INTERNATIONAL STANDARD

ISO 11972

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Corrosion-resistant cast steels for general applications

Aciers moulés résistant à la corrosion pour applications courantes

Reference number
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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11972 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 11, *Steel castings*.

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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.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4990:1986, *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 are not required except when indicated by the customer. Test coupons used to verify mechanical properties shall not have a thickness exceeding 150 mm. For pieces 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

Steel grades	Chemical composition % (m/m)								
	C	Si	Mn	P	S	Cr	Mo	Ni	Others
GX 12 Cr 12	0,15	0,8	0,8	0,035	0,025	11,5 13,5	0,5	1,0	
GX 8 CrNiMo 12 1	0,10	0,8	0,8	0,035	0,025	11,5 13,0	0,2 0,5	0,8 1,8	
GX 4 CrNi 12 4 (QT1) GX 4 CrNi 12 4 (QT2)	0,06	1,0	1,5	0,035	0,025	11,5 13,0	1,0	3,5 5,0	
GX 4 CrNiMo 16 5 1	0,06	0,8	0,8	0,035	0,025	15,0 17,0	0,7 1,5	4,0 6,0	
GX 2 CrNi 18 10	0,03	1,5	1,5	0,040	0,030	17,0 19,0	—	9,0 12,0	
GX 2 CrNiN 18 10	0,03	1,5	1,5	0,040	0,030	17,0 19,0	—	9,0 12,0	0,10 % N to 0,20 % N
GX 5 CrNi 19 9	0,07	1,5	1,5	0,040	0,030	18,0 21,0	—	8,0 11,0	
GX 6 CrNiNb 19 10	0,08	1,5	1,5	0,040	0,030	18,0 21,0	—	9,0 12,0	$8 \times$ % C $\leqslant$ Nb $\leqslant$ 1,00
GX 2 CrNiMo 19 11 2	0,03	1,5	1,5	0,040	0,030	17,0 20,0	2,0 2,5	9,0 12,0	
GX 2 CrNiMoN 19 11 2	0,03	1,5	1,5	0,040	0,030	17,0 20,0	2,0 2,5	9,0 12,0	0,10 % N to 0,20 % N
GX 5 CrNiMo 19 11 2	0,07	1,5	1,5	0,040	0,030	17,0 20,0	2,0 2,5	9,0 12,0	
GX 6 CrNiMoNb 19 11 2	0,08	1,5	1,5	0,040	0,030	17,0 20,0	2,0 2,5	9,0 12,0	$8 \times$ % C $\leqslant$ Nb $\leqslant$ 1,00
GX 2 CrNiMo 19 11 3	0,03	1,5	1,5	0,040	0,030	17,0 20,0	3,0 3,5	9,0 12,0	
GX 2 CrNiMoN 19 11 3	0,03	1,5	1,5	0,040	0,030	17,0 20,0	3,0 3,5	9,0 12,0	0,10 % N to 0,20 % N
GX 5 CrNiMo 19 11 3	0,07	1,5	1,5	0,040	0,030	17,0 20,0	3,0 3,5	9,0 12,0	
GX 2 CrNiCuMoN 26 5 3 3	0,03	1,0	1,5	0,035	0,025	25,0 27,0	2,5 3,5	4,5 6,5	2,5 % Cu to 3,5 % Cu 0,12 % N to 0,25 % N
GX 2 CrNiMoN 26 5 3	0,03	1,0	1,5	0,035	0,025	25,0 27,0	2,5 3,5	4,5 6,5	0,12 % N to 0,25 % N

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

Table 2 — Mechanical properties at room temperature [1)]

