



Copper Development
Association Inc.

C70600

C70600

Tradename: Copper-Nickel, 10%
Designation:
Active? True
Inactive Date:
US EPA Registered Antimicrobial? True

Chemical Composition

	Element					
	Cu ^(1,2)	Pb	Zn	Fe	Ni ⁽³⁾	Mn
Min (%)				1.0	9.0	
Max (%)	Rem	0.05	1.0	1.8	11.0	1.0
(1) Cu + Sum of Named Elements 99.5% min. (2) Cu value includes Ag. (3) Ni value includes Co.						

Mechanical Properties*

Form	Temper	Temper Code	Tensile Strength (ksi)	YS-0.2% Offset	YS-0.5% Ext (ksi)	Elongation (%)	Rockwell B scale	Rockwell F scale	Rockwell 30T scale
Bar	Hard	H04	50 Typ	25 Typ		15 Typ			
	Soft Anneal	O60	38 Min		15 Typ	30 Typ			
Flat Products	1/4 Hard	H01	53 Typ	16 Typ		35 Typ	60 Typ		
	As Hot Rolled	M20	40 Min for Standard		15 Typ	30 Min for Standard	3 Min for Standard		
	Hard	H04	75 Typ	73 Typ		5 Typ	80 Typ		
Tube	Annealed	O61	44 Typ		16 Typ	42 Typ	15 Typ	65 Typ	26 Typ
	Light Drawn, Light Cold Rolled	H55	45 Min for Standard		35 Min for Standard	10 Typ	72 Typ	100 Typ	70 Typ
* Measured at room temperature, 68°F (20°C).									

Physical Properties

Melting Point - Liquidus °F	2100
Melting Point - Solidus °F	2010
Density lb/cu in. at 68 °F	0.323
Specific Gravity	8.94
Electrical Conductivity % IACS at 68 °F	9
Thermal Conductivity Btu/ sq ft/ ft hr/ °F at 68 °F	26
Coefficient of Thermal Expansion $68-572 \times 10^{-6}$ per °F (68 – 572 °F)	9.5
Specific Heat Capacity Btu/ lb / °F at 68 °F	0.09
Modulus of Elasticity in Tension ksi	18000
Modulus of Rigidity ksi	6800

Fabrication Properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene Welding	Fair
Gas Shielded Arc Welding	Excellent
Coated Metal Arc Welding	Good
Spot Weld	Good
Seam Weld	Good
Butt Weld	Excellent
Capacity for Being Cold Worked	Good
Capacity for Being Hot Formed	Good
Machinability Rating	20

Common Fabrication Processes

- Forming and Bending
- Welding

Thermal Properties

Treatment	Minimum*	Maximum*	
Annealing	1100	1500	
Hot Treatment	1550	1750	
* Temperature is measured in Fahrenheit.			

Typical uses

Product Category		Product	Reason Category	Reason
Automotive		Brake Lines	Corrosion Resistance	Corrosion Resistance
		Brake Lines	Machining Characteristics	Machinability
		Brake Lines	Mechanical Properties	Moderate Strength
		Power Steering Tube	Corrosion Resistance	Corrosion Resistance
		Power Steering Tube	Machining Characteristics	Machinability
		Power Steering Tube	Mechanical Properties	Moderate Strength
Consumer		Screw Lamp Bases	Conductivity (Electrical)	Electrical Conductivity
		Screw Lamp Bases	Corrosion Resistance	Corrosion Resistance
		Screw Lamp Bases	Forming Characteristics	Formability
		Screw Lamp Bases	Mechanical Properties	Moderate Strength

