Type 304, Type 304H
UNS S30400, UNS S30409

The basic austenitic stainless steel, a versatile corrosion resistant material for general purpose applications.

Description

Type 304/304H is the modern evolution of the original "18-8" austenitic stainless steel. Type 304H is a modification of Type 304 with carbon content controlled in the range of 0.04 to 0.10 for increased strength at temperatures above about 800°F.

Type 304/304H is non-magnetic in the annealed condition but may become slightly magnetic as a result of cold working or welding

Dual Certification

It is common for 304H to be dual certified as 304 and 304H when the material meets the higher carbon and grain size requirements of 304H. The producer of the steel must certify the material as Type 304H if it is to be used as Type 304H instead of Type 304.

Specifications

Type 304/304H can be supplied to meet AMS, ASTM, ASME, QQS, and MIL-S specifications.

Product Forms Available

Plate
Sheet
Tubular Products
Bar
Angle
Wire Rod
Billet
Welding Consumables

Corrosion Resistance

Type 304/304H is a versatile, general purpose stainless steel with good resistance to atmospheric corrosion, to many organic and inorganic chemicals, and to foods and beverages.

Mechanical Properties

Table 1

		ASTM	
	Typical*	304	304H
Ultimate Tensile Strength, ksi	91	75 min	70 min
0.2% Offset Yield Strength, ksi	43	30 min	30 min
Elongation in 2 inches, %	58	40 min	40 min
Reduction in Area, %	68	—	—
Hardness, Rockwell B	83	92 max	92 max

*0.375 inch plate

Chemical Composition, wt. pct.

Table 2

	304	304H
Carbon	0.08 max	0.04-0.10
Manganese	2.00 max	2.00 max
Phosphorus	0.045 max	0.045 max
Sulfur	0.030 max	0.030 max
Silicon	0.75 max	0.75 max
Chromium	18.0-20.0	18.0-20.0
Nickel	8.0-10.5	8.0-10.5
Nitrogen*	0.10 max	0.10 max

*flat-rolled products only

Physical Properties

Table 3

Density, lb/in^3	0.285
Modulus of Elasticity, psi	29 x 10^6
Coefficient of Thermal Expansion, 68-212°F, /°F	8.9 x 10^{-6}
Thermal Conductivity, Btu/ft hr°F	8.7
Heat Capacity, Btu/lb°F	0.12
Electrical Resistivity, Ω-inch	28.7 x 10^{-6}

Heat Treatment
Annealing

Type 304/304L should be heated to 1900°F minimum and water quenched or rapidly cooled by other means.

Hardening

Type 304/304H cannot be hardened by heat treatment. However, Type 304/304H can be hardened by cold working.

Workability
Cold Working

Type 304/304H is readily formed and fabricated through a full range of cold working operations. It can be used in heading, drawing, bending, and upsetting. Any cold working operations will increase the strength and hardness of the material, and may leave it slightly magnetic.

Hot Working

Type 304/304H can be forged in the 1700-2200°F range. For maximum corrosion resistance, forgings should be annealed at 1900°F minimum and water quenched or rapidly cooled by other means after hot working operations.

Corrosion Performance of Stainless Steels

Table 4 compares the performance of Type 304 with other stainless steels in a variety of common corrosive environments. The table shows the lowest temperature at which the corrosion rate exceeds 5 mpy. All testing was done in accordance with the requirements of the Materials Technology Institute of the Chemical Process Industries (MTI).

Welding

Type 304/304H is readily welded by a full range of conventional welding procedures (except oxyacetylene). AWS E308H/ER308H filler metals

Lowest Temperature (°F) at Which the Corrosion Rate Exceeds 5 mpy

Table 4

Corrosion Environment	654 SMO®	254 SMO®	904L	Type 316L (2.7 Mo)	Type 304	2507	2205 Code Plus Two®	2304
0.2% Hydrochloric Acid	>Boiling	>Boiling	>Boiling	>Boiling	**>Boiling**	>Boiling	>Boiling	>Boiling
1% Hydrochloric Acid	203	158	122	86	**86p**	>Boiling	185	131
10% Sulfuric Acid	158	140	140	122	—	167	140	149
60% Sulfuric Acid	104	104	185	<54	—	<57	<59	<<55
96% Sulfuric Acid	86	68	95	113	—	86	77	59
85% Phosphoric Acid	194	230	248	203	**176**	203	194	203
10% Nitric Acid	>Boiling	>Boiling	>Boiling	>Boiling	**>Boiling**	>Boiling	>Boiling	>Boiling
65% Nitric Acid	221	212	212	212	**212**	230	221	203
80% Acetic Acid	>Boiling	>Boiling	>Boiling	>Boiling	**212p**	>Boiling	>Boiling	>Boiling
50% Formic Acid	158	212	212p	104	**≤50**	194	194	59
50% Sodium Hydroxide	275	239	Boiling	194	**185**	230	194	203
83% Phosphoric Acid + 2% Hydrofluoric Acid	185	194	248	149	**113**	140	122	95
60% Nitric Acid + 2% Hydrochloric Acid	>140	140	>140	>140	**>140**	>140	>140	>140
50% Acetic Acid + 50% Acetic Anhydride	>Boiling	>Boiling	>Boiling	248	**>Boiling**	230	212	194
1% Hydrochloric Acid + 0.3% Ferric Chloride	>Boiling, p	203ps	140ps	77p	**68p**	203ps	113ps	68p
10% Sulfuric Acid + 2000ppm Cl^- + N_2	149	104	131	77	—	122	95	<55
10% Sulfuric Acid + 2000ppm Cl^- + SO_2	167	140	122	<<59p	—	104	<59	<<50
WPA1, High Cl^- Content	203	176	122	≤50	**<<50**	203	113	86
WPA2, High F^- Content	176	140	95	≤50	**<<50**	167	140	95

ps = pitting can occur
ps = pitting/crevice corrosion can occur

WPA	P_2O_5	Cl^-	F^-	H_2SO_4	Fe_2O_3	Al_2O_3	SiO_2	CaO	MgO
1	54	0.20	0.50	4.0	0.30	0.20	0.10	0.20	0.70
2	54	0.02	2.0	4.0	0.30	0.20	0.10	0.20	0.70

should be used with Type 304/304H steel. After welding Type 304/304H it may be necessary to fully anneal to restore the corrosion resistance lost by sensitization to intergranular corrosion when chromium carbides were precipitated in the grain boundaries in the weld heat-affected zone.

Machinability

Type 304/304H is a tough austenitic stainless steel subject to work hardening during deformation and, unless modified for improved machining response, is resistant to chip breaking. The best machining results are achieved with slower speeds, heavier feeds, excellent lubrication, sharp tooling, and powerful, rigid equipment.

Technical Support

Outokumpu Stainless, Inc. assists users and fabricators in the selection, qualification, installation, operation, and maintenance of Type 304/304H stainless steel. Technical personnel, supported by the research laboratory of Outokumpu Stainless, can draw on years of field experience with Type 304/304H to help you make the technically and economically correct materials decision.

Outokumpu Stainless is prepared to discuss individual applications and to provide data and experience as a basis for selection and application of Type 304/304H.

Outokumpu Stainless works closely with its distributors to ensure timely availability of Type 304/304H in the forms, sizes, and quantities required by the user. For assistance with technical questions and to obtain top quality Type 304/304H, call Outokumpu Stainless, Inc. at 1-800-833-8703.

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Outokumpu Stainless is a core business within Outokumpu, a dynamic metals and technology group operating worldwide and marketing its metals, metal products, technology and services to customers in a wide range of industries.

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