
**Centrifugally cast steel and alloy
products —**

**Part 2:
Heat-resistant materials**

*Produits en acier et alliages moulés par centrifugation —
Partie 2: Aciers moulés réfractaires*

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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. 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 Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 11, *Steel castings*.

ISO 13583 consists of the following parts, under the general title *Centrifugally cast steel and alloy products*:

- *Part 1: General testing and tolerances*
- *Part 2: Heat resistant materials*

This second edition cancels and replaces the first edition (ISO 13583-2:2003), which has been technically revised with the following changes:

- [Clause 2](#), standard references added where appropriate;
- [Table 1](#), composition limits modified for various grades;
- [Tables 1, 2, 3, A.1, A.2, A.3](#), and [B.1](#);
- [Annex C](#) is added.

Centrifugally cast steel and alloy products —

Part 2: Heat-resistant materials

1 Scope

This part of ISO 13583 specifies cast steel and nickel alloy grades for elevated temperature service products manufactured by centrifugal casting.

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 4990, *Steel castings — General technical delivery conditions*

ISO 13583-1, *Centrifugally cast steel and alloy products — Part 1: General testing and tolerances*

3 General technical delivery conditions

Cast steel and alloy grades specified by this International Standard shall conform to the applicable requirements of ISO 4990 and ISO 13583-1 including the supplementary requirements that are indicated in the enquiry and purchase order.

4 Heat treatment

The cast steel and alloy grades specified by this International Standard do not require heat treatment. If heat treatment is required, the treatment shall be established by agreement between the manufacturer and the purchaser, and shall be specified in the purchase contract.

5 Chemical composition

The cast steel and nickel alloy grades shall conform to the chemical composition listed in [Table 1](#).

6 Mechanical properties

The cast steel and nickel alloy grades shall conform to the requirements given in [Tables 2](#) and [3](#).

Mechanical tests at room temperature and elevated temperature shall be performed if agreed upon between the manufacturer and purchaser at the time of enquiry and order.

7 Supplementary requirements

A list of supplementary requirements for use at the option of the purchaser is included in ISO 4990 and ISO 13583-1. These supplementary requirements may be used with this specification upon agreement between the manufacturer and purchaser. These must be agreed at the time of the order and listed in the order.

8 Additional information

Additional information on the cast steels and nickel alloy grades in this International Standard is included in [Tables A.1, A.2, A.3, B.1](#) and [C.1](#). This information is given for guidance only and is not a requirement of this International Standard.

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

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Table 1 — Chemical composition (cast analysis % by mass)^a

Grade designation Name	Number	C	Si	Mn	P	S	Cr	Ni	Mo	Nb	W	Co	Others
GX25CrNiSi18-9	1.4825	0,15 to 0,35	0,5 to 2,5	2,0	0,040	0,030	17,0 to 19,0	8,0 to 10,0	0,50				
GX40CrNiSi25-12	1.4837	0,30 to 0,50	1,0 to 2,5	2,0	0,040	0,030	24,0 to 27,0	11,0 to 14,0	0,50				
GX40CrNiSi25-20	1.4848	0,30 to 0,50	1,0 to 2,5	2,0	0,040	0,030	24,0 to 27,0	19,0 to 22,0	0,50				
GX40CrNiSiNb24-24	1.4855	0,30 to 0,50	1,0 to 2,5	2,0	0,040	0,030	23,0 to 25,0	23,0 to 25,0	0,50	0,80 to 1,80			
GX10NiCrSiNb32-20	1.4859	0,050 to 0,15	0,5 to 1,5	2,0	0,040	0,030	19,0 to 21,0	31,0 to 33,0	0,50	0,50 to 1,50			
GX40NiCrSi38-19	1.4865	0,30 to 0,50	1,0 to 2,5	2,0	0,040	0,030	18,0 to 21,0	36,0 to 39,0	0,50				
GX12NiCrSiNb35-26	1.4851	0,08 to 0,15	0,5 to 1,5	0,5 to 1,5	0,030	0,030	24,0 to 27,0	34,0 to 37,0	0,50	0,60 to 1,30			
GX40NiCrSiNb35-26	1.4852	0,30 to 0,50	1,0 to 2,5	2,0	0,040	0,030	24,0 to 27,0	33,0 to 36,0	0,50	0,80 to 1,80			
GX42NiCrSiNbTi35-25	1.4838	0,38 to 0,48	1,5 to 2,5	0,5 to 1,5	0,030	0,030	24,0 to 27,0	34,0 to 37,0	0,50	0,60 to 1,80			Ti: 0,06 min. ^b addition required
GX42NiCrWSi35-25-5	1.4836	0,38 to 0,45	1,0 to 2,0	0,5 to 1,5	0,030	0,030	24,0 to 27,0	34,0 to 37,0	0,50		4,0 to 6,0		
GX42NiCrSiNbTi45-35	1.4839	0,38 to 0,45	1,0 to 2,0	0,5 to 1,5	0,030	0,030	33,0 to 36,0	44,0 to 47,0	0,50	0,50 to 1,50			Ti: 0,06 min. ^b addition required
GX50NiCrCoW35-25-15-5	1.4869	0,45 to 0,55	1,0 to 2,0	1,0	0,040	0,030	24,0 to 26,0	33,0 to 37,0	0,50		4,0 to 6,0	14,0 to 16,0	
G-NiCr28W	2.4879	0,35 to 0,55	1,0 to 2,0	1,5	0,040	0,030	27,0 to 30,0	47,0 to 50,0	0,50		4,0 to 6,0		Fe: Balance
G-NiCr28WCo	2.4881	0,40 to 0,55	1,0 to 2,0	0,5 to 1,5	0,030	0,030	27,0 to 30,0	47,0 to 50,0	0,50		4,0 to 6,0	2,5 to 3,5	
G-NiCr50Nb	2.4680	0,10	1,0	0,5	0,020	0,020	48,0 to 52,0	balance	0,50	1,00 to 1,80			N: 0,16 Fe: 1,0

