

Technical delivery conditions for steel castings for pressure purposes

Part 1. General

The European Standard EN 10213-1 : 1995 has the status of a
British Standard

ICS 77.140.30

Committees responsible for this British Standard

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- BEAMA Ltd.
- British Pump Manufacturers' Association
- British Valve and Actuator Manufacturers' Association
- Castings Technology International
- Engineering Equipment and Materials Users' Association
- Hopkinsons Limited
- Institute of British Foundrymen
- Institution of Mechanical Engineers
- Lloyd's Register of Shipping
- Ministry of Defence
- Railway Industry Association

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National foreword

This British Standard has been prepared under the direction of the Technical committee ISE/6, Steel castings, and is the English language version of EN 10213-1 *Technical delivery conditions for steel castings for pressure purposes — Part 1: General* published by the European Committee for Standardization (CEN).

The following Parts of BS EN 10213 supersede BS 1504 : 1976 which is now withdrawn:

- BS EN 10213-1 *Technical delivery conditions for steel castings for pressure purposes Part 1 : 1996 General*
- BS EN 10213-2 *Technical delivery conditions for steel castings for pressure purposes Part 2 : 1996 Steel grades for use at room temperature and elevated temperatures*
- BS EN 10213-3 *Technical delivery conditions for steel castings for pressure purposes Part 3 : 1996 Steels for use at low temperatures*
- BS EN 10213-4 *Technical delivery conditions for steel castings for pressure purposes Part 4 : 1996 Austenitic and austenitic-ferritic steel grades*

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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Descriptors: Cast steels, structural steels, boilers, pressure equipment, delivery, generalities, designation, grades: quality, manufacturing, chemical composition, mechanical properties, tests, marking

English version

Technical delivery conditions for steel castings for pressure purposes — Part 1: General

Conditions techniques de livraison des pièces
moulées en acier pour service sous pression —
Partie 1: Généralités

Technische Lieferbedingungen für Stahlguß für
Druckbehälter —
Teil 1: Allgemeines

This European Standard was approved by CEN on 1995-10-20. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by the Technical Committee ECISS/TC 31, Steel castings, the secretariat of which is held by AFNOR.

This European Standard EN 10213 *Technical delivery conditions for steel castings for pressure purposes* consists of 4 Parts:

- Part 1: *General*
- Part 2: *Steel grades for use at room temperature and elevated temperatures*
- Part 3: *Steel grades for use at low temperatures*
- Part 4: *Austenitic and austenitic-ferritic steel grades*

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 June 1996, and conflicting national standards shall be withdrawn at the latest by June 1996.

According to the Internal Regulations of CEN/CENELEC, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This European Standard applies to steel castings for pressure-containing parts. It includes materials which are used for the manufacture of components subject to pressure vessel construction codes.

This standard relates to castings manufactured from unalloyed and alloyed steel grades (characterized by their composition and mechanical properties).

Part 1 specifies general technical delivery conditions.

The standard comprises three other Parts specifying requirements for:

- steel grades for use at room and elevated temperatures (see EN 10213-2);
- steel grades for use at low temperatures (see EN 10213-3);
- austenitic and austenitic-ferritic steel grades (see EN 10213-4).

In cases where castings are joined by welding by the founder, this EN applies.

In cases where castings are welded:

- to wrought products (plates, tubes, forgings...);
- or by non-founders;

