

STAINLESS STEEL LABORATORY CORROSION DATA

RESISTANCE OF
STAINLESS STEELS TO
CHEMICAL MEDIA



JUST MANUFACTURING COMPANY

9233 King Street - Franklin Park, IL 60131
Phone: (847) 678-5150 Fax: (847) 678-6817
www.justmfg.com e-mail: custserv@justmfg.com

1. Fully resistant	0.002-inch
2. Satisfactorily resistant	0.010-inch
3. Fairly resistant	0.020-inch
4. Slightly resistant	0.040-inch/.050-inch
5. Not resistant	0.050-inch and over

Laboratory Corrosion Resistance Data

Types 316, 304

Corrosion Rate—in./yr.

- 1—Fully Resistant 002
- 2—Satisfactorily Resistant 010
- 3—Fairly Resistant 020
- 4—Slightly Resistant..... 040-050
- 5—Not Resistant..... 050 and higher

Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304
Acetic Acid					Aluminum Chloride					Ammonium Persulphate				
5% Agitated	70°		1	1	10% Quiescent	70°		3	4	5%	70		1	1
5% Aerated	70°		1	1	25% Quiescent	70°		3	4	Ammonium Phosphate				
5%	100°		1	1	Aluminum Fluoride	70°		3	4	5%	70		1	1
5%	180°		1	1	Aluminum Hydroxide					Ammonium Potassium Sulphate (Alum.)				
10% Agitated	70°		1	1	Saturated	70°		1	*1	Dilute & saturated	Various		1	*1
10% Aerated	70°		1	1	Aluminum Sulphate					Ammonium Sulphamate				
10%	100°		1	1	5%	150°		1	*1	10%	70		1	1
10%	180°		1	1	10%	70°		1	*1	Ammonium Sulphate				
10%	Boiling		1	3	10%	Boiling		1	*2	1% Aerated	70		1	1
10%	60°		1	1	Saturated	70°		1	*1	1% Agitated	70		1	1
15%	100°		1	1	Saturated	Boiling		1	*2	5% Aerated	70		1	1
15%	180°		1	2	Aluminum Chromium Sulphate					5% Agitated	70		1	1
15%	Boiling		1	3	5%	70°		1	*1	10%	Boiling		*1	*2
20% Agitated	70°		1	1	Sp. G. 1.6	Boiling			*5	Saturated	Boiling		1	2
20% Aerated	70°		1	1	Aluminum Potassium Sulphate (Alum.)					Ammonium Sulphite	70		1	1
20% Aerated	180°		1	2	2%	70°		1	*1	Boiling			1	1
33%	70°		1	1	10%	70°		1	*1	Ammonium Thiocyanate				
33%	100°		1	1	10%	Boiling		1	*2	10%	70		1	2
33%	180°		1	2	Saturated	Boiling		2	*3	30%	154		1	2
33%	Boiling		1	3	Ammonia (Dry or Moist)					Aniline				
40% Aerated	180°		1	2	All concentrations	70-212°		1	1	3%	70		1	1
50%	70°		1	1	Ammonia Bifluoride					Concentrated crude	70		1	1
50%	Boiling		1	3	10%	80°		5	5	Aniline Hydrochloride	70		4	5
60%	60°		1	1	Ammonia (Anhydrous)	800° up		5	5	Antimony				
