INTERNATIONAL STANDARD

ISO 9327-5

First edition
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Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions —

Part 5:
Stainless steels

Pièces forgées et barres laminées ou forgées en acier pour appareils à pression — Conditions techniques de livraison —

Partie 5: Aciers inoxydables

Reference number
ISO 9327-5:1999(E)

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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 3.

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 9327-5 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 10, *Steel for pressure purposes*.

This first edition, together with parts 1 to 4 of ISO 9327, cancels and replaces ISO 2604-1:1975.

ISO 9327 consists of the following parts, under the general title *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions*:

— *Part 1: General requirements*

— *Part 2: Non-alloy and alloy (Mo, Cr and CrMo) steels with specified elevated temperature properties*

— *Part 3: Nickel steels with specified low temperature properties*

— *Part 4: Weldable fine grain steels with high proof strength*

— *Part 5: Stainless steels*

Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions —

Part 5:
Stainless steels

1 Scope

1.1 This part of ISO 9327 applies to forgings and rolled or forged bars manufactured from the austenitic and austenitic-ferritics steels given in Table 1 and delivered according to the specifications given in ISO 9327-1.

1.2 This part of ISO 9327 covers the following data:

a) In Table 1 the limits for

   — the chemical composition according to the cast analysis;

   — the tensile properties at room temperature;

   — the indications on the usual heat treatment condition at the time of delivery;

b) in Table 2 the permissible deviations of the results of the product analysis from the specified limits for the cast analysis,

c) in Table 3 the minimum elevated temperature proof strength values;

d) in Table 4 the estimated average stress rupture properties.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 9327. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 9327 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 148:1983, *Steel — Charpy impact test (V-notch).*

ISO/TR 4949:1989, *Steel names based on letter symbols.*

ISO 9327-1, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions — Part 1: General requirements*.

ISO/TR 15461:1997, *Steel forgings — Testing frequency, sampling conditions and test methods for mechanical tests.*

3 Terms and definitions

For the purposes of this part of ISO 9327, the terms and definitions given in ISO 9327-1 apply.

4 Ordering

See ISO 9327-1.

5 Requirements

See ISO 9327-1 and Tables 1 to 4.

6 Inspection, testing and conformity of products

See ISO 9327-1.

7 Marking

See ISO 9327-1.

Table 1 — Chemical composition, room temperature mechanical properties and heat treatment conditions of austenitic and austenitic-ferritic steels

Line No.	Steel type: designation[a] in accordance with "new" ISO/TR 4949	Steel type: "old" ISO 2604-1	Chemical composition[b] % by mass: C	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni	Others	Mechanical properties at room temperature[c]: Thickness of the ruling section t_R max. mm	$R_{p0,2}$ min. N/mm²	$R_{p1,0}$ min. N/mm²	R_m N/mm²	A min. DIR: x %	A min. DIR: y %	KV[d] min. DIR: x-y J	KV[d] min. DIR: y-x J	Elevated temperature properties (See Table): R_p	Creep properties	Heat treatment: Usual conditions of reference heat treatment: Symbol[e]	Solution temperature[f] °C	Cooling in[g]
1	X2CrNi18-10	F46	⩽ 0,030	1,00	2,00	0,045	0,030	17,00 to 19,00	—	9,00 to 12,00	—	250	180	215	480 to 680	30	30	85	55	3	—	Q	1000 to 1100 [h]	w, a
2	X2CrNiN18-10	—	⩽ 0,030	1,00	2,00	0,045	0,030	17,00 to 19,00	—	8,50 to 11,50	0,12 to 0,22 N	250	270	305	550 to 750	30	30	85	55	3	—	Q	1000 to 1100 [h]	w, a
3	X5CrNi18-9	F47	⩽ 0,07	1,00	2,00	0,045	0,030	17,00 to 19,00	—	8,00 to 11,00	—	250	195	230	500 to 700	30	30	85	55	3	—	Q	1000 to 1100 [h]	w, a
4	X7CrNi18-9	F48	0,04 to 0,10	1,00	2,00	0,045	0,030	17,00 to 19,00	—	8,00 to 11,00	—	250	195	230	490 to 690	30	30	85	55	3	4	Q	1050 to 1120 [i]	w, a
5	X6CrNiNb18-10	F50	⩽ 0,08	1,00	2,00	0,045	0,030	17,00 to 19,00	—	9,00 to 12,00	Nb ⩾ 10 × % C ⩽ 1,00 [j]	450	205	240	510 to 710	30	30	85	55	3	—	Q	1020 to 1120 [h]	w, a
6	X6CrNiTi18-10	F53	⩽ 0,08	1,00	2,00	0,045	0,030	17,00 to 19,00	—	9,00 to 12,00	Ti ⩾ 5 × % C ⩽ 0,80	450	200	235	510 to 710 [k]	30	30	85	55	3	—	Q	1020 to 1120 [h]	w, a
7	X7CrNiTi18-10	F54	0,04 to 0,10	1,00	2,00	0,045	0,030	17,00 to 19,00	—	9,00 to 12,00	Ti ⩾ 5 × % C ⩽ 0,80	450	175	210	490 to 690	30	30	85	55	3	4	Q	1020 to 1120 [i]	w, a
8	X7CrNiNb18-10	F51	0,04 to 0,10	1,00	2,00	0,045	0,030	17,00 to 19,00	—	9,00 to 12,00	Nb ⩾ 10 × % C ⩽ 1,20 [j]	450	205	240	510 to 710	30	30	85	55	3	4	Q	1050 to 1120 [i]	w, a
9	X2CrNiMo17-12	F59	0,030	1,00	2,00	0,045	0,030	16,50 to 18,50	2,00 to 2,50	11,00 to 14,00	—	250	190	225	490 to 690	30	30	85	55	3	—	Q	1020 to 1120 [h]	w, a

