

# Application Guide

## Reference Data

### Corrosion Guide

The Watlow Corrosion Guide represents a compilation of available data and application experience on the relative compatibility of common heater sheath materials and corrodants. This can be valuable in the initial selection of a heater sheath material to be used with a listed corrodant. Final selection, however, should be made based upon the specific exposure conditions, recommendations of the corrosive agent's manufacturer and preliminary testing.

### Rating System

**A**—Good

**B**—Fair

**C**—Conditional—Performance is dependent upon specific application conditions such as solution concentration and temperature.

**X**—Unsuitable—Should not be used.

### Notes to Corrosion Guide

1. This solution involves a mixture of various chemical compounds whose identity and proportions are unknown or subject to change without our knowledge. Check supplier to confirm choice of sheath material plus alternate sheath materials that may be used.
2. Caution—Flammable material.
3. Chemical composition varies widely. Check supplier for specific recommendations.

4. Direct immersion heaters not practical. Use clamp-on heaters on outside surface of cast iron pot.
5. Element surface loading should not exceed 3 W/cm<sup>2</sup> (20 W/in<sup>2</sup>).
6. For concentrations greater than 15 percent, element surface loading should not exceed 3 W/cm<sup>2</sup> (20 W/in<sup>2</sup>).
7. See suggested watt density chart.
8. Remove crusts at liquid level.
9. Clean often.
10. Do not exceed 2 W/cm<sup>2</sup> (12 W/in<sup>2</sup>).
11. Passivate stainless steel, Inconel<sup>®</sup> and Incoloy<sup>®</sup>.

**Note:** Blank spaces indicate an absence of data to establish a rating.

### Ref. 138

Corrodant	Boiling Point °B.P. °F.	Flash Point °F.P. °F.	Auto Ignition A.I. °F.	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel <sup>®</sup> 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy <sup>®</sup> 800	Inconel <sup>®</sup> 600	Titanium	Hastelloy <sup>®</sup> B	Quartz	Graphite	Teflon <sup>®</sup>	Comments				
Acetaldehyde	69	-33	365				B	X	B	B	B	A	A	A		B	A	C		A	A	Note 2				
Acetic Acid	244	109	800	X	X		C	X	X	B	C	C	B	A	C	C	A		A	A	A					
Crude				X			C	A/B	B	X	B	B	A/B	A/B	A	C	C					A				
Pure							X	A	B	B	A	B	A	A		C	C					A	A			
Vapors							X	C	B	X	B	B	X	X	A	C	C	A/B	A				Hastelloy <sup>®</sup> C-276 Acceptable			
150 PSI, 400°F							C	B	X	B	B				C	C										
Aerated					X	X	X	C	X	X	X	X	X	B	B		X	A								
No Air					X	X	C	B	X	A	B	C	B	B		X	A									
Acetone	134	0	1000	C	X	B	B	A	A/B	A	A	A	A	A	A	A	A	A	A	A	A	A	Note 2			
Actane <sup>™</sup> 70																						A	A	Note 1	TM: Enthone, Inc. Acid additive for pickling of metals.	
Actane <sup>™</sup> 80																							A	A	Note 1	
Actane <sup>™</sup> Salt																							A		Note 1	
Alboloy Process																										
Alcoa <sup>™</sup> R5 Bright Dip																							A	A	Note 1	TM: This is a proprietary process licensed to individuals by Alcoa.
Allyl Alcohol	207	70	713		A	A	B	A	B	A	A	A	A	A/B	A	A	A/B						A	A		
Alcohol				B	B		B	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A			Note 2	

CONTINUED

Hastelloy<sup>®</sup> is a registered trademark of Haynes International.

Teflon<sup>®</sup> is a registered trademark of E.I. du Pont de Nemours & Company.

