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Used in USDOE-NE Standards

Standard Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06045)N06696) and Nickel-Chromium-Cobalt-Molybdenum Alloy (ÚNS N06617) Plate, Sheet, and Strip¹

This standard is issued under the fixed designation B 168; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

- 1.1 This specification² covers rolled nickel-chromium-iron alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06045)*N06696)* and nickel-chromium-cobalt-molybdenum alloy (UNS N06617) plate, sheet, and strip.
- 1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information
- 1.3 The following precautionary caveat pertains only to the test methods portion, Section 12, of this specification: This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet (MSDS) for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

- 2.1 ASTM Standards: ³
- B 166 Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696) and Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617) Rod, Bar, and Wire
- B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys
- E 8 Test Methods for Tension Testing of Metallic Materials
- E 10 Test Method for Brinell Hardness of Metallic Materials
- E 18 Test Methods for Rockwell Hardness of Metallic Materials
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E 38 Methods for Chemical Analysis of Nickel-Chromium and Nickel-Chromium-Iron Alloys⁴
- E 112 Test Methods for Determining Average Grain Size
- E 140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness
- E 527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
- E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys
- F 155 Test Method for Temper of Strip and Sheet Metals for Electronic Devices (Spring-Back Method)⁰
- 2.2 Federal Standards: 5
- Fed. Std. No. 102 Preservation, Packaging and Packing Levels
- Fed. Std. No. 123 Marking for Shipment (Civil Agencies)
- Fed. Std. No. 182 Continuous Identification Marking of Nickel and Nickel-Base Alloys

¹ This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt and Their Alloys.

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^{*} New designation established in accordance with Practice E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

⁵ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.



2.3 Military Standard:⁵

MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 Descriptions of Terms Specific to This Standard—The terms given in Table 1 shall apply.

4. Ordering Information

- 4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for the safe and satisfactory performance of material ordered under this specification. Examples of such requirements include, but are not limited to, the following:
 - 4.1.1 Alloy —Name or UNS number (see Table 2),
 - 4.1.2 ASTM designation, including year of issue,
 - 4.1.3 Condition—See 6.1 and 6.2 and Appendix X1,
 - 4.1.4 Finish—Appendix X1,
 - 4.1.5 Dimensions—Thickness, width, and length,
 - 4.1.6 Quantity,
 - 4.1.7 Optional Requirements:
 - 4.1.7.1 Sheet and Strip— Whether to be furnished in coil, in cut straight lengths, or in random straight lengths,
 - 4.1.7.2 Strip—Whether to be furnished with commercial slit edge, square edge, or round edge,
 - 4.1.7.3 Plate—Whether to be furnished specially flattened (see 7.7.2); also how plate is to be cut (see 7.2.1 and 7.3.2),
 - 4.1.8 Certification— State if certification or a report of test results is required (Section 15),
 - 4.1.9 Samples for Product (Check) Analysis—Whether samples for product (check) analysis should be furnished (see 5.2), and
- 4.1.10 *Purchaser Inspection*—If the purchaser wishes to witness tests or inspection of material at the place of manufacture, the purchase order must so state indicating which tests or inspections are to be witnessed (Section 13).

5. Chemical Composition

- 5.1 The material shall conform to the requirements as to chemical composition prescribed in Table 2.
- 5.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations prescribed in Specification B 880.

https://standards.iteh.ai/catalog/standards/sist/h240ec0e_c22h_4a71_8312_hhf8304e5462/astm_h168_08

6. Mechanical Properties and Other Requirements

6.1 Mechanical Properties—The material shall conform to the mechanical properties prescribed in Table 3-

TABLE 1 Product Description

Product	Thickness, in. (mm)	Width, in. (mm)
Hot-rolled plate ^A	3/16 and over (Table 5 and Table 6)	(Table 8) ^B
Hot-rolled sheet ^A	0.018 to 0.250 (0.46 to 6.4), incl (Table 7)	(Table 10)
Cold-rolled sheet ^C	0.018 to 0.250 (0.46 to 6.4), incl (Table 7)	(Table 10)
Cold-rolled strip ^C	0.005 to 0.250 (0.13 to 6.4), incl (Table 7)	(Table 10)

A Material %16 to 1/4 in. (4.8 to 6.4 mm), incl, in thickness may be furnished as sheet or plate provided the material meets the specification requirements for the condition ordered.

^B Hot-rolled plate, in widths 10 in. (254 mm) and under, may be furnished as hot-finished rectangles with sheared or cut edges in accordance with Specification B 166, provided the mechanical property requirements of this specification are met.

C Material under 48 in. (1219 mm) in width may be furnished as sheet or strip provided the material meets the specification requirements for the condition ordered.

