



SLOVENSKI STANDARD

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Jekleni izkovki za tlačne posode - 1. del: Splošne zahteve za prosto kovane izkovke

Steel forgings for pressure purposes - Part 1: General requirements

Schmiedestücke aus Stahl für Druckbehälter - Teil 1: Allgemeine Anforderungen

Pièces forgées en acier pour appareils à pression - Partie 1: Prescriptions générales

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EUROPEAN STANDARD

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Steel forgings for pressure purposes - Part 1: General requirements for open die forgings

Pièces forgées en acier pour appareils à pression -
Partie 1: Prescriptions générales concernant les pièces
obtenues par forgeage libre

Schmiedestücke aus Stahl für Druckbehälter - Teil 1:
Allgemeine Anforderungen an
Freiformschmiedestücke

This European Standard was approved by CEN on 25 December 2016.

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 CEN-CENELEC Management Centre or to any CEN member.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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EN 10222-1:2017 (E)**European foreword**

This document (EN 10222-1:2017) has been prepared by Technical Committee ECISS/TC 111 “Steel castings and forgings”, 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of an identical text or by endorsement, at the latest by October 2017, and conflicting national standards shall be withdrawn at the latest by October 2017.

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

This document supersedes EN 10222-1:1998.

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 2014/68/EU.

For relationship with EU Directive 2014/68/EU, see informative Annex ZA, which is an integral part of this document.

EN 10222 consists of the following parts under the general title “Steel forgings for pressure purposes”:

- *Part 1: General requirements for open die forgings*
- *Part 2: Ferritic and martensitic steels with specified elevated temperature properties*
- *Part 3: Nickel steels with specified low temperature properties*
- *Part 4: Weldable fine grain steels with high proof strength*
- *Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels.*

Annex C provide details about significant changes to the versions EN 10222-1:1998.

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

1 Scope

This Part of this European Standard specifies the general technical delivery conditions for open die steel forgings, ring rolled products and forged bars for pressure purposes.

NOTE Once this standard is published in the EU Official Journal (OJEU) under Directive 2014/68/EU, presumption of conformity to the Essential Safety Requirements (ESRs) of Directive 2014/68/EU is limited to technical data of materials in this standard and does not presume adequacy of the material to a specific item of equipment. Consequently, the assessment of the technical data stated in this material standard against the design requirements of this specific item of equipment to verify that the ESRs of Directive 2014/68/EU are satisfied, needs to be done. The series EN 10222-1 to EN 10222-5 is structured so that the data related to different materials is in the part allocated for that material. The presumption of conformity to the Essential Safety Requirements of Directive 2014/68/EU depends on both the text in part 1 and the data in part 2, 3, 4 or 5.

General information on technical delivery conditions is given in EN 10021.

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

EN 10021:2006, *General technical delivery conditions for steel products*

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

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

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

EN 10079:2007, *Definition of steel products*

EN 10168:2004, *Steel products - Inspection documents - List of information and description*

EN 10204:2004, *Metallic products - Types of inspection documents*

EN 10222-2:2017, *Ferritic and martensitic steels with specified elevated temperature properties*

EN 10222-3:2017, *Nickel steels with specified low temperature properties*

EN 10222-4:2017, *Weldable fine grain steels with high proof strength*

EN 10222-5:2017, *Martensitic, austenitic and austenitic-ferritic stainless steels*

EN 10228-1:2016, *Non-destructive testing of steel forgings - Part 1: Magnetic particle inspection*

EN 10228-2:2016, *Non-destructive testing of steel forgings - Part 2: Penetrant testing*

EN 10228-3:2016, *Non-destructive testing of steel forgings - Part 3: Ultrasonic testing of ferritic or martensitic steel forgings*

EN 10228-4:2016, *Non-destructive testing of steel forgings - Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings*

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EN ISO 148-1:2016, *Metallic materials - Charpy pendulum impact test - Part 1: Test method (ISO 148-1:2016)*

EN ISO 377:2013, *Steel and steel products - Location and preparation of samples and test pieces for mechanical testing (ISO 377:2013, Corrected version 2015-06-01)*

EN ISO 3651-2:1998, *Determination of resistance to intergranular corrosion of stainless steels - Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels - Corrosion test in media containing sulfuric acid (ISO 3651-2:1998)*

EN ISO 6892-1:2016, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1:2016)*

EN ISO 6892-2:2011, *Metallic materials - Tensile testing - Part 2: Method of test at elevated temperature (ISO 6892-2:2011)*

EN ISO 9606-1:2013, *Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1:2012 including Cor 1:2012)*

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

EN ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607:2003)*

EN ISO 15609-1:2004, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15614-1:2004, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 10020:2000, EN 10021:2006, EN 10052:1993, EN 10079:2007 and the following apply.

3.1

batch

forgings of similar dimensions from the same cast, made by the same forging procedure and from the same heat treatment charge

3.2

purchaser

person or organization that orders products in accordance with this European Standard

Note 1 to entry The purchaser is not necessarily, but may be, a manufacturer of pressure equipment in accordance with the EU Directive listed in Annex ZA.

Note 2 to entry Where a purchaser has responsibilities under this EU Directive, this standard will provide a presumption of conformity with the essential requirements of the Directive so identified in Annex ZA.

4 Classification and designation

4.1 Classification

The classification of the steel grades in accordance with EN 10020 is given in the specific parts of the EN 10222 series.

4.2 Designation

The steel grades specified in the individual parts of the EN 10222 series are designated with steel names and steel numbers. The steel names have been allocated in accordance with EN 10027-1. The corresponding steel numbers have been allocated in accordance with EN 10027-2.