# Application Guide

## Reference Data

Corrodant	B.P. °F	Flash Point °F	Auto Ignition A.I. °F	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments
Aalcorite™																		A				Note 1 TM: Fredrick Gumm Chemical Co. Aluminum conversion coating.
Alkaline Solutions				A								A										
Alkaline Cleaners												A									X	Note 1
Alkaline Soaking Cleaners				A																		Note 1
Alodine™													A									Note 1 TM: Amchem Products Inc. Protective coating chemical for aluminum.
200°F												A347	A									
Aluminum (Molten)	3732																					Contact Factory
Aluminum Acetate				X	X		B	B	A	B	B	A/B	A	A		B	A	A				A
Aluminum Bright Dip																				A		A
Aluminum Chloride	356			X	X		X	X	X	X	X	X	X	X	X	X	X	A	A	A	A	Note 1
Aluminum Cleaners				C	C		X	X	X	A	A	A	A	B	A	A	B		X	X		Notes 1, 9
Aluminum Potassium Sulfate (Alum)					X	X	X	A/B	B	B	B	X	B/C	B		B	A/B					A
Aluminum Sulfate				X	X	X	X	X	B	X	X	B	B	B	X	X	A	B	A	A	A	Note 1
Alum																						See Aluminum Potassium Sulfate
Ammonia				X	X		C	X	C	X	X	X	X	X	C	B	A	A	A	A		
Ammonia (Anhydrous) (Gas)	-28		1204	B			X	X		X		A	A	A				A		A	A	Hastelloy® C-276 Acceptable
Cold				C		A	A	A	B	A	A	A	A	A		A	A					
Hot				C		C		A	X	A	A	C	C	A		A						
Ammonia and Oil				A																		
Ammonium Acetate				A	B	B	A/B	X	X	A	A	A/B	A/B	A/B	A	A	B	B				A
Ammonium Bifluoride				X	X		X	X	X	X	X	X	X	B	X	X	X	A	X	A	A	
Ammonium Chloride	640			X	X	B	X	X	X	B	B	X	C	C	C	C	A	A	A	A	A	Hastelloy® C-276 Acceptable
Ammonium Hydroxide				B	B	B	C	X	B	X	A	A	A/B	A	A	A	A	X	X	A	A	
Ammonium Nitrate				B/X	X	C	B	X	X	X	X	A	A	A	X	X	X					A
Ammonium Persulfate				X	X		B/X	X	C	X	X	B/X	B	B		X	B	X	A	A	A	
Ammonium Sulfate				X	X	B	X	X	B	B	B	C	B	B	B	B	A	B	A	A		
Amyl Acetate	298	77	714	B			A	A/B		A	A	A	A	A	A	A	A	A				Hastelloy® C-276 Acceptable
Amyl Alcohol	280	91	572	A	B	B	C	A/B		A	B	A304	A/B	A/B	A	A	A/B		A	A	A	
Aniline	364	158	1418	B	A		B	X	B	B	B		A	A	B	B	A	B	A	A	A	
Aniline, Oil				A			X	X				A	A									

Reference Data

CONTINUED



# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments	
	B.P. °F	F.P. °F	A.I. °F																				
Aniline, Dyes										A		A	A										
Anodizing				X	X		X	X	A	X	X	X	X	A	X	X	X		A	A	A		
Anodizing Solutions (10% Solution)																							
Chromic Acid 96°F				C								A	A				A						
Sulfuric Acid 70°F	626							A						A									
Sodium Hydroxide 160°F	2534			A			A			A		A	A	A	A	A							
Nigrosine 150°F Black Dye										A	B												
Nickel Acetate 200°F								C	A	B													
Arp™ 28																				A	A	Note 1 TM: Specialty Chemicals, Allied-Kelite Products Div., The Richardson Co.	
Arp™ 80 Blackening Salt																				A		Note 1	
Arsenic Acid				X	X		X	X	X	X	X	C	B	B	X	X	X		A	A	A		
Asphalt	<878	400 +	905	A	A		X	X	X	X	A/B	A/B	A	A	A	A	A		A	A	A		
Barium Chloride	2840						X				A	B	B		A	B	B		A	A			
Barium Hydroxide				B	B		X	X	X	B	A	B	A	A/B	B	B	X	B	A	A	A	Carpenter 20 Acceptable	
Barium Sulfate				B	B	B	B	B	B	B	B	B	B	B	B	B	A	B	A	A	A		
Barium Sulfide (Barium Monosulfide)				B			X	X	A/X	A		A/B	B	B						A	A		
Barium Sulfite												B											
Black Nickel																			A		A	Note 5	
Black Oxide												A										Note 5	
Bleaching Solution (1 ½ lb. Oxalic Acid per gallon H <sub>2</sub> O at 212°F)									A			F											
Bonderizing™ (Zinc Phosphate)				C		B						A	A									TM: Parker Div., OMI Corp., Paint Base	
Boric Acid				X	X		X	C	C	C	C	C	C	C	C	C	A	A	A	A	A	A	Hastelloy® C276 Acceptable
Brass Cyanide												A										Note 1	
Bright Copper–Acid See Copper Bright Acid																							
Bright Copper–Cyanide See Copper Cyanide																							
Bright Nickel																	A		A			Notes 1, 5	
Brine (Salt Water)										A						B				A	A		
Bronze Plating				A								A										Note 1	
Butanol (Butyl Alcohol)	243	84	689	A/B	A		B	A/B	A	A	A	A	A	A	A	A	A/B	B	A	A	A	Note 1	
Cadmium Black																				A		Note 1	
Cadmium Fluoborate																				A	A	Note 1	
Cadmium Plating												A			A	A						Note 1	
Calcium Chlorate				B	B		B	C	C	B	B	B	B	B	B	B			A				