60%	100°		1	1	Ammonium Hydroxide	70°		1	1	Molten	1100		5	5
60%	180°		1	2	Ammonium Bicarbonate	70°		1	1	Antimony Sulphide				
60%	Boiling		2	4	Hot			1	1	Molten	1200-1600		5	5
80%	70°		1	1	Ammonium Bromide					Antimony Trichloride	70		4	5
80%	100°		1	1	5%	70°		1	1	Arsenic Acid	150		1	1
80%	180°		1	2	Ammonium Carbonate					Barium Carbonate	70		1	1
80%	Boiling		2	4	1% Quiescent	70°		1	1	Barium Chlorate				
90% Aerated	180°		1	3	5% Quiescent	70°		1	1	10%	Boiling		4	5
100%	70°		1	1	1% Aerated	70°		1	1	Barium Chloride				
100%	100°		1	1	5% Aerated	70°		1	1	5%	70°		1	1
100%	180°		1	2	1% Agitated	70°		1	1	Saturated	70°		1	1
100%	Boiling		2	3	5% Agitated	70°		1	1	Aqueous Solution	Hot		*1	*2
100% —150 lb. Press	400°		3	5	Ammonium Chloride					Barium Hydroxide				
Acetic Anhydride					1% Quiescent	70°		1	*1	All concentrations	Cold & Hot		1	1
(90% Anhydride)	70°		1	1	1% Aerated	70°		1	*1	Barium Nitrate				
(90% Anhydride)	180°		1	1	1% Agitated	70°		1	*1	Aqueous Solution	Hot		1	1
(90% Anhydride)	Boiling		1	1	10%	Boiling		*1	*1	Barium Sulphate (Barytes-Blanc-Fixe)	70°		1	1
Aerated					20%	Boiling		*1	*1	Beer				
(90% Anhydride)	180°		3	4	28%	Boiling		*1	*2	(Barley Malt & Hops)	70°		1	1
60% Anhydride	180°		2	2	50%	Boiling		*1	*2	3.5%-4.5% Alcohol	160°		1	1
30% Anhydride	180°		2	4	Ammonium Chlorostannate					Benzene (Benzol)	70°		1	1
Acetic Acid Vapors					Saturated	70°		1	2	Hot			1	1
30%	Hot		2	3	Saturated	140°		3	5	Benzoic Acid	70°		1	1
100%	Hot		3	5	Ammonium Nitrate					Blood (Meat Juices)	Cold		1	*1
Acetone	70°		1	1	All conc. agitated)	70		1	1	Borax				
Boiling			1	1	aerated					5%	Hot		1	1
Acetyl Chloride	Cold		2	2	Saturated	Boiling		1	1	Boracic Acid				
Boiling			2	2	Ammonium Oxalate					5%	Hot or Cold		1	1
Acetylene	70°		1	1	5%	70		1	1	Boric Acid				
Acid Salt Mix					Ammonium Perchlorate					Saturated	Boiling		1	1
10% H ₂ SO ₄ Sp. G. 1.07					10%	Boiling		1	1					
+ 10% CuSO ₄ • 5H ₂ O	Boiling		1	1										
10% H ₂ SO ₄ Sp. G. 1.07														
+ 2% FeSO ₄ • 7 H ₂ O	Boiling		1	1										
Alcohol, Ethyl	70°		1	1										
Boiling			1	1										
Alcohol, Methyl	70°		1	1										
150°			2	*3										
Aluminum, Molten	1400°		5	5										
Aluminum Acetate														
Saturated	70°		1	1										
Saturated	Boiling		1	1										

