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Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties

bsi.

National foreword

This British Standard is the UK implementation of EN 10273:2016. It supersedes BS EN 10273:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/107, Steels for Pressure Purposes.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties

Barres laminées à chaud en acier soudable pour appareils à pression, avec des caractéristiques spécifiées aux températures élevées

Warmgewalzte schweißgeeignete Stäbe aus Stahl für Druckbehälter mit festgelegten Eigenschaften bei erhöhten Temperaturen

This European Standard was approved by CEN on 15 April 2016.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 10273:2016) has been prepared by Technical Committee ECISS/TC 107 “Steels for pressure purposes”, 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of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

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

This document supersedes EN 10273:2007.

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 Directive 2014/68/EU.

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

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

1 Scope

This European Standard specifies the technical delivery conditions for hot rolled weldable steel bars for the construction of pressure equipment for use at elevated temperatures with thicknesses given in Table 5.

The general technical delivery conditions in EN 10021 also apply to products supplied in accordance with this European Standard.

NOTE Once this European Standard is published in the Official Journal of the European Union (OJEU) under Directive 2014/68/EC, presumption of conformity to the Essential Safety Requirements (ESRs) of Directive 2014/68/EC is limited to technical data of materials in this European 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 the Pressure Equipment Directive are satisfied, needs to be done. .

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, *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 10058, *Hot rolled flat steel bars for general purposes — Dimensions and tolerances on shape and dimensions*

EN 10059, *Hot rolled square steel bars for general purposes — Dimensions and tolerances on shape and dimensions*

EN 10060, *Hot rolled round steel bars for general purposes — Dimensions and tolerances on shape and dimensions*

EN 10061, *Hot rolled hexagon steel bars for general purposes — Dimensions and tolerances on shape and dimensions*

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 10221:1995, *Surface quality classes for hot-rolled bars and rods — Technical delivery conditions*

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

EN ISO 148-1:2010, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2009)*

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

EN ISO 6892-1:2009, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)*

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

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

CEN/TR 10261, *Iron and steel — European standards for the determination of chemical composition*

3 Terms and definitions

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

3.1
normalizing rolling
rolling process in which the final deformation process is carried out in a certain temperature range leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after normalizing

Note 1 to entry: The symbol for this delivery condition and for the normalized condition is N.

Note 2 to entry: Definition is deviating from EN 10052:1993.

3.2
quenching and tempering
[as defined in EN 10052:1993]

Note 1 to entry: Quenching and tempering (symbol QT) also includes direct quenching plus tempering.

3.3
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.

4 Dimensions and tolerances on dimensions

The nominal dimensions and tolerances on dimensions shall be agreed at the time of enquiry and order with reference to the relevant dimensional standard EN 10058, EN 10059, EN 10060 or EN 10061.

5 Calculation of mass

A density of 7,85 kg/dm^3 shall be used as the basis for the calculation of the nominal mass from the nominal dimensions of all steel grades.

6 Classification and designation

6.1 Classification

According to EN 10020 the steel grades P235GH, P250GH, P265GH, P295GH, P355GH, P275NH and P355NH are non-alloy quality steels. All other steel grades are alloy special steels.

6.2 Designation

The steel grades are designated with steel names in accordance with EN 10027-1. The corresponding steel numbers have been allocated in accordance with EN 10027-2.

7 Information to be supplied by the purchaser

7.1 Mandatory information

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

a) quantity required;

b) shape of bars;

c) nominal dimensions of the product;

d) European Standard specifying tolerances on dimensions, shape and mass (see Clause 4 and Clause 5);

e) number of this European Standard, i.e. EN 10273;

f) steel name or number;

g) delivery condition (see 8.2);

h) inspection document to be issued (see 9.1.1).

7.2 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 products shall be supplied in accordance with the basic specification (see 7.1).

1) specification of the steelmaking process (see 8.1);

2) deviating delivery condition (see 8.2.1 and 8.2.3);

3) specification of a higher minimum chromium content (see Table 2, footnote h);

4) specification of a lower maximum copper content and a maximum tin content (see Table 2, footnote i);

5) specification of a maximum carbon equivalent value (see 8.3.3 and Table 4);

6) special surface condition (see 8.5);

7) requirements for and verification of internal soundness (see 8.6);

8) delivery of data on suitable welding conditions (see 8.7.2);

9) product analysis (see Table 8, 10.1.1 and 11.1);

10) verification of proof strength $R_{p0,2}$ at an agreed elevated temperature (see Table 8 and 11.3);

11) verification of the impact energy at a temperature other than +20 °C (see 11.4);

12) special marking requirements (see 12.2).

7.3 Examples for ordering

EXAMPLE 1 5 t bars, dimensional tolerances as specified in EN 10059, 50 mm x 50 mm, supplied in fixed lengths of 10 000 mm, made of the steel grade 16Mo3 (steel number 1.5415) in accordance with EN 10273, with inspection document 3.1 as specified in EN 10204:

5 t bars EN 10059 — 50 × 50 × 10000(F) – steel EN 10273 — 16Mo3 – inspection document 3.1

or

5 t bars EN 10059 — 50 × 50 × 10000(F) – steel EN 10273 — 1.5415 inspection document 3.1

EXAMPLE 2 2 t rounds, dimensional tolerances as specified in EN 10060, 75 mm diameter, supplied in exact lengths of 5 000 mm made of a steel grade 16Mo3 (steel number 1.5415) in accordance with EN 10273, surface quality class B in accordance with EN 10221; inspection document 3.1 as specified in EN 10204:

2 t rounds EN 10060 — 75x5000(E) – steel EN 10273 — 16Mo3 – EN 10221 — class B – inspection document 3.1

or

2 t rounds EN 10060 — 75x5000(E) – steel EN 10273 — 1.5415 EN 10221 — class B – inspection document 3.1

8 Requirements

8.1 Steelmaking process

Unless a special steelmaking process is agreed at the time of enquiry and order, the steelmaking process shall be at the discretion of the manufacturer.

8.2 Delivery condition

8.2.1 Unless otherwise agreed at the time of enquiry and order, the products covered by this European Standard shall be supplied in the delivery condition given in Table 5.