CONTINUED 

# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments
	B.P. °F	F.P. °F	A.I. °F																			
Calcium Chloride	> 2912			B	B		C	B	X	B	B	B	B	B	B	B	A	A	A	A	A	Hastelloy® C276 Acceptable
Carbolic Acid (Phenol)	362	175	1319	B	B	B	B	X	B	B	B	C	X	B	B	B	A	A	A	A	A	Hastelloy® C276 Acceptable
Carbon Dioxide–Dry Gas				X	X	A	A	A	B	A	A	A/B	A/B	A	A	A	X	A	A	X	X	Hastelloy® C-276 Acceptable
Carbon Dioxide–Wet Gas				X	X	C	A	X	B	A	A	A/B	A/B	A/B	A	A	X	A	A	X	X	
Carbon Tetrachloride				X	X	C	X	C	A	A	A	C	B	B	A	A	A	A	A	A	A	Hastelloy® C-276 Acceptable
Carbonic Acid	359	175	1319	C	C		C	C	X	C	C	A/B	B	A	B	A	A		A	A	A	
Castor Oil	595	445	840	A	A		A/B	A	A	A	A	A/B	A/B	A	A	A	A		A	A	A	
Caustic Etch				A	A		X	X		A	A	A	A	X	X	X	A		A	A	X	
Caustic Soda (Lye) (Sodium Hydroxide)					X	X	A	X	X	X	C	C	X	C	C	C	B	C		X	A	Notes 6, 8
2%					B	B	B	X	B	X	A	A	X	B	A	A	A	A				
10–30%, 210°F					B	B	A	X	B	X	A	A	A	A	A	A	A	A				
76%, 180°F					X	X	X	X	X	X	B	A	B	B	B	A	A	B				
Chlorine Gas:																						
Dry	-30			X	X	B	X	X	X	B	C	C/X	C	B	C	B	B/X	B	A	B	B	Note 2
Wet	-30			X	X	X	X	X	X	X	X	X	X	X	X	X	X		A	X	A/X	Note 2
Chloroacetic Acid (Monochloroacetic Acid)	372	None		X	X		X	X	X	B	B	X	X		C	C	A	A	A	A	A	Hastelloy® C-276 Acceptable
Chromic Acetate																			A			Note 1
Chromic Acid				X	C	X	X	X	B	X	X	X	X	X	X	X	A		A	A	X	
Chromium Plating				X	X		X	X	B	X	X	X	X	X	X	X	A		A	A	X	
Chromylite																			A			Note 1
Citric Acid				X	X	C	C	C	X	B	B	C	C	B	B	B	A	A	A	A	A	Hastelloy® C276 Acceptable
Clear Chromate													A									Note 1
Cobalt Acetate at 130°F										B	B	A	A		B	B						
Cobalt Nickel																				A		Notes 1, 6
Cobalt Plating												A								A		Note 1
Coconut Oil		420 Crude 548 Refined							B	A												
Cod Liver Oil		412					A				A	A	A	A	A	A						
Copper Acid																		A		A		Note 1
Copper Bright												A	A									Note 1
Copper Bright Acid																				A		
Copper Chloride				X	X		C/X	X	C	X	X	X	X	X	X	X	A	B	A	A	A	
Copper Cyanide				A	A		X	X		C	X	B	B	B	X	X		B	A	A	A	
Copper Fluoborate										B	B	B	B	B	B	B					A	A
Copper Nitrate				X	X	X	X	X		X	X	A/B	A/B	A/B	X	X		X	A	A	A	
Copper Plating				A																		
Copper Pyrophosphate												A										Note 1
Copper Strike				A	A							A										Note 1
Copper Sulfate				X	X	B	X	C/X	A	X	X	B	B	A/B	C	X	A	B	A	A	A	Hastelloy® C276 Acceptable