Product Category	Product	Reason Category	Reason
Industrial	Condenser Plates	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Condenser Plates	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Condenser Plates	Corrosion Resistance	Corrosion Resistance to Salt Water
	Condenser Plates	Mechanical Properties	Moderate Strength
	Condenser Plates	Mechanical Properties	Retains Strength at High Temperatures
	Condensers	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Condensers	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Condensers	Corrosion Resistance	Corrosion Resistance to Salt Water
	Condensers	Mechanical Properties	Moderate Strength
	Condensers	Mechanical Properties	Retains Strength at High Temperatures
	Distiller Tubes	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Distiller Tubes	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Distiller Tubes	Corrosion Resistance	Corrosion Resistance to Salt Water
	Distiller Tubes	Mechanical Properties	Moderate Strength
	Distiller Tubes	Mechanical Properties	Retains Strength at High Temperatures
	Evaporator Tubes	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Evaporator Tubes	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Evaporator Tubes	Corrosion Resistance	Corrosion Resistance to Salt Water
	Evaporator Tubes	Mechanical Properties	Moderate Strength
	Evaporator Tubes	Mechanical Properties	Retains Strength at High Temperatures
	Evaporators	Conductivity (Thermal)	Thermal Conductivity
	Evaporators	Corrosion Resistance	Corrosion Resistance
	Evaporators	Welding Characteristics	Weldability
	Ferrules	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Ferrules	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Ferrules	Corrosion Resistance	Corrosion Resistance to Salt Water
	Ferrules	Mechanical Properties	Moderate Strength
	Ferrules	Mechanical Properties	Retains Strength at High Temperatures
	Heat Exchanger Tubes	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Heat Exchanger Tubes	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Heat Exchanger Tubes	Corrosion Resistance	Corrosion Resistance to Salt Water
	Heat Exchanger Tubes	Mechanical Properties	Moderate Strength
	Heat Exchanger Tubes	Mechanical Properties	Retains Strength at High Temperatures
	Pressure Vessels	Corrosion Resistance	Corrosion Resistance
	Pressure Vessels	Mechanical Properties	Moderate Strength
	Pressure Vessels	Welding Characteristics	Weldability
	Pump Impellers for Oil Refining	Corrosion Resistance	Corrosion Resistance
	Pump Impellers for Oil Refining	Corrosion Resistance	Corrosion Resistance to 600 F.
	Pump Impellers for Oil Refining	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Valve Bodies	Corrosion Resistance	Corrosion Resistance
	Valve Bodies	Mechanical Properties	Moderate Strength
	Valve Bodies	Welding Characteristics	Weldability
	Weld Torch Tips	Corrosion Resistance	Corrosion Resistance
	Weld Torch Tips	Mechanical Properties	Moderate Strength
	Weld Torch Tips	Mechanical Properties	Retains Strength at High Temperatures

