Armco NITRONIC® 30 Stainless Steel

- **Good Wet Abrasion Resistance**
- **Good Resistance to Aqueous and Atmospheric Corrosion**
- **High Strength**
- **Economy**

Applications Potential

Armco NITRONIC 30 Stainless Steel offers significantly higher strength than Type 304 and potential for applications requiring good resistance to aqueous and atmospheric corrosion resistance combined with good toughness and economy.

Specific potential applications include automotive hose clamps, safety belt anchors, truck and bus frames, water supply and control structures, sewage treatment plant structures, bulk solids handling equipment, magnetic ore separator screens, coal buckets and hopper cars.

Stainless steels have served successfully in many structural components in the transportation industry. Bus space frames and bumpers take advantage of the excellent fabricability and high strength and toughness of stainless. Tensilized NITRONIC 30 Stainless Steel has been used in rapid transit structurals where the strength-to-weight ratio of up to three times that of carbon steel has improved operating efficiency. Rear frames of refrigerated trucks are easily welded and formed from NITRONIC 30 Stainless Steel, resulting in protective units that can withstand impact blows without cracking. Shipboard container structurals use stainless steel successfully because carbon steel becomes scuffed and rusts wherever the paint is damaged.

ARMCO NITRONIC 30 STAINLESS STEEL SHEET, STRIP AND PLATE

ARMCO

Product Data Bulletin No. S-1

Product Description

Armco NITRONIC 30 is a nitrogen-strengthened stainless steel developed for applications requiring a good level of aqueous corrosion resistance combined with good toughness and economy. Armco NITRONIC 30 Stainless Steel provides approximately 50% higher yield strength than Type 304L and, therefore, may allow lighter gages to further reduce costs. Armco NITRONIC 30 Stainless Steel work hardens rapidly while retaining good ductility. Unlike other nitrogen-strengthened stainless steels, Armco NITRONIC 30 Stainless Steel is subject to magnetic transformation when cold worked.

Available Forms

Armco NITRONIC 30 Stainless Steel is available in sheet, strip and plate. Inquire for other product forms.

Composition

	%
Carbon	0.03 max.
Manganese	7.0-9.0
Silicon	1.0 max.
Chromium	15.0-17.0
Nickel	1.5-3.0
Nitrogen	0.15-0.30
Copper	1.00 max.

Specifications

The following specifications are listed without year of revision indications. Contact ASTM Headquarters for latest revisions.

Armco NITRONIC 30 Stainless Steel is listed as Grade UNS S20400 in ASTM A240-Plate, Sheet and Strip for Pressure Vessels.

ASTM A666 - Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.

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Metric Practice

The values shown in this bulletin were established in U.S. customary units. The metric equivalents of U.S. customary units shown may be approximate. Conversion to the metric system, known as the International System of Units (SI), has been accomplished in accordance with the American Iron and Steel Institute Metric Practice Guide, 1978.

The newton (N) has been adopted by the SI as the metric standard unit of force as discussed in the AISI Metric Practice Guide. The term for force per unit of area (stress) is the newton per square metre (N/m^2). Since this can be a large number, the prefix mega is used to indicate 1,000,000 units and the term meganewton per square metre (MN/m^2) is used. The unit (N/m^2) has been designated a pascal (Pa). The relationship between the U.S. and the SI units for stress is: 1000 pounds/in^2 (psi) = 1 kip/in^2 (ksi) = 6.8948 meganewtons/m^2 (MN/m^2) = 6.8948 megapascals (MPa). Other units are discussed in the Metric Practice Guide.

As noted in Table 1, NITRONIC 30 has annealed mechanical properties which are well above those of typical austentic alloys such as Type 304. Excellent elongation is also maintained. This higher strength affords the opportunity to reduce gage at equivalent engineering loads.

The high work-hardening rate of NITRONIC 30 results in an exceptionally as cold worked high-strength material with elongation equal or superior to Type 304 with the same cold reduction. Comparative properties are given in Table 3 and shown graphically in Figure 1. Table 3 presents additional data on the effect of cold reduction at heavy gage. Such cold reductions would produce a smoother surface and reduce the coefficient of friction for sliding applications such as coal chutes.

Mechanical Properties

Table 1

Typical Room-Temperature Sheet and Strip Properties*

Thickness in. (mm)	Annealing Temperature F (C)	Direction	UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)	Hardness Rockwell B
0.124 (3.15)	1950 (1066)	Longitudinal	117.7 (811)	54.0 (372)	52.0	93.5
0.064 (1.62)	2050 (1121)	Longitudinal	100.0 (689)	53.8 (370)	58.5	93.0
		Transverse	103.1 (711)	53.5 (368)	58.0	93.0
0.032 (0.81)	1950 (1066)	Longitudinal	121.9 (840)	55.0 (379)	54.0	94.0
		Transverse	119.7 (825)	54.4 (375)	55.0	94.0

*Average of duplicate tests.

Table 2

Properties Acceptable for Material Specification (up to and including 1/4"(6.1 mm) plate)

As Listed in ASTM A666

Condition	UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)	Hardness Rockwell
Annealed	95 (655)	48 (331)	35 min.	B 100 max.
Tensilized	140 (965)	100 (689)	20	C 33 min.