Reference Data

CONTINUED

# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments	
	B.P. °F	F.P. °F	A.I. °F																				
Creosote	392 -482	165	637	A	B	B	C	B	X	B	B	B	B	B	B	B			A	A		Note 2	
Cresylic Acid (Cresol)	376 -397	110		C	C		C	C	X	B	B	B	A	A	C	B	B	B	A	A	A	Note 2	
Deionized Water				X	X		X	X		A	A	A	A	A	A	A						Note 11	
Deoxidine™												A										TM: Amchem Products, Inc. Metal cleaner, rust remover	
Deoxylite™												A										TM: Amchem Products, Inc.	
Deoxidizer (Etching)																			A			Note 1	
Deoxidizer (3AL-13)												A	A									Note 1 Non-Chrome	
Dichromic Seal				X	X																		
Diethylene Glycol	474	255	444	B	A		B	B	A	B	B	A	A	A	B	B	A		A	A	A		
Diphenyl 300°F–350°F	491	235	1004	A	A	A	A	A	A	A	A	A		A		A	B	B					
Disodium Phosphate				A										B							A		
Diversey™–DS9333																				A		Note 1 TM: Diversey Chemical Co.	
Diversey™ 99				A																			
Diversey™ 511																				A		Notes 1, 5	
Diversey™ 514																				A	A	Note 1	
Dowtherm™ A				A																		TM: Dow Chemical Co. Heat transfer agent	
Dur-Nu™																		A	A			Note 1, 5 TM: The Duriron Co., Inc.	
Electro Cleaner				A								A										Note 1	
Electro Polishing																				A		Note 1	
Electroless Nickel																		A	A			Note 1	
Electroless Tin																							
(Acid)																					A	Note 1	
(Alkaline)													A					A				Note 1	
Enthone Acid–80	—																				A	A	Note 1
Ether	94	-49	356	B	B		B	B	B	B	B	B	B	A	B	B	A		A			Note 2 Carpenter 20 Acceptable	
Ethyl Chloride (No Water)	54	-58	966	B	B		B	A	B	B	A	B	B	A	B	A	A	B	A	A	A	Note 2	
Ethylene Glycol	387	232	775	A	B		A	B	X	B	B	B	B	B	B	B	A	A	A	A	A	Note 5 Hastelloy® C-276 Acceptable	
Fatty Acids				X	X		A	C/X	X	B	B	C/B	A	A	B	B	A	A	A	A	A	Carpenter 20 Accep., Hastelloy® C-276 Accep.	
Ferric Chloride	606			X	X	X	X	X	X	X	X	X	X	X	X	X	A	C	A	A	A		
Ferric Nitrate				X	X		X	X		X	X	B	B	A	X	X		X	A	A	A	Carpenter 20 Acceptable	
Ferric Sulfate				X	X	X	X	X	A/B	X	C	B	B	B	C	C	A	X	A	A	A		
Fluoborate																					A	Note 1	
Fluoborate (High Speed)																					A	Note 1	
Fluorine Gas, Dry	-305			C	X		C/X	X	X	A	A	C	A/C	A/C	C	A	A	B	C	X	X		
Formaldehyde	27	122 185	806	X	X	B	B	B	X	B	B	A	A	A	B	B	A		A	A	A		
Formic Acid	213	156	1114	X	X		X	B	X	C	C	X	C	A	B	C	X	A	A	A	A	Carpenter 20 Accep., Hastelloy® C-276 Accep.	
Freon				A	A	A	A	A	A	A	A	A	A	A	A	A							
Fuel Oil–Normal				A	A		A/B	A	A	B	B	A/B	A/B	A	B	B	A	B				Notes 2, 3, 7	