Table 1 *(continued)*

Line No.	Steel type		Chemical composition[b] % by mass									Mechanical properties at room temperature [c]								Elevated temperature properties		Heat treatment		
	"new" designation[a] in accordance with ISO/TR 4949	"old" designation[a] in accordance with ISO 2604-1	C	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni	Others	Thickness of the ruling section t_R max. mm	$R_{p0,2}$ min. N/mm²	$R_{p1,0}$ min. N/mm²	R_m N/mm²	A min. DIR: x %	A min. DIR: y %	KV[d] min. DIR: x-y J	KV[d] min. DIR: y-x J	R_p See Table	Creep properties See Table	Usual conditions of reference heat treatment: Symbol[e]	Solution temperature[f] °C	Cooling in[g]
10	X2CrNiMoN17-12	—	≤ 0,030	1,00	2,00	0,045	0,030	16,50 to 18,50	2,00 to 2,50	10,50 to 13,50	0,12 to 0,22 N	160	280	315	580 to 780	30	30	85	55	3	—	Q	1020 to 1120[h]	w, a
11	X2CrNiMo17-13	F59	≤ 0,030	1,00	2,00	0,045	0,030	16,50 to 18,50	2,50 to 3,00	11,50 to 14,50	—	250	190	225	490 to 690	30	30	85	55	3	—	Q	1020 to 1120[h]	w, a
12	X2CrNiMoN17-13	—	≤ 0,030	1,00	2,00	0,045	0,030	16,50 to 18,50	2,50 to 3,00	11,50 to 14,50	0,12 to 0,22 N	160	280	315	580 to 780	30	30	85	55	3	—	Q	1020 to 1120[h]	w, a
13	X5CrNiMo17-12	F62	≤ 0,07	1,00	2,00	0,045	0,030	16,50 to 18,50	2,00 to 2,50	10,50 to 13,50	—	250	205	240	510 to 710	30	30	85	55	3	—	Q	1020 to 1120[h]	w, a
14	X5CrNiMo17-13	F62	≤ 0,07	1,00	2,00	0,045	0,030	16,50 to 18,50	2,50 to 3,00	11,00 to 14,00	—	250	205	240	510 to 710	30	30	85	55	3	—	Q	1020 to 1120[h]	w, a
15	X7CrNiMo17-12	F64	0,04 to 0,10	1,00	2,00	0,045	0,030	16,50 to 18,50	2,00 to 2,50	10,50 to 13,50	—	250	205	240	510 to 710	30	30	85	55	3	4	Q	1020 to 1120[i]	w, a
16	X6CrNiMoTi17-12	F66	≤ 0,08	1,00	2,00	0,045	0,030	16,50 to 18,50	2,00 to 2,50	11,00 to 14,00	Ti ≥ 5 × % C ≤ 0,80	450	210	245	510 to 710[k]	30	30	85	55	3	—	Q	1020 to 1120[h]	w, a
17	X6CrNi25-21	F68	≤ 0,08	1,50	2,00	0,045	0,030	24,00 to 26,00	—	19,00 to 23,00	—	160	210	250	500 to 700	30	30	85	55	3	—	Q	1000 to 1100 h	w, a