8.2.2 Normalizing may be replaced by normalizing rolling for steel grades P235GH, P250GH, P265GH, P295GH, P355GH, P275NH, P355NH and P460NH. This means that the requirements have to be met even after subsequent normalizing after delivery (see 3.1).

In the case of the grade P460NH delayed cooling or additional tempering may be necessary for small sections and in special cases.

8.2.3 Products made of steel grades P235GH, P250GH, P265GH, P295GH, P355GH, P275NH, P355NH, P460NH and 16Mo3 may also be delivered in the untreated condition if so agreed. (Annex A contains for the grades P...GH as well as for 16Mo3, 13CrMo4-5, 10CrMo9-10 and 11CrMo9-10 heat treatment information for the purchaser).

In these cases, the test pieces shall be tested in the delivery condition as indicated in Table 5.

8.3 Chemical composition

8.3.1 The cast analysis reported by the steel producer shall apply and comply with the requirements of Table 2.

8.3.2 The product analysis shall not deviate from the specified values for the cast analysis as specified in Table 2 by more than the values given in Table 3.

8.3.3 A maximum value for the carbon equivalent may be agreed upon at the time of enquiry and order for steel grades P235GH, P265GH, P295GH, P355GH, P275NH and P355NH. In this case, for the grades P275NH and P355NH the values given in Table 4 shall apply.

8.4 Mechanical properties

The values given in Tables 5 to 7 shall apply for the specified heat treatment conditions and dimensions.

NOTE Unless otherwise noted, the $R_{p0,2}$ values in Table 7 were derived in accordance with EN 10314.

If by agreement (see 8.2.3) the products are supplied in a non-heat treated condition, the mechanical properties shall be obtainable from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

Annex B gives preliminary data for the purchaser about creep strain and creep rupture properties of some steel grades covered by this European Standard.

8.5 Surface condition

Slight surface imperfections, inherent in the production process, are permitted.

If requirements for the surface condition are necessary, these may be agreed at the time of enquiry and order, where appropriate on the basis of EN 10221.

8.6 Internal soundness

The products shall be sound and free from defects that preclude their intended use.

Where appropriate, requirements relating to internal soundness together with the conditions for their verification (see 11.5.3 and Table 8) may be agreed at the time of enquiry and order.

8.7 Weldability

8.7.1 The steels specified in this European Standard are suitable for welding processes in current use (see NOTES 1 to 3 in 8.7.2). Information on welding is given in EN 1011-1 and EN 1011-2 (see Bibliography).

8.7.2 The manufacturer shall, if so agreed at the time of enquiry and order, provide the purchaser with data on suitable welding conditions determined on the basis of weld procedure tests.

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

— amount of diffusible hydrogen in the weld metal;

— microstructure of the heat affected zone;

— residual stress concentrations in the welded joint.

NOTE 2 When using recommendations as laid down, for example in EN 1011–2, the recommended welding conditions of the steel grades can be determined depending on the product diameter or thickness, the applied welding energy, the design requirements, the electrode efficiency, the welding process and the weld metal properties

NOTE 3 Inappropriate post weld heat treatment (PWHT) conditions may decrease the mechanical properties. It is therefore recommended that the purchaser seeks, at the time of enquiry and order, the advice of the manufacturer and considers, where appropriate, the verification of the mechanical properties on simulated post weld heat treated samples.

9 Inspection

9.1 Types of inspection and inspection documents

9.1.1 The compliance with the requirements of the order shall be checked for products in accordance with this European Standard by specific inspection.

The purchaser shall specify the required type of inspection document (3.1 or 3.2) in accordance with EN 10204:2004.

If an inspection document 3.1 is specified, the manufacturer shall operate a quality assurance system, certified by a competent Body established as legal entity within the European Union and having undergone a specific assessment for materials.

If an inspection certificate 3.2 is specified, the purchaser shall notify the manufacturer of the name and address of the organization or person who is to carry out the inspection and produce the inspection document. It shall also be agreed which party shall issue the certificate.

9.1.2 The inspection certificate 3.1 or 3.2 shall include, in accordance with EN 10168:2004, the following codes and information:

A	Commercial transactions and parties involved;
B	Description of products to which the inspection certificate applies (including tempering temperature in the case of quenched and tempered or tempered products);
C03	Test temperature;
C10-C13	Tensile test at room temperature and, if applicable, at elevated temperatures;
C40-C43	Impact test, if applicable;
C50-C69	Hardness test, if applicable;
C70	Steelmaking process;
C71-C92	Cast analysis and, if applicable, product analysis;
D01	Marking and dimensional checking and, if applicable, verification of the surface quality;
D02-D99	Non-destructive tests, if applicable;
Z	Validation.

9.2 Tests to be carried out

The mandatory and optional tests to be carried out, the size of the test units, and the number of samples and test pieces to be taken are specified in 10.1 and Table 8.

9.3 Retests, sorting and reprocessing

For retests, sorting and reprocessing the requirements of EN 10021 shall apply.

10 Sampling

10.1 Frequency of testing

10.1.1 For the product analysis, unless otherwise agreed, one sample per cast shall be taken for determining the elements indicated with numerical values for the particular steel grade in Table 2. The permissible tolerances given in Table 3 shall apply.

10.1.2 The test unit for the tensile test at room temperature and the impact test shall be the batch of products or part thereof, at maximum 30 000 kg, coming from the same cast and having been heat treated in the same batch and in the same heat treatment facility[1)].

The maximum diameter may be 1,25 times the smallest diameter in the batch, provided all diameters are within the same diameter range as specified in the corresponding tables of this European Standard (see Tables 5 and 7).

For tensile test at elevated temperature, the test unit shall be the cast.

One sample shall be taken for preparing the test pieces indicated in 10.2.2 from each test unit.

10.2 Selection and preparation of samples and test pieces

10.2.1 Sampling and sample preparation

10.2.1.1 Sampling and sample preparation shall be in accordance with the requirements of EN ISO 14284 and EN ISO 377. In addition, the requirements in 10.2.1.3 shall apply to the mechanical tests.

10.2.1.2 If, following agreement (see 8.2.3), the products are not to be delivered in a delivery condition in accordance with Table 5, the samples shall be heat treated to the specified condition prior to the test.