Table 3

Effect of Cold Work on Tensile Properties*

% of Cold Work	UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)	Hardness Rockwell
NITRONIC 30				
0	125 (862)	57 (393)	49	B95
10	150 (1034)	86 (593)	35	C31
20	173 (1193)	113 (779)	25	C37
30	194 (1338)	142 (979)	18	C43
40	207 (1467)	172(1186)	15	C45
Type 304				
0	83 (572)	29 (201)	68	B70
10	90 (621)	60 (414)	52	–
20	102 (703)	80 (607)	35	–
30	120 (827)	108 (745)	19	–
40	145 (1000)	131 (903)	9	C34

*Five thickness ranges - 0.215" - 0.026" (5.5 - 0.7 mm)

Table 4

Typical Annealed Plate Properties*

Thickness	UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)	Hardness Rockwell	CVN ft-lbs (J)
3/8" (10 mm)	114 (786)	57 (393)	56	B94	–
7/8" (22 mm)	124 (855)	50 (345)	50	B92	217 (244)
2"(50.8 mm)	120 (827)	52 (358)	54	–	–

Effect of Cold Work on Ferrite Number

Unlike the other NITRONIC alloys, NITRONIC 30 will undergo magnetic transformation due to cold reduction. This magnetism is the result of forming deformation martensite with cold work. This martensite increases the strength, work-hardening rate, and abrasion resistance of the alloy.

% Cold Work	Ferrite Number*
0	0
10	3
20	10
30	21
40	27

* As determined from a Ferritescope by Fisher Technology. The Ferritescope measures the % magnetic phase. Ferrite Number is therefore proportional to the amount of martensite present.

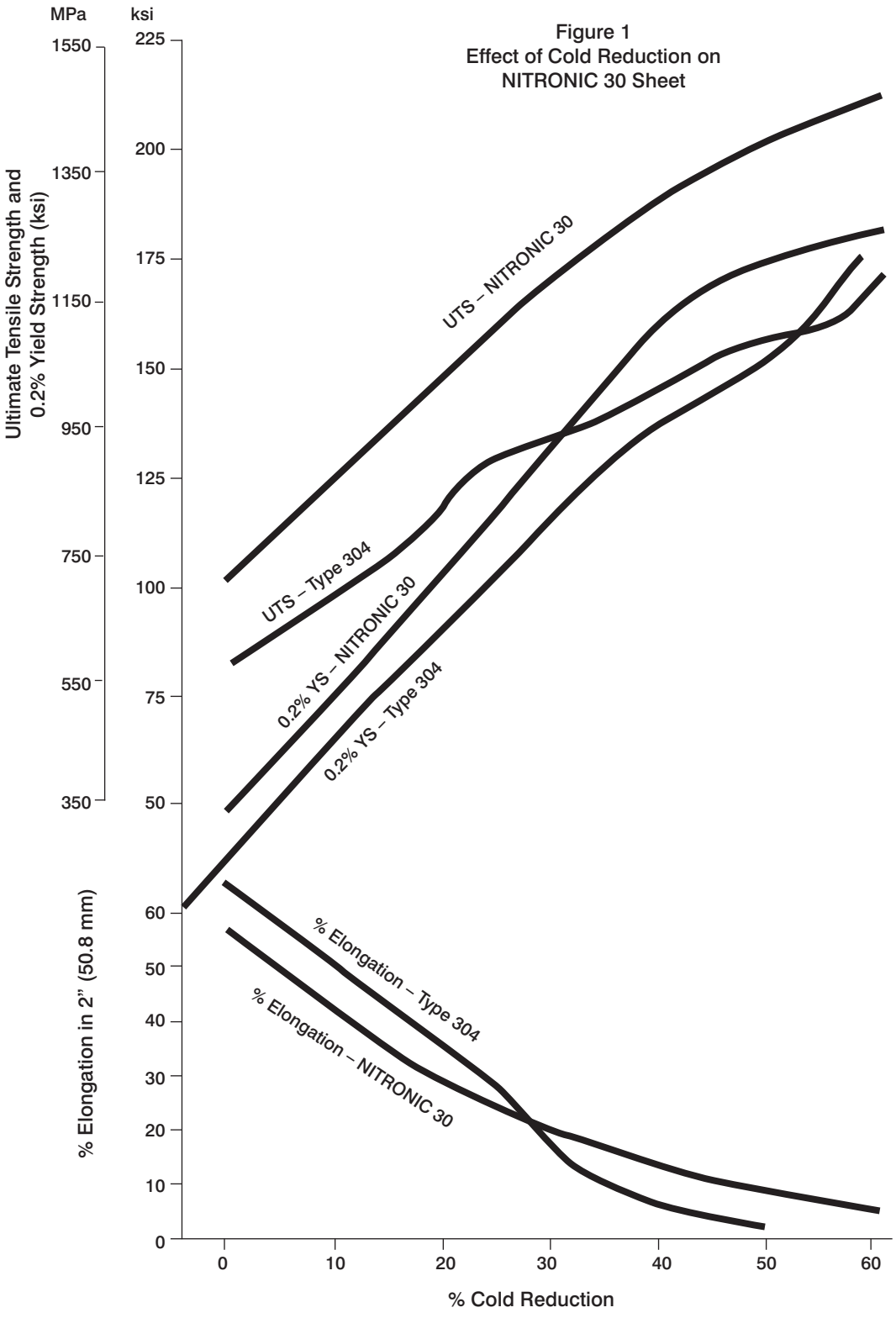
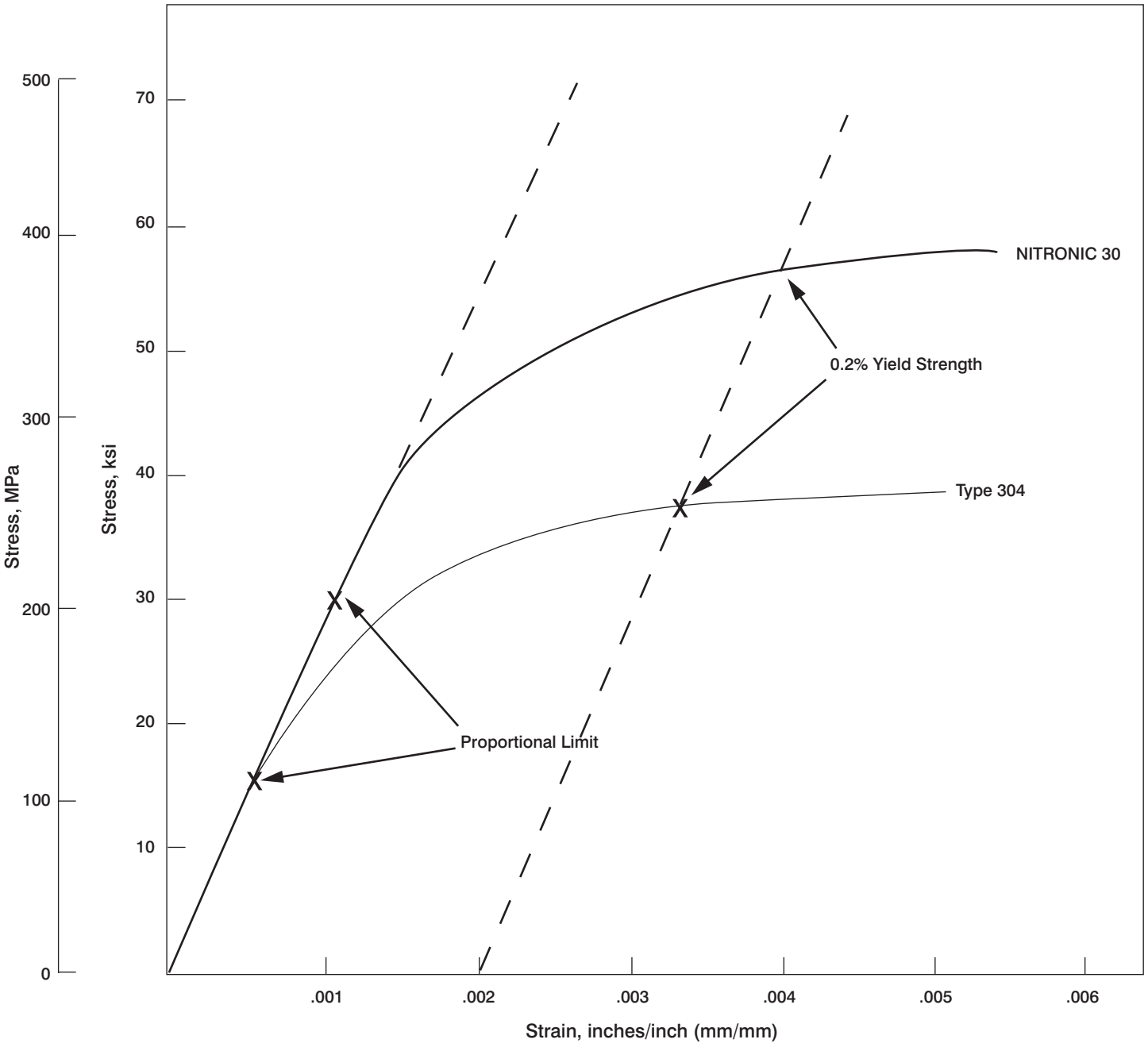