Product Category	Product	Reason Category	Reason
Marine	Boat Hulls	Corrosion Resistance	Corrosion Resistance
	Boat Hulls	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Boat Hulls	Corrosion Resistance	Corrosion Resistance to Petrochemicals
	Boat Hulls	Corrosion Resistance	Corrosion Resistance to Salt Water
	Boat Hulls	Fouling Resistance	Non-Fouling
	Boat Hulls	Mechanical Properties	Moderate Strength
	Boat Hulls	Mechanical Properties	Retains Strength at High Temperatures
	Hot Water Tanks	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Hot Water Tanks	Corrosion Resistance	Corrosion Resistance to Salt Water
	Hot Water Tanks	Mechanical Properties	Moderate Strength
	Hot Water Tanks	Mechanical Properties	Retains Strength at High Temperatures
	Propeller Sleeves	Corrosion Resistance	Corrosion Resistance
	Propeller Sleeves	Corrosion Resistance	Corrosion Resistance to 600 F.
	Propeller Sleeves	Mechanical Properties	Moderate Strength
	Salt Water Baffles	Corrosion Resistance	Corrosion Resistance
	Salt Water Baffles	Corrosion Resistance	Corrosion Resistance to Salt Water
	Salt Water Baffles	Fouling Resistance	Non-Fouling
	Salt Water Baffles	Mechanical Properties	Moderate Strength
	Salt Water Baffles	Welding Characteristics	Weldability
	Salt Water Piling Wrap	Corrosion Resistance	Corrosion Resistance
	Salt Water Piling Wrap	Corrosion Resistance	Corrosion Resistance to Salt Water
	Salt Water Piling Wrap	Fouling Resistance	Non-Fouling
	Salt Water Pipe Fittings	Corrosion Resistance	Corrosion Resistance
	Salt Water Pipe Fittings	Corrosion Resistance	Corrosion Resistance to Salt Water
	Salt Water Pipe Fittings	Fouling Resistance	Non-Fouling
	Salt Water Pipe Fittings	Mechanical Properties	Moderate Strength
	Salt Water Pipe Fittings	Welding Characteristics	Weldability
	Salt Water Piping Systems	Corrosion Resistance	Corrosion Resistance
	Salt Water Piping Systems	Corrosion Resistance	Corrosion Resistance to Salt Water
	Salt Water Piping Systems	Fouling Resistance	Non-Fouling
	Salt Water Piping Systems	Mechanical Properties	Moderate Strength
	Salt Water Piping Systems	Welding Characteristics	Weldability
	Ship Hulls	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Ship Hulls	Corrosion Resistance	Corrosion Resistance to Salt Water
	Ship Hulls	Fouling Resistance	Non-Fouling
	Ship Hulls	Mechanical Properties	Ductility
	Ship Hulls	Mechanical Properties	Moderate Strength
	Ship Hulls	Mechanical Properties	Retains Strength at High Temperatures
	Tube Sheet for Salt Water Service	Corrosion Resistance	Corrosion Resistance
	Tube Sheet for Salt Water Service	Corrosion Resistance	Corrosion Resistance to Salt Water
	Tube Sheet for Salt Water Service	Fouling Resistance	Non-Fouling
	Tube Sheet for Salt Water Service	Mechanical Properties	Moderate Strength
	Tube Sheet for Salt Water Service	Welding Characteristics	Weldability
	Water Hoses	Corrosion Resistance	Corrosion Resistance to Fresh Water
	Water Hoses	Corrosion Resistance	Corrosion Resistance to Salt Water
	Water Hoses	Fouling Resistance	Non-Fouling
	Water Hoses	Mechanical Properties	Moderate Strength
	Water Hoses	Mechanical Properties	Retains Strength at High Temperatures

Product Category	Product	Reason Category	Reason
Plumbing	Flanges	Corrosion Resistance	Corrosion Resistance
	Flanges	Welding Characteristics	Weldability