10.2.1.3 The samples shall be taken in accordance with Table 9 for the tensile test at room temperature, the tensile test at elevated temperature and the impact test.

10.2.2 Preparation of test pieces for mechanical tests

10.2.2.1 Circular test pieces for the tensile test at room temperature in accordance with EN ISO 6892-1 and, where applicable, for the tensile test at elevated temperature in accordance with EN ISO 6892-2 shall be prepared.

10.2.2.2 Longitudinal V-notched test pieces in accordance with EN ISO 148-1 shall be prepared for the impact test. The axis of the notch of impact test pieces shall be perpendicular to the surface of the product.

11 Test methods

11.1 Chemical analysis

Unless otherwise agreed at the time of enquiry and order, the choice of a suitable physical or chemical analytical method for the product analysis shall be at the discretion of the manufacturer. In cases of

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1) In the case of a continuous furnace or in process annealing, a batch is the lot heat treated without intermission with the same process parameters.

dispute, the analysis shall be carried out by a laboratory approved by both parties. In this case, the analysis method to be used shall be agreed taking into account the relevant existing European Standards. The list of available European Standards is given in CEN/TR 10261.

11.2 Tensile test at room temperature

The tensile test at room temperature shall be carried out as specified in EN ISO 6892-1, using a proportional test piece of gauge length $L_0 = 5{,}65\sqrt{S_0}$ (S_0 = initial cross-sectional area of the gauge length).

The yield strength to be determined shall be the upper yield strength R_{eH} or, if this is not pronounced, the proof strength $R_{p0,2}$.

11.3 Tensile test at elevated temperature

The tensile test for verification of proof strength $R_{p0,2}$ at elevated temperature shall be determined as specified in EN ISO 6892-2.

Unless a test temperature for which values are specified has been agreed, the test shall be carried out at 300 °C.

11.4 Impact test

The impact test shall be carried out in accordance with EN ISO 148-1:2010 at 20 °C (unless otherwise agreed), on V-notched test pieces and by using a 2 mm striker (KV_2).

The minimum impact values given apply for the mean of three test pieces. One individual value may be lower than the specified value provided that it is not less than 70 % of this value.

If the above conditions are not met, an additional set of three test pieces shall be taken from the same sample and shall be tested. In order to regard the test unit as acceptable after testing the second set, the following requirements shall be met:

a) mean value of six tests shall be equal to or greater than the specified value;

b) not more than two of the six individual values shall be less than the specified value;

c) not more than one of the six individual values shall be less than 70 % of the specified value.

If these requirements are not met, the sample product shall be rejected and re-tests shall be carried out on the remainder of the test unit.

According to the dimensions of the products the size of the impact test piece shall be in accordance with the following table:

Table 1 — Size of the impact test pieces

Test piece size	**Round cross section**	**Rectangular cross section**
		Product width ≥ 10 mm
	Nominal diameter / Nominal thickness (mm)	
No test required	d < 12	b < 6
Standard test pieces or test pieces with reduced widths at the discretion of the manufacturer. The largest width possible has to be chosen.	12 ≤ d < 15	6 ≤ b < 12
Standard 10 mm x 10 mm test pieces	d ≥ 15	b ≥ 12

Where test pieces with reduces width are used, the minimum impact energy values given shall be reduced in proportion to the cross-sectional area of the test piece.

11.5 Other testing

11.5.1 The dimensions of the products shall be checked.

11.5.2 The surface condition of the products shall be checked for conformity with 8.5 by visual examination without optical aids or, at the discretion of the manufacturer, by an approved automated process.

11.5.3 If an ultrasonic test has been agreed for verification of internal soundness, the requirements of EN 10308 shall apply.

12 Marking

12.1 The products or the bundle or boxes shall be marked in a suitable way such that it is possible to determine the cast, the steel grade and the origin of the delivery (see Table 10).

12.2 Special marking may be agreed at the time of enquiry and order.

Table 2 — Chemical composition (cast analysis)