TABLE+1 2 Permissible Variations from Flatness of Rectangular, Circular, and Sketch PlatesNote 1—Permissible variations apply to plates up to 12 ft (3660 mm) in lengtCh; of longer plates.

Note 2—If the longer dimension is under 36 in. (914 mm), the permissible variation is not greater than ¼ in. (6.4 mm).

Note 3—The shorter dimension specified is considered the width, and the permissible Revariation in flatness across the width does not exceed the tabqular amount of that dimension. Note 4—The maximum deviation from a flat surface does not customarily exceed the tabular tolerance forthe longer dimension specified.

										PerCominossible V
•				O la:	3					A SIGNES SIGNES A
Sp <u>Eleoifimed Thick</u> ness	TAllo-48 <u>V</u> (122N0), exel6600	48-tAllo-69 <u>y</u> (122 <u>N</u> 0-te 152660), exel <u>1</u>	60 tAllo-72 <u>V</u> (152N0-te 661830), exel <u>7</u>	72 tAllo 84y (483N0 te 2136690), exel	84 tAllo 96y (213N0 to 2440), exel6693	96-tAllo-108 <u>y</u> (244 <u>N</u> 0-te 27460), exel <u>25</u>	108 tAllo-120y (274No-te 360450), exel	120 tAllo 144 <u>y</u> (3N050 to 3660) , exel <u>3</u>	+44 <u>Alloy</u> (3N <u>0</u> 66 9), and over	્ક
				ST	Inches					9
				M Oe	Inches96					∲ E
to 1/4 , exel		11/18	+/+	13%	15/8	45%	ļi.	ļ:	l:	3 1
Nickel to exel	72.0 min	58.0-63.0	44.5 min	58.0 min	remainder ⁴	remainder ^A	45.0 min	remainder ^A	<u>remainder^A</u>	168
Chromium Gobalt	14.0–17.0 to ½, exel	21.0–25.0	20.0–24.0	27.0–31.0	27.0–31.0	24.0–26.0 —	<u>26.0–29.0</u> —	24.0–26.0 1½—	28.0–32.0	- 0
Cobalt	to		10.0–15.0	——————————————————————————————————————		:	: 1	: 1	0	8
Molybdenum	<u>.</u>	2 :	8.0–10.0	to '*, ox	d .i	:	:	i	1.0-3.0	
Niobium	i .	÷	: 1	: † -8.	0.5–2.5	: 1	: ተ	: !		
<u>Iron</u> Mangapese	6.0–10.0	remainder ^A	3.0 max	0.11.0	2.5-6.0	8.0–11.0	21.0–25.0 –	8.0–11.0	2.0-6.0	
Manganese	to 1, excl	1.0 max	1.0 max	0.5 max	1.0 max	0.15 max	1.0 max	0.15 max	1.0 max	
Aluminum	I	7	6.1 7.1-80	1 to 2, exc	25-40	1 8-2 4	I	2 4-3 0		
		2	2	: 39	25	- - - - - -	[።] የዛ	-0.20-0.40	 0.15-max	
Carbon 2 to 4 incl	0.15 max -	0.10 max _	0.05-0.15	0.05 max 4e5	0.15 max	0.15-0.25	0.05-0.12	0.20-0.40	0.15 max	
Copper	0.5 max	1.0 max 0.5 max	0.5 max Milli metres	0.5 max	0.5 max	0.1 max	0.3 max	0.50 max	1.5-3.0	
Silicon	0.5 max 4 .8 to 6.4, excl		1.0 metres 19. 0	0.72 57.0	31.8					
ax	0.5 max	0.5 max	0.5 max	2.5-3.0	0.50 max	1.0–2.5			c	
Sulfur 6 440 0 5 oxel	0.015 max	0.015 max	0.015 max	0.015 max	0.01 max	0.010 max	0.010 max	0.010 max	0.010 max	
Titanium 9.5 to 12.7, exel	5 ::- 51	5 4 5 6	0.6 max 475	e e e e e e e e e e e e e e e e e e e	1.0 max 23.8	0.1–0.2 28 -6	8. 8.	0.01-0.25 36 .5	1.0 max 44 4	
Phosphorus 12.7 to 19.0, excl	<u>12</u> 7	:: 4 6:	::- 12 6: 21	6: <u></u>	20.6	0.020 max 28 .6	0.020 max 28.6	0.020 max 28 .6	349	
Zirconium 19.0to 25.4, exel	<u>+2+</u>	:: 4 6:	6 . 51	6 . 51	19.0	0.01-0.10 2-0.6	23.8	0.01-0.10 25 .4	28 6	
Yttrium 25.4 to 50.8, exel	<u></u>	:: 4 6:	: 4	:: 		0.05-0.12 475	17 5	0.01-0.15 475	:	
Boron	6	<u></u> 254	0.006 max						::-	



