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Carbon and low alloy cast steels for general applications

Aciers moulés au carbone et faiblement alliés d'usage général



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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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 The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 11, *Steel castings*.

This second edition cancels and replaces the first edition (ISO 14737:2003) and ISO 3755, of which it constitutes a technical revision. Notably, the following changes have been made to the previous edition:

- *carbon* has replaced *non-alloy* in the title of the standard;
- grades G21Mn5 and G50CrMo4 have been deleted;
- [Annexes A and B](#) have been replaced;
- new values and grade numbers have been added to [Tables 1](#) and [2](#) and [Annex A](#).

Carbon and low alloy cast steels for general applications

1 Scope

This International Standard specifies requirements for carbon and low alloy cast steel grades for general applications.

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

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.

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

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

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

3 General conditions for delivery

Steel castings supplied in accordance with this International Standard shall conform to the applicable requirements of ISO 4990, including the supplementary requirements that are indicated in the inquiry and purchase order.

4 Chemical composition

The chemical composition shall conform to the values given in [Table 1](#).

5 Heat treatment

The type of heat treatment is left to the discretion of the manufacturer unless otherwise agreed upon at the time of inquiry and order. The information for heat treatment described in [Table 2](#) is for information only.

6 Mechanical properties

Mechanical properties are given in [Table 2](#) and shall be subject to an agreement at the time of inquiry and order.

Unless otherwise specified (see ISO 4990), the thickness of the test block shall be 28 mm minimum.

Properties at thicknesses greater than the maximum thickness in [Table 2](#) may be lower and are subject to an agreement between manufacturer and purchaser.

7 Test methods

7.1 The tensile test shall be performed in accordance with ISO 6892-1.

7.2 The impact test shall be performed in accordance with ISO 148-1.

8 Supplementary requirements

A list of supplementary requirements which may be used at the option of the purchaser is given in ISO 4990.

9 Marking

Marking shall be as specified in ISO 4990.

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

Grade designation		C	Si	Mn	P	S	Cr	Mo	Ni	V	Cu
Name	Number										
GE 200	1.0420	—	—	—	0,035	0,030	0,30	0,12	0,40	0,03	0,30
GS 200	1.0449	0,18	0,60	1,20	0,030	0,025	0,30	0,12	0,40	0,03	0,30
GE 240	1.0446	—	—	—	0,035	0,030	0,30	0,12	0,40	0,03	0,30
GS 240	1.0455	0,23	0,60	1,20	0,030	0,025	0,30	0,12	0,40	0,03	0,30
GS 270	1.0454	0,24	0,60	1,30	0,030	0,025	0,30 ^a	0,12 ^a	0,40 ^a	0,03 ^a	0,30 ^a
GS 340	1.0467	0,30	0,60	1,50	0,030	0,025	0,30 ^a	0,12 ^a	0,40 ^a	0,03 ^a	0,30 ^a
G28Mn6	1.1165	0,25 to 0,32	0,60	1,20 to 1,80	0,035	0,030	0,30	0,15	0,40	0,05	0,30
G28MnMo6	1.5433	0,25 to 0,32	0,60	1,20 to 1,60	0,025	0,025	0,30	0,20 to 0,40	0,40	0,05	0,30
G20Mo5	1.5419	0,15 to 0,23	0,60	0,50 to 1,00	0,025	0,020 ^b	0,30	0,40 to 0,60	0,40	0,05	0,30
G10MnMoV6-3	1.5410	0,12 max.	0,60	1,20 to 1,80	0,025	0,020	0,30	0,20 to 0,40	0,40	0,05 to 0,10	0,30
G20NiCrMo2-2	1.6741	0,18 to 0,23	0,60	0,60 to 1,00	0,035	0,030	0,40 to 0,60	0,15 to 0,25	0,40 to 0,70	0,05	0,30
G25NiCrMo2-2	1.6744	0,23 to 0,28	0,60	0,60 to 1,00	0,035	0,030	0,40 to 0,60	0,15 to 0,25	0,40 to 0,70	0,05	0,30
G30NiCrMo2-2	1.6778	0,28 to 0,33	0,60	0,60 to 1,00	0,035	0,030	0,40 to 0,60	0,15 to 0,25	0,40 to 0,70	0,05	0,30
G17CrMo5-5	1.7357	0,15 to 0,20	0,60	0,50 to 1,00	0,025	0,020 ^b	1,00 to 1,50	0,45 to 0,65	0,40	0,05	0,30
G17CrMo9-10	1.7379	0,13 to 0,20	0,60	0,50 to 0,90	0,025	0,020 ^b	2,00 to 2,50	0,90 to 1,20	0,40	0,05	0,30
G26CrMo4	1.7221	0,22 to 0,29	0,60	0,50 to 0,80	0,025	0,020 ^b	0,80 to 1,20	0,15 to 0,30	0,40	0,05	0,30
G34CrMo4	1.7230	0,30 to 0,37	0,60	0,50 to 0,80	0,025	0,020 ^b	0,80 to 1,20	0,15 to 0,30	0,40	0,05	0,30
G42CrMo4	1.7231	0,38 to 0,45	0,60	0,60 to 1,00	0,025	0,020 ^b	0,80 to 1,20	0,15 to 0,30	0,40	0,05	0,30
G30CrMoV6-4	1.7725	0,27 to 0,34	0,60	0,60 to 1,00	0,025	0,020 ^b	1,30 to 1,70	0,30 to 0,50	0,40	0,05 to 0,15	0,30
G35CrNiMo6-6	1.6579	0,32 to 0,38	0,60	0,60 to 1,00	0,025	0,020 ^b	1,40 to 1,70	0,15 to 0,35	1,40 to 1,70	0,05	0,30
G30NiCrMo7-3	1.6572	0,28 to 0,33	0,60	0,60 to 0,90	0,035	0,030	0,70 to 0,90	0,20 to 0,30	1,65 to 2,00	0,05	0,30
G40NiCrMo7-3	1.6573	0,38 to 0,43	0,60	0,60 to 0,90	0,035	0,030	0,70 to 0,90	0,20 to 0,30	1,65 to 2,00	0,05	0,30
G32NiCrMo8-5-4	1.6570	0,28 to 0,35	0,60	0,60 to 1,00	0,020	0,015	1,00 to 1,40	0,30 to 0,50	1,60 to 2,10	0,05	0,30