Steel grade		% by mass[a]																	
Steel name	Steel number	C	Si max.	Mn	P max.	S max.	Al_{total}	N max.	B max.	Cr	Cu max.	Mo	Nb max.	Ni max.	Ti max.	V max.	Zr max.	Nb+Ti+V max.	Cr+Cu+Mo+Ni max.
P235GH	1.0345	≤ 0,16	0,35	0,60 to 1,20	0,025	0,010	≥ 0,020	0,012[f]	—	≤ 0,30	0,30[i]	≤ 0,08	0,020	0,30	0,03	0,02	—	—	0,70
P250GH	1.0460	0,18 to 0,23	0,40	0,30 to 0,90	0,025	0,015	≥ 0,020	0,012[f]	—	≤ 0,30	0,30[i]	≤ 0,08	0,020	0,30	0,03	0,02	—	—	0,70
P265GH	1.0425	≤ 0,20	0,40	0,80 to 1,40	0,025	0,010	≥ 0,020	0,012[f]	—	≤ 0,30	0,30[i]	≤ 0,08	0,020	0,30	0,03	0,02	—	—	0,70
P295GH	1.0481	0,08 to 0,20	0,40	0,90 to 1,50	0,025	0,010	≥ 0,020	0,012[f]	—	≤ 0,30	0,30[i]	≤ 0,08	0,020	0,30	0,03	0,02	—	—	0,70
P355GH	1.0473	0,10 to 0,22	0,60	1,10 to 1,70	0,025	0,010	≥ 0,020	0,012[f]	—	≤ 0,30	0,30[i]	≤ 0,08	0,040	0,30	0,03	0,02	—	—	0,70
P275NH	1.0487	≤ 0,16	0,40	0,80 to 1,40	0,025	0,010	≥ 0,020[c]	0,012	—	≤ 0,30[g]	0,30[g]	≤ 0,08[g]	0,05	0,50	0,03	0,05	—	0,05	—
P355NH	1.0565	≤ 0,18	0,50	1,10 to 1,70	0,025	0,010	≥ 0,020[c]	0,012	—	≤ 0,30[g]	0,30[g]	≤ 0,08[g]	0,05	0,50	0,03	0,10	—	0,12	—
P460NH	1.8935	≤ 0,20	0,60	1,10 to 1,70	0,025	0,010	≥ 0,020[c]	0,025	—	≤ 0,30	0,70[j]	≤ 0,10	0,05	0,80	0,03	0,20[k]	—	0.22	—
P355QH[b]	1.8867	≤ 0,16	0,40	≤ 1,50	0,025	0,010	d	0,015	0,005	≤ 0,30	0,30[i]	≤ 0,25	0,05	0,50	0,03	0,06	0,05	—	—
P460QH[b]	1.8871	≤ 0,18	0,50	≤ 1,70	0,025	0,010	d	0,015	0,005	≤ 0,50	0,30[i]	≤ 0,50	0,05	1,00	0,03	0,08	0,05	—	—
P500QH[b]	1.8874	≤ 0,18	0,60	≤ 1,70	0,025	0,010	d	0,015	0,005	≤ 1,00	0,30[i]	≤ 0,70	0,05	1,50	0,05	0,08	0,15	—	—
P690QH[b]	1.8880	≤ 0,20	0,80	≤ 1,70	0,025	0,010	d	0,015	0,005	≤ 1,50	0,30[i]	≤ 0,70	0,06	2,50	0,05	0,12	0,15	—	—
16Mo3	1.5415	0,12 to 0,20	0,35	0,40 to 0,90	0,025	0,010	e	0,012	—	≤ 0,30	0,30	0,25 to 0,35	—	0,30	—	—		—	—
13CrMo4–5	1.7335	0,08 to 0,18	0,35	0,40 to 1,00	0,025	0,010	e	0,012	—	0,70[h] to 1,15	0,30	0,40 to 0,60	—	—	—	—		—	—
10CrMo9–10	1.7380	0,08 to 0,14	0,50	0,40 to 0,80	0,020	0,010	e	0,012	—	2,00 to 2,50	0,30	0,90 to 1,10	—	—	—	—		—	—
11CrMo9–10	1.7383	0,08 to 0,15	0,50	0,40 to 0,80	0,020	0,010	e	0,012	—	2,00 to 2,50	0,25	0,90 to 1,10	—	—	—	—		—	—

a Elements not listed in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate measures shall be taken to prevent the addition from scrap or other materials used in steelmaking of these elements which may affect the mechanical properties and usability.

b The manufacturer may add one or several alloying element(s) up to the maximum values specified in the order as a function of the product thickness and the steelmaking conditions in order to attain the specified properties. The chemical composition range for each manufacturer's analysis shall be given in the offer and confirmation of the order.

c If nitrogen is additionally fixed by niobium, titanium or vanadium, the specification for the minimum aluminium content does not apply. If only aluminium is used for nitrogen binding, a ratio $Al/N \geq 2$ shall apply.

d The percentage of grain refining elements shall be at least 0,015 %. Aluminium is also included in these elements. The minimum content of 0,015 % applies to dissolved aluminium. This value is regarded as attained if the total aluminium content is at least 0,018 %. In cases of dispute, the dissolved aluminium content shall be determined.

e The Al content of the cast shall be determined and given in the inspection document.

f A ratio $Al/N \geq 2$ shall apply.

g The sum of the percentage by mass of the three elements chromium, copper and molybdenum shall not exceed 0,45 %.

h If resistance to pressurized hydrogen is of importance, a minimum content of 0,80 % Cr should be agreed at the time of enquiry and order.

i For reasons of hot formability, a lower maximum copper content and a maximum tin content may be agreed at the time of enquiry and order.

j If the percentage by mass of copper exceeds 0,30 %, the percentage by mass of nickel shall be at least half the percentage by mass of copper.

k For V contents > 0,10 % special precautions should be taken to avoid reheat cracking.

Table 3 — Permissible product analysis tolerances on the limiting values given in Table 2 for the cast analysis

Element	Specified value in the cast analysis according to Table 2 % by mass	Permissible deviation[a] of the product analysis % by mass
C	≤ 0,23	±0,02
Si	≤ 0,80	±0,05
Mn	≥ 0,30 to ≤ 1,70	+ 0,10 - 0,05
P	≤ 0,015	+ 0,003
	> 0,015 to ≤ 0,025	+ 0,005
S	≤ 0,015	+ 0,003
Al_{total}	≥ 0,020	±0,005
B	≤ 0,005	±0,000 5
N	≤ 0,025	+ 0,002
Cr	≤ 1,00	±0,05
	> 1,00 to ≤ 2,50	±0,10
Cu	≤ 0,30	±0,05
	> 0,30 to ≤ 0,70	±0,07
Mo	≤ 0,35	±0,03
	> 0,35 to ≤ 1,10	+ 0,04
Nb	≤ 0,06	±0,01
Ni	≤ 1,00	+ 0,05
	> 1,00 to ≤ 2,50	±0,10
Cr+Cu+Mo+Ni	≤ 0,70	+ 0,05
Ti	≤ 0,05	+ 0,01
V	≤ 0,05	±0,01
	> 0,05 to ≤ 0,20	±0,03
Zr	≤ 0,15	+ 0,01

[a] If several product analyses are carried out on one cast, and the contents of an individual element determined lie outside the permissible range of the chemical composition specified for the cast analysis then it is only allowed to exceed the permissible maximum value or fall short of the permissible minimum value, but not both for one cast.