this European Standard does not apply.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 10002-1	<i>Metallic materials — tensile testing — Part 1: Method of test (at ambient temperature)</i>	EN 10045-1	<i>Metallic materials — Charpy impact test — Part 1: Test method</i>
EN 10002-5	<i>Metallic materials — tensile testing — Part 5: Method of test at elevated temperature</i>	EN 10204	<i>Metallic products — Types of inspection documents</i>
EN 10027-1	<i>Designation systems for steels — Part 1: Steel names, principal symbols</i>	EN 10213-2	<i>Technical delivery conditions for steel castings for pressure purposes Part 2: Steel grades for use at room and elevated temperatures</i>
EN 10027-2	<i>Designation systems for steels — Part 2: Numerical system</i>	EN 10213-3	<i>Technical delivery conditions for steel castings for pressure purposes Part 3: Steel grades for use at low temperatures</i>
		EN 10213-4	<i>Technical delivery conditions for steel castings for pressure purposes Part 4: Austenitic and austenitic-ferritic steel grades</i>
		prEN 288-12 ¹⁾	<i>Specifications and approval of welding procedures for metallic materials Part 12: Welding procedure tests for arc welding of steel castings</i>
		prEN 1369 ¹⁾	<i>Founding — Magnetic particle inspection</i>
		prEN 1370 ¹⁾	<i>Founding — Surface roughness inspection by visual tactile comparators</i>
		prEN 1371-1 ¹⁾	<i>Founding — Liquid penetrant inspection Part 1: Sand, gravity die and low pressure die castings</i>
		prEN 1559-1 ¹⁾	<i>Founding — Technical conditions of delivery Part 1: General</i>
		prEN 1559-2 ¹⁾	<i>Founding — Technical conditions of delivery Part 2: Additional requirements for steel castings</i>
		prEN 28062 ¹⁾	<i>Castings — System of dimensional allowances</i>
		CR 10260	<i>ECISS information circular No. 10 — Designation systems for steels — Additional symbols for steel names</i>
		ISO 4990	<i>Steel castings — General technical delivery requirements</i>

¹⁾ In preparation.

3 Designation

3.1 The cast steel grades are named in accordance with EN 10027-1 and CR 10260:

- either by their minimum yield strength (tensile test) for unalloyed steels (preceded by letter P related to pressure uses);
- or by their chemical composition for alloyed steels.

3.2 For a steel grade manufactured to different strength levels, according to the heat treatment, a suffix shall be added in accordance with CR 10260.

3.3 In every case the name will be preceded by the letter G to express that cast steel materials are concerned.

3.4 The cast steel grades are numbered in accordance with EN 10027-2.

The numbers can be used instead of the names.

4 General conditions for delivery

Unless otherwise specified in this European Standard castings supplied to this European Standard shall conform to the requirements of ISO 4990 : 1986²⁾

5 Ordering

5.1 In addition to the ordering information given in ISO 4990 : 1986²⁾ the following shall be observed:

- the clauses marked (●) pertain to a mandatory agreement;
- the clauses marked (●●) pertain to alternative delivery conditions which may be agreed at the time of enquiry and order.

5.2 The following information shall be given by the purchaser to the founder:

- ruling thickness (see 7.2.1)³⁾;
- conditions of inspection (see clause 8).

6 Manufacturing

6.1 Steel melting

The steel shall be produced by an electric melting process or by any other process involving secondary refining.

The alternatives are left to the discretion of the founder.

6.2 Heat treatment

Unless otherwise agreed, the type of heat treatment shall comply with tables 2 of EN 10213-2, EN 10213-3 or EN 10213-4.

6.3 Welding

Unless otherwise agreed, welding is permitted, provided that all welds shall conform to the same criteria for non-destructive testing as the relevant part of the casting. A welding procedure qualification is required (see prEN 288-12).

Conditions for preheat, interpass and post-weld heat-treatment related to welding operations are given in annex A. These conditions are given only for information for grades included in EN 10213-2 and EN 10213-3.

However, the heat treatment procedure established to qualify the weld procedure for the austenitic and austenitic-ferritic steels of EN 10213-4 is mandatory.

6.4 Further processing

Unless previously agreed the foundry shall not be held responsible for the consequences of any further processing, e.g. welding, heat treatment... undertaken by the purchaser after delivery of the castings by the foundry.

7 Requirements

7.1 Chemical composition

The chemical composition determined by a cast analysis shall comply with the values given in tables 1 of EN 10213-2, EN 10213-3 and EN 10213-4.

Permissible deviations on check analysis are indicated in annex B.

Elements unspecified in tables 1 of EN 10213-2, EN 10213-3 and EN 10213-4 shall not be intentionally added without agreement of the purchaser other than for the purpose of finishing the heat. If not otherwise agreed the maximum values in % (m/m) given in table 1 shall be applicable (for unspecified elements).

7.2 Mechanical properties

7.2.1 The mechanical properties shall comply with the values given in tables 2 of EN 10213-2, EN 10213-3 and EN 10213-4.

These values apply up to the maximum wall thickness given in tables 2 of EN 10213-2, EN 10213-3 and EN 10213-4. They are verified on test blocks of ruling thickness (see 5.2). In all cases the maximum wall thickness shall be limited to 150 mm.

In cases where the ruling thickness defined by the purchaser is above the maximum thickness given in the tables, the foreseeable lowering of the mechanical properties in the casting shall be agreed in order to enable the final calculation.