Figure 1
Effect of Cold Reduction on NITRONIC 30 Sheet

Typical engineering stress-strain curves for Armco NITRONIC 30 and Type 304 stainless steel (tested in tension) are shown in Figure 2.

Figure 2
Typical Engineering Stress-Strain Curves
(Longitudinal Direction)



Wear Resistance

The following tables and figures demonstrate the outstanding corrosive wear resistance of Armco NITRONIC 30 under many different siiding conditions. The stainless steels as a class are much more abrasion resistant than abrasion resistant (AR) steels under even mildly corrosive conditions. Armco NITRONIC 30 is more cost effective than Types 409 and 304 which are typically used in wet abrasive applications.

Table 5
Metal-to-Metal Wear*

Alloy	Hardness, Rockwell	Wear, mg/1000 cycles**		
		25 RPM	105 RPM	415 RPM
Armco NITRONIC 30	B93	1.9	3.3	2.2
Type 410	C40	–	244.0	22.5
Type 410	B95	–	261.0	116.0
4130	C47	3.8	9.4	–
4130	C32	66.0	258.0	–
4340	C52	0.8	0.7	0.5
Hadfield Mn	B95	1.7	1.2	0.4
Armco17-4 PH	C43	45.3	52.8	12.1
Stellite 6	C48	1.1	1.0	1.3
Type 304	B85	13.9	12.8	7.6
Armco NITRONIC 32	B95	2.4	7.4	3.1

* Self-mated crossed cylinders, 16 lbs (71 N), 10,000 or 40,000 cycles, unlubricated, in air, room temperature, corrected for density differences.