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 enquiry and order:

- a) the quantity of forgings required;
- b) the forging dimensions, or the drawing number(s) containing the dimensions, tolerances on dimensions, shape and surface finish, to which the forgings shall conform;
- c) number of the relevant part of this European Standard;
- d) steel name or steel number of the material of which the forgings are made (see Clause 4);
- e) delivery condition, where alternatives are possible or where it differs from those specified in the other parts of the EN 10222 series;
- f) the type of inspection document in accordance with EN 10204:2004 (see 7.1.1);
- g) the extent of dimensional inspection and visual testing for batches including more than 25 pieces.

5.2 Options

A number of options are specified in this part of the EN 10222 series and listed below. If the purchaser does not indicate a wish to implement any of these options at the time of enquiry and order, the products shall be supplied in accordance with the basic specification (see 5.1).

- 1) Steelmaking process (see 6.1.1);
- 2) Hot working process and degree of hot working (see 6.2.1);
- 3) Information on the forging procedure and the calculated forging reduction (see 6.2.2);
- 4) Limits on residual incidental elements other than those specified in the relevant part of the EN 10222 series (see 6.4.1.3 and 6.4.1.4);
- 5) maximum carbon equivalent value for steel grades of EN 10222-2 and EN 10222-4 (see 6.4.1.5);
- 6) greater tolerances to chemical composition (see 6.4.2.2);
- 7) content of residual elements (see 6.4.2.3);

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- 8) magnetic particle testing and/or penetrant testing (see 6.7, Table 1, 9.6 and 9.7);
- 9) requirements and test conditions for the ultrasonic test (see 6.8, Table 1, and 9.8);
- 10) optional tests (see Table 1);
- 11) deviating test unit (see 8.1.1 and/or 8.1.4);
- 12) test temperature for the tensile test at elevated temperature (see 9.4);
- 13) deviating test temperature for the impact test (see 9.5, paragraph 2);
- 14) deviating of direction of test pieces for impact test (see 9.5, paragraph 4);
- 15) deviating extent of testing and test duration for the hydrostatic test (see 9.10);
- 16) simulated post-weld heat treatment of samples (see 6.3.2);
- 17) verification of the surface condition (see 6.7.3);
- 18) sample location for complex pieces (see 8.1.5);
- 19) if applicable, lowered number of the test units of a batch or part of a batch (of final product) (see Table 2, footnote a);
- 20) optional impact test for austenitic stainless steels according to EN 10222-5 (see Table 1).

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6 Requirements**6.1 Steelmaking**

6.1.1 The steel shall be produced by an electric process or one of the basic oxygen processes.

Specific requirements for the steelmaking process may be agreed at the time of the enquiry and order.

6.1.2 The steel shall be fully killed.

6.2 Manufacture of the product**6.2.1 Hot working**

The choice of hot working process shall be at the discretion of the manufacturer.

For the hot working process and/or the degree of hot working, special agreements may be made at the time of the enquiry and order.

6.2.2 Forging reduction

The forging shall receive a sufficient forging reduction to completely consolidate the forging and remove the cast structure.

Information on the forging procedure, on the calculated forging reduction and the rules for calculating this ratio may be agreed at the time of enquiry and order.

6.3 Heat treatment

6.3.1 General

The forgings shall be heat treated as specified in the relevant part of the EN 10222 series, unless otherwise agreed there for the relevant steel grade at the time of enquiry and order.

6.3.2 Simulated post-weld heat treatment of samples

If the purchaser intends to incorporate the forging or fabrication in a welded vessel or structure and applies a post-weld heat treatment, samples that have received heat treatment in accordance with 6.3.1 shall also be subjected to a heat treatment that simulates the post-weld heat treatment to be applied to the welded vessel or structure by the purchaser. The post-weld heat treatment and the mechanical properties to be obtained after testing these samples in accordance with Clause 9 shall be agreed between the purchaser and the manufacturer.

NOTE 1 If any additional or unforeseen post-weld heat treatment is applied by the purchaser, the heat treatment temperature cannot exceed the temperature of the final heat treatment, i.e. either tempering or post-weld heat treatment applied to the samples.

NOTE 2 If required, the purchaser can be supplied with additional test samples cut from the forging after heat treatment in accordance with 6.3.1 with a view to subjecting these samples to additional heat treatment and subsequent mechanical testing for information purposes.

NOTE 3 The samples for simulation of post-weld heat treatment exclude test materials supplied for welding tests and can receive the heat treatments referred to in 6.3.1.

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6.4 Chemical composition

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6.4.1 Cast analysis <https://standards.iteh.ai/catalog/standards/sist/ae3bc2c2-7661-4aea-b156-4e8129090089/sist-en-10222-1-2017>

6.4.1.1 The cast analysis reported by the steel producer shall apply and comply with the requirements of the individual parts of the EN 10222 series

6.4.1.2 Elements not listed in the composition tables in the relevant part of the EN 10222 series shall not be intentionally added without the agreement of the purchaser except for finishing the cast.

6.4.1.3 Limits on residual incidental elements other than those specified in the relevant part of the EN 10222 series may be agreed at the time of enquiry and order.

6.4.1.4 If so agreed at the time of enquiry and order, the residual elements specified in the order shall be declared on the manufacturer's certificate.

6.4.1.5 If so agreed at the time of enquiry and order, forgings in accordance with EN 10222-2 and EN 10222-4 shall be supplied with a specific maximum carbon equivalent value. The relevant value is based upon cast analysis. The carbon equivalent value (CEV) shall be calculated using the following formula:

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \% \quad (1)$$

6.4.2 Product analysis

6.4.2.1 The permissible product analysis tolerances on the limiting values given for the cast analysis are specified in the individual parts of the EN 10222 series. Further restriction to composition may be imposed by the purchaser by the use of the carbon equivalent values (see 6.4.1.5).