²⁾ ISO 4990 will be replaced by EN 1559-2 at the time of publication.

³⁾ The purchaser will prescribe a ruling thickness in relation to the mechanical stresses.

Table 1. Maximum contents of unspecified elements (% (m/m))						
Element Steel types	Cr	Mo	Ni	V	Cu	Cr + Mo + Ni + V + Cu
Unalloyed steels	0,30	0,12	0,40	0,03	0,30	1,00
Alloyed steels (austenitic excluded)	0,30	0,15	0,40	0,05 ¹⁾	0,30	—
Austenitic steels	—	—	—	—	0,50	—

¹⁾ 0,08 % V for steels with Cr ≥ 10 %.

7.2.2 The values for yield and tensile strength also apply to the casting itself up to the maximum wall thickness as given in tables 2 of EN 10213-2, EN 10213-3 and EN 10213-4.

The yield strength values at room temperature correspond to:-

- 0,2 % proof stress ($R_{p0,2}$) for ferritic and austenitic-ferritic steels (or upper yield strength R_{eH});
- 1,0 % proof stress ($R_{p1,0}$) for austenitic steels.

(••) **7.2.3** For the steel grades of EN 10213-2 and EN 10213-4 that are used at elevated temperature the values of proof stress at elevated temperature are stated but their verification is performed only by agreement at the time of enquiry and order.

8 Testing and inspection

8.1 Type of inspection

For all products ordered to the requirements of this standard specific inspection and testing is required.

8.2 Formation of lots

8.2.1 In the case of castings under 1 000 kg in weight the delivered quantity shall be subdivided into lots covering castings of the same type from the same melt and having undergone the same heat treatment (see supplement **9.1** of ISO 4990 : 1986²⁾). The weight of a test lot shall be not greater than 5 000 kg.

8.2.2 In the case of castings weighing more than 1 000 kg, each individual casting shall be regarded as the test lot.

8.3 Testing

8.3.1 Chemical analysis

The chemical composition shall be determined by cast analysis.

8.3.2 Mechanical properties

8.3.2.1 General

Mechanical properties are measured on test pieces sampled from test block of relevant thickness, up to a maximum wall thickness of 150 mm.

Each test piece shall be removed from the test blocks as follows:

- up to 56 mm wall thickness the axis of the test piece shall be at 14 mm from the cast surface;
- over 56 mm wall thickness the axis of the test piece shall be at one quarter thickness from the cast surface.

(••) Further conditions for the selection of test blocks can be agreed according to ISO 4990 : 1986²⁾ (see **11.2**).

8.3.2.2 Tensile test at room temperature

One tensile test shall be carried out per test lot.

The test shall be carried out in accordance with EN 10002-1. The test piece shall have a gauge length of

$$L_0 = 5,65 \sqrt{S_0}$$

where S_0 is the original cross-section of the test piece.

8.3.2.3 Impact test

Three Charpy V notch tests shall be carried out per test lot: the temperatures of testing are given in EN 10213-2, EN 10213-3 and EN 10213-4.

The test shall be carried out in accordance with EN 10045-1. The average value from three test pieces shall be not less than the specified value. One of the three individual values may be below the specified minimum average value provided it is not less than 70 % of that value.

(••) 8.3.2.4 Tensile test at elevated temperature

When verification of tensile strength at elevated temperature is required (see **7.2.3**), the number of tests and the testing temperature shall be agreed at the time of enquiry and order. The test shall be performed according to EN 10002-5.

²⁾ ISO 4990 will be replaced by EN 1559-2 at the time of publication.

8.3.2.5 Retests for mechanical testing

When the results of the mechanical tests do not comply with the requirements, the founder may, unless otherwise agreed, adopt one of the procedures specified in ISO 4990 : 1986²⁾

8.4 Testing on castings

(••) 8.4.1 Chemical analysis

When specified, chemical analysis shall be determined on samples taken from the casting. The location of the samples and permissible deviations from the specified cast analysis shall be agreed at the time of enquiry and order.

(••) 8.4.2 Mechanical properties

When specified, mechanical properties are verified on test pieces taken from the castings. The location of the test pieces shall be agreed at the time of enquiry and order (see 7.2.1).