* Subject to pitting at air line or when allowed to dry.

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The ability of stainless steels to resist corrosion is related to the chromium content, for chromium is the alloying element that endows stainless steels with their corrosion resistance. By combining with oxygen, chromium forms a thin but transparent chromium-oxide surface protective film. A steel must contain not less than 10% chromium to be considered stainless. As a general rule, the higher the alloy content, the

more resistant it will be to corrosion because of the passive oxide film. Because of the important role of this film, care must be observed in manufacturing or in the operation and use of stainless steel components to avoid destroying or disturbing its passivity. Normally the destruction or disturbance of the protective film can be reformed or healed in the presence of oxygen to again provide maximum protection.

The stable protective nature in atmospheric or mild aqueous environments can be enhanced by higher chromium, nickel, molybdenum and other alloying elements. Chromium improves film stability; molybdenum and chromium increase resistance to chloride penetration; and nickel improves film resistance in aggressive acid environments. For example, Type 316 contains about the same amount of

Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304
Bromine					Caustic Soda (See Sodium Hydroxide)					Copper Cyanide (Cupric Cyanide)				
Bromine water		70°	4	5	Chinosol Antiseptic Aqueous Solution					Saturated solution	Boiling		1	1
Boron Trifluoride					1-500 dilution	70°		1	1	Plating solution	120°		1	2
Anhydrous		77°	1	1	Cellulose					Copper Nitrate (Cupric Nitrate)				
Buttermilk		70°	1	1	Chloroacetic Acid		70°	3	4	1% Quiescent	70°		1	1
Butyric Acid					Chlorine Gas					1% Agitated	70°		1	1
5%		70°	1	1	Dry	70°		1	1	1% Aerated	70°		1	1
5%		150°	1	1	Moist	70°		3	4	5% Quiescent	70°		1	1
Aqueous Solution					212°			4	5	5% Agitated	70°		1	1
Sp. G. .964		Boiling	1	1	Chlorinated Water					50% Aqueous Sol.	Boiling		1	1
Calcium Carbonate		70°	1	1	Saturated	70°		***2	***3	Copper Sulphate (Cupric Sulphate)				
Calcium Chlorate					Chloric Acid		70°	4	5	5% Agitated	70°		1	1
Dilute		Cold & Hot	1	1	Chlorobenzene (Phenyl Chloride)					5% Aerated	70°		1	1
Calcium Chloride					C.P.	70°		1	1	Saturated solution	Boiling		1	2
Dilute		70°	*1	*2	Boiling			1	1	Cream of Tartar		Cold & Hot	1	1
Conc. Solutions		330°	5	5	Chloroform		70°	1	1	Creosote (Coal Tar)		Hot	1	1
Calcium Chlorohypochlorite (Bleaching Powder)					Chlorosulphonic Acid					Creosote Oil		Hot	1	1
1%		70°	***2	***3	Dilute	70°		5	5	Cyanogen Gas		70°	1	1