Applicable Specifications

Form	Sub-Form	Specific Sub-Form	Application	System	Standard	Description
Bar				ASTM	B122/B122M	COPPER-NICKEL-ZINC ALLOY (NICKEL-SILVER) AND COPPER-NICKEL PLATE, SHEET, STRIP, AND ROLLED BAR
				ASTM	B151/B151M	COPPER-NICKEL-ZINC ALLOY (NICKEL-SILVER) AND COPPER-NICKEL ROD AND BAR
				MILITARY	MIL-C-15726	COPPER-NICKEL ALLOY ROD, FLAT PRODUCTS (FLAT WIRE, STRIP, SHEET, BAR, AND PLATE) AND FORGINGS
Condenser & Heat Exchanger Tube with Integral Fins		Welded		ASTM	B956/B956M	WELDED COPPER AND COPPER-ALLOY CONDENSER AND HEAT EXCHANGER TUBES WITH INTEGRAL FINS
Forgings	Forgings					
Pipe		Seamless		ASME	SB466	SEAMLESS COPPER-NICKEL PIPE AND TUBE
		Welded		ASME	SB467	WELDED COPPER-NICKEL PIPE
		Seamless		ASTM	B466/B466M	SEAMLESS COPPER-NICKEL PIPE AND TUBE
		Welded		ASTM	B467	WELDED COPPER-NICKEL PIPE
Plate			Condenser Tube	ASME	SB171	COPPER ALLOY CONDENSER TUBE PLATES
				ASTM	B122/B122M	COPPER-NICKEL-ZINC ALLOY (NICKEL-SILVER) AND COPPER-NICKEL PLATE, SHEET, STRIP, AND ROLLED BAR
			Condenser Tube	ASTM	B171/B171M	COPPER ALLOY CONDENSER TUBE PLATES
		Clad		ASTM	B432	COPPER AND COPPER ALLOY CLAD STEEL PLATE
				MILITARY	MIL-C-15726	COPPER-NICKEL ALLOY ROD, FLAT PRODUCTS (FLAT WIRE, STRIP, SHEET, BAR, AND PLATE) AND FORGINGS
			Condenser Tube	SAE	J461	WROUGHT AND CAST COPPER ALLOYS
			Condenser Tube	SAE	J463	WROUGHT COPPER AND COPPER ALLOYS
Rod				ASTM	B151/B151M	COPPER-NICKEL-ZINC ALLOY (NICKEL-SILVER) AND COPPER-NICKEL ROD AND BAR
			Welding	AWS	A5.15	WELDING RODS FOR WELDING CAST IRON
				MILITARY	MIL-C-15726	COPPER-NICKEL ALLOY ROD, FLAT PRODUCTS (FLAT WIRE, STRIP, SHEET, BAR, AND PLATE) AND FORGINGS
Sheet				ASTM	B122/B122M	COPPER-NICKEL-ZINC ALLOY (NICKEL-SILVER) AND COPPER-NICKEL PLATE, SHEET, STRIP, AND ROLLED BAR
				MILITARY	MIL-C-15726	COPPER-NICKEL ALLOY ROD, FLAT PRODUCTS (FLAT WIRE, STRIP, SHEET, BAR, AND PLATE) AND FORGINGS
				SAE	J461	WROUGHT AND CAST COPPER ALLOYS
				SAE	J463	WROUGHT COPPER AND COPPER ALLOYS
Strip				ASTM	B122/B122M	COPPER-NICKEL-ZINC ALLOY (NICKEL-SILVER) AND COPPER-NICKEL PLATE, SHEET, STRIP, AND ROLLED BAR
				MILITARY	MIL-C-15726	COPPER-NICKEL ALLOY ROD, FLAT PRODUCTS (FLAT WIRE, STRIP, SHEET, BAR, AND PLATE) AND FORGINGS

Form	Sub-Form	Specific Sub-Form	Application	System	Standard	Description
Tube			Condenser Tube	ASME	SB111	COPPER AND COPPER ALLOY SEAMLESS CONDENSER TUBES & FERRULE STOCK
		Finned		ASME	SB359	COPPER & COPPER ALLOY SEAMLESS CONDENSER & HEAT EXCHANGER TUBES WITH INTEGRAL FINS
		U-Bend		ASME	SB395	U-BEND SEAMLESS COPPER & COPPER ALLOY HEAT EXCHANGER & CONDENSER TUBE
		Seamless		ASME	SB466	SEAMLESS COPPER-NICKEL PIPE AND TUBE
		Welded		ASME	SB543	WELDED COPPER AND COPPER ALLOY TUBE
			Condenser Tube	ASTM	B111/B111M	COPPER AND COPPER ALLOY SEAMLESS CONDENSER TUBES AND FERRULE STOCK
		Finned		ASTM	B359/B359M	COPPER AND COPPER-ALLOY SEAMLESS CONDENSER AND HEAT EXCHANGER TUBES WITH INTEGRAL FINS
		U-Bend		ASTM	B395/B395M	U-BEND SEAMLESS COPPER AND COPPER ALLOY HEAT EXCHANGER AND CONDENSER TUBES
		Seamless		ASTM	B466/B466M	SEAMLESS COPPER-NICKEL PIPE AND TUBE
		Seamless		ASTM	B469	SEAMLESS COPPER ALLOY TUBES FOR PRESSURE APPLICATION
		Welded		ASTM	B543/B543M	WELDED COPPER AND COPPER ALLOY HEAT EXCHANGER TUBE
			Condenser Tube	ASTM	B552	SEAMLESS AND WELDED COPPER-NICKEL TUBES FOR WATER DESALTING PLANTS
			Condenser Tube	MILITARY	MIL-T-15005	TUBES, COPPER-NICKEL ALLOY CONDENSER AND HEAT EXCHANGER
		Welded		MILITARY	MIL-T-16420	TUBE, COPPER-NICKEL ALLOY, SEAMLESS AND WELDED
		Seamless		MILITARY	MIL-T-16420	TUBE, COPPER-NICKEL ALLOY, SEAMLESS AND WELDED
		Finned		MILITARY	MIL-T-22214	TUBE, CONDENSER AND HEAT EXCHANGER WITH INTEGRAL FINS
			Condenser Tube	SAE	J461	WROUGHT AND CAST COPPER ALLOYS
			Condenser Tube	SAE	J463	WROUGHT COPPER AND COPPER ALLOYS
Wire				MILITARY	MIL-C-15726	COPPER-NICKEL ALLOY ROD, FLAT PRODUCTS (FLAT WIRE, STRIP, SHEET, BAR, AND PLATE) AND FORGINGS

