard it was recognized that present European Standards may not yet cover all relevant aspects in pipeline design, execution, etc. In the meantime, reference may be made to international, national or other standards.

(20) The design methods in this Prestandard require material properties that may not yet be well covered in the available reference standards. Therefore, in this Prestandard functional requirements are given of line pipe, in terms of:

- strength (yield strength, ultimate strength, yield to ultimate ratio);
- overmatching requirement for the welds;
- ductility, both for the parent material and for the weld metal including the effect of weld discontinuities.

1 General

1.1 Scope

(1) Part 4.3 of Eurocode 3 provides principles and application rules for the structural design of cylindrical steel pipelines for the transport of liquids or gases or mixtures of liquids and gases at ambient temperatures, that are not treated by other European standards covering particular applications.

(2) Standards dealing with specific pipeline applications should be used for these purposes, notably

- prEN 805 for water supply systems;
- prEN 1295 for buried pipelines under various conditions of loading;
- prEN 1594 for gas supply systems for operating pressures over 16 bar;
- prEN 12007 for gas supply systems up to and including 16 bar;
- prEN 12732 for welding;
- prEN xxxx for pipelines for waste water;
- prEN yyyy for preinsulated bonded pipelines for district heating;
- prEN zzzz for industrial pipelines;
- ISO/DIS 13623 for pipeline transportation systems for the petroleum and natural gas industries.

(3) Rules related to special requirements of seismic design are provided in ENV 1998-4 (Eurocode 8: Part 4 "Design of structures for earthquake resistance: Silos, tanks and pipelines"), which complements the rules of Eurocode 3 specifically for this purpose.

(4) This prestandard is restricted to buried pipelines, corresponding to the scope of Eurocode 8: Part 4 for pipelines. It is specifically intended for use on:

- buried pipelines in settlement areas and in non-settlement areas;
- buried pipelines crossing dykes, traffic roads, railways and canals.

(5) The design of pipelines involves many different aspects. Examples are routing, pressure safety systems, corrosion protection, construction, welding, operation and maintenance. For aspects other than the structural design of the pipeline itself, reference should be made to the relevant European standards listed in 1.3. This is also the case for elements like valves, fittings, insulating couplings, tees and caps.

(6) Pipelines usually comprise several associated facilities such as pumping stations, operation centres, maintenance stations, etc., each of them housing different sorts of mechanical and electrical equipment. Since these facilities have a considerable influence on the continued operation of the system, it is necessary to give them adequate consideration in the design process aimed at satisfying the overall reliability requirements. However, explicit treatment of these facilities is not included within the scope of this Prestandard.

(7) Although large diameter pipelines are within the scope of this Prestandard, the corresponding design criteria should not be used for apparently similar facilities like railway tunnels and large underground gas reservoirs.

(8) The provisions in this Prestandard are not necessarily complete for particular applications. Where this is the case, additional provisions specific to those applications should be adopted.

(9) This Prestandard specifies the requirements regarding material properties of plates and welds in terms of strength and ductility. For detailed guidelines and requirements about materials and welding, reference should be made to the relevant standards listed in 1.3.

(10) The scope of this Prestandard is limited to steel grades with a specified minimum yield strength not exceeding 690 N/mm^2.

1.2 Distinction between principles and application rules

(1)P Depending on the character of the individual paragraphs, a distinction is made in this Part between principles and application rules.

(2)P The principles comprise:

- general or definitive statements for which there is no alternative;
- requirements and analytical models for which no alternative is permitted unless specifically stated.

(3) The principles are identified by the letter P following the paragraph number.

(4)P The application rules are generally recognised rules that follow the principles and satisfy their requirements. Alternative design rules different from the application rules given in the Eurocode may be used, provided that it is shown that the alternative rule accords with the relevant principles and has at least the same reliability.

(5) In this Part the application rules are identified by a number in brackets, as in this paragraph.

1.3 Normative references

This European Prestandard incorporates, by dated and undated reference, provisions from other standards. 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 the European Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1011 *Recommendations for arc welding of steels;*

ENV 1090 *Execution of steel structures;*

prEN 1295 *Structural design of buried pipelines under various conditions of loading;*

Part 1: *General requirements;*

prEN 1594 *Gas supply systems: Pipelines - Maximum Operating Pressure over 16 bar, Functional Requirements;*

ENV 1991 *Eurocode 1: Basis of design and actions on structures;*

Part 1: *Basis of design;*

Part 2.1: *Densities, self weight and imposed loads;*

Part 2.2: *Actions on structures exposed to fire;*

Part 2.3: *Snow loads;*

Part 2.4: *Wind loads;*

Part 2.5: *Thermal loads;*

Part 4: *Actions on silos and tanks;*

ENV 1993 *Eurocode 3: Design of steel structures;*

Part 1.1: *General rules and rules for buildings;*

Part 1.3: *General rules - supplementary rules for cold formed thin gauge members and sheeting;*

Part 1.6: *General rules - supplementary rules for the strength and stability of shell structures;*

Part 1.7: *General rules - supplementary rules for planar plated structures loaded transversely;*

Part 4.1: *Silos;*

Part 4.2: *Tanks;*

ENV 1997 *Eurocode 7: Geotechnical design;*