5%			***3	***3	Chromic Acid					Dichloroethane		Boiling	1	1
Calcium Hypochlorite					5% C.P.	70°		1	1	Dinitrochlorobenzene				
2%		70°	***1	***2	10% C.P.	70°		2	2	Melted and solidified	70°		1	1
Aqueous Solution					10% C.P.	Boiling		2	3	Distillery Wort		70°	1	1
Sp. G. 1.04		100°	***1	***3	50% C.P.	70°		2	2	Dyewood Liquor		70°	1	+1
Calcium Chlorate					50% C.P.	Boiling		3	3	Epsom Salt (Magnesium Sulphate)		Hot & Cold	1	1
Dilute Solution		70°	1	1	Commercial 50%					Ether		70°	1	1
Dilute Solution		Hot	1	1	(Cont. SO ₂)	70°		1	1	Ethyl Chloride		70°	1	1
Calcium Hydroxide					Commercial 50%	Boiling		3	*4	Ethylene Chloride		70°	1	1
10%		Boiling	1	1	Chromium Plating Bath	70°		1	1	Ferric Chloride				
20%		Boiling	1	1	Cider		70°	1	1	1% to Saturation	70°		5	5
50%		Boiling	2	3	Citric Acid					Ferric Hydroxide (Hydrated Iron Oxide)		70°	1	*1
Calcium Sulphate					5% Quiescent	70°		1	1	Ferric Nitrate				
Saturated		70°	1	1	5% Quiescent	150°		1	1	1% Quiescent	70°		1	1
Cadmium		Molten	3	3	10%	50°		1	1	5% Quiescent	70°		1	1
Camphor		70°	1	1	10%	Boiling		1	2	1% Agitated	70°		1	1
Cane Juice (Sugar Cane)		Hot	1	1	15%	70°		1	1	5% Agitated	70°		1	1
Carbolic Acid (Phenol)					15%	Boiling		1	2	1% Aerated	70°		1	1
C.P. + 10% water		Boiling	1	1	25%	70°		1	1	5% Aerated	70°		1	1
C.P.		70°	1	1	25%	Boiling		1	4	10% Agitated	70°		1	1
C.P.		360° (boil)	1	1	50%	70°		1	1	Ferric Sulphate				
Crude		212°	1	1	50%	Boiling		1	4	1% Quiescent	70°		1	1
Crude		Boiling	1	1	Conc.	Boiling		2	3	1% Aerated	70°		1	1
Carbon Bisulphide		70°	1	1	5%—45 lb. sq. in.					1% Agitated	70°		1	1
Carbon Monoxide Gas		1400°	1	1	Press	284°		2	4	1% Agitated	70°		1	1
		1600°	1	1	Coca-Cola Syrup (Pure)	70°		1	1	5% Quiescent	70°		1	1
Carbon Tetrachloride					Coffee		Boiling	1	1	5% Aerated	70°		1	1
C.P.		70°	1	1	Copperas (See Ferrous Sulphate)					5% Agitated	70°		1	1
C.P.		Boiling	1	1	Copper Acetate					10%	Boiling		1	1
Commercial plus					Saturated solution	70°		1	1	Ferrous Chloride				
1% water		Boiling	*2	..	Copper Carbonate					Saturated	275°		5	5
Commercial plus					Sat. Sol. in 50% NH ₄ OH			1	1	Ferrous Iodide		75°	5	5
1% HCl		Boiling	*2	..	Copper Chloride (Cupric Chloride)					62%				
Carbonated Beverages					1% Agitated	70°		*1	*2	Ferrous Sulphate				
Various conc.		Cold	1	1	1% Aerated	70°		*1	*2	10%	70°		1	*1
Carbonated Water (Carbonic Acid)					5% Agitated	70°		*2	*3	10%	Boiling		3	3
Carbonic Acid					5% Aerated	70°		*3	*5	Fluorine (Gas)		70°	5	5
All concentrations		Cold & Hot	1	1	10% Quiescent	70°		1	5	Formalin				
Carnalite										40% Formaldehyde		70°	1	1
Saturated solution		Boiling	2	2										
(KC1 • MgCl ₂ • 6H ₂ O)														