Corrosion Properties

Environmental Category	Specific Environment	Resistance Level	Corrosion notes
		Excellent	Resistant at cryogenic and room temperatures
Alkali	Aluminum Hydroxide	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Ammonium Hydroxide	Poor	Reduced corrosion resistance due to soluble complex ion formation
	Barium Carbonate	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Barium Hydroxide	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Black Liquor, Sulfate Process	Fair	Corrosion rate increases at elevated temperatures or with traces of moisture
	Calcium Hydroxide	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Lime	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Lime-Sulfur	Fair	Corrosion rate increases at elevated temperatures or with traces of moisture
	Magnesium Hydroxide	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Potassium Carbonate	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Potassium Hydroxide	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Sodium Bicarbonate	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Sodium Carbonate	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Sodium Hydroxide	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Sodium Phosphate	Excellent	
	Sodium Silicate	Excellent	Corrosion increases at elevated temperatures and in presence of oxidizers such as chromates or hypochlorates
	Sodium Sulfide	Fair	Corrosion rate increases at elevated temperatures or with traces of moisture
Atmosphere	Atmosphere, Industrial	Excellent	Affected by pollutants and other environmental factors. Hydrogen sulfide causes rapid tarnishing.
	Atmosphere, Marine	Excellent	Protective green basic copper chloride or carbonate patina.
	Atmosphere, Rural	Excellent	Low corrosion rates, no localized attack
Chlor. organic	Carbon Tetrachloride, Dry	Excellent	Corrosion rate increases at elevated temperatures or with traces of moisture
	Carbon Tetrachloride, Moist	Good	Corrosion rate increases at elevated temperatures
	Chloroform, Dry	Excellent	Corrosion rate increases at elevated temperatures or with traces of moisture
	Ethyl Chloride	Good	Corrosion rate increases at elevated temperatures or with traces of moisture
	Methyl Chloride, Dry	Excellent	Corrosion rate increases at elevated temperatures or with traces of moisture
	Trichlorethylene, Dry	Excellent	Corrosion rate increases at elevated temperatures or with traces of moisture
	Trichlorethylene, Moist	Good	Corrosion rate increases at elevated temperatures
Fatty acid	Oleic Acid	Excellent	Corrosion rate increases at elevated temperatures or with traces of moisture
	Palmitic Acid	Good	Corrosion rate increases at elevated temperatures or with traces of moisture
	Stearic Acid	Good	Corrosion rate increases at elevated temperatures or with traces of moisture

