
Corrosion-resistant cast steels for general applications

Aciers moulés résistant à la corrosion pour applications courantes

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Contents

Page

Foreword	iv
1 Scope	1
2 Normative reference	1
3 General conditions for delivery	1
4 Chemical composition	1
5 Mechanical properties	1
6 Heat treatment	1
7 Supplementary requirements	5
Annex A (informative) UNS cast grades similar to ISO cast grades	6
Bibliography	7

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC17, *Steel*, Subcommittee SC11, *Steel castings*.

This second edition cancels and replaces the first edition (ISO 11972:1998), which has been technically revised with the following changes:

- [Clause 7](#) revised;
- [Table 1](#) composition limits modified — various grades;
- [Tables 1, 2, and 3](#) — grade numbers added;
- [Annex A](#) added.

Corrosion-resistant cast steels for general applications

1 Scope

This International Standard specifies cast steels for general corrosion-resistant applications. The grades covered by this International Standard represent types of alloy steel castings suitable for broad ranges of application which are intended for a wide variety of corrosion applications.

NOTE [Annex A](#) gives information on ISO grade designation and available UNS numbers which are similar to the ISO grade designation.

2 Normative reference

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.

ISO 4990, *Steel castings — General technical delivery conditions*

3 General conditions for delivery

Materials furnished according to this International Standard shall conform to the applicable requirements of ISO 4990 including the supplementary requirements that are indicated on the inquiry and purchase order.

4 Chemical composition

The steel shall conform to the requirements for chemical composition specified in [Table 1](#).

5 Mechanical properties

Steel used for castings shall conform to the mechanical property requirements given in [Table 2](#) up to the maximum ruling thickness. Verification of impact tests is not required except when indicated by the customer. Test blocks used to verify mechanical properties shall not have a thickness exceeding 150 mm. For samples removed from castings, the mechanical properties required shall be agreed between the manufacturer and purchaser.

6 Heat treatment

Castings shall be heat treated in accordance with the requirements in [Table 3](#).

Table 1 — Chemical composition, % (m/m)

Grade designation		Chemical composition								
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	Others
GX12Cr12	1.4011	0,15	1,0	1,0	0,035	0,025	11,5 to 13,5	0,50	1,0	
GX7CrNiMo12-1	1.4008	0,10	1,0	1,0	0,035	0,025	12,0 to 13,5	0,20 to 0,50	1,0 to 2,0	
GX4CrNi13-4 (QT1) GX4CrNi13-4 (QT2)	1.4317	0,06	1,0	1,0	0,035	0,025	12,0 to 13,5	0,70	3,5 to 5,0	
GX4CrNiMo16-5-1	1.4405	0,06	0,8	1,0	0,035	0,025	15,0 to 17,0	0,70 to 1,50	4,0 to 6,0	
GX2CrNi19-11	1.4309	0,03	1,5	2,0	0,035	0,025	18,0 to 20,0	–	9,0 to 12,0	N 0,20
GX2CrNi19-11	1.4487	0,03	1,5	1,5	0,040	0,030	18,0 to 20,0	–	9,0 to 12,0	N 0,12 to 0,20
GX5CrNi19-10	1.4308	0,07	1,5	1,5	0,040	0,030	18,0 to 20,0	–	8,0 to 11,0	
GX5CrNiNb19-11	1.4552	0,07	1,5	1,5	0,040	0,030	18,0 to 20,0	–	9,0 to 12,0	8 × C ≤ Nb ≤ 1,00
GX2CrNiMo19-11-2	1.4409	0,03	1,5	2,0	0,035	0,025	18,0 to 20,0	2,00 to 2,50	9,0 to 12,0	N 0,20
GX2CrNiMo19-11-2	1.4490	0,03	1,5	2,0	0,035	0,030	18,0 to 20,0	2,00 to 2,50	9,0 to 12,0	N 0,12 to 0,20
GX4CrNiMo26-5-2	1.4474	0,05	1,0	2,0	0,035	0,025	25,0 to 27,0	1,30 to 2,00	4,5 to 6,5	N 0,12 to 0,20
GX5CrNiMo19-11-2	1.4408	0,07	1,5	1,5	0,040	0,030	18,0 to 20,0	2,00 to 2,50	9,0 to 12,0	
GX5CrNiMoNb19-11-2	1.4581	0,07	1,5	1,5	0,040	0,030	18,0 to 20,0	2,00 to 2,50	9,0 to 12,0	8 × C ≤ Nb ≤ 1,00
GX2CrNiMo19-11-3	1.4518	0,03	1,5	1,5	0,040	0,030	18,0 to 20,0	3,00 to 3,50	9,0 to 12,0	
GX2CrNiMo19-11-3	1.4508	0,03	1,5	1,5	0,040	0,030	18,0 to 20,0	3,00 to 3,50	9,0 to 12,0	N 0,10 to 0,20
GX2CrNiMo22-5-3	1.4470	0,03	1,0	2,0	0,035	0,025	21,0 to 23,0	2,50 to 3,50	4,5 to 6,5	N 0,12 to 0,20
GX2CrNiMo25-7-3	1.4417	0,03	1,0	1,5	0,030	0,020	24,0 to 26,0	3,00 to 4,00	6,0 to 8,5	Cu 1,00 N 0,15 to 0,25 W 1,00
GX2CrNiMo26-7-4	1.4469	0,03	1,0	1,0	0,035	0,025	25,0 to 27,0	3,00 to 5,00	6,0 to 8,0	N 0,12 to 0,22 Cu 1,30
GX5CrNiMo19-11-3	1.4412	0,07	1,5	1,5	0,040	0,030	18,0 to 20,0	3,00 to 3,50	10,0 to 13,0	
GX2NiCrMo- CuN25-20-6	1.4588	0,02	1,0	2,00	0,035	0,020	19,0 to 21,0	6,00 to 7,00	24,0 to 26,0	N 0,10 to 0,25 Cu 0,50 to 1,50
GX2CrNiMo- CuN20-18-6	1.4557	0,02	1,0	1,20	0,030	0,010	19,5 to 20,5	6,00 to 7,00	17,5 to 19,5	N 0,18 to 0,24 Cu 0,50 to 1,00
GX2CrNiMo- CuN25-6-3-3	1.4517	0,03	1,0	1,50	0,035	0,025	24,5 to 26,5	2,50 to 3,50	5,0 to 7,0	N: 0,12 to 0,22 Cu: 2,75 to 3,50
GX3CrNiMoCuN26-6-3	1.4515	0,03	1,0	2,00	0,030	0,020	24,5 to 26,5	2,50 to 3,50	5,5 to 7,0	N 0,12 to 0,25 Cu: 0,80 to 1,30
GX2CrNiMoN25-6-3	1.4468	0,03	1,0	2,0	0,035	0,025	24,5 to 26,5	2,50 to 3,50	5,5 to 7,0	N 0,12 to 0,25