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 *** Not recommended for standing baths.

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 † May attack when sulfuric acid is present.

chromium as Type 304, more nickel, and 2 to 3% molybdenum. Type 316 is more resistant to corrosion than Type 304, especially chloride's pitting attack, and it is widely used in chemical processing because of its increased resistance to aggressive agents.

In rural atmospheres, virtually all stainless steels will give completely satisfactory service in terms of atmospheric corrosion resistance. In

industrial environments, the choice of which stainless steel to use is fairly broad, except many users tend to prefer the 300 Series stainless steels, such as Type 304, because of their all-around good corrosion performance and ease of fabrication. While there is little concern about the sulphur content of the atmosphere, which has been known to accelerate corrosion in other metals, the primary concern with stainless steel is

the presence of chlorides. In industrial area, dust and flying ash containing chlorides accumulate on flat surfaces. And if there is insufficient rainfall to wash away the accumulation, the possibility of some staining or pitting attack on the stainless steels with lower alloy content must be considered. Higher alloy grades such as Type 316 may be advisable.

As the chloride content of the

Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304
Formic Acid					Lard		70°	1	1	Nickel Chloride				
5%		70°	1	2	Lead					Solution		70°	*1	*1
5%		150°	1	2	Molten		750°	2	2	Saturated		200°	4	5
10%		70°	1	2	Lead Acetate					Nickel Nitrate				
10%		Boiling	1	1	5%		Boiling	1	1	All concentrations		Cold & Hot	1	1
50%		70°	1	2	Linseed Oil		70°	1	1	Nickel Sulphate		Cold & Hot	1	1
50%		Boiling	1	1	Plus 3% H ₂ SO ₄		390°	1	1	Niter Cake		Fused	1	2
90%		Boiling	1	1	Lithium Chloride					Nitrating Solutions		Cold & Hot	2	2
100%		70°	1	1	30%		240°	1	1	Nitric Acid				
100%		Boiling	2	2	Lysol		70°	1	1	5%		70°	1	1
Fruit Juices		70°	1	1	Magnesium Carbonate					5%		Boiling	1	1
Fuel Oil		Hot	1	1	All concentrations		Cold & Hot	1	1	20%		70°	1	1
Cont. Sulphuric Acid			2	3	Magnesium Chloride					20%		Boiling	1	1
Furfural		70°	1	1	1% Quiescent		70°	1	*1	40%		70°	1	1
Galic Acid					1% Quiescent		Hot	*2	*3	40%		Boiling	1	1
5%		70°	1	1	5% Quiescent		70°	1	*1	50%		70°	1	1
5%		150°	1	1	5% Quiescent		Hot	*2	*3	50%		Boiling	1	1
Sat. at 212°F.		Boiling	1	1	35%		160°	2	2	65%		70°	1	1
Gasoline		70°	1	1	48%		330°	5	5	65%		Boiling	2	2
Gelatin		Cold to 140°	1	1	Magnesium Hydroxide					Conc.		70°	1	1
Flauber's Sale (See Sodium Sulphate)					Thick suspension		70°	1	1	Conc.		Boiling	2	2
Glue					Magnesium Nitrate					Fuming Conc.		70°	1	1
Dry		70°	1	1	All concentrations		Cold & Hot	1	1	Fuming Conc.		110°	1	1
Acid Solution		70°	1	*2	Magnesium Oxchloride		70°	*2	*3	Fuming Conc.		Boiling	4	4
Acid solution		140°	1	*2	Magnesium Sulphate (See Epsom Salt)					Nitrous Acid				
Glycerine		70°	1	1	Any		Any	1	1	5%		70°	1	1
Gypsum (See Calcium Sulphate)					Malic Acid		Cold & Hot	1	1	Oils				
Hydrochloric Acid					Manganese Carbonate					Crude		Cold & Hot	*1	*1
All concentrations		70°	5	5	All concentrations		Cold & Hot	1	1	Oils, Vegetable				
Hydrobromic Acid					Manganous Chloride					Mineral		Cold & Hot	1	*1
All concentrations		Cold & Hot	5	5	37%		220°	5	5	Oleic Acid		70°	1	*1
Hydrocyanic Acid		70°	1	1	Mash		Hot	1	1	300°			1	*1
Hydrofluosilicic Acid		70°	4	5	Mayonnaise		70°	1	*1	400°			1	*1
Hydrofluoric Acid					Mercury			1	1	Oxalic Acid				
All concentrations		Cold & Hot	5	5	Mercuric Chloride					5%		70°	1	1
Hydrogen Peroxide		70°	1	+1	Dilute solution		70°	*4	*5	5%		Boiling	1	1
Boiling			1	+2	Mercurous Nitrate					10%		70°	1	1
Hydrogen Sulphide					All concentrations		Cold & Hot	1	1	10%		Boiling	3	4
Dry		70°	1	1	Methanol (See Alcohol, Methyl)					25%		Boiling	3	4
Wet		70°	+1	+3	Methylene Chloride					50%		Boiling	3	4
Ink		70°	1	+2	40%		Cold & Hot	1	1	Paraffin		Cold & Hot	1	1
Iodine		70°	4	5	Milk					Paregoric Compound		70°	1	1
Iodoform		70°	1	1	Fresh or Sour		70°	1	1	Phenol (See Carboic Acid)				
Kerosene		70°	1	1	Boiling			1	1	Phenolic Resins		Cold & Hot	1	1
Ketchup					Mine Water-Acid		60°	*1	*1	Petroleum Ether			1	1
Quiescent		70°	1	*1	Molasses			1	1	Phosphoric Acid				
Quiescent		150°	1	*1	Molybdc Acid					1%		70°	++1	++1
Lactic Acid					5%		70°	1	1	1%		Boiling	1	1
1%		70°	1	1	Mustard		70°	1	*1	1% 45 lb. Press.		284°	1	1
1%		Boiling	1	1	Muriatic Acid		70°	5	5	5% Quiescent		70°	1	1
5%		70°	1	1	Naptha					5% Agitated		70°	1	1
5%		150°	1	2	Pure		70°	1	1	5% Aerated		70°	1	1
5%		Boiling	1	2	Crude		70°	1	1	10 Quiescent		70°	1	1
10%		70°	1	1	Naphthalenesulfonic Acid		70°	1	1	10% Agitated		70°	1	1
10%		150°	1	2						10% Aerated		70°	1	1
10%		Boiling	1	2						10%		Boiling	1	1
Conc.		70°	1	1						25%		Boiling	2	1
Conc.		Boiling	2	3						45%		Boiling	2	2
										50%		Boiling	2	2
										80%		70°	2	2
										80%		230°	3	5
										80%		Boiling	3	5