** Relative wear rate for comparison of alloys and not for design purposes.

Table 6
Metal-to-Metal Weld Wear*

Alloy	Hardness, Rockwell	Total Wear (Mated to 17-4 PH, Condition H 900), 105 RPM mg/100 cycles
Armco NITRONIC 30 Weld**	C24	27.56
Type 420 Weld 1150 F (621 C) Temper	C34	68.32

* Self-mated crossed cylinders, 16 lbs (71 N), 10,000 or 40,000 cycles, unlubricated, in air, room temperature, corrected for density differences.

**Weldment in stationary position.

Table 7
Abrasive Wear*

Alloy	Hardness Rockwell	Volume of Metal Removed			
		Alloy Wear-Mated to WC (mm^3/10,000 cycles)		Alloy Wear-Mated to SiC (mm^3/10,000 cycles)	
		105 RPM	415 RPM	105 RPM	415 RPM
Armco NITRONIC 30	B93	1.9	3.3	3.8	11.3
4340	C52	0.1	0.1	0.8	–
Type 431	C42	9.8	1.5	22.6	–
Armco 17-4 PH	C42	9.9	5.6	104.2	37.9
Type 304	B85	6.2	13.2	25.2	13.5
Colmonoy 6	C56	1.1	0.8	2.9	2.2
Armco NITRONIC 32	B95	4.2	4.3	7.1	6.8
Armco NITRONIC 60	B95	2.8	2.3	–	–

* Crossed cylinders, 16 lbs (71 N), 10,000 or 40,000 cycles, unlubricated, in air, room temperature, corrected for density differences.

Table 8
Corrosive Wear Hub Test*

		Wear, mm^3	
Alloy	Hardness, Rockwell	Dry	5% NaCl + 0.5% Acetic Acid
Armco NITRONIC 30	B91	2.79	8.15
Armco 17-4 PH	C46	3.32	11.95
Type 409	B85	10.56	28.50
Armco NITRONIC 33	B94	3.40	13.74
AISI 4340	C49	2.27	45.47
Hadfield Mn	B93	2.28	39.20

* Abrasives: 2.5 litres pea gravel plus slag, 1 litre angular quartz, 400 hours, 1000 in./min tip speed, 0.095" (2.4 mm) sheet thickness, triplicate tests, sheet specimens mounted on hub rotating in and out of slurry.