Environmental Category	Specific Environment	Resistance Level	Corrosion notes
Food/beverage	Beer	Excellent	May affect color or taste
	Beet Sugar Syrups	Excellent	May affect color or taste
	Cane Sugar Syrups	Excellent	May affect color or taste
	Carbonated Beverages	Good	Acidity increases corrosion. May affect color or taste.
	Carbonated Water	Good	Acidity increases corrosion. May affect color or taste.
	Cider	Excellent	May affect color or taste
	Coffee	Excellent	May affect color or taste
	Corn Oil	Excellent	May affect color or taste
	Cottonseed Oil	Excellent	May affect color or taste
	Fruit Juices	Good	Acidity increases corrosion. May affect color or taste.
	Gelatine	Excellent	May affect color or taste
	Milk	Excellent	May affect color or taste
	Sugar Solutions	Excellent	May affect color or taste
	Vinegar	Good	Acidity increases corrosion. May affect color or taste.
Gas	Ammonia, Absolutely Dry	Excellent	Rapid corrosion increases with traces of moisture
	Ammonia, Moist	Poor	More corrosion resistant in dry gas
	Carbon Dioxide, Dry	Excellent	Corrosion increases with trace of moisture
	Carbon Dioxide, Moist	Good	More corrosion resistant in dry gas
	Hydrogen	Excellent	Copper and copper alloys containing copper oxide susceptible to attack
	Oxygen	Excellent	Scaling at elevated temperatures
Halogen gas	Bromine, Dry	Excellent	Rapid corrosion increases with traces of moisture
	Bromine, Moist	Good	More corrosion resistant in dry gas
	Chlorine, Dry	Excellent	Rapid corrosion increases with traces of moisture
	Chlorine, Moist	Fair	More corrosion resistant in dry gas

Environmental Category	Specific Environment	Resistance Level	Corrosion notes
Hydrocarbon	Acetylene	Poor	Forms explosive compound in presence of moisture
	Asphalt	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Benzine	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Benzol	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Butane	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Creosote	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Crude Oil	Good	Careful consideration must be given to specific contaminants when selecting materials for this complex environment
	Freon	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Fuel Oil	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Gasoline	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Hydrocarbons, Pure	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Kerosene	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Natural Gas	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Paraffin	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Propane	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Tar	Not Recommended	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
	Turpentine	Excellent	Contaminants such as water, sulfides, acids and various organic compounds can increase corrosion significantly
Inorg. acid non-ox.	Boric Acid	Excellent	Increased corrosion at elevated temperatures and with oxidizers including oxygen (air), dichromates, permanganates and sulfates
	Carbolic Acid	Good	Increased corrosion at elevated temperatures and with oxidizers including oxygen (air), dichromates, permanganates and sulfates
	Hydrobromic Acid	Fair	Increased corrosion at elevated temperatures and with oxidizers including oxygen (air), dichromates, permanganates and sulfates
	Hydrochloric Acid	Fair	Generally limited to applications in cold, oxidizer free, dilute (<1%) or concentrated solutions
	Hydrocyanic Acid	Poor	Reduced corrosion resistance due to soluble complex ion formation
	Hydrofluoric Acid	Fair	Generally limited to applications in cold, oxidizer free, dilute (<1%) or concentrated solutions
	Hydrofluosilicic Acid	Good	Generally limited to applications in cold, oxidizer free, dilute (<1%) or concentrated solutions
	Phosphoric Acid	Good	Increased corrosion at elevated temperatures and with oxidizers including oxygen (air), dichromates, permanganates and sulfates
	Sulfuric Acid	Good	Not suitable for hot concentrated solutions
Inorg. acid ox.	Chromic Acid	Poor	Severe oxidizing environment.
	Nitric Acid	Poor	Severe oxidizing environment.
	Sulfurous Acid	Fair	Increased corrosion at elevated temperatures and with oxidizers including oxygen (air), dichromates, permanganates and sulfates
Liquid metal	Mercury	Poor	Severe liquid metal embrittlement

