# SLOVENSKI STANDARD

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**Jekla za poboljšanje - 1. del: Splošni tehnični dobavni pogoji**

Steels for quenching and tempering - Part 1: General technical delivery conditions



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English Version

# Steels for quenching and tempering - Part 1: General technical delivery conditions

Aciers pour trempe et revenu - Partie 1: Conditions techniques générales de livraison

Vergütungsstähle - Teil 1: Allgemeine technische Lieferbedingungen

This European Standard was approved by CEN on 7 July 2006.

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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.



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## Foreword

This document (EN 10083-1:2006) has been prepared by Technical Committee ECISS/TC 23 “Steels for heat treatment, alloy steels and free-cutting steels - Qualities and dimensions”, 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of an identical text or by endorsement, at the latest by February 2007, and conflicting national standards shall be withdrawn at the latest by February 2007.

Together with Part 2 and Part 3 of this standard, this Part 1 is a revision of the following European Standards:

EN 10083-1:1991 + A1:1996, *Quenched and tempered steels — Part 1: Technical delivery conditions for special steels*

EN 10083-2:1991 + A1:1996, *Quenched and tempered steels — Part 2: Technical delivery conditions for unalloyed quality steels*

EN 10083-3:1995, *Quenched and tempered steels — Part 3: Technical delivery conditions for boron steels*

and of



EURONORM 86:1970, *Steels for flame and induction hardening — Quality specifications*

The specific requirements for steels for quenching and tempering are given in the following parts:



Part 2: Technical delivery conditions for non alloy steels

Part 3: Technical delivery conditions for alloy steels

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

# 1 Scope

This part of EN 10083 specifies the general technical delivery requirements for

— semi-finished products, hot formed, e.g. blooms, billets, slabs (see NOTES 2 and 3),

— bars (see NOTE 2),

— rod,

— wide flats,

— hot-rolled strip and sheet/plate,

— forgings (see NOTE 2)

manufactured from the direct hardening non alloy steels for quenching and tempering (see EN 10083-2), the direct hardening alloy steels for quenching and tempering (see EN 10083-3), the non alloy flame and induction hardening steels (see EN 10083-2) and the alloy flame and induction hardening steels (see EN 10083-3), and supplied in one of the heat treatment conditions given for the different types of products in the relevant tables of EN 10083-2 and EN 10083-3 and in one of the surface conditions given in the relevant tables of EN 10083-2 and EN 10083-3.

The steels are generally intended for the manufacture of quenched and tempered, flame or induction hardened machine parts, but can also be used in the normalized condition (see EN 10083-2).



Where applicable, the requirements for mechanical properties given in EN 10083-2 and EN 10083-3 are restricted to the relevant tables in these documents.



NOTE 1 European Standards on similar grades are listed in Annex C.

NOTE 2 Hammer forged semi-finished products (blooms, billets, slabs etc.), seamless rolled rings and hammer forged bars are in the following covered under semi-finished products or bars and not under the term "forgings".

NOTE 3 Special agreements should be made when ordering un-worked continuously cast semi-finished products.

NOTE 4 In accordance with EN 10020, the steels covered by EN 10083-2:2006 are quality and special steels, the steels covered by EN 10083-3:2006 are special steels. The differences between quality and special steels are characterized by the following requirements, which are valid for special steels only:

— the minimum impact values in the quenched and tempered condition (for non alloy special steels in the case of mean percentages by mass of carbon < 0,50 % only);

— limiting hardenability values in the Jominy test (for non alloy steels in the case of percentages by mass of carbon > 0,30 % only);

— limited oxide inclusion content;

— lower maximum contents for phosphorus and sulphur.

NOTE 5 This European Standard does not apply for bright steel products. For bright steel products EN 10277-1 and EN 10277-5 apply.

In special cases, variations in these technical delivery requirements or additions to them may be agreed at the time of enquiry and order (see Annex B).