^a A single value indicates a maximum limit.

^b Other micro alloying elements can be substituted for titanium. The total micro alloying elements shall be 0,06 % min.

Table 2 — Mechanical properties at room temperature

Grade designation		$R_{p0.2}$	R_m	A_5
Name	Number	MPa ^a min	MPa ^a min.	% min.
GX25CrNiSi18-9	1.4825	230	450	15
GX40CrNiSi25-12	1.4837	220	450	10
GX40CrNiSi25-20	1.4848	220	450	8
GX40CrNiSiNb24-24	1.4855	220	450	10
GX10NiCrSiNb32-20	1.4859	180	440	20
GX40NiCrSi38-19	1.4865	220	420	6
GX12NiCrSiNb35-26	1.4851	175	440	20
GX40NiCrSiNb35-26	1.4852	220	440	4
GX42NiCrSiNbTi35-25	1.4838	220	450	8
GX42NiCrWSi35-25-5	1.4836	220	450	4
GX42NiCrSiNbTi45-35	1.4839	270	480	5
GX50NiCrCoW35-25-15-5	1.4869	250	450	5
G-NiCr28W	2.4879	240	440	3
G-NiCr28WCo	2.4881	220	400	5
G-NiCr50Nb	2.4680	230	540	8

^a 1 MPa = 1 N/mm²

Table 3 — Short time rupture test: minimum time to rupture of 100 h at constant stress and temperature

Grade designation		Temperature °C	Stress MPa
Name	Number		
GX25CrNiSi18-9	1.4825	800	60
GX40CrNiSi25-12	1.4837	900	34
GX40CrNiSi25-20	1.4848	900	47
GX40CrNiSiNb24-24	1.4855	900	48
GX10NiCrSiNb32-20	1.4859	800	84
GX40NiCrSi38-19	1.4865	900	34
GX12NiCrSiNb35-26	1.4851	800	70
GX40NiCrSiNb35-26	1.4852	900	49
GX42NiCrSiNbTi35-25	1.4838	950	42
GX42NiCrWSi35-25-5	1.4836	950	35
GX42NiCrSiNbTi45-35	1.4839	1 050	21
GX450NiCrCoW35-25-15-5	1.4869	950	40
G-NiCr28W	2.4879	1 050	20
G-NiCr28WCo	2.4881	1 050	20
G-NiCr50Nb	2.4680	900	60

Annex A (informative)

Mean values for 1 % elongation and creep rupture

**Table A.1 — Mean values of stress for 1 % elongation in 10 000 h
(mean values out of a scatter band ± 20 %)**

Grade designation		$R_{1/10\,000}$	$R_{1/10\,000}$	$R_{1/10\,000}$	$R_{1/10\,000}$	$R_{1/10\,000}$	$R_{1/10\,000}$
Name	Number	at 600 °C	at 700 °C	at 800 °C	at 900 °C	at 1 000 °C	at 1 100 °C
GX25CrNiSi18-9	1.4825	78	44	22	9		
GX40CrNiSi25-12	1.4837		50	26	13	6	
GX40CrNiSi25-20	1.4848		65	36	17	7	2,5
GX40CrNiSiNb24-24	1.4855		80	46	22	7,5	
GX10NiCrSiNb32-20	1.4859		64	36	15,5	5	
GX40NiCrSi38-19	1.4865		55	32	18	7	
GX12NiCrSiNb35-26	1.4851		64	36	15,5	5	
GX40NiCrSiNb35-26	1.4852		72	41	22	9	3
GX42NiCrSiNbTi35-25	1.4838		84	54	29	14	4
GX42NiCrWSi35-25-5	1.4836		73	43	22	9,8	2,6
GX42NiCrSiNbTi45-35	1.4839		84	50	28	15,4	7,1
GX50NiCrCoW35-25-15-5	1.4869		90	60	32	17	6
G-NioCr28W	2.4879		70	41	22	10	4
G-NiCr28WCo	2.4881		90	55	29	13,5	6
G-NiCr50Nb	2.4680		71	38	18	6,8	

NOTE Purchasers should consider the effects of atmospheres and temperatures in service when assessing the suitability of component design and selection of grade.