Table 4 — Maximum carbon equivalent value (if agreed at the time of enquiry and order, see 8.3.3)

Steel grade		Carbon equivalent (CEV)[a] % max. for specified diameter or thickness in mm		
Steel name	Steel number	≤ 70	> 70 to ≤ 100	> 100 to ≤ 150
P275NH	1.0487	0,40	0,40	0,42
P355NH	1.0565	0,43	0,45	0,45

a $CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$

Table 5 — Mechanical properties at room temperature

Steel grade		Usual delivery condition[a]	Diameter *d* or thickness *b* mm	Yield strength R_{eH}[b] MPa min.	Tensile strength R_m MPa	Elongation after fracture A (longitudinal) % min.
Steel name	Steel number					
P235GH	1.0345	+N	≤ 16	235	360 to 480	25
			16 < *(d or b)* ≤ 40	225		
			40 < *(d or b)* ≤ 60	215		
			60 < *(d or b)* ≤ 100	200		24
			100 < *(d or b)* ≤ 150	185	350 to 480	
P250GH	1.0460	+ N	≤ 50	250	410 to 540	25
			50 < *(d or b)* ≤ 100	240		
			100 < *(d or b)* ≤ 150	230		
P265GH	1.0425	+N	≤ 16	265	410 to 530	23
			16 < *(d or b)* ≤ 40	255		
			40 < *(d or b)* ≤ 60	245		
			60 < *(d or b)* ≤ 100	215		22
			100 < *(d or b)* ≤ 150	200	400 to 530	
P295GH	1.0481	+N	≤ 16	295	460 to 580	22
			16 < *(d or b)* ≤ 40	290		
			40 < *(d or b)* ≤ 60	285		
			60 < *(d or b)* ≤ 100	260		21
			100 < *(d or b)* ≤ 150	235	440 to 570	
P355GH	1.0473	+N	≤ 16	355	510 to 650	21
			16 < *(d or b)* ≤ 40	345		
			40 < *(d or b)* ≤ 60	335		
			60 < *(d or b)* ≤ 100	315	490 to 630	20
			100 < *(d or b)* ≤ 150	295	480 to 630	
P275NH	1.0487	+N	≤ 16	275	390 to 510	24
			16 < *(d or b)* ≤ 35	275		
			35 < *(d or b)* ≤ 50	265		
			50 < *(d or b)* ≤ 70	255		
			70 < *(d or b)* ≤ 100	235	370 to 490	23
			100 < *(d or b)* ≤ 150	225	350 to 470	

Steel grade		Usual delivery condition[a]	Diameter *d* or thickness *b* mm	Yield strength R_{eH}[b] MPa min.	Tensile strength R_m MPa	Elongation after fracture *A* (longitudinal) % min.
Steel name	**Steel number**					
P355NH	1.0565	+N	≤ 16	355	490 to 630	22
			16 < *(d or b)* ≤ 35	355		
			35 < *(d or b)* ≤ 50	345		
			50 < *(d or b)* ≤ 70	325		
			70 < *(d or b)* ≤ 100	315	470 to 610	21
			100 < *(d or b)* ≤ 150	295	450 to 590	
P460NH	1.8935	+N[c]	≤ 16	460	570 to 720	17
			16 < *(d or b)* ≤ 35	450		
			35 < *(d or b)* ≤ 50	440		
			50 < *(d or b)* ≤ 70	420		
			70 < *(d or b)* ≤ 100	400	540 to 710	16
			100 < *(d or b)* ≤ 150	380	520 to 690	
P355QH	1.8867	+QT	≤ 50	355	490 to 630	22
			50 < *(d or b)* ≤ 100	335		
			100 < *(d or b)* ≤ 150	315	450 to 590	
P460QH	1.8871	+QT	≤ 50	460	550 to 720	19
			50 < *(d or b)* ≤ 100	440		
			100 < *(d or b)* ≤ 150	400	500 to 670	
P500QH	1.8874	+QT	≤ 50	500	590 to 770	17
			50 < *(d or b)* ≤ 100	480		
			100 < *(d or b)* ≤ 150	440	540 to 720	
P690QH	1.8880	+QT	≤ 50	690	770 to 940	14
			50 < *(d or b)* ≤ 100	670		
			100 < *(d or b)* ≤ 150	630	720 to 900	
16Mo3	1.5415	+N[d]	≤ 16	275	440 to 590	24
			16 < *(d or b)* ≤ 40	270		
			40 < *(d or b)* ≤ 60	260		23
			60 < *(d or b)* ≤ 100	240	430 to 580	22
			100 < *(d or b)* ≤ 150	220	420 to 570	19
13CrMo4–5	1.7335	+NT	≤ 16	300	450 to 600	20
			16 < *(d or b)* ≤ 60	295		
		+NT or +QA or +QL	60 < *(d or b)* ≤ 100	275	440 to 590	19
		+QL	100 < *(d or b)* ≤ 150	255	430 to 580	

Steel grade		Usual delivery condition[a]	Diameter *d* or thickness *b* mm	Yield strength R_{eH}[b] MPa min.	Tensile strength R_m MPa	Elongation after fracture *A* (longitudinal) % min.
Steel name	**Steel number**					
10CrMo9–10	1.7380	+NT	≤ 16	310	480 to 630	18
			16 < *(d or b)* ≤ 40	300		
			40 < *(d or b)* ≤ 60	290		
		+NT or +QA or +QL	60 < *(d or b)* ≤ 100	270	470 to 620	17
			100 < *(d or b)* ≤ 150	250	460 to 610	
11CrMo9–10	1.7383	+NT or +QA or +QL	≤ 60	310	520 to 670	18
		+QL	60 < *(d or b)* ≤ 100			17

[a] +N: normalized (including normalizing rolled; see 8.2.2); +QT: quenched and tempered; +NT: normalized and tempered; +QA: air quenched and tempered, +QL: liquid quenched and tempered.

[b] If the upper yield strength (ReH) is not pronounced, this shall be replaced by determination of the 0,2 % proof strength ($Rp_{0,2}$). In this case, 10 MPa lower minimum values apply for $Rp_{0,2}$.

[c] See 8.2.2 (second paragraph).

[d] This steel grade may, at the discretion of the manufacturer, also be supplied in the condition +NT.

Table 6 — Impact energy values

Steel grade		Minimum impact energy value KV_2 (longitudinal) *J* at temperatures in °C of		
Steel name	**Steel number**	**–20**	**0**	**+20**
P235GH	1.0345	27	40	47
P250GH	1.0460			
P265GH	1.0425			
P295GH	1.0481			
P355GH	1.0473			
P275NH	1.0487	40	47	55
P355NH	1.0565			
P460NH	1.8935			
P355QH	1.8867	40	60	80
P460QH	1.8871			
P500QH	1.8874			
P690QH	1.8880			
16Mo3	1.5415	_ a	_ a	40
13CrMo4–5	1.7335			
10CrMo9–10	1.7380			
11CrMo9–10	1.7383			

[a] Values may be agreed at time of enquiry and order.