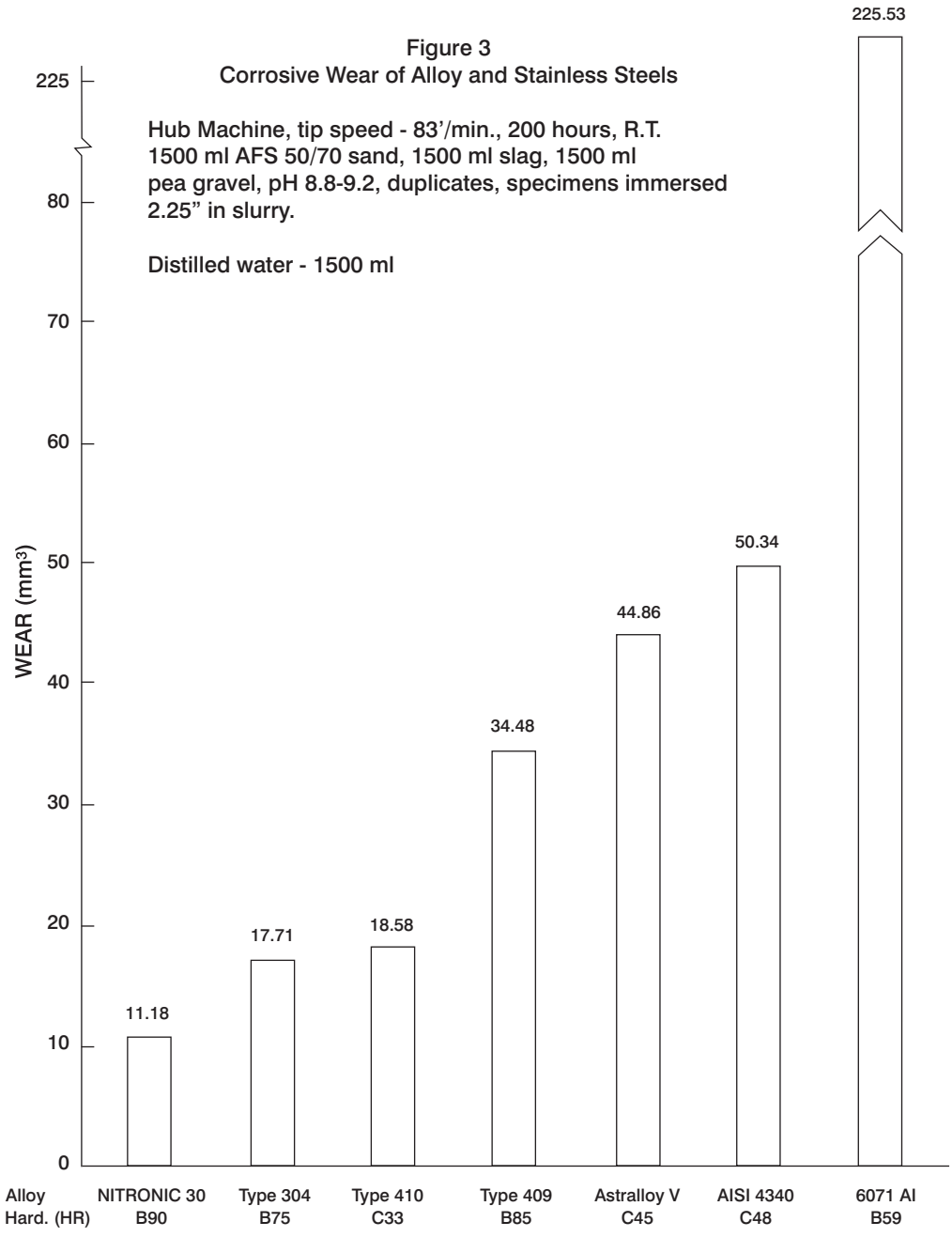


Table 9
Ball Mill Test*

Alloy	Hardness, Rockwell	Wear, mm^3
Armco NITRONIC 30	B91	4.89
Armco NITRO NIC 33	B94	6.46
Armco 17-4 PH	C46	7.00
Type 304	B75	7.76
Type 409	B85	10.15
Astralloy V	C45	32.14
AISI 4340	C49	36.54

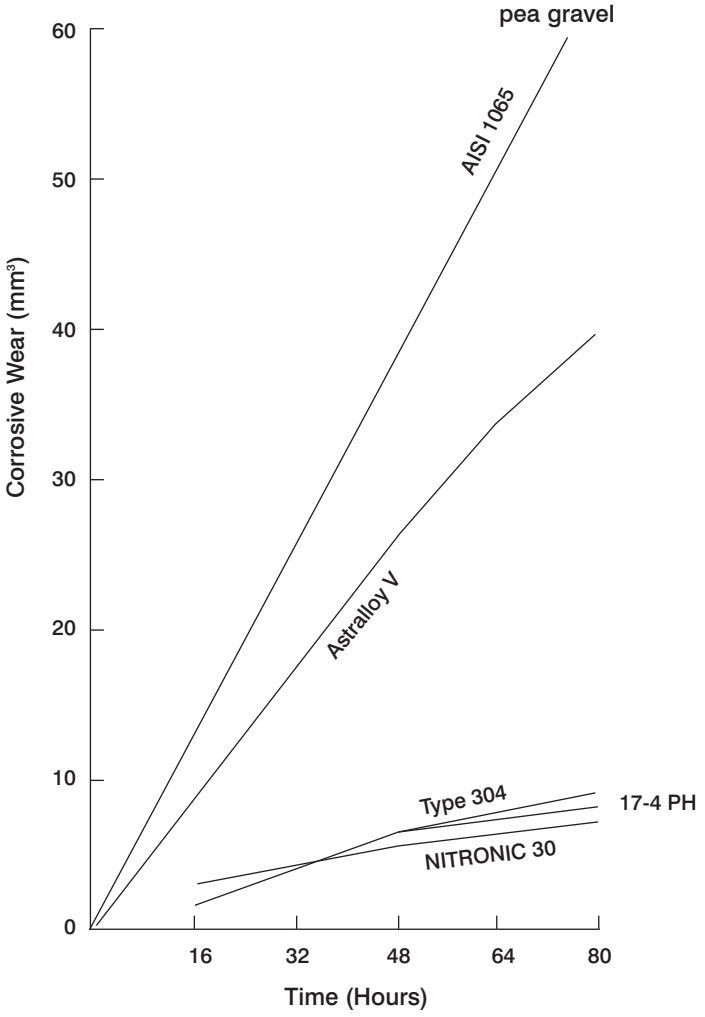
* 2 litres 2g/l sulfate + 0.2g/l chloride ions, pH 9.1-9.6, 126 ft/min speed, five 16-hour periods, 0. 1 l -1/4 + 1/8" plus 0. 1 l -3/8 + 1/4" pea gravel abrasives, average of duplicate tests.

Figure 4

Corrosive Wear of Alloy and Stainless Steels

Ball Mill - Synthetic Nickel Mine Water

Speed – 126'/min., R.T., pH 9.1-9.6
2000 ml of 2 g/l sulfate + 0.2 g/l chloride ion 100 ml – 1/4" + 1/8" and 100 ml – 3/8" +1/4" pea gravel



Corrosion Resistance

Armco NITRONIC 30 Stainless Steel exhibits good corrosion resistance to a variety of media. Pitting resistance, as measured by tests in 10% $FeCl_3$ solution, is better than Type 304. In sulfuric acid and hydrochloric acid, Armco NITRONIC 30 is much better than Types 409 and 410 and approaches Type 304 in more dilute solutions. Typical laboratory test data obtained on these alloys are shown in Table 10. Atmospheric corrosion resistance is shown in Figure 5.

Intergranular Attack

Intergranular attack tests were performed following the procedures of ASTM A262 on duplicate annealed sheet specimens of NITRONIC 30 and Type 304 stainless steels. Before testing, some of these specimens were heat treated at 1250 F (675 C) for one hour and air cooled to exaggerate the conditions that might be found in the heat-affected zones of heavy weldments. The results are shown in Table 11.

Stress-Corrosion Cracking

The threshold stress for cracking of NITRONIC 30 stainless in boiling 42% $MgCl_2$ solution (a very severe test) is about 25 ksi (172 MPa), compared with about 10 ksi (69 MPa) for Types 304 and 304L. This means that NITRONIC 30 is markedly more resistant than these alloys to cracking in hot chloride solutions at lower stress levels. At higher stress levels (about 25 ksi and above) the chloride stress-corrosion cracking resistance of NITRONIC 30 is about like that of Types 304 and 304L.