NOTE A single value in the table indicates the maximum limit.

Table 2 — Mechanical properties at room temperature^b

Grade designation		$R_{p0,2}$	R_m	A	KV	Maximum ruling
Name	Number	min MPa	min. MPa	min. %	min. J	thickness mm
GX12Cr12	1.4011	450	620	15	20	150
GX7CrNiMo12-1	1.4008	440	590	15	27	300
GX4CrNi13-4 (QT1)	1.4317	550	750	15	50	300
GX4CrNi13-4 (QT2)		830	900	12	35	300
GX4CrNiMo16-5-1	1.4405	540	760	15	60	300
GX2CrNi19-11	1.4309	185	440	30	80	150
GX2CrNiN19-11	1.4487	230 ^a	510	30	80	150
GX5CrNi19-10	1.4308	175 ^a	440	30	60	150
GX5CrNiNb19-11	1.4552	175 ^a	440	25	40	150
GX2CrNiMo19-11-2	1.4409	195 ^a	440	30	80	150
GX2CrNiMoN19-11-2	1.4490	230 ^a	510	30	80	150
GX4CrNiMoN26-5-2	1.4474	420	600	20	30	150
GX5CrNiMo19-11-2	1.4408	185 ^a	440	30	60	150
GX5CrNiMoNb19-11-2	1.4581	185 ^a	440	25	40	150
GX2CrNiMo19-11-3	1.4518	180 ^a	440	30	80	150
GX2CrNiMoN19-11-3	1.4508	230 ^a	510	30	80	150
GX2CrNiMoN22-5-3	1.4470	420	600	20	30	150
GX2CrNiMoN25-7-3	1.4417	480	650	22	50	150
GX2CrNiMoN26-7-4	1.4469	480	650	22	50	150
GX5CrNiMo19-11-3	1.4412	205 ^a	440	30	60	150
GX2NiCrMoCuN25-20-6	1.4588	210	480	30	60	50
GX2CrNiMoCuN20-18-6	1.4557	260	500	35	50	50
GX2CrNiMoCuN25-6-3-3	1.4517	480	650	22	50	150
GX3CrNiMoCuN26-6-3	1.4515	480	650	22	60	200
GX2CrNiMoN25-6-3	1.4468	480	650	22	50	150
^a The minimum $R_{p1,0}$ value is 25 MPa higher.						
^b 1 MPa = 1 N/mm ²						

