

INTERNATIONAL STANDARD

ISO
9328-3

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Steel plates and strips for pressure purposes — Technical delivery conditions —

Part 3:

Nickel-alloyed steels with specified low
temperature properties

ISO 9328-3:1991

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Toles et bandes en acier pour service sous pression — Conditions techniques de livraison

Partie 3: Aciers alliés au nickel à propriétés spécifiées à basses températures



Reference number
ISO 9328-3:1991(E)

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.

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 9328-3 was prepared by Technical Committee ISO/TC 17, *Steel*, Sub-Committee SC 10, *Steel for pressure purposes*.

Parts 1 to 5 of ISO 9328 cancel and replace the first editions of ISO 2604-4:1975, ISO/TR 2604-7:1986 and ISO 2604-8:1985, of which they constitute a technical revision.

ISO 9328 consists of the following parts, under the general title *Steel plates and strips for pressure purposes — Technical delivery conditions*:

- *Part 1: General requirements*
- *Part 2: Unalloyed and low-alloyed steels with specified room temperature and elevated temperature properties*
- *Part 3: Nickel-alloyed steels with specified low temperature properties*
- *Part 4: Weldable fine grain steels with high proof stress supplied in the normalized or quenched and tempered condition*
- *Part 5: Austenitic steels*

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Steel plates and strips for pressure purposes — Technical delivery conditions —

Part 3:

Nickel-alloyed steels with specified low temperature properties

1 Scope

1.1 This part of ISO 9328 applies to plates and strip of 3 mm to 50 mm thickness manufactured of the steels covered in table 1 and to be delivered according to the specifications given in ISO 9328-1.

1.2 This part of ISO 9328 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,
 - indications on the usual heat-treatment conditions 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 impact properties at low temperatures.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9328. At the time of publication, the editions indicated were valid. All standards are

subject to revision, and parties to agreements based on this part of ISO 9328 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 9328-1:1991, *Steel plates and strips for pressure purposes — Technical delivery conditions — Part 1: General requirements*.

3 Definitions

See ISO 9328-1.

4 Ordering and designation

See ISO 9328-1.

5 Requirements

See ISO 9328-1 and tables 1 to 3.

6 Inspection, testing and conformity of products

See ISO 9328-1.

7 Marking

See ISO 9328-1.

Table 1 – Chemical composition (cast analysis), room temperature mechanical properties and heat-treatment conditions of Ni-alloyed steels with specified low temperature properties

Line No.	Steel type designation ¹⁾	Chemical composition [% (m/m)] ²⁾							
		C max.	Si max.	Mn	P max.	S max.	Al _{total} min.	Ni	Others
1	11 MnNi 5 3	0,14	0,50	0,70 to 1,50	0,030	0,025	0,020	0,30 to 0,80	Nb < 0,05 V < 0,05
2	13 MnNi 6 3	0,16	0,50	0,85 to 1,65	0,030	0,025	0,020	0,30 to 0,85	Nb < 0,05 V < 0,05
3	15 NiMn 6	0,18	0,35	0,80 to 1,50	0,025	0,020	—	1,30 to 1,70	V < 0,05
4	12 Ni 14 G1	0,15	0,35	0,30 to 0,80	0,025	0,020	—	3,25 to 3,75	V < 0,05
5	12 Ni 14 G2	0,15	0,35	0,30 to 0,80	0,025	0,020	—	3,25 to 3,75	V < 0,05
6	X 8 Ni 9	0,10	0,35	0,30 to 0,80	0,025	0,020	—	8,5 to 10,0	Mo < 0,10 V < 0,05

1) All data on designations in this part of ISO 9328 are to be regarded as preliminary and will be revised as soon as a general system for the designation of steels and steel products has been established.

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2) See also ISO 9328-1, 5.2.1.1. [https://standards.iteh.ai/catalog/standards/sist/380c2b36-7666-4200-a74c-](https://standards.iteh.ai/catalog/standards/sist/380c2b36-7666-4200-a74c-872063e046d9/iso-9328-3-1991)

3) R_e : yield stress (see ISO 9328-1, table 3, footnote 4); [872063e046d9/iso-9328-3-1991](https://standards.iteh.ai/catalog/standards/sist/380c2b36-7666-4200-a74c-872063e046d9/iso-9328-3-1991)

R_m : tensile strength;

A : percentage elongation after fracture on original gauge length $L_0 = 5,65 \sqrt{S_0}$ (where S_0 is the original cross-sectional area);

KV : impact strength of ISO V-notch test pieces.

4) For thicknesses over 50 mm, the values are to be agreed upon.