TABLE 3Mechanical Properties for Plate, Sheet, and Strip (All Thicknesses and Sizes Unless Otherwise Indicated)

Condition (Temper)	Tensile Strength, min, psi (MPa	Yield Strength ^A (0.2% offset), min, p	esi Elongation in 2 in. or 50 m (or 4 <i>D</i>), min,%	nm Rockwell Hardness ^{B.Q}
		Hot-Rolled Plate	(6. 12),,70	
JNS N06600:				
Annealed As-rolled ^{D,E}	80 000 (550) 85 000 (586)	35 000 (240) 35 000 (240)	30-30	
JNS N06601:	, , , , , ,	, , , , , ,		
Annealed	-80-000 (550)	30000 (205)	30	
JNS N06603:	, ,	, ,		
Annealed	-94-000 (650)	43 000 (300)	25	
JNS N06617:	, ,	,		
Annealed	-95-000 (655)	35 000 (240)	35	
JNS N06690:	()			
Annealed	-85-000 (586)	35 000 (240)	30	
As-rolled ^{D,E}	-85 000 (586)	35 000 (240)	30	
nnealed ^F	-75 000 (514)	30 000 (206)	30	
JNS N06693 Annealed	100 000 (690)	50 000 (345)	30	
JNS N06025 Annealed	- 98 000 (680)	39 000 (270)	30	
INS N06045 Annealed	90 000 (620)	35 000 (240)	35	
NO NOO45 Allilealed	90 000 (020)			•••
		Hot-Rolled Sheet		
JNS N06600:				
Innealed	-80-000 (550)	35 000 (240)	30	
JNS N06601:				
Innealed	-80-000 (550)	30000 (205)	30	
JNS N06603:				
nnealed	-94-000 (650)	43 000 (300)	25	
INS N06617:	,	, ,		
Annealed	-95-000 (655)	35 000 (240)	30	
JNS N06690:	\/	,		
nnealed	85 000 (586)	35 000 (240)	30	
INS N06693 Annealed	100 000 (690)	50 000 (345)	30	
INS N06025 Annealed	98 000 (680)	39 000 (270)	30	
INS N06045 Annealed	-90 000 (620)	35 000 (270) 35 000 (240)	35	
Annealed	- 90 000 (620)	35 000 (240)	***	
		Cold-Rolled Plate		
JNS N06603				
Annealed	-94-000 (650)	43-000 (300)	25	
JNS N06025 Annealed	98 000 (680)	43 000 (300) 39 000 (270)	16 W 30	
JNS N06045 Annealed	90 000 (620)	35 000 (270) 35 000 (240)	35	
710 1100043 Aillicaica	-30 000 (020)			
		Cold-Rolled Sheet		
		AS 11V1 D100-00		
JNS N06600: Annealed Hard	-80-000 (550) ^G 125-000 (860)	9 ^G 35 000 (240) 90 000 (620)	_9317_1 30^G_2^G 4-54	6 7/z stm-b168-08
	is.icii.al catarog standard	² 35 000 (240) 90 000 (620) 4271	-8312-b 306-26 4e54	6 2/as tm-b168-08
Annealed Hard //standard	-80 000 (550) ^G 125 000 (860)	1 ² 35 000 (240) 90 000 (620) 4871 30000 (205)	-8312-b 30g-2 g4e54	6 2/a stm-b168-08
unnealed Hard JNS N06601: unnealed	is.icii.al catarog standard	5/5151/UZ4UCCUC-CZZU-4a/1		
Annealed Hard //standard JNS N06601: Annealed JNS N06603:	is.icii.arcatarog standard	30000 (205)		
Innealed Hard INS N06601: Innealed INS N06603: Innealed	-80 000 (550)^G	5/5151/UZ4UCCUC-CZZU-4a/1	30 ^G	
Annealed Hard JNS N06601: Annealed JNS N06603: Annealed JNS N06617:	-80-000 (550) ^G -94-000 (650)	30000 (205) 43-000 (300)	30 ^G	
Annealed Hard JNS N06601: Annealed JNS N06603: Annealed JNS N06617: Annealed	-80 000 (550)^G	30000 (205)	30 [©] 25 [©]	
Annealed Hard JNS N06601: Innealed JNS N06603: Innealed JNS N06617: Innealed JNS N06690:	-80 000 (550) ^G -94 000 (650) -95 000 (655) ^G	30000 (205) 43 000 (300) 35 000 (240)	25 ^Q	
Annealed Hard JNS N06601: Annealed JNS N06603: Annealed JNS N06617: Annealed JNS N06690: Annealed Hard	-80 -000 (550) ^G -94 -000 (650) -95 -000 (655) ^G -85 -000 (586) ^G 125 -000 (860)	30000 (205) 43 000 (300) 35 000 (240) 1 ² 35 000 (240) 90 000 (620)	30 ^G 2 ^G	
Innealed Hard INS N06601: INS N06603: INS N06603: INS N06617: Innealed INS N06690: Innealed INS N06690: Innealed Hard INS N06693 Annealed	-80 000 (550) ^G -94 000 (650) -95 000 (655) ^G -85 000 (586) ^G 125 000 (860) 100 000 (690)	30000 (205) 43 000 (300) 35 000 (240) 10 35 000 (240) 90 000 (620) 50 000 (345)	30 [©] 25 [©] 25 [©] 30 [©] 2 [©] 30	