(••) 8.4.3 Non-destructive testing

The castings are subjected to non-destructive examination under conditions agreed at the time of enquiry and order. Every order shall include information about:

- NDT method(s), to be applied (visual, magnetic particle, liquid penetrant, ultrasonic, radiographic...);
- severity levels for every method;
- areas of the castings to be tested.

This inspection shall be performed according to the relevant European Standards:

- visual;
- magnetic particle prEN 1369;
- liquid penetrant prEN 1371-1;
- radiographic;
- ultrasonic;
- roughness prEN 1370.

(••) 8.4.4 Dimensions

Machining allowances and dimensional tolerances shall be defined at the time of enquiry and order in accordance with prEN 28062.

9 Marking

9.1 The castings shall be legibly marked to allow traceability. The marking shall include:

- a) the acronym of the founder;
- b) symbols, letters or numbers which relate the inspection documents, test pieces and castings to each other.

(••) 9.2 Except as provided in 9.3 the identification marks shall be stamped or cast on each piece in such a location and in such a manner as agreed with the purchaser.

(••) 9.3 For small castings it may be agreed at the time of enquiry and order that they are batched and that the identification is marked on a label attached to each batch.

10 Inspection documents

10.1 Castings manufactured according to this standard shall be supplied with an inspection certificate according to EN 10204.

10.2 Unless otherwise agreed an inspection certificate 3.1B shall be provided to the purchaser.

10.3 The inspection certificate shall include:

- a) the amounts of all elements specified for the steel grade required;
- b) the results of the mechanical tests as required for the specific steel grade;
- c) a statement on the result of agreed dimensional check and non-destructive testing;
- (••) d) the results of any further mutually agreed testing.

(••) 11 Supplementary requirements

11.1 General

One or more of the following supplementary requirements may be applied, but only when specified in the enquiry and order.

Details of these supplementary requirements shall be agreed by the founder and purchaser at the time of enquiry and order. The specified tests shall be carried out by the founder before delivery of the castings.

²⁾ ISO 4990 will be replaced by EN 1559-2 at the time of publication.

11.2 Requirements quoted in ISO 4990 : 1986²⁾

A list of standardized supplementary requirements for use at the option of the purchaser is described in ISO 4990 : 1986²⁾. Those which are considered suitable are listed below by title only.

From ISO 4990 : 1986²⁾:

- 9.1.2 Reporting of the steel making process;
- 9.1.3 Agreed manufacturing procedure;
- 9.1.4 Dividing up the cast;
- 9.1.6 Mass and tolerance on mass;
- 9.3 Chemical analysis for residual elements;
- 9.4.3 Brinell hardness test;
- 9.6.1 Test blocks representative of the castings;
- 9.6.3 Test blocks attached to the casting;
- 9.7.2 Details of the heat-treatment;
- 9.8.1 Prior agreement relating to major repair welds;⁴⁾
- 9.8.2 Weld maps (sketches);
- 9.10.1 Intergranular corrosion test (only for austenitic stainless steels);
- 9.10.3 Pressure tightness.

11.3 Requirements not quoted in ISO 4990 : 1986²⁾

Other supplementary tests may be specified such as:

- ferrite measurement in austenitic steels or austenitic-ferritic steels;
- simulated post-weld heat treatment.

²⁾ ISO 4990 will be replaced by EN 1559-2 at the time of publication.

⁴⁾ In general production welds are considered major when the depth of the cavity prepared for welding exceeds 40 % of the wall thickness.

Annex A (informative for grades of EN 10213-2, EN 10213-3 and normative for grades of EN 10213-4)

Welding conditions

Table A.1 Welding conditions					
Designation		Preheat temperature °C ¹⁾	Max. interpass temperature °C	Post-heat treatment °C	
Name	Number				
GP240GR	1.0621	20 to 150	350	No heat treatment necessary	Informative
GP240GH	1.0619				
GP280GH	1.0625				
G17Mn5	1.1131				
G20Mn5	1.6220				
G18Mo5	1.5422	20 to 200	350	≥ 650	
G20Mo5	1.5419	20 to 200	350	≥ 650	
G17CrMo5-5	1.7357	150 to 250	350	≥ 650	
G17CrMo9-10	1.7379	150 to 250	350	≥ 680	
G12MoCrV5-2	1.7720	200 to 300	400	≥ 680	
G17CrMoV5-10	1.7706	200 to 300	400	≥ 680	
G9Ni10	1.5636	20 to 150	350	≥ 570	
G17NiCrMo13-6	1.6781	20 to 200	350	≥ 580	
G9Ni14	1.5638	20 to 200	300	≥ 560	
GX15CrMo5	1.7365	150 to 250	350	≥ 650	
GX8CrNi12	1.4107	100 to 200	350	Same as normal tempering temperature	
GX4CrNi13-4	1.4317	100 to 200	300	Same as normal tempering temperature	
GX3CrNi13-4	1.6982	20 to 200	8)	8)	
GX23CrMoV12-1	1.4931	20 to 450	450	≥ 680 °C after cooling under 80 – 130 °C	
GX4CrNiMo16-5-1	1.4405	No preheat	200	Same as normal tempering temperature	

