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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 (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).

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 SC 11, *Steel castings*.

This third edition cancels and replaces the second edition (ISO 13583-2:2015), of which it constitutes a minor revision. The changes are as follows:

— editorial update.

A list of all parts in the ISO 13583 series can be found on the ISO website.

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.

Centrifugally cast steel and alloy products —

Part 2:
Heat-resistant materials

1 Scope

This document specifies cast steel and nickel alloy grades for elevated temperature service products manufactured by centrifugal casting.

2 Normative references

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 requirements*

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

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 technical delivery conditions

Cast steel and alloy grades specified by this document 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.

5 Heat treatment

The cast steel and alloy grades specified by this document 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.

6 Chemical composition

The cast steel and nickel alloy grades shall conform to the chemical composition listed in Table 1.

7 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.

8 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 shall be agreed at the time of the order and listed in the order.

9 Additional information

Additional information on the cast steels and nickel alloy grades in this document is included in Tables A.1, A.2, A.3, B.1 and C.1.

Annex C gives information on ISO grade designation and available UNS numbers which are similar to the ISO grade designation.

Table 1 — Chemical composition (mass fraction in %)[a]

Grade designation		C	Si	Mn	P	S	Cr	Ni	Mo	Nb	W	Co	Others
Name	Number												
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/mm^2

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

Grade designation		Temperature	Stress
Name	Number	°C	MPa
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		$R_{1/10\,000}$ at 600 °C	$R_{1/10\,000}$ at 700 °C	$R_{1/10\,000}$ at 800 °C	$R_{1/10\,000}$ at 900 °C	$R_{1/10\,000}$ at 1 000 °C	$R_{1/10\,000}$ at 1 100 °C
Name	Number						
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	
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

Table A.2 *(continued)*

Grade designation		Creep rupture strength MPa at				
Name	**Number**	**700 °C**	**800 °C**	**900 °C**	**1 000 °C**	**1 100 °C**
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	