nnealed Hard NS N06601: nnealed NS N06603: nnealed NS N06617: nnealed NS N06690: nnealed Hard NS N06693 Annealed NS N06025 Annealed	-80 -000 (550) ^G -94 -000 (650) -95 -000 (655) ^G -85 -000 (586) ^G 125 -000 (860) 100 -000 (690) -98 -000 (680)	30000 (205) 43 000 (300) 35 000 (240) 9 35 000 (240) 90 000 (620) 50 000 (345) 39 000 (270)	30 [©] 25 [©] 25 [©] 30 [©] 2 [©] 30 30	
nnealed Hard NS N06601: nnealed NS N06603: nnealed NS N06617: nnealed NS N06690: nnealed Hard NS N06693 Annealed NS N06025 Annealed	-80 000 (550) ^G -94 000 (650) -95 000 (655) ^G -85 000 (586) ^G 125 000 (860) 100 000 (690)	30000 (205) 43 000 (300) 35 000 (240) 10 35 000 (240) 90 000 (620) 50 000 (345)	30 [©] 25 [©] 25 [©] 30 [©] 2 [©] 30	
nnealed Hard NS N06601: nnealed NS N06603: nnealed NS N06617: nnealed NS N06690: nnealed Hard NS N06693 Annealed NS N06025 Annealed	-80 -000 (550) ^G -94 -000 (650) -95 -000 (655) ^G -85 -000 (586) ^G 125 -000 (860) 100 -000 (690) -98 -000 (680)	30000 (205) 43 000 (300) 35 000 (240) 9 35 000 (240) 90 000 (620) 50 000 (345) 39 000 (270)	30 [©] 25 [©] 25 [©] 30 [©] 2 [©] 30 30	
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Innealed Hard INS N06601: Innealed INS N06603: Innealed INS N06617: Innealed INS N06690: Innealed INS N06693 Annealed INS N06095 Annealed INS N06045 Annealed INS N06045 Annealed INS N06001: INS N066001: INS N066001: Innealed INS N066001: Innealed INS N066001: Innealed Ikin-hard	-80 000 (550) ^G -94 000 (650) -95 000 (655) ^G -85 000 (586) ^G 125 000 (860) 100 000 (690) -98 000 (680) -90 000 (620) -80 000 (550) ^G	30000 (205) 43 000 (300) 35 000 (240) 50 000 (345) 39 000 (270) 35 000 (240) Cold-Rolled Strip 35 000 (240)	30 ^G 25 ^G 25 ^G 30 ^G 2 ^G 30 30 35	
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INS N06601: INS N06601: Innealed INS N06603: Innealed INS N06603: Innealed INS N06617: Innealed INS N06690: Innealed INS N06693 Annealed INS N06035 Annealed INS N06045 Annealed INS N066060: Innealed INS N06600: Innealed INS N06600: Innealed INS N06600: Innealed INS N06601: Innealed INS N06601: Innealed	-80 -000 (550) ^G -94 -000 (650) -95 -000 (655) ^G -85 -000 (586) ^G 125 -000 (860) 100 -000 (690) -98 -000 (680) -90 -000 (620) -80 -000 (550) ^G 125 -000 (860) ^G	30000 (205) 43 000 (300) 35 000 (240) 50 000 (345) 39 000 (270) 35 000 (240) Cold-Rolled Strip 35 000 (240) 90 000 (620)	30 ^G 2 ^G 30 35 35 30 G	
Innealed Hard INS N06601: Innealed INS N06603: Innealed INS N06617: Innealed INS N06690: Innealed INS N06690: Innealed INS N06693 Annealed INS N06025 Annealed INS N06045 Annealed INS N066045 Annealed INS N06600: Innealed INS N06600: Innealed INS N06601: Innealed INS N06601: Innealed	-80 -000 (550) ^G -94 -000 (655) ^G -95 -000 (655) ^G -85 -000 (586) ^G 125 -000 (860) 100 -000 (690) -98 -000 (680) -90 -000 (620) -80 -000 (550) ^G 125 -000 (860) ^G	30000 (205) 43 000 (300) 35 000 (240) 50 000 (345) 39 000 (270) 35 000 (240) Cold Rolled Strip 35 000 (240) :: ::: ::: ::: ::: ::: ::: ::: ::: :	30 ^G 2 ^G 30 35 35 35 36 36 37 37 37 37 37 37 37 37 37 37 37 37 37	
