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Vroče valjani izdelki iz konstrukcijskih jekel - 4. del: Tehnični dobavni pogoji za termomehansko obdelana valjana variva drobnozrnata konstrukcijska jekla

Hot rolled products of structural steels - Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels

Warmgewalzte Erzeugnisse aus Baustählen - Teil 4: Technische Lieferbedingungen für thermomechanisch gewalzte schweißgeeignete Feinkornbaustähle

Produits laminés à chaud en aciers de construction - Partie 4 : Conditions techniques de livraison pour les aciers de construction soudable à grains fins obtenus par laminage thermomécanique

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This draft European Standard is submitted to ECISS/COCOR before submission to CEN members for formal vote. It has been drawn up by the Technical Committee ECISS/TC 103.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Foreword

This document (prEN 10025-4:2014) has been prepared by Technical Committee ECISS/TC 103 “Structural steels other than reinforcements”, the secretariat of which is held by DIN.

This document is currently submitted to the COCOR Vote.

This document will supersede EN 10025-4:2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

The titles of the other parts of this document are:

Part 1: General;

Part 2: Technical delivery conditions for non-alloy structural steels;

Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels;

Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance;

Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition.

SIST EN 10025-4:2019

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prEN 10025-4:2014 (E)**1 Scope**

Part 4 of this document, in addition to Part 1, specifies technical delivery conditions for flat and long products of hot rolled weldable fine grain structural steels in the thermomechanical rolled condition in the grades and qualities given in Tables 1 to 3 (chemical composition) and Tables 4 to 6 (mechanical properties) in thickness ≤ 120 mm for flat products and in thickness ≤ 150 mm for long products.

In addition to prEN 10025-1:2014 the steels specified in this document are especially intended for use in heavily loaded parts of welded structures such as, bridges, flood gates, storage tanks, water supply tanks, etc., for service at ambient and low temperatures.

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.

2.1 General standards

- EN 1011-2, *Welding – Recommendations for welding of metallic materials - Part 2: Arc welding of ferritic steels.*
- EN 10020:2000, *Definition and classification of grades of steel.*
- EN 10021, *General technical delivery conditions for steel products*
- prEN 10025-1:2014, *Hot rolled products of structural steels - Part 1: General*
- EN 10027-1, *Designation systems for steels - Part 1: Steel names*
- EN 10027-2, *Designation systems for steels - Part 2: Numerical system*
- EN 10079:2007, *Definition of steel products*
- EN 10163-1, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections – Part 1: General requirements*
- EN 10163-2, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections – Part 2: Plates and wide flats*
- EN 10163-3, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections – Part 3: Sections*
- EN 10164, *Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions*
- EN 10168, *Steel products – Inspection documents – List of information and description*
- EN 10204, *Metallic products – Types of inspection documents*
- EN 10221, *Surface quality classes for hot-rolled round bars and rods - Technical delivery conditions*
- EN ISO 14713-2:2009, *Guidelines and recommendations for the protection against corrosion of iron and steel structures – Zinc coating – Part 2: Hot dip galvanizing (ISO 14713-2:2009)*
- CEN/TR 10347, *Guidance for forming of structural steels in processing*

2.2 Standards on dimensions and tolerances (see 7.7.1)

- EN 10017, *Non-alloy steel rod for drawing and/or cold rolling – Dimensions and tolerances*
- EN 10024, *Hot rolled taper flange I sections - Tolerances on shape and dimensions*
- EN 10029, *Hot rolled steel plates 3 mm thick or above - Tolerances on dimensions and shape*
- EN 10034, *Structural steel I and H sections - Tolerances on shape and dimensions*
- EN 10048, *Hot rolled narrow steel strip - Tolerances on dimensions and shape*
- EN 10051, *Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels - Tolerances on dimensions and shape*
- EN 10055, *Hot-rolled steel equal flange tees with radiused root and toes - Dimensions and tolerances on shape and dimensions*
- EN 10056-1, *Structural steel equal and unequal leg angles - Part 1: Dimensions*
- EN 10056-2, *Structural steel equal and unequal leg angles - Part 2: Tolerances on shape and dimensions*
- EN 10058, *Hot rolled flat steel bars for general purposes - Dimensions and tolerances on shape and dimensions*
- EN 10059, *Hot rolled square steel bars - Dimensions and tolerances on shape and dimensions*
- EN 10060, *Hot rolled round steel bars - Dimensions and tolerances on shape and dimensions*
- EN 10061, *Hot rolled hexagon steel bars - Dimensions and tolerances on shape and dimensions*
- EN 10067, *Hot rolled bulb flats - Dimensions and tolerances on shape, dimensions and mass*
- EN 10279, *Hot rolled steel channels - Tolerances on shape, dimensions and mass*