Table 10
Immersion Tests in Various Media

	Corrosion Rates in IPY Unless Otherwise Indicated[1]			
Test Medium	NITRONIC 30	Type 304	Type 409	Type 410
10% $FeCl_3$ @ 25 C plain[2]	.227gm/in^2	.424 gm/in^2	.772 gm/in^2	–
10% $FeCl_3$ @ 25 C creviced[3]	.192 gm/in^2	.358 gm/in^2	.636 gm/in^2	–
65% HNO_3 @ Boiling	.043	.010	.671	.266
50% H_3PO_4 @ Boiling	.008	.008	.485	12.1 @ 80 C
5% Formic @ 80 C	<.001	<.001	.056[4]	.334 @35 C
1% H_2SO_4 @ 80 C	<. 001-.360	<.001-.063	Dissolved	1.00-1/2% @ 35 C
1% HCl @ 35 C	<.001-.012	<.001	.535	2.11
2% HCl @ 35 C	.100	<.001-.014	–	–
33% Acetic @ Boiling	Nil	Nil	–	–

[1] Immersion tests of 1" x 2" sheet coupons in lab-annealed (1950 F – 5 min. – A.C.) condition for NITRONIC 30, and mill-annealed for the other alloys. Results are the average of duplicate specimens exposed for five 48-hour periods. Those specimens tested at 35 C and at 80 C were intentionally activated for the third, fourth and fifth periods. Where both active and passive conditions occurred, the averages of both are shown.

[2] Exposed for 48 hours uncreviced.

[3] Exposed for 48 hours with rubber bands to produce crevices.

[4] Average of three 48-hour periods, not activated.

Table 11
Intergranular Corrosion Resistance of NITRONIC 30

Alloy	Treatment	Practice C Boiling 65% $HN0_3$ (Huey Test)	Practice E Copper-Accelerated Copper Sulfate
NITRONIC 30 (.039% C)	Annealed	.0034 IPM	Passed
NITRONIC 30 (.039% C)	1250 F (675 C) 1 hr.	.0052 IPM	Passed
Type 304 (.062% C)	Annealed	.0010 IPM	Passed
Type 304 (.062% C)	1250 F (675 C) 1 hr.	.062 IPM	Failed badly

Note that although the nitric acid attack rate for NITRONIC 30 in the annealed condition is higher than that for Type 304, it did not increase greatly with the 1250 F (675 C) heat treatment. This indicates that there would be little tendency for preferential attack of weldments in service. NITRONIC 30 Stainless Steel is currently being limited to a maximum 0.03% carbon content.

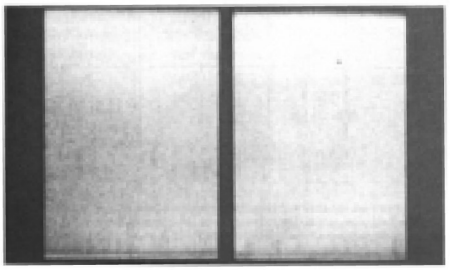
Table 12
Resistance to Hot Chloride Stress- Corrosion Cracking

	Time to Failure, Hr, Under Stress of:		
Alloy	75 ksi (517 MPa)	50 ksi (345 MPa)	25 ksi (172 MPa)
NITRONIC 30	–	0.3	890
Types 304, 304L	0.2	0.6	2.5
Types 316, 316L	0.8	2.5	7.0

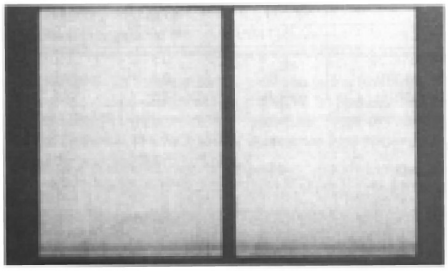
All materials were in the annealed condition, direct tension loaded and tested in boiling 42% $MgCl_2$ solution.

Figure 5

NITRONIC 30
KESTERNICH TEST
10 CYCLES-16 Hr EXPOSED & 8 Hr DRY



Type 304
KESTERNICH TEST
10 CYCLES-16 Hr EXPOSED & 8 Hr DRY
TYPE 304



Both Armco NITRONIC 30 and Type 304 Stainless Steels exhibited acceptable corrosion protection to the following environment with no discernible color differences:

Specimen size - 0.125" x 4" x 6" (3 mm x 101 mm x 152 mm); mill annealed; 60 grit finish; autogenous weld bead down center and ground flush; duplicates; 2L distilled water; 2L SO_2; 104 F (40 C); 10 cycles (1 cycle - 8 hours exposure + 16 hours drying).

Table 13
Salt Spray Test*

	Corrosion Rates			
Test Medium	NITRONIC 30	Type 304	Type 409	Type 410
5% Salt Fog @ 35 *Per ASTM B117 Salt Spray	OK after 500 hrs	OK after 500 hrs	Rusting in 24 hrs	Rusting in 24 hrs

Sulfide Stress Cracking

Laboratory tests show that Armco NITRONIC 30 Stainless has excellent resistance to sulfide stress cracking. When stressed to 100% of its yield strength and exposed to the solution described in NACE TM-01-77 at room temperature (5% NaCl + 1/2% acetic acid, saturated with H_2S), NITRONIC 30 did not fail in over 720 hours. This criterion is used by some oil companies as a minimum requirement for sulfide service as described in NACE Standard MR-01-75, "Sulfide Stress Cracking Resistance Metallic Material for Oil Field Equipment."

