TECHNICAL DATA

CORROSION

The corrosion data given in this table is for general comparison only.

The presence of contaminates and the effect of temperature in chemical environments can greatly affect the corrosion of any material.

PHD strongly suggests that field service tests or simulated laboratory tests using actual environmental conditions are conducted in order to determine the proper materials and finishes to be selected.

Chemical	Aluminum	PVC	Type 304 Stainless	Type 316 Stainless	Zinc Coated Steel
Acetic Acid 10%	R	R	R	R	NR
Acetic Acid 2%	R	R	R	R	NR
Acetone	R	NR	R	R	R
Ammonium Hydroxide-Conc,	R	R	R	R	-
Ammonium Hydroxide 10%	F	R	R	R	-
Ammonium Hydroxide 2%	R	R	R	R	-
Benzene	R	NR	R	R	-
Bromine Water	NR	R	NR	NR	-
Butanol (Butyl Alcohol)	R	R	R	R	R
Carbon Disulfide	R	NR	R	R	-
Carbon Tetrachloride	F	F	R	R	-
Chlorine Water	R	R	NR	F	R
Cutting Oil	-	-	-	-	-
Diethanolamine	R	NR	-	-	NR
Ethanol	R	R	R	R	R
Ethyl Acetate	R	NR	-	-	R
Ethylene Dichloride	F	NR	-	-	R
Formaldehyde 20%	R	R	R	R	R
Gasoline	R	R	R	R	R
Glycerine	R	R	R	R	R
Household Detergent 10%	F	R	R	R	-
Hydrochloric Acid 40%	NR	R	NR	NR	NR
Hydrochloric Acid 10%	NR	-	NR	NR	NR
Hydrochloric Acid 2%	NR	-	NR	NR	NR
Hydrogen Peroxide 30%	R	R	R	R	-
Hydrogen Peroxide 3%	R	-	R	R	-
Hydrofen Sulfide (Gas)	R	R	F	R	-
JP-4 Jet Fuel	R	R	R	R	-
Lactic Acid 85%	F	R	NR	-	-
Latex	R	-	R	R	NR
Linseed Oil Fatty Acid	R	R	R	R	-
Methanol	R	R	R	R	R
Methyl Ethyl Ketone	R	NR	-	-	R
Methyl Isobutyl Ketone	R	NR	-	-	R
Mineral Spirits	R	-	-	-	-
Motor Oil - 10W	R	R	R	R	R
Naphtha, VM&P	R	R	R	R	R
Nitric Acid 2%	F	R	R	R	-
Perchloroethylene	R	-	-	-	NR
Petroleum Ether	-	-	R	R	R
Phenol 10%	R	NR	R	R	R
Phosophoric Acid 2%	F	R	R	R	NR
Potassium Hydroxide 50%	NR	R	R	R	-
Potassium Hydroxide 10%	NR	R	R	R	-
Potassium Hydroxide 2%	NR	R	R	R	-
Sodium Chloride 25%	F	R	R	R	F
Sodium Hydroxide 50%	NR	R	R	R	NR
Sodium Hydroxide 10%	NR	R	R	R	F
Sodium Hydroxide 2%	NR	R	-	-	-
Sodium Hypochlorite-C1. 10%	F	R	-	-	-
Sodium Hypochlorite-C1. 6%	F	R	NR	R	-
Sulfuric Acid 50%	F	R	NR	R	NR
Tall Oil Fatty Acid 50%	R	R	-	-	-
Tannic Acid 50%	F	R	R	R	-
Water-Deionized	R	R	R	R	F
Water-Sea	F	R	R	R	F
Water-Tap	R	R	F	F	R
Xyol	R	R	NR	-	-

R= Recommended

F= May be used under some conditions

NR= Not Recommended

– Information not available

TECHNICAL DATA

CORROSION

All metal surfaces are affected by corrosion. Depending on the physical properties of the metal and the environment to which it is exposed, chemical or electromechanical corrosion may occur.

Atmospheric Corrosion

Atmospheric corrosion occurs when metal is exposed to airborne liquids, solids or gases. Some sources of atmospheric corrosion are moisture, salt, dirt and sulphuric acid. This form of corrosion is typically more severe outdoors, especially near marine environments.

Chemical Corrosion

Chemical corrosion takes place when metal comes in direct contact with a corrosive solution. Some factors which affect the severity of chemical corrosion include: chemical concentration level, duration of contact, frequency of washing, and operating temperature.

Storage Corrosion

Wet storage stain (white rust) is caused by the entrapment of moisture between surfaces of closely packed and poorly ventilated material for an extended period. Wet storage stain is usually superficial, having no affect on the properties of the metal.

Light staining normally disappears with weathering. Medium to heavy buildup should be removed in order to allow the formation of normal protective film. Proper handling and storage will help to assure stain-free material. If product arrives wet, it should be unpacked and dried before storage. Dry material should be stored in a well ventilated “low moisture” environment to avoid condensation formation. Outdoor storage is undesirable, and should be avoided whenever possible.

Galvanic Corrosion

Galvanic corrosion occurs when two or more dissimilar metals are in contact in the presence of an electrolyte (ie. moisture). An electrolytic cell is created and the metals form an anode or a cathode depending on their relative position on the Galvanic Series Table. The anodic material will be the one to corrode. Anodic or cathodic characteristics of two dissimilar metals will depend on the type of each material. For example: If zinc and steel are in contact, the zinc acts as the anode and will corrode; the steel acts as the cathode, and will be protected. If steel and copper are in contact, the steel is now the anode and will corrode. The rate at which galvanic corrosion occurs depends on several factors:

1. The relative position on the Galvanic Series Table - the further apart materials are in the Galvanic Series Table, the greater the potential for corrosion of the anodic material.

2. The amount and concentration of electrolyte present - an indoor, dry environment will have little or no galvanic corrosion compared to a wet atmosphere.

3. The relative size of the materials – a small amount of anodic material in contact with a large cathodic material will result in greater corrosion. Likewise, a large anode in contact with a small cathode will decrease the rate of attack.

GALVANIC SERIES IN SEA WATER

Anodic End

↑ More Anodic

Magnesium
Magnesium Alloys
Zinc (Galvanized Coating)
Beryllium
Aluminum - Zinc Alloys
Aluminum - Magnesium Alloys
Aluminum
Aluminum - Magnesium Alloys
Aluminum - Magnesium - Silicon Alloys
Cadmium
Aluminum - Copper Alloys
Low Carbon Steel, Cast Iron, Wrought Iron
Austenitic Nickel Cast Iron
Type 410 Stainless Steel (active)
Type 316 Stainless Steel (active)
Type 304 Stainless Steel (active)
Naval Brass, Yellow Brass, Red Brass
Tin
Copper
Lead-Tin Solders
Admiralty Brass, Aluminum Brass
Manganese Bronze
Silicon Bronze
Tin Bronze
Type 410 Stainless Steel (passive)
Nickel - Silver
Copper Nickel Alloys
Lead
Nickel - Aluminum Bronze
Silver Solder
Nickel 200
Silver
Type 316 Stainless Steel (passive)
Type 304 Stainless Steel (passive)
Incoloy 825
Hastelloy B
Titanium
Hastelloy C
Platinum
Graphite

Cathodic End

Metals in descending order of activity in the presence of an electrolyte.