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Annealed Hard JNS N06601: Innealed JNS N06603: Innealed JNS N06617: Innealed JNS N06690:	-80 -000 (550) ^G -94 -000 (650) -95 -000 (655) ^G -85 -000 (586) ^G 125 -000 (860) 100 -000 (690) -98 -000 (680) -90 -000 (620) -80 -000 (550) ^G 125 -000 (860) ^G 80 -000 (550) ^G	30000 (205) 43-000 (300) 35-000 (240) 9-35-000 (240) 50-000 (345) 30-000 (270) 35-000 (240) Cold-Rolled Strip 35-000 (240) 90-000 (620) 30000 (205)	30 ^G 2 ^G 30 35 35 35 36 36 37 37 37 37 37 37 37 37 37 37 37 37 37	
Annealed Hard JNS N06601: Innealed JNS N06603: Innealed JNS N06603: Innealed JNS N06617: Innealed JNS N06690: Innealed JNS N06693 Annealed JNS N06095 Annealed JNS N06095 Annealed JNS N06005 Annealed JNS N0600605 Innealed JNS N06600: Innealed JNS N06600: Innealed JNS N06601: Innealed JNS N06601: Innealed JNS N06603: Innealed JNS N06603: Innealed	-80 000 (550) ^G -94 000 (655) ^G -95 000 (655) ^G -85 000 (586) ^G 125 000 (860) 100 000 (690) -98 000 (680) -90 000 (620) -80 000 (550) ^G 125 000 (860) ^G 80 000 (550) ^G 94 000 (650)	30000 (205) 43 000 (300) 35 000 (240) 50 000 (345) 39 000 (270) 35 000 (240) Cold-Rolled Strip 35 000 (240) 90 000 (620) 30000 (205) 43 000 (300)	30 ^G 2 ^G 30 35 35 35 36 36 37 37 37 37 37 37 37 37 37 37 37 37 37	
INS N06601: Innealed Hard INS N06601: Innealed INS N06603: Innealed INS N06617: Innealed INS N06690: Innealed INS N06693 Annealed INS N06095 Annealed INS N06095 Annealed INS N06045 Annealed INS N066061: Innealed	-80 -000 (550) ^G -94 -000 (650) -95 -000 (655) ^G -85 -000 (586) ^G 125 -000 (860) 100 -000 (690) -98 -000 (680) -90 -000 (620) -80 -000 (550) ^G 125 -000 (860) ^G 80 -000 (550) ^G	30000 (205) 43-000 (300) 35-000 (240) 9-35-000 (240) 50-000 (345) 30-000 (270) 35-000 (240) Cold-Rolled Strip 35-000 (240) 90-000 (620) 30000 (205)	30 ^G 2 ^G 30 30 30 35 35 35 30 30 30 30 35 35 30 30 30 30 30 30 30 30 30 30 30 30 30	
INS N06601: Innealed Hard INS N06601: Innealed INS N06603: Innealed INS N06617: Innealed INS N06690: Innealed INS N06690: Innealed INS N06693 Annealed INS N06045 Annealed INS N066045 Annealed INS N066060: Innealed INS N06600: Innealed INS N06601: Innealed INS N06603: Innealed INS N06603: Innealed INS N06601: Innealed INS N06617: Innealed INS N06617: Innealed INS N06690:	-80 -000 (550) ^G -94 -000 (650) -95 -000 (555) ^G -85 -000 (586) ^G 125 -000 (860) 100 -000 (690) -98 -000 (680) -90 -000 (650) -80 -000 (550) ^G 125 -000 (860) ^G -80 -000 (550) ^G -94 -000 (655) -95 -000 (655) ^G	30000 (205) 43 000 (300) 35 000 (240) 90 000 (240) 50 000 (240) 50 000 (240) Cold-Rolled Strip 35 000 (240) 90 000 (620) 30000 (205) 43 000 (240) 35 000 (240)	30 ^G 25 ^G 25 ^G 30 ^G 2 ^G 30 30 35 30 ^G 2 ^G 30 ^G 25 ^G 30 ^G 30 35	
nnealed Hard NS N06601: nnealed NS N06603: nnealed NS N06617: nnealed NS N06690: nnealed NS N06690: nnealed Hard NS N06693 Annealed NS N06025 Annealed NS N06045 Annealed NS N06045 Annealed NS N066060: nnealed kin hard tuarter hard lard pring NS N06601: nnealed NS N06603: nnealed NS N06603: nnealed NS N06603: nnealed NS N06603: nnealed NS N06617: nnealed	-80 000 (550) ^G -94 000 (655) ^G -95 000 (655) ^G -85 000 (586) ^G 125 000 (860) 100 000 (690) -98 000 (680) -90 000 (620) -80 000 (550) ^G 125 000 (860) ^G 80 000 (550) ^G 94 000 (650)	30000 (205) 43 000 (300) 35 000 (240) 50 000 (345) 39 000 (270) 35 000 (240) Cold-Rolled Strip 35 000 (240) 90 000 (620) 30000 (205) 43 000 (300)	30 ^G 2 ^G 30 30 30 35 35 35 30 30 30 30 35 35 30 30 30 30 30 30 30 30 30 30 30 30 30	

