ISO 13583-2

INTERNATIONAL STANDARD

ISO 13583-2

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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

Отливки из стали и сплавов, полученные центробежным способом. Часть 2. Жаропрочные материалы.

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 13583-2 was prepared by 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 corrected version of ISO 13583-2:2003 incorporates the following corrections.

Clause 2, normative reference to ISO 4990 has been updated.

Table 1, row 17, column 13 (C + N = 0,20 max.).

Table 2, row 12, column 1 (GX42NiCrWSi35-25-5).

Table 3, row 11, column 1 (GX42NiCrSiNbTi35-25).

Table A.1, row 7, column 1 (GX40NiCrSi38-18).

Table A.3, row 13, column 1 (GX42NiCrSiNbTi45-35).

Centrifugally cast steel and alloy products —

Part 2:
Heat resistant materials

1 Scope

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

2 Normative references

The following referenced documents are indispensable for the application 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 4990:2003, *Steel castings — General technical delivery requirements*

ISO 13583-1:2000, *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 mutual agreement between the manufacturer and the purchaser, and shall be specified in the purchase contract.

5 Chemical requirements

The cast steels and alloy grades shall conform to the chemical requirements listed in Table 1.

6 Mechanical properties

The cast steel and 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.

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

Designation	C	Si	Mn	P max.	S max.	Cr	Ni	Mo max.	Nb	W	Co	Others
GX30CrNiSi19-9	0,25 0,35	1,30 1,80	0,50 1,50	0,03	0,03	18,0 20,0	8,0 10,0	0,5				
GX40CrNiSi25-12	0,35 0,45	1,00 2,00	0,50 1,50	0,03	0,03	24,0 26,0	11,0 13,0	0,5				
GX42CrNiSi25-20	0,38 0,45	1,00 2,00	0,50 1,50	0,03	0,03	24,0 26,0	19,0 21,0	0,5				
GX30CrNiSiNb24-24	0,25 0,35	0,70 2,00	0,50 1,50	0,03	0,03	23,0 25,0	23,0 25,0	0,5	1,20 1,80			
GX12NiCrSiNb32-21	0,08 0,15	0,50 1,50	0,50 1,50	0,03	0,03	19,0 22,0	31,0 33,0	0,5	0,60 1,30			
GX40NiCrSi38-18	0,35 0,45	1,30 2,00	0,50 1,50	0,03	0,03	17,0 19,0	36,0 39,0	0,5				
GX12NiCrSiNb35-25	0,08 0,15	0,50 1,50	0,50 1,50	0,03	0,03	24,0 27,0	34,0 37,0	0,5	0,60 1,30			
GX42NiCrSiNb35-25	0,38 0,45	0,50 1,50	0,50 1,50	0,03	0,03	24,0 27,0	34,0 37,0	0,5	0,60 1,25			
GX43NiCrSiNb35-25	0,38 0,48	1,50 2,50	0,50 1,50	0,03	0,03	24,0 27,0	34,0 37,0	0,5	0,60 1,80			
GX42NiCrSiNbTi35-25	0,38 0,45	1,00 2,00	0,50 1,50	0,03	0,03	24,0 27,0	34,0 37,0	0,5	0,60 1,80			Ti 0,06 min.[a] addition required
GX42NiCrWSi35-25-5	0,38 0,45	1,00 2,00	0,50 1,50	0,03	0,03	24,0 27,0	34,0 37,0	0,5		4,00 6,00		
GX42NiCrSiNbTi45-35	0,38 0,45	1,00 2,00	0,50 1,50	0,03	0,03	33,0 36,0	44,0 47,0	0,5	0,50 1,50			Ti 0,06 min.[a] addition required
GX45NiCrCoW35-25-15-5	0,40 0,50	1,00 2,00	0,50 1,50	0,03	0,03	24,0 26,0	33,0 37,0	0,5		4,00 6,00	14,0 16,0	
GX48NiCrWSi48-28-5	0,40 0,55	1,00 1,75	0,50 1,50	0,03	0,03	27,0 29,0	47,0 49,0	0,5		4,00 6,00		
GX48NiCrWCo48-28-5-3	0,40 0,55	1,00 1,75	0,50 1,50	0,03	0,03	27,0 29,0	47,0 49,0	0,5		4,00 6,00	2,50 3,50	
GX8NiCrNb50-50	0,1 max.	0,5 max.	0,5 max.	0,02	0,02	47,0 52,0	balance	0,5	1,40 1,70			N 0,16 max., C + N = 0,20 max. Fe 1,0 max.