Table A.1 Welding conditions (concluded)						
Designation		Preheat temperature °C ¹⁾	Max. interpass temperature °C	Post-heat treatment		
Name	Number			°C		
				Minor welds	Major welds ⁹⁾	Normative
GX2CrNi19-11	1.4309	No preheat	8)	No heat tr. necess.	No heat tr. necess. ¹⁰⁾	
GX5CrNi19-10	1.4308			2)	+ AT ⁶⁾ 11)	
GX5CrNiNb19-11	1.4552			No heat tr. necess. but ³⁾		
GX2CrNiMo19-11-2	1.4409			No heat tr. necess.	No heat tr. necess.	
GX5CrNiMo19-11-2	1.4408			2)	+ AT ⁶⁾ 11)	
GX5CrNiMoNb19-11-2	1.4581			No heat tr. necess. but ³⁾		
GX2NiCrMo28-20-2	1.4458	20 to 100	150	No heat tr. necess. but ⁴⁾	+ AT ⁶⁾	
GX2CrNiMoN22-5-3	1.4470	20 to 100	250	+ AT ⁵⁾ 7)	+ AT ⁷⁾	
GX2CrNiMoCuN25-6-3-3	1.4517	20 to 100	250	+ AT ⁵⁾ 7)	+ AT ⁷⁾	
GX2CrNiMoN26-7-4	1.4469	20 to 100	250	+ AT ⁵⁾ 7)	+ AT ⁷⁾	
1) The preheating temperature is related to the geometry and the thickness of the casting and climate conditions. 2) These steels are not suitable for corrosion applications where minor welds would systematically need post-weld heat treatment. 3) For improving the corrosion resistance a special stabilization heat treatment in the range of 600 °C to 650 °C for GX5CrNiNb19-11 and 550 °C to 600 °C for GX5CrNiMoNb19-11-2 may be agreed. 4) For minor welds, special arrangement shall be agreed upon according to corrosion conditions. 5) + AT may only be suppressed if welding is performed with restricted heat input conditions. 6) The heat treatment for all the mentioned steels is + AT (solution annealing); it is usually made by liquid quenching or by air quenching if so agreed for very small and thin castings. 7) The heat treatment for all the mentioned steels is + AT (solution annealing). Air quenching may be agreed for very small and thin castings. After solution annealing at high temperatures, castings may be cooled down to 1040 °C to 1010 °C prior to water quenching in order to improve corrosion resistance and prevent cracks in complex shapes. 8) At the discretion of the manufacturer unless otherwise agreed. 9) See 11.2 — footnote 4. 10) For use at low temperature + AT is required. 11) For use at high temperature + AT may be suppressed.						

Annex B (normative) Permissible deviations of the check analysis with respect to the specified cast analysis