Environmental Category	Specific Environment	Resistance Level	Corrosion notes
Miscellaneous	Glue	Excellent	Low corrosion rates, no localized attack
	Linseed Oil	Good	Low corrosion rates, no localized attack
	Rosin	Excellent	Low corrosion rates, no localized attack
	Sewage	Excellent	Corrosion affected by salt concentration, temperature, velocity, dissolved oxygen content and pollutants.
	Soap Solutions	Excellent	Corrosion affected by salt concentration, temperature, velocity, dissolved oxygen content and pollutants.
	Varnish	Excellent	Low corrosion rates, no localized attack
Neutral/acid salt	Alum	Good	
	Alumina	Excellent	Low corrosion rates, no localized attack
	Aluminum Chloride	Good	Strong agitation and aeration increases corrosion
	Aluminum Sulfate	Good	Suitable for neutral or alkaline conditions
	Ammonium Chloride	Poor	Reduced corrosion resistance due to soluble complex ion formation
	Ammonium Sulfate	Fair	Reduced corrosion resistance due to soluble complex ion formation
	Barium Chloride	Good	Strong agitation and aeration increases corrosion
	Barium Sulfate	Excellent	Low corrosion rates, no localized attack
	Barium Sulfide	Fair	High zinc content alloys preferred
	Calcium Chloride	Excellent	Hydrolysis produces weak acidic condition
	Carbon Disulfide	Good	High zinc content alloys preferred
	Magnesium Chloride	Good	Hydrolysis produces weak acidic condition
	Magnesium Sulfate	Excellent	Low corrosion rates, no localized attack
	Potassium Chloride	Excellent	Hydrolysis produces weak acidic condition
	Potassium Cyanide	Poor	Reduced corrosion resistance due to soluble complex ion formation
	Potassium Dichromate Acid	Poor	Highly oxidizing under acidic conditions
	Potassium Sulfate	Excellent	Low corrosion rates, no localized attack
	Sodium Bisulfate	Excellent	Suitable for neutral or alkaline conditions
	Sodium Chloride	Excellent	Hydrolysis produces weak acidic condition
	Sodium Cyanide	Poor	Low corrosion rates, no localized attack
	Sodium Dichromate, Acid	Poor	Highly oxidizing under acidic conditions
	Sodium Sulfate	Excellent	Low corrosion rates, no localized attack
	Sodium Sulfite	Good	Suitable for neutral or alkaline conditions
	Sodium Thiosulfate	Fair	High zinc content alloys preferred
	Zinc Chloride	Fair	Hydrolysis produces weak acidic condition
	Zinc Sulfate	Good	Suitable for neutral or alkaline conditions

Environmental Category	Specific Environment	Resistance Level	Corrosion notes
Org. solvent	Acetone	Excellent	Resistant up to 200F unless contaminated by water, acids, alkalies or salts
	Alcohols	Excellent	Resistant up to 200F unless contaminated by water, acids, alkalies or salts
	Amyl Acetate	Excellent	
	Amyl Alcohol	Excellent	
	Butyl Alcohol	Excellent	Resistant up to 200F unless contaminated by water, acids, alkalies or salts
	Ethers	Excellent	Resistant up to 200F unless contaminated by water, acids, alkalies or salts
	Ethyl Acetate	Excellent	
	Ethyl Alcohol	Excellent	Resistant up to 200F unless contaminated by water, acids, alkalies or salts
	Lacquer Solvents	Excellent	Resistant up to 200F unless contaminated by water, acids, alkalies or salts
	Methyl Alcohol	Excellent	
	Toluene	Excellent	Resistant up to 200F unless contaminated by water, acids, alkalies or salts
Organic acid	Acetic Acid	Good	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Acetic Anhydride	Good	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Benzoic Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Butyric Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Chloracetic Acid	Good	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Citric Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Formic Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Lactic Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Oxalic Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Tannic Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Tartaric Acid	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Trichloroacetic Acid	Good	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
Organic comp.	Aniline	Fair	Corrosion rate increases at elevated temperatures or with traces of moisture
	Aniline Dyes	Fair	Corrosion rate increases at elevated temperatures or with traces of moisture
	Castor Oil	Excellent	Low corrosion rates, no localized attack
	Ethylene Glycol	Excellent	Low corrosion rates, no localized attack
	Formaldehyde	Excellent	Low corrosion rates, no localized attack
	Furfural	Excellent	Low corrosion rates, no localized attack
	Glucose	Excellent	Low corrosion rates, no localized attack
	Glycerine	Excellent	Low corrosion rates, no localized attack
	Lacquers	Excellent	Low corrosion rates, no localized attack

