STAINLESS STEEL LABORATORY CORROSION DATA

RESISTANCE OF STAINLESS STEELS TO CHEMICAL MEDIA

JUST MANUFACTURING COMPANY

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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
Acetic Acid				
	5% Agitated	70°	1	1
	5% Aerated	70°	1	1
	5%	100°	1	1
	5%	180°	1	1
	10% Agitated	70°	1	1
	10% Aerated	70°	1	1
	10%	100°	1	1
	10%	180°	1	1
	10%	Boiling	1	3
	10%	60°	1	1
	15%	100°	1	1
	15%	180°	1	2
	15%	Boiling	1	3
	20% Agitated	70°	1	1
	20% Aerated	70°	1	1
	20% Aerated	180°	1	2
	33%	70°	1	1
	33%	100°	1	1
	33%	180°	1	2
	33%	Boiling	1	3
	40% Aerated	180°	1	2
	50%	70°	1	1
	50%	Boiling	1	3
	60 %	60°	1	1
	60%	100°	1	1
	60%	180°	1	2
	60%	Boiling	2	3
	80%	70°	1	1
	80%	100°	1	1
	80%	180°	1	2
	80%	Boiling	2	4
	90% Aerated	180°	1	3
	100%	70°	1	1
	100%	100°	1	1
	100%	180°	1	2
	100%	Boiling	2	3
	100% —150 lb. Press.	400°	3	5
Acetic Anhydride				
	(90% Anhydride)	70°	1	1
	(90% Anhydride)	180°	1	1
	(90% Anhydride)	Boiling	1	1
	Aerated			
	(90% Anhydride)	180°	3	4
	60% Anhydride	180°	2	2
	30% Anhydride	180°	2	4
Acetic Acid Vapors				
	30%	Hot	2	3
	100%	Hot	3	5
Acetone		70°	1	1
		Boiling	1	1
Acetyl Chloride		Cold	2	2
		Boiling	2	2
Acetylene		70°	1	1
Acid Salt Mix				
	10% H_2SO_4 Sp.G. 1.07 + 10% $CuSO_4 \cdot 5H_2O$	Boiling	1	1
	10% H_2SO_4 Sp.G. 1.07 + 2% $FeSO_4 \cdot 7\ H_2O$	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.

Substance	Condition	Temp. F.	Type 316	Type 304
Aluminum Chloride				
	10% Quiescent	70°	3	4
	25% Quiescent	70°	3	4
Aluminum Fluoride		70°	3	4
Aluminum Hydroxide				
	Saturated	70°	1	*1
Aluminum Sulphate				
	5%	150°	1	*1
	10%	70°	1	*1
	10%	Boiling	1	*2
	Saturated	70°	1	*1
	Saturated	Boiling	1	*2
Aluminum Chrominum Sulphate				
	5%	70°	1	*1
	Sp.G. 1.6	Boiling		*5
Aluminum Postassium Sulphate (Alum)				
	2%	70°	1	*1
	10%	70°	1	*1
	10%	Boiling	1	*2
	Saturated	Boiling	2	*3
Ammonia (Dry or Moist)				
	All concentrations	70-212°	1	1
Ammonia Biflouride				
	10%	80°	5	5
Ammonia (Anhydrous)		800° up	5	5
Ammonium Hydroxide		70°	1	1
		Boiling	1	1
Ammonium Bicarbonate		70°	1	1
		Hot	1	1
Ammonium Bromide				
	5%	70°	1	1
Ammonium Carbonate				
	1% Quiescent	70°	1	1
	5% Quiescent	70°	1	1
	1% Aerated	70°	1	1
	5% Aerated	70°	1	1
	1% Agitated	70°	1	1
	5% Agitated	70°	1	1
Ammonium Chloride				
	1% Quiescent	70°	1	*1
	1% Aerated	70°	1	*1
	1% Agitated	70°	1	*1
	10%	Boiling	*1	*1
	20%	Boiling	*1	*1
	28%	Boiling	*1	*2
	50%	Boiling	*1	*2
Ammonium Chlorostannate				
	Saturated	70°	1	2
	Saturated	140°	3	5
Ammonium Nitrate				
	All conc. agitated) aerated	70	1	1
	Saturated	Boiling	1	1
Ammonium Oxalate				
	5%	70	1	1
Ammonium Perchlorate				
	10%	Boiling	1	1

