

Corrosion

Media	Utility Ferritics			Cr-Ni Austenitics			Cr-Ni-Mo Austenitics			Duplex		
	20°C	60°C	100°C	20°C	60°C	100°C	20°C	60°C	100°C	20°C	60°C	100°C
Aldhydes	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1
Acetic acid (10%)	R	R	ND	R	R	R	R	R	R	R	R	R
Acetic acid (glacial and anhydrous)	ND	ND	ND	R	R	ND	R	R	R	R	R	ND
Acetic anhydride	R2	NR	ND	R2	NR	NR	R	R	NR	R	R	R
Acetylene	NR	NR	NR	R3	R3	R3	R3	R3	R3	R4	NR	NR
Alcohols	R	R	R	R	R	R	R	R	R	R	R	R
Aliphatic esters	R	ND	ND	R	R	R	R	R	R	R	R	R
Alkyl chlorides	R5	ND	ND	R5	R5	R5	R5	R5	R5	R	R	R
Alum	ND	ND	ND	R	R6	NR	R	R1	NR	R	R	NR
Ammonia	R	R	R	R	R	R	R	R	R	R	R	R
Amyl acetate	R	R	R	R	R	R	R	R	R	R	R	R
Aniline	R	R	R	R	R	R	R	R	R	R	R	R
Antimony trichloride	NR	NR	NR	R5	NR	NR	R5	R5	NR	R	R	NR
Aromatic solvents	R	R	R	R	R	R	R	R	R	R	R	R
Atmospheric : Industrial	R7	ND	ND	R7	ND	ND	R	ND	ND	R	ND	ND
Atmospheric : Marine	R7	ND	ND	R7	ND	ND	R	ND	ND	R	ND	ND
Atmospheric : Rural	R7	ND	ND	R	ND	ND	R	ND	ND	R	ND	ND
Ascorbic acid	R1	ND	ND	R1	R1	R1	R	R	R	R	R	R
Benzoic acid	R	R	R	R	R	R	R	R	R	R	R	R
Boric acid	R	R	R	R	R	R	R	R	R	R	R	R
Brines, saturated	NR	NR	NR	R8	NR	NR	R8	NR	NR	R	R	R
Bromide (gaseous)	NR	NR	NR	R9	NR	NR	R9	R9	R9	R	ND	ND
Bromide (aqueous)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Butyl acetate	R	R	R	R	R	R	R	R	R	R	R	R
Calcium chloride	NR	NR	NR	NR	NR	NR	R8	NR	NR	R10	R10	R10
Carbon disulphide	R	R	R	R	R	ND	R	R	ND	R	R	R
Carbonic acid	R	R9	NR	R	R	R	R	R	R	R	R	R
Carbon tetrachloride	R	R	R	R	R	R	R	R	R	R	R	R
Caustic soda and potash	ND	R6	R6	R	R	R6	R	R	R6	R6	R6	ND
Cellulose paint	R	R	R	R	R	R	R	R	R	R	R	R
Chlorates of Na, K, Ba	ND	ND	ND	R1	R1	R1	R1	R1	R1	R	R	R
Chlorine, dry	ND	ND	ND	R	R	R	R	R	R	R	R	ND
Chlorine, wet	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	ND
Chlorides of Na, K, Mg, Ca, Ni, NH4, Al, Sn, Zn	R5	NR	NR	R10	NR	NR	R9	R11	R11	R	R	ND
Chlorosulphonic acid	ND	ND	ND	NR	NR	NR	R10	NR	NR	ND	ND	ND
Chromic acid (80%)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Citric acid	NR	NR	NR	R6	R6	R6	R	R	R6	R	R	R
Cresylic acids (50%)	R	R	R	R	R	R	R	R	R	R	R	R
Detergents, synthetic	R	R	R	R	R	R	R	R	R	R	R	R
Emulsifiers (all concentrations)	ND	ND	ND	R	R	R	R	R	R	R	R	R

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Corrosion (continued)