Environmental Category	Specific Environment	Resistance Level	Corrosion notes
Oxidizing salt	Ammonium Nitrate	Poor	Reduced corrosion resistance due to soluble complex ion formation
	Bleaching Powder, Wet	Good	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Borax	Excellent	Low corrosion rates, no localized attack
	Bordeaux Mixture	Excellent	Low corrosion rates, no localized attack
	Calcium Bisulfite	Good	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Calcium Hypochlorite	Good	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Copper Chloride	Fair	Severe oxidizing environment.
	Copper Nitrate	Fair	Oxidizing environment
	Copper Sulfate	Good	Hydrolysis produces weak acidic condition
	Ferric Chloride	Poor	Severe oxidizing environment.
	Ferric Sulfate	Poor	Severe oxidizing environment.
	Ferrous Chloride	Good	Strong agitation and aeration increases corrosion
	Ferrous Sulfate	Good	Hydrolysis produces weak acidic condition
	Hydrogen Peroxide	Good	Oxidizing environment
	Mercury Salts	Poor	Noble metal salt, plates on copper surface
	Potassium Chromate	Excellent	Suitable for neutral or alkaline conditions
	Silver Salts	Poor	Noble metal salt, plates on copper surface
	Sodium Bisulfite	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Sodium Chromate	Excellent	Suitable for neutral or alkaline conditions
	Sodium Hypochlorite	Fair	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Sodium Nitrate	Excellent	Useful corrosion resistance with moderate oxidizers levels and <5% chlorides. Optimum resistance at room temperature and above boiling point.
	Sodium Peroxide	Good	Low corrosion rates, no localized attack
Sulfur comp.	Hydrogen Sulfide, Dry	Excellent	Rapid corrosion increases with traces of moisture
	Hydrogen Sulfide, Moist	Poor	High zinc content alloys preferred
	Sulfur Chloride, Dry	Excellent	Rapid corrosion increases with traces of moisture
	Sulfur Dioxide, Dry	Excellent	Scaling at elevated temperatures
	Sulfur Dioxide, Moist	Fair	Mixed oxide and sulfide scale forms
	Sulfur Trioxide, Dry	Excellent	Corrosion increases with trace of moisture
	Sulfur, Dry	Good	High zinc content alloys preferred
	Sulfur, Molten	Poor	Forms non-protective copper sulfide

Environmental Category	Specific Environment	Resistance Level	Corrosion notes
Water	Brines	Excellent	Resistant to most oxidizers. Refer to specific salt solution ratings.
	Mine Water	Fair	Acidic waters containing oxidizers are highly corrosive.
	Sea Water	Excellent	Corrosion affected by salt concentration, temperature, velocity, dissolved oxygen content and pollutants.
	Steam	Excellent	Resistant to pure steam. Carbon dioxide, dissolved oxygen can increase corrosion. Resistant to ammonia attack.
	Water, Potable	Excellent	Corrosion affected by water chemistry (mineral content, acidity) system design and fabrication. Free carbon dioxide can cause pitting in cold water. Pitting in hot water caused by cathodic deposits.