Table B.1 Permissible deviations of the check analysis with respect to the specified cast analysis		
Element	Specified cast analysis % (m/m)	Permissible deviation % (m/m)
Carbon	$\leq 0,030$	+ 0,005
	> 0,030 to $\leq 0,08$	$\pm 0,01$
	> 0,08 to $\leq 0,26$	$\pm 0,02$
Silicon	$\leq 1,50$	+ 0,10
Manganese	$\leq 0,70$	$\pm 0,06$
	> 0,70 to $\leq 2,00$	$\pm 0,10$
Phosphorus	$\leq 0,040$	+ 0,005
Sulfur	$\leq 0,030$	+ 0,005
Chromium	$\leq 2,00$	$\pm 0,10$
	> 2,00 to $\leq 10,00$	$\pm 0,20$
	> 10,00 to $\leq 15,00$	$\pm 0,30$
	> 15,00	$\pm 0,40$
Molybdenum	$\leq 1,00$	$\pm 0,07$
	> 1,00 to $\leq 2,00$	$\pm 0,10$
	> 2,00 to $\leq 5,00$	$\pm 0,15$
Nickel	$\leq 1,00$	$\pm 0,06$
	> 1,00 to $\leq 2,00$	$\pm 0,10$
	> 2,00 to $\leq 5,00$	$\pm 0,15$
	> 5,00 to $\leq 10,00$	$\pm 0,20$
	> 10,00 to $\leq 20,00$	$\pm 0,25$
	> 20,00	$\pm 0,30$
Niobium	$\leq 1,00$	$\pm 0,05$
Vanadium	$\leq 0,35$	$\pm 0,03$
Copper	$\leq 2,00$	$\pm 0,10$
	> 2,00 to $\leq 3,50$	$\pm 0,15$
Nitrogen	$\leq 0,22$	$\pm 0,01$
Tungsten	$\leq 0,50$	+ 0,05
Tin	$\leq 0,025$	+ 0,005

Annex C (informative)**Physical and creep properties****C.1 Physical properties**

Information on physical properties of steel grades is given in table C.1.

C.2 Creep properties

Information on creep properties for some grades used at high temperature is given in table A.1 of EN 10213-2 and EN 10213-4.

Table C.1. Physical properties									
Designation		Density kg/dm ³	Mean thermal expansion 10 ^{−6} K ^{−1} from 20 °C to			Thermal conductivity W/(m·K) at		Specific heat J/(kg·K)	Magnetic properties
Name	Number	Temperatures							
		20 °C	100 °C	300 °C	500 °C	50 °C	100 °C	20 °C	
GP240GR	1.0621	7,8	12,6	13,4	14	45		460	Magnetic
GP240GH	1.0619	7,8	12,6	13,4	14	45		460	
GP280GH	1.0625	7,8	12,8	13,6	14,5	45		460	
G17Mn5	1.1131	7,8	13,0	13,8	15	45		460	
G20Mn5	1.6220	7,8	13,0	13,8	15	45		460	
G18Mo5	1.5422	7,85	12,4	13,1	13,8	43		460	
G20Mo5	1.5419	7,85	12,4	13,1	13,8	43		460	
G17CrMo5-5	1.7357	7,85	11,8	12,9	13,7	38,5		460	
G17CrMo9-10	1.7379	7,85	11,8	12,6	13,4			460	
G12MoCrV5-2	1.7720	7,85						460	
G17CrMoV5-10	1.7706	7,85	12,4	13,6	14,5			460	
G9Ni10	1.5636	7,85	11,8	12,4	13,6	36		460	
G17NiCrMo13-6	1.6781	7,85						460	
G9Ni14	1.5638	7,85						460	
GX15CrMo5	1.7365	7,8	11,8	12,3	12,7	30,1		460	
GX8CrNi12	1.4107	7,7	10,5	11,5	12,3	26	27	460	
GX4CrNi13-4	1.4317	7,7	10,5	11	12	26	27	460	
GX3CrNi13-4	1.6982	7,7	10,5	11	12	26	27	460	
GX23CrMoV12-1	1.4931	7,7						460	
GX4CrNiMo16-5-1	1.4405	7,8	10,8	11,5	12	17	18	460	
GX2CrNi19-11	1.4309	7,88	16,8	17,9	18,6	15,2	16,5	530	Non to slight magnetic
GX5CrNi19-10	1.4308	7,88	16,8	17,9	18,6	15,2	16,5	530	
GX5CrNiNb19-11	1.4552	7,88	16,8	17,9	18,6	15,2	16,5	530	Slight magnetic
GX2CrNiMo19-11-2	1.4409	7,9	15,8	17	17,7	14,5	15,8	530	
GX5CrNiMo19-11-2	1.4408	7,9	15,8	17	17,7	14,5	15,8	530	
GX5CrNiMoNb19-11-2	1.4581	7,9	15,8	17	17,7	14,5	15,8	530	
GX2NiCrMo28-20-2	1.4458	8,0	14,5	16,2	17	16	17	500	
GX2CrNiMoN22-5-3	1.4470	7,7	13	14		18	18	450	Appreciably magnetic
GX3CrNiMoCuN25-6-3-3	1.4517	7,7	13	14		17	18	450	
GX2CrNiMoN26-7-4	1.4469	7,7	13	14		17	18	450	

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