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	20°C	60°C	100°C	20°C	60°C	100°C	20°C	60°C	100°C	20°C	60°C	100°C
Esters and ethers	R	R	R	R	R	R	R	R	R	R	R	R
Fatty acids (>C ₆)	R	R	R	R	R	R	R	R	R	R	R	R
Ferric chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Fluorinated refrigerants, aerosols, eg freon	R ⁵	R	NR	R ⁵	R	R	R ⁵	R	R	R	R	R
Fluoride, dry	ND	ND	ND	R	ND	ND	R	ND	ND	R	R	ND
Formic acid	NR	NR	NR	R	NR	NR	R	R	ND	R	R	RND
Fruit juices	R ¹²	NR	NR	R ¹²	R	R	R	R	R	R	R	R
Gelatine	R ¹	R ¹	ND	R ¹	R	R	R ¹	R	R	R	R	R
Glycol	R	R	R	R	R	R	R	R	R	R	R	R
Hydrobromic acid (50%)	NR	NR	NR	NR	NR	ND	NR	NR	ND	NR	NR	ND
Hydrochloric acid (10%)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	ND
Hydrochloric acid (concentrated)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	ND
Hydrocyanic acid	R	ND	ND	R	R	ND	R	R	ND	R	R	ND
Hydrofluoric acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hydrogen peroxide (30%)	R	R	ND	R	R	R	R	R	R	R	R	R
Hydrogen sulphide	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵	R ⁵
Hydrochlorite (Na 12-14%)	R ¹⁴	ND	ND	R ¹⁴	NR	NR	R ¹⁴	NR	ND	R ¹⁴	ND	ND
Ketones	R	ND	ND	R	R	R	R	R	R	R	R	R
Lactic acid (100%)	NR	NR	NR	R	NR	NR	R	R	NR	R	R	ND
Lead acetate	R	R	R ⁶	R	R	R	R	R	R	R	R	R
Lead perchlorate	NR	NR	NR	R ¹	R ¹	R ¹	R	R ¹	ND	ND	ND	ND
Lime (CaO)	R	R	R	R	R	R	R	R	R	R	R	R
Manganate, potassium (K)	R ⁶	ND	ND	R	R	R	R	R	R	R	ND	ND
Meat juices	R ⁷	NR	NR	R	R	ND	R	R	ND	R	R	R
Mercuric chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	R	R	R
Milk and milk products	R	NR	NR	R	R	R	R	R	R	R	R	R
Molasses	R	R	R	R	R	R	R	R	R	R	R	R
Monoethanalamine	R	R	R	R	R	R	R	R	R	R	R	R
Naphthalene	R	R	R	R	R	R	R	R	R	R	R	R
Nitrates of Na, K, NH ₃ , Ag	R	R	R	R	R	R	R	R	R	R	R	R
Nitric acid (< 25%)	R	R ¹⁵	NR	R	R	R	R	R	R	R	R	R
Nitric acid (50%)	R	R ¹⁵	NR	R	R	R	R	R	R	R	R	R
Nitric acid (90%)	R	NR	NR	R	NR	NR	R	NR	NR	R	NR	ND
Nitric acid, fuming	ND	ND	ND	R	R ²	NR	R	NR	NR	R	NR	ND
Oil, diesel, petroleum spirits	R	R	R	R	R	R	R	R	R	R	R	ND
Oils, essential	R	R	R	R	R	R	R	R	R	R	R	R
Oils, lube with aromatic adds	R	R	R	R	R	R	R	R	R	R	R	R
Oils, vegetable and animal	R	R	R	R	R	R	R	R	R	R	R	R
Oxalic acid	NR	NR	NR	R ⁶	NR	NR	R ⁶	N ¹⁶	N ¹⁶	NR	R	R
Perchloric acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

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Corrosion (continued)

