SLOVENSKI STANDARD

SIST EN 1993-1-10:2005

01-oktober-2005

Evrokod 3: Projektiranje jeklenih konstrukcij – 1-10. del: Izbira kakovosti jekla glede na žilavost in lamelarni lom

Eurocode 3: Design of steel structures - Part 1-10: Material toughness and through-thickness properties

Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-10: Stahlsortenauswahl im Hinblick auf Bruchzähigkeit und Eigenschaften in Dickenrichtung

Eurocode 3 - Calcul des structures en acier - Partie 1-10 : Choix des qualités d'acier

Ta slovenski standard je istoveten z: **EN 1993-1-10:2005**

ICS:

91.010.30	Tehniļ ni vidiki	Technical aspects
91.080.10	Kovinske konstrukcije	Metal structures

SIST EN 1993-1-10:2005 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1993-1-10

May 2005

ICS 91.010.30

Supersedes ENV 1993-1-1:1992

English version

Eurocode 3: Design of steel structures - Part 1-10: Material toughness and through-thickness properties

Eurocode 3 - Calcul des structures en acier vis-à-vis de la ténacité et des propriétés dans le sens de l'épaisseur - Partie 1-10 : Choix des qualités d'acier

Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-10 :Stahlsortenauswahl im Hinblick auf Bruchzähigkeit und Eigenschaften in Dickenrichtung

This European Standard was approved by CEN on 23 April 2004.

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, 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

Ref. No. EN 1993-1-10:2005: E

Contents

Page

Foreword

This European Standard EN 1993, Eurocode 3: Design of steel structures, has been prepared by Technical Committee CEN/TC250 « Structural Eurocodes », the Secretariat of which is held by BSI. CEN/TC250 is responsible for all Structural Eurocodes.

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 November 2005, and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode supersedes ENV 1993-1-1.

According to the CEN-CENELEC Internal Regulations, the National Standard Organizations of the following countries are bound to implement these 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.

Background to the Eurocode programme

In 1975, the Commission of the European Community decided on an action programme in the field of construction, based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonization of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonized technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme, which led to the first generation of European codes in the 1980s.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement[1] between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to CEN through a series of Mandates, in order to provide them with a future status of European Standard (EN). This links *de facto* the Eurocodes with the provisions of all the Council's Directives and/or Commission's Decisions dealing with European standards (*e.g.* the Council Directive 89/106/EEC on construction products - CPD - and Council Directives 93/37/EEC, 92/50/EEC and 89/440/EEC on public works and services and equivalent EFTA Directives initiated in pursuit of setting up the internal market).

The Structural Eurocode programme comprises the following standards generally consisting of a number of Parts:

EN 1990	Eurocode 0:	Basis of Structural Design
EN 1991	Eurocode 1:	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 of structures for earthquake resistance
EN 1999	Eurocode 9:	Design of aluminium structures

[1] Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

Eurocode standards recognize the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level where these continue to vary from State to State.

Status and field of application of Eurocodes

The Member States of the EU and EFTA recognize that Eurocodes serve as reference documents for the following purposes:

– as a means to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC, particularly Essential Requirement N°1 – Mechanical resistance and stability – and Essential Requirement N°2 – Safety in case of fire;

– as a basis for specifying contracts for construction works and related engineering services;

– as a framework for drawing up harmonized technical specifications for construction products (ENs and ETAs)

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents[2] referred to in Article 12 of the CPD, although they are of a different nature from harmonized product standards[3]. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical Committees and/or EOTA Working Groups working on product standards with a view to achieving full compatibility of these technical specifications with the Eurocodes.

The Eurocode standards provide common structural design rules for everyday use for the design of whole structures and component products of both a traditional and an innovative nature. Unusual forms of construction or design conditions are not specifically covered and additional expert consideration will be required by the designer in such cases.

National Standards implementing Eurocodes

The National Standards implementing Eurocodes will comprise the full text of the Eurocode (including any annexes), as published by CEN, which may be preceded by a National title page and National foreword, and may be followed by a National annex.

The National annex may only contain information on those parameters which are left open in the Eurocode for national choice, known as Nationally Determined Parameters, to be used for the design of buildings and civil engineering works to be constructed in the country concerned, *i.e.* :
– values and/or classes where alternatives are given in the Eurocode,
– values to be used where a symbol only is given in the Eurocode,
– country specific data (geographical, climatic, etc.), *e.g.* snow map,
– the procedure to be used where alternative procedures are given in the Eurocode.
It may contain
– decisions on the application of informative annexes,
– references to non-contradictory complementary information to assist the user to apply the Eurocode.

[2] According to Art. 3.3 of the CPD, the essential requirements (ERs) shall be given concrete form in interpretative documents for the creation of the necessary links between the essential requirements and the mandates for harmonized ENs and ETAGs/ETAs.

[3] According to Art. 12 of the CPD the interpretative documents shall :
a) give concrete form to the essential requirements by harmonizing the terminology and the technical bases and indicating classes or levels for each requirement where necessary ;
b) indicate methods of correlating these classes or levels of requirement with the technical specifications, *e.g.* methods of calculation and of proof, technical rules for project design, etc. ;
c) serve as a reference for the establishment of harmonized standards and guidelines for European technical approvals.

The Eurocodes, *de facto*, play a similar role in the field of the ER 1 and a part of ER 2.

Links between Eurocodes and harmonized technical specifications (ENs and ETAs) for products

There is a need for consistency between the harmonized technical specifications for construction products and the technical rules for works[4]. Furthermore, all the information accompanying the CE Marking of the construction products, which refer to Eurocodes, should clearly mention which Nationally Determined Parameters have been taken into account.