5) N: normalized,

N(+T): normalized and (if appropriate) tempered,

Q+T: quenched and tempered.

6) a: air, o: oil, w: water.

Mechanical properties at room temperature ^{3), 4)}				Low temperature properties <i>KV</i> See table	Heat treatment				
Thickness mm	$R_{e \text{ min.}}$ N/mm ²	R_m N/mm ²	$A \text{ min.}$ %		Symbol ⁵⁾	Austenitizing or solution temperature °C	Cooling in ⁶⁾	Tempering °C	Cooling in ⁶⁾
≥ 3 < 30	285	420 to 530	24	3	N(+T)	880 to 940	a	580 to 640	a
> 30 < 50	275		24						
≥ 3 < 30	355	490 to 610	22	3	N(+T)	880 to 940	a	580 to 640	a
> 30 < 50	345		22						
≥ 3 < 30	355	490 to 640	22	3	N	850 to 900	a	—	—
> 30 < 50	345		N+T		22	850 to 900	a	600 to 660	a or w
			Q+T		850 to 900	w or o	600 to 660	a or w	
≥ 3 < 30	285	450 to 600	23	3	N	830 to 880	a	—	—
> 30 < 50	275		N+T		23	830 to 880	a	580 to 640	a or w
			Q+T		830 to 870	w or o	580 to 640	a or w	
≥ 3 < 30	355	470 to 620	22	3	N	830 to 880	a	—	—
> 30 < 50	345		N+T		22	830 to 880	a	580 to 640	a or w
			Q+T		820 to 870	w or o	580 to 640	a or w	
≥ 3 < 30	490	640 to 840	18	3	N+N+T	880 to 930	a	540 to 600	a or w
> 30 < 50	480		18		770 to 820	w or o	540 to 600		

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Table 2 — Permissible deviations of the product analysis from the specified limits for the cast analysis

Element	Maximum of specification range in the cast analysis	Permissible deviation ¹⁾
	% (m/m)	% (m/m)
C	≤ 0,18	+ 0,03
Si	≤ 0,50	+ 0,05
Mn	≤ 1,65	± 0,10
P	≤ 0,030	+ 0,005
S	≤ 0,025	+ 0,005
Al	≥ 0,020	− 0,005
Ni	≤ 3,75 > 3,75 ≤ 10,0	± 0,07 ± 0,10

1) The deviations, other than when maxima only are specified, apply either above or below the specified limits of the range but not both above and below for the same element from different sample products from the same cast. When maxima only are specified the deviations are positive only. The values are valid only if the samples were selected according to clause A.6 of ISO 9328-1.

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Table 3 — Impact properties at low temperatures for steels according to table 1

Steel type designation	Reference heat-treatment ^{1), 2)}	Product thickness ⁶⁾ mm	Minimum impact energy values <i>KV</i> , average of three tests (J) ^{3), 4)}											
			Longitudinal test pieces ⁵⁾											
			Temperature (°C)											
			20	0	-20	-40	-50	-60	-80	-100	-120	-150	-170	-195
11 MnNi 5 3 13 MnNi 6 3	N(+T)	≤ 50	70	60	55	50	45	40	—	—	—	—	—	—
15 NiMn 6	N N+T Q+T	≤ 50	65	65	65	60	50	50	40	—	—	—	—	—
12 Ni 14 G1 12 Ni 14 G2	N N+T Q+T	≤ 50	65	60	55	55	50	50	45	40	—	—	—	—
X 8 Ni 9	N+N+T Q+T	≤ 50	70	70	70	70	70	70	70	60	50	50	45	40

1) N: normalized, Q+T: quenched and tempered, (N+T): normalized and (if appropriate) tempered.

2) For temperatures and cooling conditions, see table 1.

3) One of the three individual values may be below the specified minimum average value, provided that it is not less than 70 % of this value.

4) The values apply to standard 10 mm × 10 mm Charpy V-notch impact test pieces (See ISO 148). For subsidiary test pieces see the note in 5.3.1 of ISO 9328-1.

5) See table 3, column 3, of ISO 9328-1.

6) For greater thicknesses, the minimum impact energy values shall be agreed upon.

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Minimum impact energy values KV , average of three tests (J) ^{3), 4)}											
Transverse test pieces ⁵⁾											
Temperature (°C)											
20	0	-20	-40	-50	-60	-80	-100	-120	-150	-170	-195
45	40	40	35	30	27	—	—	—	—	—	—
45	45	45	40	35	35	27	—	—	—	—	—
45	40	40	35	35	35	30	27	—	—	—	—
50	50	50	50	50	50	50	40	35	35	30	27

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