TABLE 3 Continued

Condition (Temper)	Tensile Strength, min, psi (MPa	Yield Strength ^A (0.2% offset), min, psi (MPa)	Elongation in 2 in. or 50 mm (or 4 <i>D</i>), min,%	Rockwell Hardness ^{B.C}
Half-hard				B93 to B98
Three-quarter-hard				B97 to C25
Hard	125 000 (860)^G	90 000 (620)	<u>-2^G</u>	
Spring				C30 min
UNS N06693 Annealed	100 000 (690)	50 000 (345)	30	
UNS N06025 Annealed	-98 000 (680)	39 000 (270)	30	
UNS N06045 Annealed	-90 000 (620)	35 000 (240)	35	

[&]quot;Yield strength requirements do not apply to material under 0.020 in. (0.51 mm) in thickness.

- 6.2 Deep Drawing and Spinning Quality Sheet and Strip—The material shall conform to the grain size and hardness requirements as prescribed in Table 4.
 - 6.2.1 The mechanical properties of Table 3 do not apply to deep drawing and spinning quality sheet and strip.

7. Dimensions and Permissible Variations

- 7.1 Thickness and Weight:
- 7.1.1 *Plate*—For plate up to 2 in. (50.8 mm), inclusive, in thickness, the permissible variation under the specified thickness and permissible excess in overweight shall not exceed the amounts prescribed in Table 5.
 - 7.1.1.1 For use with Table 5, plate shall be assumed to weigh 0.304 lb/in.³(8.415 g/cm³).
- 7.1.2 *Plate*—For plate over 2 in. (50.8 mm) in thickness, the permissible variations over the specified thickness shall not exceed the amounts prescribed in Table 6.
- 7.1.3 Sheet and Strip— The permissible variations in thickness of sheet and strip shall be as prescribed in Table 7. The thickness of strip and sheet shall be measured with the micrometer spindle 3/8 in. (9.5 mm) or more from either edge for material 1 in. (25.4 mm) or over in width and at any place on the strip under 1 in. in width.
 - 7.2 Width or Diameter:
- 7.2.1 *Plate*—The permissible variations in width of rectangular plates and diameter of circular plates shall be as prescribed in Table 8 and Table 9.
 - 7.2.2 Sheet and Strip— The permissible variations in width for sheet and strip shall be as prescribed in Table 10.
 - 73 Lenoth
- 7.3.1 Sheet and strip of all sizes may be ordered to cut lengths, in which case a variation of ½ in. (3.2 mm) over the specified length shall be permitted.
 - 7.3.2 Permissible variations in length of rectangular plate shall be as prescribed in Table 11.
 - 7.4 Straightness:
- 7.4.1 The edgewise curvature (depth of chord) of flat sheet, strip, and plate shall not exceed 0.05 in. multiplied by the length in feet (0.04 mm multiplied by the length in centimetres).
 - 7.4.2 Straightness for coiled material is subject to agreement between the manufacturer and the purchaser.
 - 7.5 *Edges*:
 - 7.5.1 When finished edges of strip are specified in the contract or order, the following descriptions shall apply:
 - 7.5.1.1 Square-edge strip shall be supplied with finished edges, with sharp, square corners, without bevel or rounding.
- 7.5.1.2 Round-edge strip shall be supplied with finished edges, semicircular in form, the diameter of the circle forming the edge being equal to the strip thickness.
- 7.5.1.3 When no description of any required form of strip edge is given, it shall be understood that edges such as those resulting from slitting or shearing will be acceptable.
 - 7.5.1.4 Sheet shall have sheared or slit edges.
 - 7.5.1.5 Plate shall have sheared or cut (machined, abrasive-cut, powder-cut, or inert-arc cut) edges, as specified.
- 7.6 Squareness (Sheet)—For sheets of all thicknesses, the angle between adjacent sides shall be $90 \pm 0.15^{\circ}$ (½ in. in 24 in. (1.6 mm in 610 mm)).
 - 7.7 Flatness:
- 7.7.1 There shall be no flatness requirements for "deep-drawing quality," "spinning quality," or "as rolled" sheet and strip (see X1.4).
- 7.7.2 Standard flatness tolerances for plate shall conform to the requirements of Table 12. "Specially flattened" plate, when so specified, shall have permissible variations in flatness as agreed upon between the manufacturer and the purchaser.

