
**Corrosion-resistant cast steels for
general applications**

Aciers moulés résistant à la corrosion pour applications courantes

STANDARDSISO.COM : Click to view the full PDF of ISO 11972:2023



STANDARDSISO.COM : Click to view the full PDF of ISO 11972:2023



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

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

STANDARDSISO.COM : Click to view the full PDF of ISO 11972:2023

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC11, *Steel castings*.

This third edition cancels and replaces the second edition (ISO 11972:2015), which has been technically revised.

The main changes are as follows:

- the mandatory Terms and definitions clause (see [Clause 3](#)) has been added and subsequent clauses have been renumbered;
- the title for [Table 1](#) has been changed;
- supplementary requirements (see [Clause 8](#)) has been updated;
- the document has been editorially revised to conform to the most recent version of the ISO/IEC Directives, Part 2.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Corrosion-resistant cast steels for general applications

1 Scope

This document specifies cast steels for general corrosion-resistant applications. The grades covered by this document 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 are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 General conditions for delivery

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

5 Chemical composition

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

6 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.

7 Heat treatment

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

Table 1 — Chemical composition, mass fraction in %

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)	1.4317	0,06	1,0	1,0	0,035	0,025	12,0 to 13,5	0,70	3,5 to 5,0	
GX4CrNi13-4 (QT2)										
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
GX2CrNiMoN19-11-2	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
GX4CrNiMoN26-5-2	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	
GX2CrNiMoN19-11-3	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
GX2CrNiMoN22-5-3	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
GX2CrNiMoN25-7-3	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
GX2CrNiMoN26-7-4	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	
GX2NiCrMoCuN 25-20-6	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
GX2CrNiMoCuN 20-18-6	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
GX2CrNiMoCuN 25-6-3-3	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 this table indicates the maximum limit.

Table 2 — Mechanical properties at room temperature^b

Grade designation		$R_{p0,2}$	R_m	A	AV	Maximum ruling thickness
Name	Number	Min. MPa	min. MPa	min. %	min. J	
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

^a The minimum $R_{p1,0}$ value is 25 MPa higher.
^b 1 MPa = 1 N/mm²

Table 2 (continued)

Grade designation		$R_{p0,2}$	R_m	A	AV	Maximum ruling thickness mm
Name	Number	Min. MPa	min. MPa	min. %	min. J	
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/mm²

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 °C to 1 150 °C; quench. Depending on thickness, accelerated air cooling.
GX2CrNiN19-11	1.4487	Solution treat at 1 050 °C; quench. Depending on thickness, accelerated air cooling.

Table 3 (continued)

Grade designation		Treatment
Name	Number	
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 °C 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.
GX2CrNiMoN19-11-2	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 °C 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.
GX2CrNiMoN19-11-3	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 °C 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.
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.

8 Supplementary requirements

A list of standardized supplementary requirements for use at the option of the purchaser is included in ISO 4990.

STANDARDSISO.COM : Click to view the full PDF of ISO 11972:2023