In addition to the specifications of this European Standard, the general technical delivery conditions given in EN 10021 are applicable unless otherwise specified.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10020:2000, *Definition and classification of grades of steel*

EN 10021, *General technical delivery requirements for steel and iron products*

EN 10027-1, *Designation systems for steels — Part 1: Steel names*

EN 10027-2, *Designation systems for steels — Part 2: Numerical system*

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

EN 10052:1993, *Vocabulary of heat treatment terms for ferrous products*

EN 10079:1992, *Definition of steel products*

EN 10083-2:2006, *Steels for quenching and tempering — Part 2: Technical delivery conditions for non alloy steels*



EN 10083-3:2006, *Steels for quenching and tempering — Part 3: Technical delivery conditions for alloy steels*

EN 10160, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*

EN 10163-2, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 2: Plates and wide flats*



EN 10204, *Metallic products — Types of inspection documents*

EN 10221, *Surface quality classes for hot-rolled bars and rods — Technical delivery conditions*

CR 10261, *ECISS Information Circular 11 — Iron and steel — Review of available methods of chemical analysis*

EN 10308, *Non destructive testing — Ultrasonic testing of steel bars*

EN ISO 377:1997, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*

EN ISO 642, *Steel — Hardenability test by end quenching (Jominy test) (ISO 642:1999)*

EN ISO 643, *Steels — Micrographic determination of the apparent grain size (ISO 643:2003)*

EN ISO 3887, *Steels — Determination of depth of decarburization (ISO 3887:2003)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2005)*

EN ISO 6508-1:2005, *Metallic materials — Rockwell hardness test— Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (ISO 6508-1:2005)*

EN ISO 14284:2002, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 10020:2000, EN 10052:1993, EN 10079:1992, EN ISO 377:1997, EN ISO 14284:2002 and the following apply.

**3.1**
**flame and induction hardening steels**
flame and induction hardening steels are characterized by the fact that, when in the usual quenched and tempered condition, they are capable of being surface hardened by local heating and quenching without any appreciable impairment of the strength and toughness properties of the core

**3.2**
**quenched and tempered steels**
quenched and tempered steels are engineering steels which because of their chemical composition are suitable for hardening and in the quenched and tempered condition have good toughness at a given tensile strength

**3.3**
**ruling section**
section for which the specified mechanical properties apply (see Annex A). Independent of the actual shape and dimensions of the cross-section of the product the size of its ruling section is always given by a diameter. This corresponds to the diameter of an "equivalent round bar". That is, a round bar, which, at the position of its cross-section specified for taking the test pieces for the mechanical tests, will, when being cooled from austenitizing temperature, show the same cooling rate as the actual ruling section of the product concerned at its position for taking the test pieces



## 4 Classification and designation



### 4.1 Classification

The classification of the relevant steel grades according to EN 10020 is indicated in EN 10083-2 and EN 10083-3.

### 4.2 Designation

#### 4.2.1 Steel names

For the steel grades covered by this European Standard, the steel names as given in the relevant tables of EN 10083-2 and EN 10083-3 shall be allocated in accordance with EN 10027-1.

#### 4.2.2 Steel numbers

For the steel grades covered by this European Standard, the steel numbers as given in the relevant tables of EN 10083-2 and EN 10083-3 shall be allocated in accordance with EN 10027-2.

# 5 Information to be supplied by the purchaser

## 5.1 Mandatory information

The manufacturer shall obtain the following information from the purchaser at the time of enquiry and order:

a) the quantity to be delivered;

b) the designation of the product form (e.g. round bar, rod, sheet or forging);

c) the number of the dimensional standard (e.g. EN 10060);

d) the dimensions and tolerances on dimensions and shape and, if applicable, letters denoting relevant special tolerances;

e) the number of this European Standard including the number of the relevant part;

f) steel name or steel number (see 4.2, EN 10083-2 and EN 10083-3);

g) the type of inspection document in accordance with EN 10204 (see 8.1).

## 5.2 Options

A number of options are specified in this European Standard and listed below. If the purchaser does not indicate his wish to implement any of these options, the supplier shall act in accordance with the basic specification of this European Standard (see 5.1):



a) any particular heat treatment condition (see 6.3.2);

b) any particular surface condition (see 6.3.3);

c) any verification of the product analysis (see 7.1.1.2 and B.6);

d) any requirement to the hardenability (+H, +HH, +HL) for special steels (see 7.1.2) and if agreed the information about calculation of the hardenability (see 10.3.2);

e) any verification of mechanical properties of reference test pieces in the quenched and tempered (+QT) or normalized (+N) condition (see B.1 and B.2);

f) any fine grain requirements or verification of fine grain size (see 7.4 and B.3);

g) any requirements for the verification of non-metallic inclusion content of special steels (see 7.4 and B.4);

h) any requirement for internal soundness (see 7.5 and B.5);

i) any requirement relating to surface quality (see 7.6.3);

j) any requirement regarding the permissible depth of decarburization (see 7.6.4);

k) suitability of bars and rod for bright drawing (see 7.6.5);

l) any requirement relating to removal of surface defects (see 7.6.6);

m) inspection of surface condition and dimensions shall be carried out by the purchaser at the manufacturer's works (see 8.1.4);

n) any requirement concerning special marking of the products (see Clause 11 and B.7).