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Substance	Condition	Temp. F.	Type 316	Type 304
Ammonium Persulphate				
	5%	70	1	1
Ammonium Phosphate				
	5%	70	1	1
Ammonium Potassium Sulphate (Alum.)				
	Dilute & saturated	Various	1	*1
Ammonium Sulfamate				
	10%	70	1	1
Ammonium Sulphate				
	1% Aerated	70	1	1
	1% Agitated	70	1	1
	5% Aerated	70	1	1
	5% Agitated	70	1	1
	10%	Boiling	*1	*2
	Saturated	Boiling	1	2
Ammonium Sulphite		70	1	1
		Boiling	1	1
Ammonium Thiocyanate				
	10%	70	1	2
	30%	154	1	2
Aniline				
	3%	70	1	1
	Concentrated crude	70	1	1
Aniline Hydrochloride		70	4	5
Antimony				
	Molten	1100	5	5
Antimony Sulphide				
	Molten	1200-1600	5	5
Antimony Trichloride		70	4	5
Arsenic Acid		150	1	1
Barium Carbonate		70	1	1
Barium Chlorate				
	10%	Boiling	4	5
Barium Chloride				
	5%	70°	1	1
	Saturated	70°	1	1
	Aqueous Solution	Hot	*1	*2
Barium Hydroxide				
	All concentrations	Cold & Hot	1	1
Barium Nitrate				
	Aqueous Solution	Hot	1	1
Barium Sulphate				
	(Barytes-Blanc-Fixe)	70°	1	1
Beer				
	(Barley Malt & Hops)	70°	1	1
	3.5%-4.5% Alcohol	160°	1	1
Benzene (Benzol)		70°	1	1
		Hot	1	1
Benzoic Acid		70°	1	1
Blood (Meat Juices)		Cold	1	*1
Borax				
	5%	Hot	1	1
Boracic Acid				
	5%	Hot or Cold	1	1
Boric Acid				
	Saturated	Boiling	1	1

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

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
Bromine				
Bromine water		70°	4	5
Boron Trifluoride				
Anhydrous		77°	1	1
Buttermilk		70°	1	1
Butyric Acid				
5%		70°	1	1
5%		150°	1	1
Aqueous Solution				
Sp.G. .964		Boiling	1	1
Calcium Carbonate		70°	1	1
Calcium Chlorate				
Dilute		Cold & Hot	1	1
Calcium Chloride				
Dilute		70°	*1	*2
Conc. Solutions		330°	5	5
Calcium Chlorohypochlorite				
(Bleaching Powder)				
1%		70°	***2	***3
5%			***3	***3
Calcium Hypochlorite				
2%		70°	***1	***2
Aqueous Solution				
Sp.G. 1.04		100°	***1	***3
Calcium Chlorate				
Dilute Solution		70°	1	1
Dilute Solution		Hot	1	1
Calcium Hydroxide				
10%		Boiling	1	1
20%		Boiling	1	1
50%		Boiling	2	3
Calcium Sulphate				
Saturated		70°	1	1
Cadmium		Molten	3	3
Camphor		70°	1	1
Cane Juice				
(Sugar Cane)		Hot	1	1
Carbolic Acid (Phenol)				
C.P. + 10% water		Boiling	1	1
C.P.		70°	1	1
C.P.		360° (boil)	1	1
Crude		212°	1	1
Crude		Boiling	1	1
Carbon Bisulphide		70°	1	1
Carbon Monoxide Gas		1400°	1	1
		1600°	1	1
Carbon Tetrachloride				
C.P.		70°	1	1
C.P.		Boiling	1	1
Commercial plus				
1% water		Boiling	*2	..
Commercial plus				
1% HCl		Boiling	*2	..
Carbonated Beverages				
Various conc.		Cold	1	1
Carbonated Water				
(Carbonic Acid)			1	1
Carbonic Acid				
All concentrations		Cold & Hot	1	1
Carnalite				
Saturated solution		Boiling	2	2
($KCl \bullet MgCl_2 \bullet 6H_2O$)				

*Subject to pitting at air line or when allowed to dry.
***Not recommended for standing baths.