2.3 Standards on testing

- EN 10160, *Ultrasonic testing of steel flat product of thickness equal to or greater than 6 mm (reflection method)*
- EN 10306, *Iron and steel - Ultrasonic testing of H beams with parallel flanges and IPE beams*
- EN 10308, *Non-destructive testing - Ultrasonic testing of steel bars*
- EN ISO 148-1, *Metallic materials – Charpy pendulum impact test – Part 1: Test method (ISO 148-1:2009)*
- EN ISO 643, *Steels – Micrographic determination of the apparent grain size (ISO 643:2003)*
- EN ISO 6892-1, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature (ISO 6892-1:2009)*
- EN ISO 14284, *Steel and iron – Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

prEN 10025-4:2014 (E)**3 Terms and definitions**

For the purposes of this document, the terms and definitions given in prEN 10025-1:2014 and the following apply.

3.1**thermomechanical rolling**

rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition with certain properties which cannot be achieved or repeated by heat treatment alone

Note 1 to entry Hot forming or post weld heat treatment at a temperature above 580 °C may lower the strength values and should not be performed. Flame straightening can be applied in accordance with CEN/TR 10347.

Note 2 to entry Thermomechanical rolling can include processes with an increasing cooling rate with or without tempering including self-tempering but excluding direct quenching and quenching and tempering.

Note 3 to entry In some publications the word TMCP (Thermomechanical Control Process) is also used.

3.2**fine grained steels**

steels with fine grain structure with an equivalent index of ferritic grain size ≥ 6

Note 1 to entry For the determination of grain sizes see EN ISO 643.

4 Classification and designation**4.1 Classification****4.1.1 Main quality classes**

All steel grades specified in this document shall be classified as alloy special steels according to EN 10020 except grade S275 which is a non-alloy quality steel.

4.1.2 Grades and qualities

This document specifies five steel grades S275, S355, S420, S460 and S500. All steel grades may be supplied in the following qualities as specified at the time of the order:

- with specified minimum values of impact energy at temperatures not lower than -20 °C, designated as M;
- with specified minimum values of impact energy at temperatures not lower than -50 °C, designated as ML.

4.2 Designation

4.2.1 The designation shall be in accordance with prEN 10025-1.

4.2.2 The designation shall consist of:

- number of this document (prEN 10025-4);
- steel name or the steel number; the steel name consisting of:
 - symbol S (for structural steel);

- indication of the minimum specified yield strength for thickness ≤ 16 mm expressed in MPa¹⁾;
- delivery condition M;
- capital letter L for the quality with specified minimum values of impact energy at temperatures not lower than -50 °C.

EXAMPLE Thermomechanical rolled structural steel (S) with a specified minimum yield strength at room temperature of 355 MPa¹⁾ and with a specified minimum value of impact energy at -50 °C:

Steel prEN 10025-4 - S355ML

or

Steel prEN 10025-4 - 1.8834

5 Information to be supplied by the purchaser

5.1 Mandatory information

The following information shall be supplied by the purchaser at the time of the order:

- a) quantity to be delivered;
- b) product form;
- c) number of the relevant part of this document;
- d) steel name or the steel number (see 4.2.2);
- e) nominal dimensions and tolerances on dimensions and shape (see 7.7.1);
- f) additional requirements of inspection and testing as specified in prEN 10025-4;
- g) type of inspection document according to EN 10204 (see 8.2);
- h) all required options (see 5.2).

5.2 Options

A number of options are specified in Clause 13. In the event that the purchaser does not indicate his wish to implement any of these options, the supplier shall supply in accordance with the basic specification (see 5.1 a) to g).

6 Manufacturing process

6.1 Steel making process

The steel making process is at the discretion of the manufacturer with the exclusion of the open hearth (Siemens-Martin) process.

See option 1.