Table 1 *(concluded)*

Line No.	Steel type		Chemical composition[b] % by mass									Mechanical properties at room temperature [c]								Elevated temperature properties		Heat treatment		
	"new"	"old"	C	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni	Others	Thickness of the ruling section	$R_{p0,2}$ min.	$R_{p1,0}$ min.	R_m	A min. DIR:		KV[d] min. DIR:		R_p	Creep properties	Usual conditions of reference heat treatment		
	designation[a] in accordance with											t_R max.				x	y	x-y	y-x	See Table		Symbol[e]	Solution temperature[f]	Cooling in[g]
	ISO/TR 4949	ISO 2604-1										mm	N/mm²	N/mm²	N/mm²	%	%	J	J				°C	
18	X2NiCrMoCu25-20-5[l]	—	≤ 0,025	1,00	2,00	0,030	0,020	19,00 to 22,00	4,00 to 5,00	24,00 to 27,00	1,00 to 2,00 Cu, (≤ 0,15 N)[m]	160	220[m]	225[m]	520 to 720[m]	30	30	85	55	3	—	Q	1050 to 1150[h]	w, a
19	X2CrNiN23-4	—	≤ 0,030	1,00	2,50	0,035	0,020	22,00 to 24,00	≤0,60	3,50 to 5,00	≤ 0,60 Cu 0,05 to 0,20 N	160	400		600 to 820	25	20	85	55	3	—	Q	970 to 1070	w, a
20	X2CrNiMoN22-5-3	—	≤ 0,030	1,00	2,00	0,035	0,020	21,00 to 23,00	2,50 to 3,50	4,50 to 6,50	0,08 to 0,20 N	250	450		600 to 860	25	20	85	55	3	—	Q	1020 to 1100	w, a

a All data on designations in this part of ISO 9327 are to be regarded as preliminary (see NOTE 2 of 4.1 in ISO 9327-1:1999).

b See 5.2.1.1 of ISO 9327-1:1999.

c $R_{p0,2}$ or $R_{p1,0}$ is the proof strength;

R_m is the tensile strength;

A is the percentage elongation after fracture on gauge length;

L_o is the gauge length = 5,65 $\sqrt{S_o}$;

KV is the Charpy V-notch impact energy.

DIR:x, DIR:x-y, DIR:y and DIR: y-x are the directions of the test piece in relation to the main direction of grain flow. For detailed explanations see Table 5 and Figures 9 and 10 of ISO/TR 15461:1997.

d Average of three tests. One of the individual values may be below the specified minimum average, provided it is not less than 70 % of this value. The values apply to standard 10 mm × 10 mm Charpy V-notch impact test pieces (see ISO 148). Austenitic stainless steels do not exhibit any transition range of impact values so that there is no important decrease in the impact values down to low temperatures.

e Q = quenched.

f For guidance only, except in cases where testing of reference test pieces is required.

g a = air – cooling sufficiently rapid; w = water.

h In the case of heat treatment in the course of processing after delivery, the lower part of the given solution temperature range shall be aimed for. If, in the course of hot working, the temperature is not below the specified lower limit of the solution temperature, the following temperatures are sufficient for repeat heat treatments: 980 °C in the case of Mo-free steels, 1 000 °C in the case of steels with ≤ 3 % Mo.

i For the steels for which stress rupture values are given in table 4, the treatment temperature shall not be less than the minimum of the reference temperature range.

j Niobium content including tantalum determined as niobium.

k For diameters above 100 mm, lower values are to be agreed.

l Since this steel is at the stage of development, small deviations in chemical composition are permitted, provided the other requirements are fulfilled.

m By agreement, nitrogen may be added up to a limit of 0,15 %. In this case higher proof strength and tensile strength values may also be agreed upon.