Steel grades	$R_{p0,2}$ min. N/mm^2	R_m min. N/mm^2	A min. %	KV min. J	Maximum ruling thickness mm
GX 12 Cr 12	450	620	14	20	150
GX 8 CrNiMo 12 1	440	590	15	27	300
GX 4 CrNi 12 4 (QT1)	550	750	15	45	300
GX 4 CrNi 12 4 (QT2)	830	900	12	35	300
GX 4 CrNiMo 16 5 1	540	760	15	60	300
GX 2 CrNi 18 10	180 [2)]	440	30	80	150
GX 2 CrNiN 18 10	230 [2)]	510	30	80	150
GX 5 CrNi 19 9	180 [2)]	440	30	60	150
GX 6 CrNiNb 19 10	180 [2)]	440	25	40	150
GX 2 CrNiMo 19 11 2	180 [2)]	440	30	80	150
GX 2 CrNiMoN 19 11 2	230 [2)]	510	30	80	150
GX 5 CrNiMo 19 11 2	180 [2)]	440	30	60	150
GX 6 CrNiMoNb 19 11 2	180 [2)]	440	25	40	150
GX 2 CrNiMo 19 11 3	180 [2)]	440	30	80	150
GX 2 CrNiMoN 19 11 3	230 [2)]	510	30	80	150
GX 5 CrNiMo 19 11 3	180 [2)]	440	30	60	150
GX 2 CrNiCuMoN 26 5 3 3	450	650	18	50	150
GX 2 CrNiMoN 26 5 3	450	650	18	50	150

1) $R_{p0,2}$: 0,2 % proof stress
R_m: tensile strength
A: percentage elongation after fracture on original gauge-length L_0
$L_0 = 5{,}65\sqrt{S_0}$ (where S_0 is the original cross-section)
KV: ISO V-notch impact strength

2) The minimum $R_{p1,0}$ value is 25 N/mm^2 higher (1 N/mm^2 = 1 MPa)

Table 3 — Heat treatment

Steel grades	Treatment
GX 12 Cr 12	Austenitize at 950 °C to 1 050 °C; air cool Temper at 650 °C to 750 °C; air cool
GX 8 CrNiMo 12 1	Austenitize at 1 000 °C to 1 050 °C; air cool Temper at 620 °C to 720 °C; air or furnace cool
GX 4 CrNi 12 4 (QT1)	Austenitize at 1 000 °C to 1 100 °C; air cool Temper at 570 °C to 620 °C; air or furnace cool
GX 4 CrNi 12 4 (QT2)	Austenitize at 1 000 °C to 1 100 °C; air cool Temper at 500 °C to 530 °C; air or furnace cool
GX 4 CrNiMo 16 5 1	Austenitize at 1 020 °C to 1 070 °C; air cool Temper at 580 °C to 630 °C; air or furnace cool
GX 2 CrNi 18 10	Solution treat at 1 050 °C min.; quench Depending on thickness, accelerated air cooling
GX 2 CrNiN 18 10	Solution treat at 1 050 °C min.; quench Depending on thickness, accelerated air cooling
GX 5 CrNi 19 9	Solution treat at 1 050 °C min.; quench Depending on thickness, accelerated air cooling
GX 6 CrNiNb 19 10	Solution treat at 1 050 °C min.; quench Depending on thickness, accelerated air cooling
GX 2 CrNiMo 19 11 2	Solution treat at 1 080 °C min.; quench Depending on thickness, accelerated air cooling
GX 2 CrNiMoN 19 11 2	Solution treat at 1 080 °C min.; quench Depending on thickness, accelerated air cooling
GX 5 CrNiMo 19 11 2	Solution treat at 1 080 °C min.; quench Depending on thickness, accelerated air cooling
GX 6 CrNiMoNb 19 11 2	Solution treat at 1 080 °C min.; quench Depending on thickness, accelerated air cooling
GX 2 CrNiMo 19 11 3	Solution treat at 1 120 °C min.; quench Depending on thickness, accelerated air cooling
GX 2 CrNiMoN 19 11 3	Solution treat at 1 120 °C min.; quench Depending on thickness, accelerated air cooling
GX 5 CrNiMo 19 11 3	Solution treat at 1 120 °C min.; quench Depending on thickness, accelerated air cooling
GX 2 CrNiCuMoN 26 5 3 3	Solution treat at 1 120 °C min.; 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
GX 2 CrNiMoN 26 5 3	Solution treat at 1 120 °C min.; 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