Substance	Condition	Temp. F.	Type 316	Type 304
Caustic Soda (See Sodium Hydroxide)				
Chinosol Antiseptic				
Aqueous Solution				
1-500 dilution		70°	1	1
Cellulose			1	1
Chloracetic Acid		70°	3	4
Chlorine Gas				
Dry		70°	1	1
Moist		70°	3	4
		212°	4	5
Chlorinated Water				
Saturated		70°	***2	***3
Chloric Acid		70°	4	5
Chlorobenzene				
(Phenyl Chloride)				
C.P.		70°	1	1
		Boiling	1	1
Chloroform		70°	1	1
Chlorosulphonic Acid				
Dilute		70°	5	5
Chromic Acid				
5% C.P.		70°	1	1
10% C.P.		70°	2	2
10% C.P.		Boiling	2	3
50% C.P.		70°	2	2
50% C.P.		Boiling	..	3
Commercial 50%				
(Cont. SO_3)		70°	1	1
Commercial 50%				
(Cont. SO_3)		Boiling	3	*4
Chromium Plating Bath		70°	1	1
Cider		70°	1	1
Citric Acid				
5% Quiescent		70°	1	1
5% Quiescent		150°	1	1
10%		50°	1	1
10%		Boiling	1	2
15%		70°	1	1
15%		Boiling	1	2
25%		70°	1	1
25%		Boiling	1	4
50		70°	1	1
50%		Boiling	1	4
Conc.		Boiling	2	3
5%—45 lb. sq. in.				
Press		284°	2	4
Coca-Cola Syrup (Pure)		70°	1	1
Coffee		Boiling	1	1
Copperas (See Ferrous Sulphate)				
Copper Acetate				
Saturated solution		70°	1	1
Copper Carbonate				
Sat. Sol. in 50%				
NH_4OH			1	1
Copper Chloride				
(Cupric Chloride)				
1% Agitated		70°	*1	*2
1% Aerated		70°	*1	*2
5% Agitated		70°	*2	*3
5% Aerated		70°	*3	*5
10% Quiescent		70°	1	5

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***Not recommended for standing baths.

Substance	Condition	Temp. F.	Type 316	Type 304
Copper Cyanide				
(Cupric Cyanide)				
Saturated solution		Boiling	1	1
Plating solution		120°	1	2
Copper Nitrate				
(Cupric Nitrate)				
1% Quiescent		70°	1	1
1% Agitated		70°	1	1
1% Aerated		70°	1	1
5% Quiescent		70°	1	1
5% Agitated		70°	1	1
5% Aerated		70°	1	1
50% Aqueous Sol.		Boiling	1	1
Copper Sulphate				
Cupric Sulphate)				
5% Agitated		70°	1	1
5% Aerated		70°	1	1
Saturated solution		Boiling	1	2
Cream of Tartar		Cold & Hot	1	1
Creosote (Coal Tar)		Hot	1	1
Creosote Oil		Hot	1	1
Cyanogen Gas		70°	1	1
Dichloroethane		Boiling	1	1
Dinitrochlorobenzene				
Melted and solidified		70°	1	1
Distillery Wort		70°	1	1
Dyewood Liquor		70°	1	†1
Epsom Salt (Magnesium Sulphate)		Hot & Cold	1	1
Ether		70°	1	1
Ethyl Chloride		70°	1	1
Ethylene Chloride		70°	1	1
Ferric Chloride				
1% to Saturation		70°	5	5
Ferric Hydroxide				
(Hydrated Iron Oxide)		70°	1	*1
Ferric Nitrate				
1% Quiescent		70°	1	1
5% Quiescent		70°	1	1
1% Agitated		70°	1	1
5% Agitated		70°	1	1
1% Aerated		70°	1	1
5% Aerated		70°	1	1
Ferric Sulphate				
1% Quiescent		70°	1	1
1% Aerated		70°	1	1
1% Agitated		70°	1	1
5% Quiescent		70°	1	1
5% Aerated		70°	1	1
5% Agitated		70°	1	1
10%		Boiling	1	1
Ferrous Chloride				
Saturated		275°	5	5
Ferrous Iodide				
62%		75°	5	5
Ferrous Sulphate				
10%		70°	1	*1
10%		Boiling	3	3
Fluorine (Gas)		70°	5	5
Formalin				
40% Formaldehyde		70°	1	1