[a] 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

Designation	$R_{p0,2}$ MPa [a] min.	R_m MPa [a] min.	A_5 % min.
GX30CrNiSi19-9	230	450	15
GX40CrNiSi25-12	230	450	10
GX42CrNiSi25-20	220	450	8
GX30CrNiSiNb24-24	220	450	10
GX12NiCrSiNb32-21	170	440	20
GX40NiCrSi38-18	220	420	6
GX12NiCrSiNb35-25	175	440	20
GX42NiCrSiNb35-25	220	450	8
GX43NiCrSiNb35-25	220	450	8
GX42NiCrSiNbTi35-25	220	450	8
GX42NiCrWSi35-25-5	220	450	4
GX42NiCrSiNbTi45-35	250	450	5
GX45NiCrCoW35-25-15-5	250	450	5
GX48NiCrWSi48-28-5	220	400	5
GX48NiCrWCo48-28-5-3	220	400	5
GX8NiCrNb50-50	250	550	8

[a] 1 N/mm^2 = 1 MPa.

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

Designation	Temperature °C	Stress MPa
GX30CrNiSi19-9	800	47
GX40CrNiSi25-12	900	34
GX42CrNiSi25-20	900	40
GX30CrNiSiNb24-24	900	48
GX12NiCrSiNb32-21	800	70
GX40NiCrSi38-18	900	34
GX12NiCrSiNb35-25	800	70
GX42NiCrSiNb35-25	950	40
GX43NiCrSiNb35-25	950	40
GX42NiCrSiNbTi35-25	950	42
GX42NiCrWSi35-25-5	950	35
GX42NiCrSiNbTi45-35	1 050	21
GX45NiCrCoW35-25-15-5	950	40
GX48NiCrWSi48-28-5	1 050	20
GX48NiCrWCo48-28-5-3	1 050	20
GX8NiCrNb50-50	900	40

7 Supplementary requirements

A list of standardized 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 alloy grades in this International Standard is included in Tables A.1, A.2 and A.3 and in Annex B. This information is given for guidance only and is not a requirement of this International Standard.

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 %)

Values in megapascals

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
GX30CrNiSi19-9	78	44	22	9		
GX40CrNiSi25-12		50	26	13	6	
GX42CrNiSi25-20		65	36	17	7	2,4
GX30CrNiSiNb24-24		80	46	22	7,5	
GX12NiCrSiNb32-21		64	36	15,5	5	
GX40NiCrSi38-18		55	32	18	7	
GX12NiCrSiNb35-25		64	36	15,5	5	
GX42NiCrSiNb35-25		80	51	28	13	3,6
GX43NiCrSiNb35-25		74	46	25	10,5	2,9
GX42 NiCrSiNbTi35-25		84	54	29	14	4
GX42NiCrWSi35-25-5		73	43	22	9,8	2,6
GX42NiCrSiNbTi 45-35		84	50	28	15,4	7,1
GX45NiCrCoW35-25-15-5		90	60	32	17	6
GX48NiCrWSi48-28-5			46	27	13	4
GX48NiCrWCo48-28-5-3		90	55	29	13,5	6
GX8NiCrNb50-50		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 hours
(mean values out of a scatter band ± 20 %)