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+May attack when sulfuric acid is present.

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* Subject to pitting at air line or when allowed to dry.
+May attack when sulfuric acid is present.
++May attack when hydrochloric acid is present.

industrial environment increases, such as near chemical plants producing chlorine or hydrochloric acid, corrosive attack can be accelerated. Three stainless steels exposed in New York City for periods of up to 26 years were essentially unaffected. The same materials exposed to a chemical environment near Niagara Falls were attacked to varying degrees in much shorter periods. In such areas, the

selection of materials is more critical, but the choice can still be made from among the range of stainless steel alloys.

Marine environments are also high in chlorides and are notoriously aggressive to metals, but stainless steels are preferred for construction in many coastal applications. A thin rust film may develop on the surface of those stainless steel types, but in most

instances this is more a visual impairment than a functional failure from corrosion. Type 304 is used for coastal atmospheres and does very nicely especially where the metal is exposed to regular rainfall or is washed occasionally. Where staining is objectionable as with architectural applications, Type 316 is the preferred choice which has greater resistance to staining.

Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304	
Phosphoric Anhydride	Dry	Cold & Hot	1	1	Potassium Nitrate	Quiescent				Sodium Bisulphate	All concentrations	Cold & Hot	1	*1	
Photographic Solutions	Film and paper developers	70°	1	1	1% Agitated	70°	1	1		Sodium Borate	All concentrations	Cold & Hot	1	1	
	Hypo (Acid fixing baths)	70°	+1	+1	Aerated	Quiescent				Sodium Chlorate	25%	Cold & Hot	1	1	
	Other Solutions (Toners, Reducers, Tray Cleaners, etc.)	request			5% Agitated	70°	1	1		Sodium Chloride	5% Quiescent	70°	1	*1	
Picric Acid		70°	1	1	50% Quiescent	70°	1	1		5% Quiescent	150°	1	*1		
Pine Tar Oil		Cold & Hot	1	1	Molten	1022°	1	1		20% Aerated	70°	1	*1		
Potash (See Potassium Hydroxide)					Potassium Oxalate	70°	1	1		Saturated	70°	1	*1		
Potassium Aluminum Sulfate	10%	60°	1	1	Potassium Permanganate	5%	70°	1	1	Saturated	Boiling	1	4		
Potassium Bichromate	25%	70°	1	1	10%	Boiling	1	1		Sodium Chlorite pH5	5%	77°	1	5	
	25%	Boiling	1	1	Potassium Persulfate	5%	95°	1	1		Sodium Citrate	All concentrations	Cold & Hot	1	1
Potassium Bromide		70°	*1	*2	4.8% 1H3	90°	1	1		Sodium Ferricyanide	5% (neutral)	Cold & Hot	*1	*1	
Potassium Carbonate	1% Quiescent				Potassium Sulphate	1% Quiescent	70°	1	1	Sodium Hypochlorite	5%	70°	***1	***2	
	1% Agitated	70°	1	1	1% Agitated	70°	1	1		3%	70°	3	5		
	1% Aerated				1% Aerated	70°	1	1		1%	140°	2	4		
	50%	Boiling	1	1	5% Quiescent	70°	1	1		Sodium Lactate	10%	Cold & Hot	1	1	
Potassium Chlorate	Saturated at 212°	Boiling	1	1	5% Agitated	70°	1	1		Sodium Nitrate	All concentrations	Cold & Hot	1	1	