¹⁾ 1 MPa = 1 N/mm².

1) 1 MPa = 1 N/mm²

prEN 10025-4:2014 (E)**6.2 Grain structure**

The steels shall have a fine grain structure containing sufficient amounts of nitrogen binding elements (see Table 1).

6.3 Delivery conditions

The products shall be supplied in the thermomechanical rolled condition as defined in Clause 3.

7 Requirements**7.1 General**

The following requirements apply when sampling, preparation of test pieces and testing specified in Clauses 8, 9 and 10 are carried out.

7.2 Chemical composition

7.2.1 The chemical composition determined by ladle analysis shall comply with the specified values of Table 1. On special request of the purchaser the manufacturer shall inform the purchaser at the time of the order which of the alloying elements appropriate to the steel grade required will be deliberately added to the material to be delivered.

See option 29.

For elements not defined in tables for the chemical composition for ladle analysis, limit values of Table 1 of EN 10020:2000 shall apply as maximum values.

7.2.2 The upper limits applicable for the product analysis are given in Table 2. The product analysis shall be carried out when specified at the time of the order.

See option 2.

For elements not defined in tables for the chemical composition for product analysis, limit values of Table 1 of EN 10020:2000 shall apply as maximum values.

7.2.3 The maximum carbon equivalent values based on the ladle analysis, given in Table 3 shall apply. For the carbon equivalent value formula see 4.4 of prEN 10025-1:2014.

7.2.4 When products are supplied with a control on Si e.g. for hot-dip zinc-coating so that there could be a need to increase the content of other elements like C and Mn to achieve the required tensile properties, the maximum carbon equivalent values of Table 3 shall be increased as follows:

- for $Si \leq 0,04 \%$, increase the value of the CEV by 0,02;
- for $Si \leq 0,25 \%$, increase the value of the CEV by 0,01.

7.3 Mechanical properties**7.3.1 General**

7.3.1.1 Under the inspection and testing conditions as specified in Clauses 8, 9 and 10 and in the delivery condition as specified in 6.3 the mechanical properties shall comply with the values given in Tables 4 to 6.

NOTE Stress relieving at more than 580 °C or for over 1 h may lead to a deterioration of the mechanical properties of the steel grades as defined in prEN 10025-4. If the purchaser intends to stress relief the products at higher temperatures or for longer times than mentioned above the minimum values of the mechanical properties after such a treatment should be agreed at the time of the order.

7.3.1.2 For flat products the nominal thickness applies. For long products of irregular section the nominal thickness of that part from which the samples are taken applies (see Annex A of prEN 10025-1:2014).

7.3.2 Impact properties

7.3.2.1 The verification of the impact energy value shall be carried out in accordance with prEN 10025-1.

Furthermore the verification of the impact energy value shall be carried out, unless otherwise agreed (see 7.3.2.2 and 7.3.2.3) with longitudinal test pieces for:

- M at -20 °C;
- ML at -50 °C.

7.3.2.2 Another temperature (given in Tables 5 and 6) may be agreed at the time of the order.

See option 3.

7.3.2.3 If agreed at the time of the order transverse impact energy values as given in Table 6 shall apply instead of longitudinal values.

See option 30.

7.3.3 Improved deformation properties perpendicular to the surface

If agreed at the time of the order flat and long products shall comply with one of the requirements of EN 10164.

See option 4.

7.4 Technological properties

7.4.1 Weldability

The steels specified in this document shall be suitable for welding.

General requirements for arc welding of the steels specified in this document shall be as given in EN 1011-2.

NOTE 1 With increasing product thickness and strength level cold cracking can occur. Cold cracking is caused by the following factors in combination:

- the amount of diffusible hydrogen in the weld metal;
- a brittle structure of the heat affected zone;
- significant tensile stress concentrations in the welded joint.

NOTE 2 Due to their favourable chemical composition in comparison to a normalized steel at the same yield strength level, thermomechanically treated steels according to prEN 10025-4:2014 exhibit enhanced weldability.

7.4.2 Formability and flame straightening

NOTE Recommendations regarding hot forming, cold forming and flame straightening are laid down in CEN/TR 10347.

7.4.2.1 Hot forming

Hot forming shall not be undertaken.

NOTE The products ordered and supplied in the thermomechanical rolled condition are not suitable for hot forming.