⁸For Rockwell or equivalent hardness conversions, see Hardness Conversion Tables E140. CCaution should be served in using the Rockwell test on thin material, as the results may be affected by specimen thickness. For thicknesses under 0.050 in. (1.3 mm), the use of the Rockwell superficial or the Vickers hardness test is suggested.

²As-rolled plate may be given a stress relieving heat treatment subsequent to final rolling.

EAs-rolled plate specified "suitable for hot forming" shall be furnished from heats of known good hot-malleability characteristics (see X1.2.2). There are no applicable tensile or hardness requirements for such material.

FAnnealed at 1850°F (1010°C) minimum.

^GNot applicable for thickness under 0.010 in. (0.25 mm).



TABLE-2 3 Chemical Requirements

		Element			Comp
	ATensilloy N06601e Strength		AEllo y N ngation in 2 in. or		
HCoy N06600ndition (Temper)	min,	(0 6617 .2 % offset), min,	50 6690 mm	AllRoy N06693	Ackwell Har
	psi (MPa)	psi (MPa)	(or 4 <i>D</i>), min,%		
		Hoy N06025			Alloy No
		<u>H</u> o y N06025			Allt-Roy 1
ickel NS N06600:	72.0 min	58.0 63.0	44.5 min	58.0 mi	
nremainder ^A	remainder ^A	4 5.0 min	remainder ^A 35 000 (240)	30	
The mainder	remainder	4 3.0 11111	35 000 (240)	30	<u></u>
Annealed	remainder, E	80 000 (550)	35 000 (240)	30 30 30 30	<u></u>
As-rolled ^D	_	85 000 (586)	35 000 (240)	30	<u></u>
nromium	14.0–17.0	21.0 25.0			
IS N06601:					
Annealed	2 0. 0 24.0	27.0 31.0	30		
Annealed	80 000 (550)	30 000 (205)	<u>30</u>	<u></u>	
IS N06603:	27.0–31.0	24.0 26.0			
IS N06603:	00.0.0.0.0	04.0.00 (000)	225	•	
Annealed	26.0-2-9.0	24.0-00 (300)	265	.0	
Annealed balt	94 000 (650)	43 0 <u>00 (300)</u>	2 <u>5</u>		
ран IS N06617:					
	1 0.0 15.0		35	_	
 	95 000 (655)	35 000 (240)	35 <u>35</u>		
 IS N06690:	<u> </u>	<u>00 000 (240)</u>	<u>55</u>	<u></u>	
			30		
		35 000 (240)	30		
		35 000 (240)	30		
As-rolled ^{D,E}		<u>35 000 (240)</u>	30 30	<u></u>	
	8.0 -10.0	30 000 (206)	30	_	
<u></u>	8.0-10.0	30 000 (206)	<u>30</u>	<u></u>	
IS N06693					
					