**Table A.2 — Mean values for creep rupture strength for 10 000 h
(mean values out of a scatter band ±20 %)**

Grade designation		Creep rupture strength MPa at				
Name	Number	700 °C	800 °C	900 °C	1 000 °C	1 100 °C
GX25CrNiSi18-9	1.4825	56	26	14		
GX40CrNiSi25-12	1.4837	56	28	14	7	
GX40CrNiSi25-20	1.4848		45	23	9,6	2,5
GX40CrNiSiNb24-24	1.4855		56	28	12	
GX10NiCrSiNb32-20	1.4859	80	43	23	9	
GX40NiCrSi38-19	1.4865			27	12,5	
GX12NiCrSiNb35-26	1.4851	90	52	26	11	
GX40NiCrSiNb35-26	1.4852		55	32	14,5	4
GX42NiCrSiNbTi35-25	1.4838		64	39	17	7
GX42NiCrWSi35-25-5	1.4836			32	14	5,3
GX42NiCrSiNbTi45-35	1.4839		54	34	18,6	8,3
GX40NiCrCoW35-25-15-5	1.4869		65	38	17	6
G-NiCr28W	2.4879		52	29	14	5
G-NiCrWCo	2.4881		54	33	17	7,8
G-NiCr50Nb	2.4680		49	21	4,5	

**Table A.3 — Mean values for creep rupture strength for 100 000 h
(mean values out of a scatter band ± 20 %)**

Grade designation		Creep rupture strength MPa at				
Name	Number	700 °C	800 °C	900 °C	1 000 °C	1 100 °C
GX25CrNiSi18-9	1.4525	36	18	7,7		
GX40CrNiSi25-12	1.4837	36	19	8	3	
GX40CrNiSi25-20	1.4848		29	12	5	
GX40CrNiSiNb24-24	1.4855		40	18,5	7	
GX10NiCrSiNb32-20	1.4859	60	32	14	4,5	
GX40NiCrSi38-19	1.4865		27	10	3	
GX12NiCrSiNb35-26	1.4851	65	35	16	5,4	
GX40NiCrSiNb35-26	1.4852	65	49	24	9	2,3
GX42NiCrSiNbTi35-25	1.4838		50	28	14	4
GX42NiCrWSi35-25-5	1.4836		35	16,5	6,6	1,7
GX42NiCrSiNbTi45-35	1.4839	84	42	24	11	4
GX50NiCrCoW35-25-15-5	1.4869		49	25	9,8	3
G-NiCr28W	2.4879		36	17	7,4	2,6
G-NiCr28WCo	2.4881		36	17	8	3
G-NiCr50Nb	2.4680		28,5	13	3,8	

Annex B (informative)

Table of physical properties ([Table B.1](#))

Table B.1 — Physical properties

Grade designation		Density kg/dm ³ at 20 °C	Specific heat capac- ity J/(kg K) at 20 °C	Thermal conductivity W/(m K) at				Thermal expansion 10 ⁻⁶ K ⁻¹ at		
				20 °C	100 °C	800 °C	1 000 °C	400 °C	800 °C	1 000 °C
Name	Number									
GX25CrNiSi18-9	1.4825	7,8	500	14,8	15,5	26	30	17,4	18,3	18,8
GX40CrNiSi25-12	1.4837	7,8	500	14	15	25,4	28,8	17,5	18,4	19,3
GX40CrNiSi25-20	1.4848	7,8	500	14,6	16,7	25	28	17	18	19
GX40CrNiSiNb24-24	1.4855	8,0	500	14,0	15,5	25,5	27,7	16,8	18,0	18,5
GX10NiCrSiNb32-20	1.4859	8,0	500	12,8	13,0	25,1		17,6	18,7	19,5
GX40NiCrSi38-19	1.4865	8,0	500	12,0	12,3	23,3	26,5	15,3	17,0	17,6
GX12NiCrSiNb35-26	1.4851	8,0	500	12,8	13,0	25,1		17,6	18,7	19,5
GX40NiCrSiNb35-26	1.4852	8,0	500	12,8	13,0	23,5	27,7	16	17,8	18,6
GX42NiCrSiNbTi35-25	1.4838	8,0	500	12,8	13,0	23,5	27,7	16,0	17,0	18,5
GX42NiCrWSi35-25-5	1.4836	8,3	500	12,7	13,0	23,4	28,0	16,2	17,4	18,6
GX42NiCrSiNbTi45-35	1.4839	8,0	500	12,0	12,2	30,6	36,1	14,3	15,3	15,7
GX40NiCrCoW35-25-15-5	1.4869	8,2	500	10,0	12,6	27,0	28,0	16,9	17,2	17,3
G-NiCr28W	2.4879	8,2	500	11,0	11,3	30,6	36,1	14,3	15,3	15,7
G-NiCr28WCo	2.4881	8,2	500	11,0	11,3	30,6	36,1	14,4	15,7	16,3
G-NiCr50Nb	2.4680	8,0	450	12,7	14,2	26,8	31,2	13	15	15