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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
Formic Acid				
	5%	70°	1	2
	5%	150°	1	2
	10%	70°	1	2
	10%	Boiling	1	1
	50%	70°	1	2
	50%	Boiling	1	1
	90%	Boiling	1	1
	100%	70°	1	1
	100%	Boiling	2	2
Fruit Juices		70°	1	1
Fuel Oil		Hot	1	1
Cont. Sulphuric Acid			2	3
Furfural		70°	1	1
Galic Acid				
	5%	70°	1	1
	5%	150°	1	1
	Sat. at 212°F.	Boiling	1	1
Gasoline		70°	1	1
Gelatin		Cold to 140°	1	1
Flauber's Sale (See Sodium Sulphate)				
Glue				
	Dry	70°	1	1
	Acid Solution	70°	1	*2
	Acid solution	140°	1	*2
Glycerine		70°	1	1
Gypsum (See Calcium Sulphate)				
Hydrochloric Acid				
	All concentrations	70°	5	5
Hydrobromic Acid				
	All concentrations	Cold & Hot	5	5
Hydrocyanic Acid		70°	1	1
Hydrofluosilicic Acid		70°	4	5
Hydrofluoric Acid				
	All concentrations	Cold & Hot	5	5
Hydrogen Peroxide		70°	1	†1
		Boiling	1	†2
Hydrogen Sulphide				
	Dry	70°	1	1
	Wet	70°	†1	†3
Ink		70°	1	†2
Iodine		70°	4	5
Iodoform		70°	1	1
Kerosene		70°	1	1
Ketchup				
	Quiescent	70°	1	*1
	Quiescent	150°	1	*1
Lactic Acid				
	1%	70°	1	1
	1%	Boiling	1	1
	5%	70°	1	1
	5%	150°	1	2
	5%	Boiling	1	2
	10%	70°	1	1
	10%	150°	1	2
	10%	Boiling	1	2
	Conc.	70°	1	1
	Conc.	Boiling	2	3

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†May attack when sulfuric acid is present.

Substance	Condition	Temp. F.	Type 316	Type 304
Lard		70°	1	1
Lead				
	Molten	750°	2	2
Lead Acetate				
	5%	Boiling	1	1
Linseed Oil		70°	1	1
	Plus 3% H_2SO_4	390°	1	1
Lithium Chloride				
	30%	240°	1	1
Lysol		70°	1	1
Magnesium Carbonate				
	All concentrations	Cold & Hot	1	1
Magnesium Chloride				
	1% Quiescent	70°	1	*1
	1% Quiescent	Hot	*2	*3
	5% Quiescent	70°	1	*1
	5% Quiescent	Hot	*2	*3
	35%	160°	2	2
	48%	330°	5	5
Magnesium Hydroxide				
	Thick suspension	70°	1	1
Magnesium Nitrate				
	All concentrations	Cold & Hot	1	1
Magnesium Oxychloride		70°	*2	*3
Magnesium Sulphate				
(See Epsom Salt				
	Any	Any	1	1
Malic Acid		Cold & Hot	1	1
Manganese Carbonate				
	All concentrations	Colt & Hot	1	1
Manganous Chloride				
	37%	220°	5	5
Mash		Hot	1	1
Mayonnaise		70°	1	*1
Mercury			1	1
Mercuric Chloride				
	Dilute solution	70°	*4	*5
Mercurous Nitrate				
	All concentrations	Cold & Hot	1	1
Methanol (See Alcohol, Methyl)				
Methylene Chloride				
	40%	Cold & Hot	1	1
Milk,				
	Fresh or Sour	70°	1	1
		Boiling	1	1
Mine Water-Acid		60°	*1	*1
Molasses			1	1
Molybdic Acid				
	5%	70°	1	1
Mustard		70°	1	*1
Muriatic Acid		70°	5	5
Naptha				
	Pure	70°	1	1
	Crude	70°	1	1
Naphthalenesulfonic Acid		70°	1	1