Table 7 — Minimum proof strength *R*p0.2 at elevated temperatures[a]

Steel grade		Diameter *d* or thickness *b*[b]	Proof strength $R_{p0,2}$ MPa min. at a temperature in °C of									
Steel name	**Steel number**	**mm**	**50**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**
P235GH[c]	1.0345	≤ 16	227	214	198	182	167	153	142	133	–	–
		16 < (*d or b*) ≤ 40	218	205	190	174	160	147	136	128	–	–
		40 < (*d or b*) ≤ 60	208	196	181	167	153	140	130	122	–	–
		60 < (*d or b*) ≤ 100	193	182	169	155	142	130	121	114	–	–
		100 < (*d or b*) ≤ 150	179	168	156	143	131	121	112	105	–	–
P250GH[c]	1.0460	≤ 50	242	237	216	190	170	150	130	110	90	–
		50 < (*d or b*) ≤ 100	234	230	210	185	165	145	125	100	80	–
		100 < (*d or b*) ≤ 150	224	220	200	175	155	135	115	90	70	–
P265GH[c]	1.0425	≤ 16	256	241	223	205	188	173	160	150	–	–
		16 < (*d or b*) ≤ 40	247	232	215	197	181	166	154	145	–	–
		40 < (*d or b*) ≤ 60	237	223	206	190	174	160	148	139	–	–
		60 < (*d or b*) ≤ 100	208	196	181	167	153	140	130	122	–	–
		100 < (*d or b*) ≤ 150	193	182	169	155	142	130	121	114	–	–
P295GH[c]	1.0481	≤ 16	285	268	249	228	209	192	178	167	–	–
		16 < (*d or b*) ≤ 40	280	264	244	225	206	189	175	165	–	–
		40 < (*d or b*) ≤ 60	276	259	240	221	202	186	172	162	–	–
		60 < (*d or b*) ≤ 100	251	237	219	201	184	170	157	148	–	–
		100 < (*d or b*) ≤ 150	227	214	198	182	167	153	142	133	–	–
P355GH[c]	1.0473	≤ 16	343	323	299	275	252	232	214	202	–	–
		16 < (*d or b*) ≤ 40	334	314	291	267	245	225	208	196	–	–
		40 < (*d or b*) ≤ 60	324	305	282	259	238	219	202	190	–	–
		60 < (*d or b*) ≤ 100	305	287	265	244	224	206	190	179	–	–
		100 < (*d or b*) ≤ 150	285	268	249	228	209	192	178	167	–	–
P275NH[d]	1.0487	≤ 16	266	250	232	213	195	179	166	156	–	–
		16 < (*d or b*) ≤ 40	256	241	223	205	188	173	160	150	–	–
		40 < (*d or b*) ≤ 60	247	232	215	197	181	166	154	145	–	–
		60 < (*d or b*) ≤ 100	227	214	198	182	167	153	142	133	–	–
		100 < (*d or b*) ≤ 150	218	205	190	174	160	147	136	128	–	–
P355NH[d]	1.0565	≤ 16	343	323	299	275	252	232	214	202	–	–
		16 < (*d or b*) ≤ 40	334	314	291	267	245	225	208	196	–	–
		40 < (*d or b*) ≤ 60	324	305	282	259	238	219	202	190	–	–
		60 < (*d or b*) ≤ 100	305	287	265	244	224	206	190	179	–	–
		100 < (*d or b*) ≤ 150	295	277	257	236	216	199	184	173	–	–
P460NH[d]	1.8935	≤ 16	445	419	388	356	326	300	278	261	–	–
		16 < (*d or b*) ≤ 40	430	405	375	345	316	290	269	253	–	–
		40 < (*d or b*) ≤ 60	416	391	362	333	305	281	260	244	–	–
		60 < (*d or b*) ≤ 100	387	364	337	310	284	261	242	227	–	–
		100 < (*d or b*) ≤ 150	368	346	320	294	270	248	230	216	–	–
P355QH	1.8867	≤ 50	340	310	285	260	235	215	–	–	–	–
		50 < (*d or b*) ≤ 100	320	290	265	240	215	195	–	–	–	–
		100 < (*d or b*) ≤ 150	280	250	225	200	175	155	–	–	–	–

Steel grade		Diameter d or thickness b[b]	Proof strength $R_{p0,2}$ MPa min. at a temperature in °C of									
Steel name	**Steel number**	**mm**	**50**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**
P460QH	1.8871	≤ 50	445	425	405	380	360	340	–	–	–	–
		50 < (d or b) ≤ 100	425	405	385	360	340	320	–	–	–	–
		100 < (d or b) ≤ 150	385	365	345	320	300	280	–	–	–	–
P500QH	1.8874	≤ 50	490	470	450	420	400	380	–	–	–	–
		50 < (d or b) ≤ 100	470	450	430	400	380	360	–	–	–	–
		100 < (d or b) ≤ 150	430	410	390	360	340	320	–	–	–	–
P690QH	1.8880	≤ 50	670	645	615	595	575	570	–	–	–	–
		50 < (d or b) ≤ 100	650	625	595	575	555	550	–	–	–	–
		100 < (d or b) ≤ 150	610	585	555	535	515	510	–	–	–	–
16Mo3	1.5415	≤ 16	273	264	250	233	213	194	175	159	147	141
		16 < (d or b) ≤ 40	268	259	245	228	209	190	172	156	145	139
		40 < (d or b) ≤ 60	258	250	236	220	202	183	165	150	139	134
		60 < (d or b) ≤ 100	238	230	218	203	186	169	153	139	129	123
		100 < (d or b) ≤ 150	218	211	200	186	171	155	140	127	118	113
13CrMo4–5	1.7335	≤ 16	294	285	269	252	234	216	200	186	175	164
		16 < (d or b) ≤ 60	285	275	260	243	226	209	194	180	169	159
		60 < (d or b) ≤ 100	265	256	242	227	210	195	180	168	157	148
		100 < (d or b) ≤ 150	250	242	229	214	199	184	170	159	148	139
10CrMo9–10	1.7380	≤ 16	288	266	254	248	243	236	225	212	197	185
		16 < (d or b) ≤ 40	279	257	246	240	235	228	218	205	191	179
		40 < (d or b) ≤ 60	270	249	238	232	227	221	211	198	185	173
		60 < (d or b) ≤ 100	260	240	230	224	220	213	204	191	178	167
		100 < (d or b) ≤ 150	250	237	228	222	219	213	204	191	178	167
11CrMo9–10[d]	1.7383	≤ 100	–	–	–	–	255	235	225	215	205	195

a The values correspond to the lower band of the relevant trend curve determined in accordance with EN 10314 with a confidence limit of about 98 % (2 s).

b Delivery condition as given in Table 5.

c The values are reflecting the minimum values for furnace normalized test pieces.

d $Rp_{0,2}$ not determined in accordance with EN 10314. They are minimum values of the scatter band considered until now.