National annex for EN 1993-1-10

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. The National Standard implementing EN 1993-1-10 should have a National Annex containing all Nationally Determined Parameters for the design of steel structures to be constructed in the relevant country.

National choice is allowed in EN 1993-1-10 through clauses:

- 2.2(5)
- 3.1(1)

[4] see Art.3.3 and Art.12 of the CPD, as well as clauses 4.2, 4.3.1, 4.3.2 and 5.2 of ID 1.

1 General

1.1 Scope

(1) EN 1993-1-10 contains design guidance for the selection of steel for fracture toughness and for through thickness properties of welded elements where there is a significant risk of lamellar tearing during fabrication.

(2) Section 2 applies to steel grades S 235 to S 690. However section 3 applies to steel grades S 235 to S 460 only.

NOTE EN 1993-1-1 is restricted to steels S235 to S460.

(3) The rules and guidance given in section 2 and 3 assume that the construction will be executed in accordance with EN 1090.

1.2 Normative references

(1) This European Standard incorporates by dated and 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 (including amendments).

NOTE The Eurocodes were published as European Prestandards. The following European Standards which are published or in preparation are cited in normative clauses:

EN 1011-2	Welding. Recommendations for welding of metallic materials: Part 2: Arc welding of ferritic steels
EN 1090	Execution of steel structures
EN 1990	Basis of structural design
EN 1991	Actions on structures
EN 1998	Design provisions for earthquake resistance of structures
EN 10002	Tensile testing of metallic materials
EN 10025	Hot rolled products of structural steels
EN 10045-1	Metallic materials - Charpy impact test - Part 1: Test method
EN 10155	Structural steels with improved atmospheric corrosion resistance - Technical delivery conditions
EN 10160	Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)
EN 10164	Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions
EN 10210-1	Hot finished structural hollow sections of non-alloy and fine grain structural steels – Part 1: Technical delivery requirements
EN 10219-1	Cold formed welded structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery requirements

1.3 Terms and definitions

1.3.1
K_V-value

The K_V (Charpy V-Notch)-value is the impact energy $A_V(T)$ in Joules [J] required to fracture a Charpy V-notch specimen at a given test temperature T. Steel product standards generally specify that test specimens should not fail at an impact energy lower than 27J at a specified test temperature T.

1.3.2
Transition region
The region of the toughness-temperature diagram showing the relationship $A_V(T)$ in which the material toughness decreases with the decrease in temperature and the failure mode changes from ductile to brittle. The temperature values T_{27J} required in the product standards are located in the lower part of this region.

1.3.3
Upper shelf region
The region of the toughness-temperature diagram in which steel elements exhibit elastic-plastic behaviour with ductile modes of failure irrespective of the presence of small flaws and welding discontinuities from fabrication.

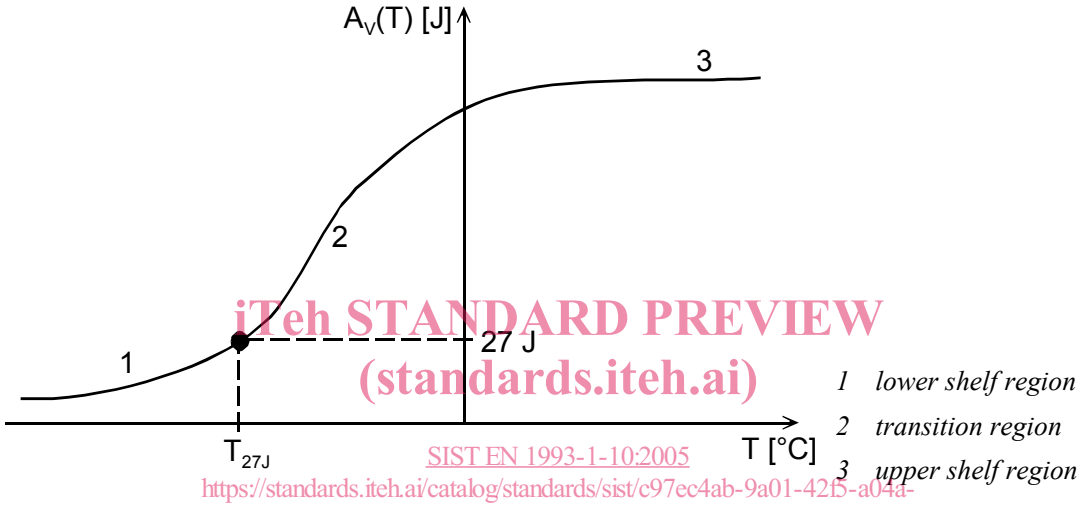

Figure 1.1: Relationship between impact energy and temperature

1.3.4
T_{27J}
Temperature at which a minimum energy A_V will not be less than 27J in a Charpy V-notch impact test.

1.3.5
Z-value
The transverse reduction of area in a tensile test (see EN 10002) of the through-thickness ductility of a specimen, measured as a percentage.

1.3.6
K_{Ic}-value
The plane strain fracture toughness for linear elastic behaviour measured in $N/mm^{3/2}$.

> **NOTE** The two internationally recognized alternative units for the stress intensity factor K are $N/mm^{3/2}$ and $MPa\sqrt{m}$ (ie $MN/m^{3/2}$) where 1 $N/mm^{3/2}$ = 0,032 $MPa\sqrt{m}$.

1.3.7
Degree of cold forming
Permanent strain from cold forming measured as a percentage.