Single values indicate maximums.

^a Cr + Mo + Ni + V + Cu max. 1,00 %.

^b For castings of ruling thickness < 28 mm, S ≤ 0,030 % is permitted.

**Table 2 — Mechanical properties at room temperature
(heat treatment for information only)**

Grade designation		Symbol ^c	Heat treatment		Thickness <i>t</i> mm	Mechanical properties			
			Normalizing or Austenitizing °C	Tempering °C		<i>R_{p0,2}</i> min. MPa	<i>R_m</i> MPa	<i>A</i> min. %	<i>KV</i> min. J
Name	No.								
GE 200	1.0420	+N	900 to 980		≤ 300	200	380 to 530	25	27
GS 200	1.0449	+N	900 to 980		≤ 100	200	380 to 530	25	35
GE 240	1.0446	+N	900 to 980		≤ 300	240	450 to 600	22	27
GS 240	1.0455	+N	880 to 980		≤ 100	240	450 to 600	22	31
GS 270	1.0454	+N	880 to 960		≤ 100	270	480 to 630	18	27
GS 340	1.0467	+N	880 to 960		≤ 100	340	550 to 700	15	20
G28Mn6	1.1165	+N	880 to 950		≤ 250	260	520 to 670	18	27
		+QT1		630 to 680	≤ 100	450	600 to 750	14	35
		+QT2		580 to 630	≤ 50	550	700 to 850	10	31
G28MnMo6	1.5433	+QT1	880 to 950	630 to 680	≤ 50	500	700 to 850	12	35
				≤ 100	480	670 to 830	10	31	
		+QT2		580 to 630	≤ 100	590	850 to 1 000	8	27
G20Mo5	1.5419	+QT	920 to 980	650 to 730	≤ 100	245	440 to 590	22	27
G10MnMoV6-3	1.5410	QT1	950 to 980	640 to 660	≤ 50	380	500 to 650	22	60
					50 < <i>t</i> ≤ 100	350	480 to 630	22	60
					100 < <i>t</i> ≤ 150	330	480 to 630	20	60
		QT2		150 < <i>t</i> ≤ 250	330	450 to 600	18	60	
				50 < <i>t</i> ≤ 100	500	600 to 750	18	60	
				50 < <i>t</i> ≤ 100	400	550 to 700	18	60	
		QT3 ^a		100 < <i>t</i> ≤ 150	380	500 to 650	18	60	
				150 < <i>t</i> ≤ 250	350	460 to 610	18	60	
				740 to 760 + 600 to 650	<i>t</i> ≤ 100	400	520 to 650	22	27 ^b 60
G20NiCrMo2-2	1.6741	+NT	900 to 980	610 to 660	<i>t</i> ≤ 100	200	550 to 700	18	10
		+QT1		600 to 650		430	700 to 850	15	25
		+QT2		500 to 550		540	820 to 970	12	25
G25NiCrMo2-2	1.6744	+NT	900 to 980	580 to 630	<i>t</i> ≤ 100	240	600 to 750	18	10
		+QT1		500 to 650		500	750 to 900	15	25
		+QT2		550 to 500		600	850 to 1 000	12	25
G30NiCrMo2-2	1.6778	+NT	900 to 980	600 to 650	<i>t</i> ≤ 100	270	630 to 780	18	10
		+QT1		600 to 650		540	820 to 970	14	25
		+QT2		550 to 600		630	900 to 1 050	11	25
Normalise		+N							
Normalise and temper		+NT							
Quench and temper		+QT							
a Double temper.									
b -20 °C test temperature.									
c Number 1, 2 or 3 after "T" indicates a different tempering temperature.									