Table 8 — Summary of tests and extent of testing

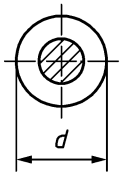
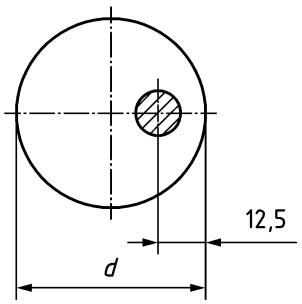
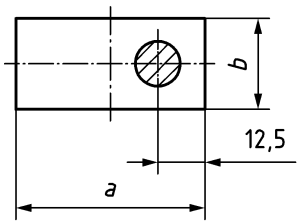
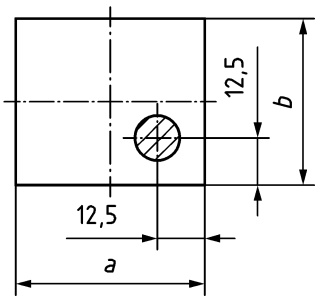
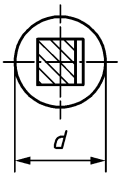
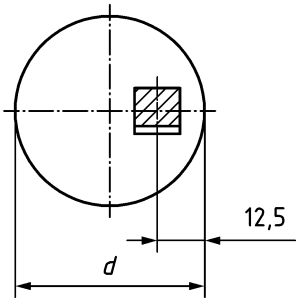
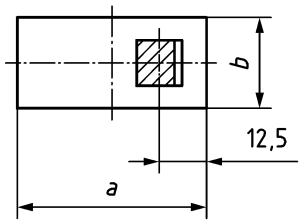
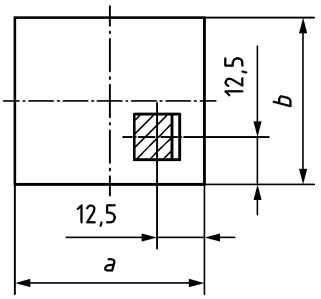
Type of inspection and test		Number of test pieces[a]	Refer to
Mandatory tests	Cast analysis	1 per cast	8.3.1
	Tensile test at room temperature	1 per sample	10.1.2, 10.2 and 11.2
	Impact test	3 per sample	10.1.2, 10.2 and 11.4
	Dimensional and visual inspection	Each product	11.5.1 and 11.5.2
Optional tests	Product analysis	1 per cast	10.1.1, 10.2.1 and 11.1
	Tensile test at elevated temperature	1 per cast	10.1.2, 10.2 and 11.3
	Verification of internal soundness	[b]	8.6 and 11.5.3

a For sampling and the size of test units, see 10.1.

b To be agreed at the time of enquiry and order.

Table 9 — Position of the (longitudinal) test pieces

Dimensions in millimetres

Type of test	Products with circular cross-section	Products with rectangular cross-section
Tensile	Tensile test piece	
	$d \leq 25$[b]  $25 < d \leq 160$ 	$b \leq 25$ $a \geq b$  $25 < b \leq 160$ $a \geq b$  c
Impact[a]	Impact test piece	
	$12 \leq d \leq 25$  $25 < d \leq 160$ 	$6 \leq b \leq 25$ $a \geq b$  $25 < b \leq 160$ $a \geq b$  c

a For products with circular cross-section, the axis of the notch is approximately parallel to the diameter: For products with rectangular cross-section, the axis of the notch is perpendicular to the greatest rolled surface.

b Test pieces of product may alternatively be tested un-machined, in accordance with EN ISO 377.

c Value of 12,5 mm is valid only if a ≥ 25 mm, otherwise the value shall be at least a/2.

The samples shall be protected by a thermal buffer which means they shall be taken at least at a distance of one radius far from the end of a bar.

Table 10 — Marking of the products

Marking of	Symbol[a]
Manufacturer's name, trade mark or logo	+
Number of this European Standard	(+)
Steel name or number	+
Type of finish	(+)
Identification number	+[b]
Nominal diameter or thickness	(+)
Nominal dimensions other than diameter or thickness	(+)
Inspector's mark	+[c]
Customer's order No.	(+)

[a] The symbols mean:
+ = the marking shall be applied;
(+) = the marking shall be applied if so agreed, or at the manufacturer's discretion.

[b] The numbers or letters used for identification shall allow the product(s) to be related to the relevant inspection certificate or inspection report. This shall permit the traceability of the cast number.

[c] The inspector's mark may be omitted if the relevant inspector can be identified in another way.

Annex A
(informative)

Guidelines for heat treatment

Table A.1 gives reference data for heat treatment temperatures.

Table A.1 — Guidelines on the temperatures for heat treatment

Steel grade		Temperature, °C		
name	number	Normalizing	Austenitizing	Tempering[b]
P235GH	1.0345	890 to 950[a]	–	–
P250GH	1.0460	890 to 950[a]	–	–
P265GH	1.0425	890 to 950[a]	–	–
P295GH	1.0481	890 to 950[a]	–	–
P355GH	1.0473	890 to 950[a]	–	–
16Mo3	1.5415	890 to 950[a]	–	_ [c]
13CrMo4–5	1.7335		890 to 950	630 to 730
10CrMo9–10	1.7380		920 to 980	650 to 750
11CrMo9–10	1.7383		920 to 980	650 to 750

[a] When normalizing, after the required temperatures have been attained over the whole cross-section, no further holding is necessary and should be generally avoided.