IS N06693		50 000 (345)			
	100 000 (690)	50 000 (345)			
	, ,	30 000 (043)		-	
			<u></u>		
obium	Do		view		
obium NS N06025	Do	cument Pre	view	 	
obium NS N0602 <u>5</u> Anneale <u>d</u>		cument Pre	view	 	
obium NS N06025 Annealed NS N06045 Annealed	Do	cument Pre	view	 	
obium IS N06025 Annealed IS N06045 Annealed	98 000 (680) -0.5-2.5	cument Pre	view <u>30</u>	 	
IS N06025 Annealed IS N06045 Annealed IS N06045	98 000 (680) -0.5-2.5	eument Pre	view		_
IS N06025 Annealed IS N06045 Annealed IS N06045	98 000 (680) -0.5-2.5	39 000 (270) 	view	 	
NS N06025 Annealed NS N06045 Annealed NS N06045 Annealed NS N06045 Annealed Annealed	98 000 (680) -0.5-2.5 0.5-2.5 0.5-2.5 10 90 000 (620) 2/standar	39 000 (270)	view		— —
IS N06025 Annealed IS N06045 Annealed IS N06045 Annealed ps://standards.	98 000 (680) -0.5-2.5	39 000 (270) 	view		
IS N06025 Annealed IS N06045 Annealed IS N06045 Annealed IS N06045 Annealed IS N06005	98 000 (680) -0.5-2.5 0.5-2.5 10 90 000 (620) 2/standar	39 000 (270)	view 30 35394e5462	/astm-b1 <u>.6</u> 8-08	— —
NS N06025 Annealed NS N06045 Annealed NS N06045 Annealed NS N06005 NO6000: O max	98 000 (680) -0.5-2.5 0.5-2.5 10.90 000 (620) 2/standar -6.0-10.0 -7.0-11.0	39 000 (270) ASTM B168-08 ds 35 000 (240) ec0e-c22b-4 Hot-Rolled Sheet remainder -2.5-6.0	view		— —
S N06025 Annealed S N06045 Annealed S N06045 Annealed ps://standards.	98 000 (680) -0.5-2.5 0.5-2.5 10 90 000 (620) pg/standar -6.0-10.0 -7.0-11.0 -7.0-11.0	39 000 (270) 39 000 (270) ASTM P1 68 08 ds 35 000 (240) c00e-c22b-4 Hot-Rolled Sheet remainder ⁴ -2.5 -6.0 35 000 (240)	view 30 35394e5462	/astm-b1 <u>.6</u> 8-08	— —
IS N06025 Annealed IS N06045 Annealed IS N06045 Annealed IS N0600: 0 max IS N06601:	98 000 (680) -0.5-2.5 0.5-2.5 10.90 000 (620) 2/standar -6.0-10.0 -7.0-11.0	39 000 (270) ASTM B168-08 ds 35 000 (240) ec0e-c22b-4 Hot-Rolled Sheet remainder -2.5-6.0	view	/astm-b1 <u>.6</u> 8-08	— — —
IS N06025 Annealed IS N06045 Annealed IS N06045 Annealed ps://standards Photographic in the standards Photographic in the	98 000 (680) -0.5-2.5 0.5-2.5 0.5-2.5 10 90 000 (620) 2/standar -6.0-10.0 -7.0-11.0 -8.0-11.0	39 000 (270)	wiew = 30 353 94e5462 30 30 30 30 30 30 30	/astm-b1 <u></u> 8-08	— —
S N06025 Annealed IS N06045 Annealed IS N06045 Annealed ps://standards P S N06600: 0 max 0 max IS N06601: S N06601: Annealed	98 000 (680) -0.5 - 2.5 0.5 - 2.5 10 90 000 (620) g/standar -6.0 - 10.0 -7.0 - 11.0 -8.0 - 11.0 8.0 - 11.0	39 000 (270) 39 000 (270) ASTM P1 68 08 ds 35 000 (240) c00e-c22b-4 Hot-Rolled Sheet remainder ⁴ -2.5 -6.0 35 000 (240)	view	/astm-b1 <u>.6</u> 8-08	
Annealed IS N06025 Annealed IS N06045 Annealed IS N06045 Annealed IS N0600: O max IS N06601: IS N06601: Annealed	98 000 (680) -0.5-2.5 0.5-2.5 0.5-2.5 10 90 000 (620) 2/standar -6.0-10.0 -7.0-11.0 -8.0-11.0	39 000 (270)	wiew = 30 353 94e5462 30 30 30 30 30 30 30	/astm-b1 <u></u> 8-08	
Annealed IS N06025 Annealed IS N06045 Annealed IS N06045 Annealed IS N06045 Annealed IS N06600: 0 max IS N06601: IS N06601: Annealed Inganese IS N06603:	98 000 (680) -0.5 - 2.5 0.5 - 2.5 10 90 000 (620) g/standar -6.0 - 10.0 -7.0 - 11.0 -8.0 - 11.0 8.0 - 11.0	39 000 (270)	wiew	/astm-b1 <u>.6</u> 8-08	
S N06025 Annealed S N06045 Annealed S N06045 Annealed ps://standards. Part	98 000 (680) -0.5 - 2.5 10.5	## Pre 39 000 (270) ## ASTM PI 68 08 ## Hot-Rolled Sheet Femainder Astm Pi 68 08	wiew 30 30 30 30 30 30 30 25	/astm-b1 <u>6</u> 8-08	——————————————————————————————————————
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Price	98 000 (680) -0.5-2.5 0.5-2.5 10 90 000 (620) p/standar -6.0-10.0 -7.0-11.0 -7.0-11.0 -8.0-11.0 -1.0 max	## Pressure ## Pre	25 25 30 30 30 30 30 30 30 25 25 30 30		
IS N06025 Annealed IS N06045 Annealed IS N06045 Annealed IS N0600: -0 max -0 ma		## Pressure ## Pre	25 25 30 30 30 30 30 30 30 30 30 30 30 30 30	/astm-b1_68-08	
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