Potassium Chloride	1% Quiescent	70°	1	1	5% Aerated	70°	1	1		Sodium Nitrite	All concentrations	Cold & Hot	1	1	
	1% Agitated	70°	1	1	5%	Hot	1	1		Sodium Fluoride	5%	70°	*1	*2	
	1% Aerated	70°	1	1	Progallie Acid		1	1		Sodium Hydroxide	20%	Boiling	1	1	
	5% Quiescent	70°	1	1	Quinine Sulphate	Dry		1	1	30%	Boiling	2	2		
	5% Agitated	70°	1	1	Quinine Bisulphate	Dry		1	2	Molten	600°	2	2		
	5% Aerated	70°	1	1	Rosin			1	1	Sodium Nitrate		Fused	1	2	
	5% Aerated	70°	1	1	Molten			1	1	Sodium Perchlorate	10%	70°	1	1	
	32%	180°	2	2	Sauerkraut			1	5	10%	Boiling	1	1		
Potassium Chromium Sulphate	45% + 5% free acid	122°	1	5	Brine	70°	1	5		Sodium Peroxide	10%	70°	1	1	
Potassium Dichromate	All concentrations (Neutral)	Cold & Hot	1	1	Sea Water	70°	1	*1		10%	200°	1	1		
Potassium Ferricyanide	5%	70°	1	1	Sewage			+1	+1	Sodium Phenolate	20%	250°	1	2	
	25%	70°	1	1	Silver Bromide			*1	*2	Sodium Phosphate	5%	Cold & Hot	1	1	
	25%	Boiling	1	1	Silver Chloride			5	5	Sodium Salicylate	All concentrations	70°	1	1	
Potassium Ferrocyanide	5%	70°	1	1	Silver Nitrate	10%	70°	1	1	Sodium Silicate		Cold & Hot	1	1	
Potassium Hydroxide	5% Quiescent	70°	1	1	10%	Boiling	1	1		Sodium Silicate		Cold & Hot	1	1	
	5% Agitated	70°	1	1	Soaps	70°	1	1		Sodium Sulphate	5%	70°	1	1	
	5% Aerated	70°	1	1	Sodium Acetate	Moist		1	*1	Saturated	Boiling	1	1		
	27%	Boiling	1	1	Sodium Aluminate	10%	60°	1	1	Sodium Sulphite	5%	70°	1	1	
	50%	Boiling	1	2	Sodium Carbonate	5%	70°	1	1	10%	150°	1	1		
Potassium Hypochlorite	Conc.	70°	2	2	5%	Boiling	1	1		25%	Boiling	1	1		
Potassium Iodide	All concentrations	Cold & Hot	1	1	50%	Boiling	1	1		50%	Boiling	1	1		
					Molten	1650°	5	5		Sodium Sulphite	25%	70°	1	+1	
					Sodium Bicarbonate	All concentrations	70°	1	1	25%	Boiling	1	1		
					5% Quiescent	150°	1	1							
					Sodium Bichromate	All concentrations (neutral)	Cold & Hot	1	1						
					Sodium Bifluoride			5	5						

* Subject to pitting at air line or when allowed to dry.
† May attack when sulfuric acid is present.

* Subject to pitting at air line or when allowed to dry.
† May attack when sulfuric acid is present.

* Subject to pitting at air line or when allowed to dry.
*** Not recommended for standing baths.
† May attack when sulfuric acid is present.

Conditions below the surface of the ground can be fair more aggressive than those in the atmosphere, because materials are frequently submerged for long periods in soils containing water, salts, or chemicals, all of which increase the potential corrosivity of the environment. These soils are subject to a complex set of conditions that may vary from time to time, depending upon the weather and other circumstances.

Nevertheless, stainless steels are often preferred for sub-surface environments. To provide more complete data on the performance of stainless steels in underground applications, including data on many different soil conditions, the Committee of Stainless Steel Producers initiated an extended test program in cooperation with the National Bureau of Standards. The results of this program, which continue, are available

from Washington Steel Corporation.