[b] When tempering, the specified temperatures shall, when they have been attained over the whole cross-section, be maintained for at least 30 min.

[c] In certain cases, tempering at 590 °C to 650 °C may be necessary.

Annex B
(informative)
Reference data on creep strain and creep rupture

NOTE 1 The values given in Table B.1 were derived as mean values in accordance with ISO 6303 with a scatter band of ± 20 %.

NOTE 2 The strength values for 1 % (plastic) creep strain and creep rupture given up to the elevated temperatures listed in Table B.1 do not mean that the steels can be used in continuous duty up to these temperatures. The governing factor is the total stressing during operation. Where relevant it is important that the oxidation conditions are also taken into account.

Table B.1 — Strength for 1 % (plastic) creep strain and creep rupture

Steel grade		Temperature	Strength for 1 % (plastic) creep strain in MPa for		Creep rupture strength in MPa for		
Steel name	Steel number	°C	10 000 h	100 000 h	10 000 h	100 000 h	200 000 h
P235GH, P265GH	1.0345, 1.0425	380	164	118	229	165	145
		390	150	106	211	148	129
		400	136	95	191	132	115
		410	124	84	174	118	101
		420	113	73	158	103	89
		430	101	65	142	91	78
		440	91	57	127	79	67
		450	80	49	113	69	57
		460	72	42	100	59	48
		470	62	35	86	50	40
		480	53	30	75	42	33
P250GH	1.0460	380	164	118	229	165	145
		390	150	106	211	148	129
		400	136	95	191	132	115
		410	124	84	174	118	101
		420	113	73	158	103	89
		430	101	65	142	91	78
		440	91	57	127	79	67
		450	80	49	113	69	57
		460	72	42	100	59	48
		470	62	35	86	50	42
		480	53	30	75	42	33
P295GH, P355GH	1.0481, 1.0473	380	195	153	291	227	206
		390	182	137	266	203	181
		400	167	118	243	179	157
		410	150	105	221	157	135
		420	135	92	200	136	115
		430	120	80	180	117	97
		440	107	69	161	100	82
		450	93	59	143	85	70
		460	83	51	126	73	60
		470	71	44	110	63	52
		480	63	38	96	55	44
		490	55	33	84	47	37
		500	49	29	74	41	30
16Mo3	1.5415	450	216	167	298	239	217
		460	199	146	273	208	188
		470	182	126	247	178	159
		480	166	107	222	148	130

Steel grade		Temperature	Strength for 1 % (plastic) creep strain in MPa for		Creep rupture strength in MPa for		
Steel name	**Steel number**	**°C**	**10 000 h**	**100 000 h**	**10 000 h**	**100 000 h**	**200 000 h**
16Mo3	1.5415	490	149	89	196	123	105
		500	132	73	171	101	84
		510	115	59	147	81	69
		520	99	46	125	66	55
		530	84	36	102	53	45
13CrMo4–5	1.7335	450	245	191	370	285	260
		460	228	172	348	251	226
		470	210	152	328	220	195
		480	193	133	304	190	167
		490	173	116	273	163	139
		500	157	98	239	137	115
		510	139	83	209	116	96
		520	122	70	179	94	76
		530	106	57	154	78	62
		540	90	46	129	61	50
		550	76	36	109	49	39
		560	64	30	91	40	32
		570	53	24	76	33	26
10CrMo9–10	1.7380	450	240	166	306	221	201
		460	219	155	286	205	186
		470	200	145	264	188	169
		480	180	130	241	170	152
		490	163	116	219	152	136
		500	147	103	196	135	120
		510	132	90	176	118	105
		520	119	78	156	103	91
		530	107	68	138	90	79
		540	94	58	122	78	68
		550	83	49	108	68	58
		560	73	41	96	58	50
		570	65	35	85	51	43
		580	57	30	75	44	37
		590	50	26	68	38	32
		600	44	22	61	34	28
11CrMo9–10	1.7383	450				221	
		460				205	
		470				188	
		480				170	
		490				152	
		500				135	
		510				118	
		520				103	

Annex C
(informative)

Significant changes to the previous version EN 10273:2007

Significant changes to the previous version EN 10273:2007 are listed below:

1) Normative references actualised;
2) Addition of Table 1;
3) Alignment of the chemical composition of steel grades to other standards for pressure purposes;
4) Data concerning inspection documents in 9.1 updated;
5) The last alternative for the test pieces widths in 11.4 (impact testing) deleted;
6) Figures in Table 9 concerning test pieces for impact testing and correspondence data revised;
7) Footnote c) in Table 9 new added;
8) Content of Table 8 concerning testing and extent of testing updated;
9) Table ZA.1 actualised in accordance with the new Directive 2014/68/EU;
10) Editorial changes.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of Directive 2014/68/EU

This European Standard has been prepared under a Commission's standardization request M/071 to provide one voluntary means of conforming to Essential Requirements of Directive 2014/68/EU.

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of Directive 2014/68/EU, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2014/68/EU

Requirements of Directive 2014/68/EU	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
4.1a	8.4; Tables 5 and 6	Appropriate material properties
4.1d	8.2, 8.5 and 8.6	Suitable for processing procedures
4.3	9.1, 10.1.2, 11.2, 11.4 and Table 8	Inspection documentation NOTE For details related to 9.1.1 see EC PED guidelines 7/2 and 7/16 which specify the material manufacturer obligations in respect to the QA system and the specific assessment for materials.

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 1011-1, *Welding — Recommendations for welding of metallic materials — Part 1: General guidance for arc welding*

[2] EN 1011-2, *Welding — Recommendations for welding of metallic materials — Part 2: Arc welding of ferritic steels*

[3] EN 10314, *Method for the derivation of minimum values of proof strength of steel at elevated temperatures*

[4] ISO 6303, *Pressure vessel steels not included in ISO 2604, Parts 1 to 6 — Derivation of long-time stress rupture properties*

[5] *Guidelines 7/2 and 7/16 of the EU Commission and the Member States*

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