Table 3 — Heat treatment

Grade designation		Treatment
Name	Number	
GX12Cr12	1.4011	Austenitize at 950 °C to 1 050 °C; air cool. Temper at 650 °C to 750 °C; air cool.
GX7CrNiMo12-1	1.4008	Austenitize at 1 000 °C to 1 050 °C; air cool. Temper at 620 °C to 720 °C; air or furnace cool.
GX4CrNi13-4 (QT1)	1.4317	Austenitize at 1 000 °C to 1 050 °C; air cool. Temper at 570 °C to 620 °C; air or furnace cool.
GX4CrNi13-4 (QT2)	1.4317	Austenitize at 1 000 °C to 1 050 °C; air cool. Temper at 500 °C to 530 °C; air or furnace cool.
GX4CrNiMo16-5-1	1.4405	Austenitize at 1 020 °C to 1 070 °C; air cool. Temper at 580 °C to 630 °C; air or furnace cool.
GX2CrNi19-11	1.4309	Solution treat at 1 050 to 1 150 °C; quench. Depending on thickness, accelerated air cooling.
GX2CrNi19-11	1.4487	Solution treat at 1 050 °C; quench. Depending on thickness, accelerated air cooling.
GX5CrNi19-10	1.4308	Solution treat at 1 050 °C to 1 150 °C; quench. Depending on thickness, accelerated air cooling.
GX5CrNiNb19-11	1.4552	Solution treat at 1 050 to 1 150 °C; quench. Depending on thickness, accelerated air cooling.
GX2CrNiMo19-11-2	1.4409	Solution treat at 1 080 °C to 1 150 °C; quench. Depending on thickness, accelerated air cooling.
GX2CrNiMo19-11-2	1.4490	Solution treat at 1 080 °C; quench. Depending on thickness, accelerated air cooling.
GX4CrNiMoN26-5-2	1.4474	Solution treat at 1 120 °C to 1 150 °C; quench in water. After solution annealing at high temperature, castings may be cooled to 1 040 °C to 1 010 °C prior to water quenching in order to prevent cracks in complex shapes.
GX5CrNiMo19-11-2	1.4408	Solution treat at 1 080 °C to 1 150 °C; quench. Depending on thickness, accelerated air cooling.
GX5CrNiMoNb19-11-2	1.4581	Solution treat at 1 080 to 1 150 °C; quench. Depending on thickness, accelerated air cooling.
GX2CrNiMo19-11-3	1.4518	Solution treat at 1 120 °C min.; quench. Depending on thickness, accelerated air cooling.
GX2CrNiMo19-11-3	1.4508	Solution treat at 1 120 °C min.; quench. Depending on thickness, accelerated air cooling.
GX2CrNiMoN22-5-3	1.4470	Solution treat at 1 120 °C to 1 150 °C; quench in water. After solution annealing at high temperature, castings may be cooled to 1 040 °C to 1 010 °C prior to water quenching in order to prevent cracks in complex shapes.
GX2CrNiMoN25-7-3	1.4417	Solution treat at 1 120 °C to 1 150 °C; quench in water. After solution annealing at high temperature, castings may be cooled to 1 040 °C to 1 010 °C prior to water quenching in order to prevent cracks in complex shapes.
GX2CrNiMoN26-7-4	1.4469	Solution treat at 1 120 °C to 1 150 °C; quench in water. After solution annealing at high temperature, castings may be cooled to 1 040 °C to 1 010 °C prior to water quenching in order to prevent cracks in complex shapes.
GX5CrNiMo19-11-3	1.4412	Solution treat at 1 120 to 1 180 °C; quench. Depending on thickness, accelerated air cooling.
GX2NiCrMoCuN25-20-6	1.4588	Solution treat at 1 200 °C to 1 240 °C for 4 h minimum, quench in water.

Table 3 (continued)

Grade designation		Treatment
Name	Number	
GX2CrNiMoCuN20-18-6	1.4557	Solution treat at 1 200 °C to 1 240 °C for 4 h minimum, quench in water.
GX2CrNiMoCuN25-6-3-3	1.4517	Solution treat at 1 120 °C to 1 150 °C; quench in water. After solution annealing at high temperature, castings may be cooled to 1 040 °C to 1 010 °C prior to water quenching in order to prevent cracks in complex shapes.
GX3CrNiMoCuN26-6-3	1.4515	Solution treat at 1 120 °C to 1 150 °C; quench in water. After solution annealing at high temperature, castings may be cooled to 1 040 °C to 1 010 °C prior to water quenching in order to prevent cracks in complex shapes.
GX2CrNiMoN25-6-3	1.4468	Solution treat at 1 120 °C to 1 150 °C; quench in water. After solution annealing at high temperature, castings may be cooled to 1 040 °C to 1 010 °C prior to water quenching in order to prevent cracks in complex shapes.

7 Supplementary requirements

A list of standardized supplementary requirements for use at the option of the purchaser is included in ISO 4990. Others, whether or not in ISO 4990, may be used with this International Standard upon agreement by the manufacturer and purchaser.