Table 2 (continued)

Grade designation		Symbol ^c	Heat treatment		Thickness <i>t</i> mm	Mechanical properties						
			Normalizing or Austenitizing °C	Tempering °C		<i>R</i> _{p0,2} min. MPa	<i>R</i> _m MPa	<i>A</i> min. %	<i>KV</i> min. J			
Name	No.											
G17CrMo5-5	1.7357	+QT	920 to 960	680 to 730	<i>t</i> ≤ 100	315	490 to 690	20	27			
G17CrMo9-10	1.7379	+QT	930 to 970	680 to 740	<i>t</i> ≤ 150	400	590 to 740	18	40			
G26CrMo4	1.7221	+QT1	880 to 950	600 to 650	<i>t</i> ≤ 100	450	600 to 750	16	40			
		100 < <i>t</i> ≤ 250			300	550 to 700	14	27				
		+QT2	880 to 950	550 to 600	<i>t</i> ≤ 100	550	700 to 850	10	18			
G34CrMo4	1.7230	+NT	880 to 950	600 to 650	<i>t</i> ≤ 100	270	630 to 780	16	10			
		+QT1			100 < <i>t</i> ≤ 150	480	620 to 770	10	27			
					150 < <i>t</i> ≤ 250	330	620 to 770	10	16			
		+QT2		550 to 600	<i>t</i> ≤ 100	650	830 to 980	10	27			
G42CrMo4	1.7231	+NT	880 to 950	600 to 650	<i>t</i> ≤ 100	300	700 to 850	15	10			
		+QT1			100 < <i>t</i> ≤ 150	550	700 to 850	10	27			
					150 < <i>t</i> ≤ 250	350	650 to 800	10	16			
		+QT2		550 to 600	<i>t</i> ≤ 100	700	850 to 1 000	10	27			
G30CrMoV6-4	1.7725	+QT1	880 to 950	600 to 650	<i>t</i> ≤ 100	700	850 to 1 000	14	45			
					100 < <i>t</i> ≤ 150	550	750 to 900	12	27			
					150 < <i>t</i> ≤ 250	350	650 to 800	12	20			
					+QT2	530 to 600	<i>t</i> ≤ 100	750	900 to 1 100	12	31	
G35CrNiMo6-6	1.6579	+N	860 to 920	600 to 650	<i>t</i> ≤ 150	550	800 to 950	12	31			
					150 < <i>t</i> ≤ 250	500	750 to 900	12	31			
		QT1		600 to 650	<i>t</i> ≤ 100	700	850 to 1 000	12	45			
				600 to 650	100 < <i>t</i> ≤ 150	650	800 to 950	12	35			
				600 to 650	150 < <i>t</i> ≤ 250	650	800 to 950	12	30			
		+QT2		510 to 560	<i>t</i> ≤ 100	800	900 to 1 050	10	35			
G30NiCrMo7-3	1.6572	+NT	900 to 980	630 to 680	<i>t</i> ≤ 100	550	760 to 900	12	10			
		+QT1				690	930 to 1 100	10	25			
		+QT2				580 to 630	795	1 030 to 1 200	8	25		
G40NiCrMo7-3	1.6573	+NT	900 to 980	630 to 680	<i>t</i> ≤ 100	585	860 to 1 100	10	10			
		+QT1				760	1 000 to 1 140	8	25			
		+QT2				580 to 630	795	1 030 to 1 200	8	25		
Normalise		+N										
Normalise and temper		+NT										
Quench and temper		+QT										
a Double temper.												
b -20 °C test temperature.												
c Number 1, 2 or 3 after "T" indicates a different tempering temperature.												