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Substance	Condition	Temp. F.	Type 316	Type 304
Nickel Chloride				
	Solution	70°	*1	*1
	Saturated	200°	4	5
Nickel Nitrate				
	All concentrations	Cold & Hot	1	1
Nickel Sulphate		Cold & Hot	1	1
Niter Cake		Fused	1	2
Nitrating Solutions		Cold & Hot	2	2
Nitric Acid				
	5%	70°	1	1
	5%	Boiling	1	1
	20%	70°	1	1
	20%	Boiling	1	1
	40%	70°	1	1
	40%	Boiling	1	1
	50%	70°	1	1
	50%	Boiling	1	1
	65%	70°	1	1
	65%	Boiling	2	2
	Conc.	70°	1	1
	Conc.	Boiling	2	2
	Fuming Conc.	70°	1	1
	Fuming Conc.	110°	1	1
	Fuming Conc.	Boiling	4	4
Nitrous Acid				
	5%	70°	1	1
Oils				
	Crude	Cold & Hot	†1	†1
Oils, Vegetable				
	Mineral	Cold & Hot	1	†1
Oleic Acid		70°	1	*1
		300°	1	*1
		400°	1	*1
Oxalic Acid				
	5%	70°	1	1
	5%	Boiling	1	1
	10%	70°	1	1
	10%	Boiling	3	4
	25%	Boiling	3	4
	50%	Boiling	3	4
	Paraffin	Cold & Hot	1	1
Paregoric Compound		70°	1	1
Phenol (See Carbolic Acid				
Phenolic Resins		Cold & Hot	1	1
Petroleum Ether			1	1
Phosphoric Acid				
	1%	70°	††1	††1
	1%	Boiling	1	1
	1% 45 lb. Press.	284°	1	1
	5% Quiescent	70°	1	1
	5% Agitated	70°	1	1
	5% Aerated	70°	1	1
	10 Quiescent	70°	1	1
	10% Agitated	70°	1	1
	10% Aerated	70°	1	1
	10%	Boiling	1	1
	25%	Boiling	2	1
	45%	Boiling	2	2
	50%	Boiling	2	2
	80%	70°	2	2
	80%	230°	3	5
	80%	Boiling	3	5

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

*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/.050-inch
0.050-inch and over

Substance	Condition	Temp. F.	Type 316	Type 304
Sodium Sulphide				
	Saturated	70°	1	*2
	0.4%	108°	1	2
	50%	320°	..	5
Soy Bean Oil		Cold & Hot	1	1
Stannic Chloride				
	Sp.G. 1.21	70°	3	4
	Sp.G. 1.21	Boiling	4	5
Stannous Chloride				
	Saturated	120°	1	2
		Boiling	..	5
Starch				
	Aq. solution		1	1
Stearic Acid			1	1
Strontium Hydroxide			1	1
Strontium Nitrate				
	Solution	Hot	1	1
Sugar Juice		Hot	1	1
Sulphur Chloride		Cold & Hot	5	5
	98%	280°	2	4
Sulphur				
	Moist	70°	*1	*2
	Molten	266°	1	1
	Molten	833°	3	3
Sulphur Monochloride		70°	1	1
Sulphur Dioxide Gas				
	Moist	70°	1	2
	Gas	575°	1	1
Sulphuric Acid				
	5%	70°	2	3
	5%	Boiling	3	5
	10%	70°	2	3
	10%	Boiling	4	5
	50%	70°	3	4
	50%	Boiling	4	5
	Conc.	70°	1	1
	Conc.	Boiling	4	4
	Conc.	300°	5	5
	Fuming	70°	2	3
Sulphuric Acid				
	Saturated	70°	2	3
	Saturated 60 lb. 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
Trichloracetic Acid		70°	4	5

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

Substance	Condition	Temp. F.	Type 316	Type 304
Tung Oil		Cold & Hot	1	1
Terpentine Oil		95°	1	1
Uranium Trichloride				
	15%	Boiling	5	5
Uric Acid		70°	1	1
Varnish		70°	1	1
		Hot	1	1
Vegetable Juices				
Vinegar				
	Quiescent	70°	1	1
	Agitated	70°	1	1
	Aerated	70°	1	1
		Hot	1	1
Vinegar Fumes		70°	1	2
Whiskey			1	1
Wine				
	All phases of processing and storage	75°	1	1
Wood Pulp			1	1
Wood Pulp Liquors				
	Digestive Liquors (3% $Ca(HSO_3)$ + 2% H_2SO_4 + SO_2 + Air	Boiling	1	5
	Black Waste Liquors (Alkaline Fired	1800°	5	5
	Black Waste Liquors	Boiling	1	1
Wort			1	1
Yeast			1	1
Zinc				
	Molten		5	5
Zinc Chloride				
	5%	70°	1	1
	5%	Boiling	*1	*2
	20%	70°	1	1
	20%	Boiling	1	2
	70%	70°	1	1
	70%	Boiling	5	5
Zinc Sulphate				
	5%	70°	1	1
	25%	Boiling	1	1
	Saturated	70°	1	1

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