Laboratory Corrosion Resistance

Tables The data contained in the following tables, while indicative of what can be expected in service, cannot be considered an absolute reference in predicting service results. Whenever possible, samples should be exposed to actual operating conditions before drawing any conclusions.

For comparative purposes, these tables include data on Type 304 and 316. If there is any question as to the suitability in a specific corrosive environment, the question should be referred to our customer service. The approximate corrosion resistance is represented as follows:

1. Fully resistant
2. Satisfactorily resistant
3. Fairly resistant
4. Slightly resistant
5. Not resistant

- 0.002-inch
- 0.010-inch
- 0.020-inch
- 0.040-inch/0.050-inch
- 0.050-inch and over

Substance	Condition	Temp. F.	Type 316	Type 304	Substance	Condition	Temp. F.	Type 316	Type 304
Sodium Sulphide					Tung Oil	Cold & Hot		1	1
Saturated	70°		1	*2	Terpentine Oil	95°		1	1
0.4%	108°		1	2	Uranium Trichloride				
50%	320°		..	5	15%	Boiling		5	5
Soy Bean Oil	Cold & Hot		1	1	Uric Acid	70°		1	1
Stannic Chloride					Varnish	70°		1	1
Sp. G. 1.21	70°		3	4		Hot		1	1
Sp. G. 1.21	Boiling		4	5	Vegetable Juices				
Stannous Chloride					Vinegar				
Saturated	120°		1	2	Quiescent	70°		1	1
	Boiling		..	5	Agitated	70°		1	1
Starch					Aerated	70°		1	1
Aq. solution			1	1		Hot		1	1
Stearic Acid			1	1	Vinegar Fumes	70°		1	2
Strontium Hydroxide			1	1	Whiskey			1	1
Strontium Nitrate					Wine				
Solution	Hot		1	1	All phases of processing				
Sugar Juice	Hot		1	1	and storage	75°		1	1
Sulphur Chloride	Cold & Hot		5	5	Wood Pulp			1	1
98%	280°		2	4	Wood Pulp Liquors				
Sulphur					Digestive Liquors				
Moist	70°		*1	*2	(3% Ca(HSO ₃) +				
Molten	266°		1	1	2% H ₂ SO ₄ + SO ₂ +				
Molten	833°		3	3	Air	Boiling		1	5
Sulphur Monochloride	70°		1	1	Black Waste				
Sulphur Dioxide Gas					Liquors (Alkaline Fired)	1800°		5	5
Moist	70°		1	2	Black Waste Liquors	Boiling		1	1
Gas	575°		1	1	Wort			1	1
Sulphuric Acid					Yeast			1	1
5%	70°		2	3	Zinc				
5%	Boiling		3	5	Molten			5	5
10%	70°		2	3	Zinc Chloride				
10%	Boiling		4	5	5%	70°		1	1
50%	70°		3	4	5%	Boiling		*1	*2
50%	Boiling		4	5	20%	70°		1	1
Conc.	70°		1	1	20%	Boiling		1	2
Conc.	Boiling		4	4	70%	70°		1	1
Conc.	300°		5	5	70%	Boiling		5	5
Fuming	70°		2	3	Zinc Sulphate				
Sulphuric Acid					5%	70°		1	1
Saturated	70°		2	3	25%	Boiling		1	1
Saturated 60 lb.					Saturated	70°		1	1
press	250°		2	3					
Saturated 70-125 lb.									
press	310°		3	3					
Saturated 150 lb.									
press	375°		3	3					
Spray	70°		*4	*4					
Sweet Water	Hot		1	1					
Syrup	Hot		1	1					
Tannic Acid	70°		1	1					
	150°		1	2					
Tanning Liquor	70°		1	1					
Tar			1	1					
Tartaric Acid									
10%	70°		1	1					
10%	Boiling		1	1					
50%	Boiling		1	1					
Saturated at 212°	Boiling		..	5					
Tin									
Molten			3	3					
Trichloroacetic Acid	70°		4	5					

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*Subject to pitting at air line or when allowed to dry.