Table 2 (continued)

Grade designation		Symbol ^c	Heat treatment		Thickness <i>t</i> mm	Mechanical properties			
			Normalizing or Austenitizing °C	Tempering °C		<i>R_{p0,2}</i> min. MPa	<i>R_m</i> MPa	<i>A</i> min. %	<i>KV</i> min. J
Name	No.								
G32NiCrMo8-5-4	1.6570	+QT1	880 to 920	600 to 650	<i>t</i> ≤ 100	700	850 to 1 000	16	50
					100 < <i>t</i> ≤ 250	650	820 to 970	14	35
		+QT2	500 to 550	<i>t</i> ≤ 100	950	1 050 to 1 200	10	35	
Normalise		+N							
Normalise and temper		+NT							
Quench and temper		+QT							
a		Double temper.							
b		-20 °C test temperature.							
c		Number 1, 2 or 3 after "T" indicates a different tempering temperature.							

Annex A (informative)

Guidance data for welding

Table A.1 — Guidance data for welding

Grade designation		Preheat temperature ^a °C	Interpass temperature °C max.	Post weld heat treatment
Name	Number			
GE200	1.0420	20 to 150	350	None
GS200	1.0449			
GE240	1.0446			
GS240	1.0455			
GS270	1.0454			
GS 340	1.0467	150 to 300		≥ 620
G28Mn6	1.1165	20 to 150		b
G28MnMo6	1.5433	150 to 300		b
G20Mo5	1.5419	20 to 200		≥ 650 ^b
G10MnMoV6-3	1.5410	20 to 150		None
G20NiCrMo2-2	1.6741			
G25NiCrMo2-2	1.6744	100 to 200	b	
G30NiCrMo2-2	1.6778			
G17CrMo5-5	1.7357	150 to 250	≥ 650 ^b	
G17CrMo9-10	1.7379		> 680 ^b	
G26CrMo4	1.7221	150 to 300		
G34CrMo4	1.7230	200 to 350		
G42CrMo4	1.7231			
G30CrMoV6-4	1.7725		b	
G35CrNiMo6-6	1.6579			
G30NiCrMo7-3	1.6572	200 to 350		
G40NiCrMo7-3	1.6573			
G32NiCrMo8-5-4	1.6570	200 to 350		

^a The preheating temperature is related to the geometry, the thickness of the casting and climatic conditions.

^b The post weld heat treatment temperature shall be at least 20 °C, but not more than 50 °C below tempering temperature.

Annex B (informative)

UNS cast grades similar¹⁾ to ISO cast grades

Table B.1 — UNS grades similar¹⁾ to ISO cast grades

Grade designation		UNS number (similar grade)
Name	Number	
GE200	1.0420	J03000
GS200	1.0449	J02001
GE240	1.0446	J03000
GS240	1.0455	J02003
GS270	1.0454	J02503
GS 340	1.0467	J03003
G28Mn6	1.1165	—
G28MnMo6	1.5433	—
G20Mo5	1.5419	—
G10MnMoV6-3	1.5410	—
G20NiCrMo2-2	1.6741	J12047, J12095
G25NiCrMo2-2	1.6744	J12595
G30NiCrMo2-2	1.6778	J13095
G17CrMo5-5	1.7357	—
G17CrMo9-10	1.7379	—
G26CrMo4	1.7221	J13502
G34CrMo4	1.7230	J14047, J23259
G42CrMo4	1.7231	—
G30CrMoV6-4	1.7725	—
G35CrNiMo6-6	1.6579	—
G30NiCrMo7-3	1.6572	J23259
G40NiCrMo7-3	1.6573	J24053
G32NiCrMo8-5-4	1.6570	—

NOTE The grade designations including the names and the numbers follow the rules of EN 10027-1 and EN 10027-2.

1) The similar UNS (Unified Numbering System) grades may not be equivalent to the grades in this International Standard.

Bibliography

- [1] ISO 3755, *Cast carbon steels for general engineering purposes*
- [2] EN 10027-1, *Designation system for steels — Part 1: Steel names*
- [3] EN 10027-2, *Designation system for steels — Part 2: Steel numbers*