EXAMPLE
20 round bars with the nominal diameter 20 mm and the nominal length of 8000 mm according to EN 10060 made of steel grade 25CrMo4 (1.7218) according to EN 10083-3 in the heat treatment condition +A, inspection certificate 3.1 as specified in EN 10204.

20 round bars EN 10060 - 20x8000
EN 10083-3 – 25CrMo4+A
EN 10204 - 3.1

or

20 round bars EN 10060 - 20x8000
EN 10083-3 – 1.7218+A
EN 10204 - 3.1

# 6 Manufacturing process

## 6.1 General

The manufacturing process of the steel and of the products is left to the discretion of the manufacturer with the restrictions given by the requirements in 6.2 to 6.4.

## 6.2 De-oxidation

All steels shall be killed.



## 6.3 Heat treatment and surface condition at delivery



### 6.3.1 Untreated condition

Unless otherwise agreed at the time of enquiry and order, the products shall be delivered in the untreated, i.e. hot worked, condition.

NOTE Depending on product shape and dimensions, not all steel grades can be delivered in the hot worked untreated condition.

### 6.3.2 Particular heat treatment condition

If so agreed at the time of enquiry and order, the products shall be delivered with one of the particular heat-treatment conditions given in Table 1, lines 3 to 7, of EN 10083-2:2006 or Table 1, lines 3 to 6, of EN 10083-3:2006.

### 6.3.3 Particular surface condition

If so agreed at the time of enquiry and order, the products shall be delivered with one of the particular surface conditions given in Table 2, lines 3 to 7, of EN 10083-2:2006 or EN 10083-3:2006.

## 6.4 Cast separation

The products shall be delivered separated by cast.

# 7 Requirements

## 7.1 Chemical composition, hardenability and mechanical properties

### 7.1.1 Chemical composition

**7.1.1.1** The chemical composition determined by cast analysis shall comply with the values in Table 3 of EN 10083-2:2006 or EN 10083-3:2006 respectively.

**7.1.1.2** Permissible deviations between the limiting values for cast analysis and the values for product analysis are given in Tables 4 of EN 10083-2:2006 and EN 10083-3:2006 respectively.

The product analysis shall be carried out when specified at the time of the order (see B.6).

### 7.1.2 Hardenability

Where the steel is ordered by using the symbols for normal (+H) or restricted (+HL, +HH) hardenability requirements, the hardenability values given in the relevant tables of EN 10083-2 and EN 10083-3 shall apply.

### 7.1.3 Mechanical properties

Where the steel is ordered without hardenability requirements, the requirements for mechanical properties specified in EN 10083-2 and EN 10083-3 apply as appropriate for the particular heat treatment condition.



The mechanical property values given in EN 10083-2 and EN 10083-3 apply to test pieces in the quenched and tempered or normalized condition which have been taken and prepared in accordance with Figure 1 or Figures 2 and 3.



## 7.2 Machinability

All steels delivered in the soft annealed (+A) condition are machinable. Where improved machinability is required, the grades with a specified sulphur range should be ordered and/or with a specific treatment to improve machinability (e.g. Ca treatment).

## 7.3 Shearability of semi-finished products and bars

The relevant specifications in EN 10083-2 and EN 10083-3 shall apply.

## 7.4 Structure

The requirements specified in the relevant clauses of EN 10083-2 and EN 10083-3 shall apply.

Regarding fine grain requirements and/or verification of fine grain size see B.3.

Regarding the verification of non-metallic inclusion content of special steels see B.4.

NOTE Segregation is the result of a natural phenomenon. Segregations can be found in ingots as well as in slabs, blooms and billets from the continuous casting process. The positive segregation is a concentration of various elements at different locations in the ingot, slab, bloom and billet. In case of flat products customers should note, that these segregations can occur parallel to the surface of the product. Especially for medium and high carbon contents segregations lead to a higher hardness and should be taken into consideration during further heat treatments.