Weldability

Early experience with NITRONIC 30 stainless shows good welding characteristics. It can be fusion welded with the usual arc welding processes employed for austenitic stainless steels. Armco NITRONIC 30 provides superior ductility and toughness, as well as resistance to weld cracking without the need for preheating or postheating, as most martensitic and heavygage ferritic stainless steels require.

A small quantity of ferrite will form in autogenous NITRONIC 30 stainless welds to minimize any hot cracking sensitivity. Arc welding parameters more closely approximate those of the other NITRONIC grades (e.g., slower weld travel, hotter shielding gas for GTAW - Ar + 5% H_2 or He), rather than the standard austenitic stainless steels. Standard AWS austenitic stainless fillers or the newly included AWS A5.9 and A5.4 NITRONIC fillers (209, 240, 219) can be selected for any particular application.

Table 14

Mechanical Properties of Unwelded Armco NITRONIC 30 Compared to Various AWS Austenitic Stainless Steel All-weld Metal Deposits

Type	UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)
AWS E240 (NITRONIC 35W)	106 (731)	85 (586)	24
AWSE308	89 (614)	68 (469)	37
AWS E312	110 (758)	80 (550)	30
NITRONIC 30 (0.08" sheet-annealed)	115 (793)	50 (345)	55

Table 15

Weld Bend Test Results*

Bend Direction	Bend Diameter
Weld Face	OT
Weld Root	OT

* NITRONIC 30 hot rolled and pickled sheet (.112"/2.8 mm) has been autogenous gas tungsten arc welded to make bend tests.

Bend tests on this material (HR Condition) were successfully flattened (0 bend diameter) when either the weld face or weld root was in tension, illustrating the excellent formability of as-welded NITRONIC 30.

Table 16

Typical Mechanical Properties of NITRONIC 30 in Autogenous Gas Tungsten Arc Welding

GTA Welded vs. Unwelded Annealed (2050 F [1121 C])
Mechanical Properties - Duplicate Tests

Area Tested	Thickness in (mm)	UTS ksi (MPa)	.2% YS ksi (MPa)	% Elongation in 2" (50.8 mm)	Hardness R_B
As-Welded (Stressed Transverse to Weld Direction)	.060 (1.52)	119.1 (821)	57.6 (397)	50.7	87
Unwelded (Annealed)	.060 (1.52)	113.0 (779)	46.1 (318)	55.7	87
Unwelded (As hot-rolled)	.112 (2.8)	120.4 (829)	48.9 (337)	60.0	89.5

Impact Strength (W/A) in-lbs/in² (mm•N/mm²)

	Thickness in (mm)	Test Temperature, F (C)		
		RT	32 (0)	-15.0 (-101)
Weld Metal*	.112 (2.8)	10,510 (1839)	9,610 (1682)	7,450 (1304)
Base Metal (As hot-rolled)	.112 (2.8)	7,640 (1337)	7,340 (1284)	6,180 (1082)

*Notch in weld

Figure 6
Effect of Temperature on the Impact Toughness
of Armco NITRONIC 30, Type 304 and Type 409*