Designation	Creep rupture strength MPa at				
	700 °C	800 °C	900 °C	1 000 °C	1 100 °C
GX30CrNiSi19-9	56	26	14		
GX40CrNiSi25-12	56	28	14	7	
GX42CrNiSi25-20		45	23	9,6	2,5
GX30CrNiSiNb24-24		56	28	12	
GX12NiCrSiNb32-21	80	43	23	9	
GX40NiCrSi38-18			27	12,5	
GX12NiCrSiNb35-25	90	52	26	11	
GX42NiCrSiNb35-25		55	32	14,5	4
GX43NiCrSiNb35-25		45	26	11,5	4
GX42NiCrSiNbTi 35-25		64	39	17	7
GX42NiCrWSi35-25-5			32	14	5,3
GX42NiCrSiNbTi45-35		54	34	18,6	8,3
GX45NiCrCoW35-25-15-5		65	38	17	6
GX48NiCrWSi48-28-5		52	29	14	5
GX48NiCrWCo48-28-5-3		54	33	17	7,8
GX8NiCrNb50-50		49	21	4,5	

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

Designation	Creep rupture strength MPa at				
	700 °C	800 °C	900 °C	1 000 °C	1 100 °C
GX30CrNiSi19-9	36	18	7,7		
GX40CrNiSi25-12	36	19	8	3	
GX42CrNiSi25-20		29	12	5	
GX30CrNiSiNb24-24		40	18,5	7	
GX12NiCrSiNb32-21	60	32	14	4,5	
GX40NiCrSi38-18		27	10	3	
GX12NiCrSiNb35-25	65	35	16	5,4	
GX42NiCrSiNb35-25		49	24	9	2,3
GX43NiCrSiNb35-25		40	22	8	2,1
GX42NiCrSiNbTi35-25		50	28	14	4
GX42NiCrWSi35-25-5		35	16,5	6,6	1,7
GX42NiCrSiNbTi45-35	84	42	24	11	4
GX45NiCrCoW35-25-15-5		49	25	9,8	3
GX48NiCrWSi48-28-5		36	17	7,4	2,6
GX48NiCrWCo48-28-5-3		36	17	8	3
GX8NiCrNb50-50		28,5	13	3,8	

Annex B
(informative)

Physical properties

Designation	Density kg/dm³ at 20 °C	Specific heat capacity 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 °
GX30CrNiSi19-9	7,8	500	14,8	15,5	26,0	30,0	17,4	18,3	18,8
GX40CrNiSi25-12	7,8	500	14,0	15,0	25,4	28,8	17,5	18,4	19,3
GX42CrNiSi25-20	7,8	500	14,6	16,7	25,0	28,0	17,0	18,0	19,0
GX30CrNiSiNb24-24	8,0	500	14,0	15,5	25,5	27,7	16,8	18,0	18,5
GX12NiCrSiNb32-21	8,0	500	12,8	13,0	25,1		17,6	18,7	19,5
GX40NiCrSi38-18	8,0	500	12,0	12,3	23,3	26,5	15,3	17,0	17,6
GX12NiCrSiNb35-25	8,0	500	12,8	13,0	25,1		17,6	18,7	19,5
GX42NiCrSiNb35-25	8,0	500	12,8	13,0	23,5	27,7	16,0	17,0	18,5
GX43NiCrSiNb35-25	8,0	500	12,8	13,0	23,5	27,7	16,0	17,0	18,5
GX42NiCrSiNbTi35-25	8,0	500	12,8	13,0	23,5	27,7	16,0	17,0	18,5
GX42NiCrWSi35-25-5	8,3	500	12,7	13,0	23,4	28,0	16,2	17,4	18,6
GX42NiCrSiNbTi45-35	8,0	500	12,0	12,2	30,6	36,1	14,3	15,3	15,7
GX45NiCrCoW35-25-15-5	8,2	500	10,0	12,6	27,0	28,0	16,9	17,2	17,3
GX48NiCrWSi48-28-5	8,2	500	11,0	11,3	30,6	36,1	14,3	15,3	15,7
GX48NiCrWCo48-28-5-3	8,2	500	11,0	11,3	30,6	36,1	14,4	15,7	16,3
GX8NiCrNb50-50	8,0	450	12,7	14,2	26,8	31,2	13,1	15,0	14,8

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