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	20°C	60°C	100°C	20°C	60°C	100°C	20°C	60°C	100°C	20°C	60°C	100°C
Phenol	R	R	R	R	R	R	R	R	R	R	R	R
Phosphoric acid (20%)	NR	NR	NR	R	R	R	R	R	R	R	R	R
Phosphoric acid (50%)	NR	NR	NR	R	R	NR	R	R	R	R	R	R
Phosphoric acid (95%)	NR	NR	NR	R	R	NR	R	R	NR	R17	R17	R17
Phosphorous pentoxide	ND	ND	ND	R	R	R5	R	R	R5	R	R	R
Pyridine	R	R	R	R	R	R	R	R	R	R	R	R
Sea water	NR	NR	NR	R17	NR	NR	R9	NR	NR	R	R	R
Silicic acid	R	R	R	R	R	R	R	R	R	R	R	R
Sodium peroxide	NR	NR	NR	R16	NR	NR	R6	R16	R16	R	R	R
Sodium silicate	R	R	R	R	R	R	R	R	R	R	R	R
Sodium sulphate	R6	R6	NR	R	R	NR	R	R	NR	R	R	NR
Starch	R	R	R	R	R	R	R	R	R	R	R	R
Sugar, syrup, jam	R12	R12	R12	R12	R	R	R	R	R	R	R	R
Sulphamic acid	NR	NR	NR	R18	NR	NR	R	R	R19	R	R	NR
Sulphates (Na, K, Mg, Ca, Al, Fe)	R	R	R	R	R	R	R	R	R	R	R	R
Sulphates	NR	NR	NR	R	R	R	R	R	R	R	R	R
Sulphur dioxide, dry	R	R	R	R	R	R	R	R	R	R	R	R
Sulphur dioxide, wet	NR	NR	NR	R	NR	NR	R	R	NR	R	R	NR
Sulphur dioxide, ag. soln (96%)	NR	NR	NR	R	NR	NR	R	R	R	R	R	R
Sulphur trioxide	NR	NR	NR	NR	NR	NR	R5	R5	R5	R5	R5	R5
Sulphuric acid (<50%)	NR	NR	NR	NR	NR	NR	R16	NR	NR	R	R	NR
Sulphuric acid (70%)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sulphuric acid (95%)	R15	NR	NR	R	NR	NR	R	NR	NR	R	NR	NR
Sulphuric acid, fuming	R2	R2	NR	R	R2	NR	R	NR	NR	R	R	NR
Tannic acid (10%)	R	R	NR	R	R	R	R	R	R	R	R	R
Tartaric acid	NR	NR	NR	R	R	R	R	R	R	R	R	R
Trichlorethylene	R5	R5	R5	R5	R5	R5	R5	R5	R5	R5	R5	R5
Urea (30%)	R	R	R	R	R	R	R	R	R	R	R	R
Water, pure	R	R	R	R	R	R	R	R	R	R	R	R
Yeast	R	R	R	R	R	R	R	R	R	R	R	R

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1 = Not if chlorides are present

2 = Limited data

3 = Depends on the acid

4 = Dry acid fumes, attack may occur if moisture builds up

5 = Anhydrous

6 = Depends on concentration

7 = May discolour with time

8 = In strong solutions only when inhibited

9 = Pitting possible in stagnant conditions

10 = Possibility of pitting

11 = May cause stress corrosion cracking

12 = When free of SO₂

13 = May cause contamination of product

14 = Dilute hypochlorites can be used to sterilise some stainless steels

15 = General corrosion may become excessive

16 = 10%

17 = In the absence of impurities

18 = Dilute

19 = Some attack at high temperatures

PITTING AND CREVICE CORROSION RESISTANCE:

Exposure in chloride containing media can result in localised corrosion.

In order of increasing resistance to localised corrosion: 3CR12 < 430 < 304L < 316L < 2205.

CONDITIONS FOR AVOIDING PITTING AND CREVICE CORROSION:

- Design vessels for complete drainage - avoid sharp corners and stagnant areas.
- Close crevices and lap joints by continuous welding.
- Remove solids in suspension. Prevent sedimentation. Ensure continous agitation and adequate flow rates.
- Use compressive non-absorbent gaskets or inert sealing compounds.
- Ensure non-impairment of passive surface. Repair/restore any affected areas.