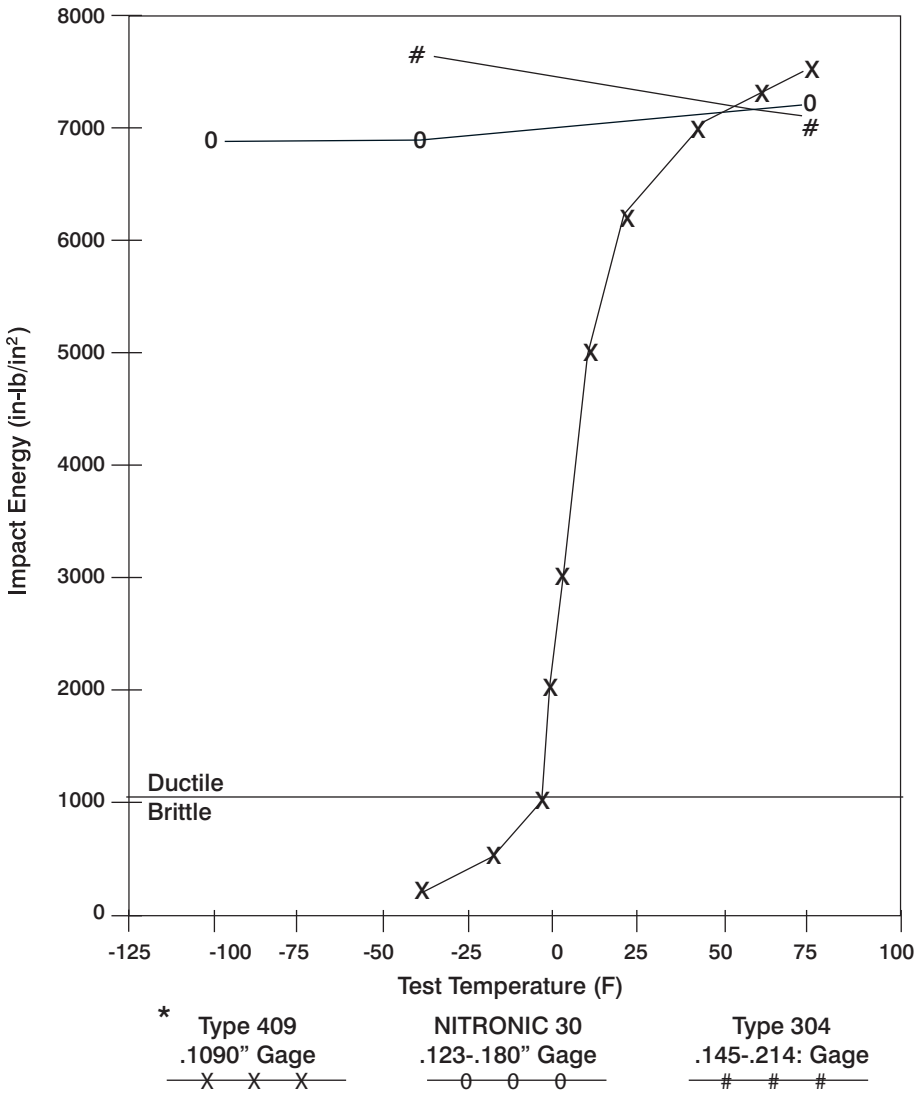


Table 17

Cryogenic Impact Strength of Annealed NITRONIC 30 Stainless Steel Plate

Thickness	Test Temperature	Direction	Impact Strength (CVN) ft-lbs (J)	Lateral Expansion, mils
7/8" (22 mm)	-100 F (-73 C)	Transverse	125* (167)	69 (1.8 mm)
	-150 F (-101 C)		77 (103)	47 (1.2 mm)
	-320 F (-195 C)		25 (33)	14 (0.4 mm)

*Average of 4 tests.

Resistance cross-wire welding of NITRONIC 30 has proven very successful. Resistance spot welding of sheet will require higher electrode tip pressures than is used for the standard austenitic stainless steels. Guidelines for resistance welding parameters can be found in the AWS Handbook, Volume 4, 7th edition, 1982.

Formability

Table 18
Formability

Alloy	Olsen Cup Height, in (mm)
NITRONIC 30 Base Metal	.480 (12.2)
NITRONIC 30 Weld Face in Tension	.483 (12.3)
NITRONIC 30 Weld Root in Tension	498 (12.6)
Type 301 Base Metal	.480 (12.2)

Typical bending limits for annealed NITRONIC 30 Stainless Steel:
Thickness to 0.187" (4.7 mm).
Bend radius = 1/2 thickness for 180° bend.
Springback may be slightly greater than for Type 304 due to higher strength of NITRONIC 30 Stainless Steel.
For 100 ksi (689 MPa) minimum yield strength: Bend radius = 1 T for 90° bend up to 0.187" (4.7 mm)

	3" Stretch Cup	LDR*
Type 304L	1.14	2.04
NITRONIC 30	1.40	2.04
Type 301	–	2.06

*Limiting Draw Ratio

Table 19
Effect of Cold Work on Formability
ASTM E643 Biaxial Stretch (Cup Height)

0.2% Yield Strength ksi (MPa)	Type 304L in (mm)	NITRONIC 30 in (mm)
40 (276)	0.43 (11)	0.52 (13)
50 (345)	0.39 (10)	0.46 (12)
60 (414)	0.36 (9)	0.40 (10)
70 (483)	0.34 (9)	0.40 (10)
80 (552)	0.32 (8)	0.37 (9)
90 (621)	0.31 (8)	0.34 (9)
100 (689)	0.30 (8)	0.33 (8)

Physical Properties

Density at 70 F (21 C)
7.862 g/cm^3
0.284 lbs/in.^{3}

Modulus of Elasticity at 70 F
(21 C) – 28.0 x 10^6 psi
(0.193 x 10^6 MPa)

Magnetic Permeability

Table 20
Magnetic Permeability (Annealed)

Field Strength Oersteds	Permeability
100	1.011
200	1.011
500	1.014
1000	1.015

Thermal Expansion

Table 21
Thermal Expansion

Temperature F	Relative Expansion, %	Coefficient of Expansion ΔL/L/°F x 10^{-6}	Temperature C	Relative Expansion, %	Coefficient of Expansion ΔL/L/°C x 10^{-6}
79- 200	0.123	9.35	26- 50	0.048	16.13
79- 300	0.223	9.60	26- 100	0.135	16.90
79- 400	0.326	9.81	26- 150	0.225	17.29
79- 500	0.432	10.01	26- 200	0.317	17.64
79- 600	0.541	10.18	26- 250	0.413	17.95
79- 700	0.654	10.35	26- 300	0.511	18.24
79- 800	0.768	10.50	26- 350	0.611	18.51
79- 900	0.884	10.63	26- 400	0.713	18.77
79- 1000	1.002	10.75	26- 450	0.817	19.00
79- 1100	1.123	10.88	26- 500	0.922	19.20
79- 1200	1.245	11.00	26- 550	1.029	19.41
79- 1300	1.368	11.11	26- 600	1.137	19.61
79- 1400	1.492	11.21	26- 650	1.248	19.80
79- 1500	1.619	11.31	26- 700	1.358	19.98
79- 1600	1.749	11.42	26- 750	1.470	20.14
			26- 800	1.583	20.31
			26- 850	1.700	20.48

Average of Duplicate Tests.
Full heating and cooling curves available upon request.

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