CONTINUED 

# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments	
	B.P. °F	F.P. °F	A.I. °F																				
Fuel Oil–Acid				X	X	X	X	X	A	C	C	C	B	A	C	C	A						Notes 2, 3, 7 Carpenter 20 Acceptable
Gasoline–Refined	280±	-45	495	A	A	A	A/B	A/B	A	B	B	A	A	A	B	B		B	A	A	A		Notes 2, 5
Gasoline–Sour				C	C		C	C	A	X	X	B	B	A	X	X		B	A	A	A		Notes 2, 3, 5 Carpenter 20 Acceptable
Glycerine (Glycerol)	554	320	739	B	C	B	A	B	B	A	A	A	A	A	A	A	A	A	A	A	A		Hastelloy® C-276 Acceptable
Gold–Acid				A													A	A					Note 1
Gold–Cyanide												A	A										Note 1
Grey Nickel																	A	A					Notes 1, 5
Holdene 310A Tempering Bath											A												
Hot Seal Sodium Dichromate													A										Note 1
Houghtone Mar Tempering Salt				C							C												
Hydrocarbons–Aliphatic				A	A		A	A		A	A	A	A	A	A	A			A	A			Note 2
Hydrocarbons–Aromatic				A	A		A	A		A	A	A	A	A	A	A			A	A			Note 2
Hydrochloric Acid (No Air)	-120																						
<150°F				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		A	A		
>150°F				X	X		X	X	X	X	X	X	X	X	X	X	X	X		A	A	A	
Hydrocyanic Acid (No Air)	78	0	100	X	X		B	X	X	B	B	B	B	B	B	B			A	A	A		
Hydrofluoric Acid	67																						
Cold <65%				X	X	X	X	X	X	C	X	X	X	C/X	X	X	X	C	X	A	A		Note 5
>65%				B	X	X	X	X	X	C	X	X	X	C	X	X	X	B		X	A		
Hot <65%				X			X	X	X	C	X	X											
>65%				X			X	X	X	C	X	X	X	X	X	X	X	C		X	A		
Hydrogen Peroxide				X	X	X	A	X	X	C	B	B	B	B	B	B	A	C	A	X	A		
Indium	3632																		A	A			Note 1
Iridite™ #4-75, #4-73, #14, #14-2, #14-9, #18-P													A										Note 1 TM: Allied-Kelite Products Div., Chromate treatment for ferrous and non-ferrous metals.
Iridite™ #1, #2, #3, #4-C, #4PC & S, #4P-4, #4-80, #4L-1, #4-2, #4-2A, #4-2P, #5P-1, #7-P, #8, #8-P, #8-2, #12-P, #15, #17P, #18P																				A			
Iridite™ Dyes–#12L-2, #40, #80																			A	A			Note 1
Irilac™																			A	A			Note 1 TM: Allied-Kelite Products Div., Protective coating, clear finish for all metals.

Reference Data

CONTINUED

# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments	
	B.P. °F	F.P. °F	A.I. °F																				
Iron Fluoborate																					A	A	Note 1
Iron Phosphate (Parkerizing)				C		B						A	A										
Isoprep™ Deoxidizer #187, #188														A									Note 1 TM: Allied-Kelite Products Div., Cleaners and surface preparation materials.
Isoprep™ Acid Aluminum Cleaner #186													A										Note 1
Isoprep™ #191 Acid Salts																					A	A	Note 1
Isopropanol (Isopropyl Alcohol)	180	53	750	C			B	A		A	A	A	A/B	A		A			B		A	A	
Jetal™												A											Note 1 TM: Technic Inc. Blackening Salt
Kerosene	347 617	100 165	444	A			A	A	A	A	A	A	A	A	A	A	B	B			A	A	Note 2
Kolene™											A												TM: Metal Processing Co., Kolene process-metal cleaning
Lacquer Solvent				B	A	A	A	B	A	B	B	A	A	A	B	B	A			A			Note 2
Lead Acetate				X	X		X	X	X	A	A	A/B	A/B	A/B	A	A	A	A	B	A	A	A	
Lead Acid Salts												A											Note 1
Lime Saturated Water				B	B		X	B	X	B	B	B	A	B	B	B					X	A	
Linseed Oil	649	432 Raw 403 Boiled	650	X	A		B	B	X	B	B	A	A	A	B	B	B	B	B	A	X	A	Note 2
Magnesium Chloride	2574			X	C	B	X	B	X	B	A	B	B	A/B	B	A	A	A	A	A	A	A	Carpenter 20 Accep. Hastelloy® C-276 Accep.
Magnesium Hydroxide				A	A	A	B	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	Hastelloy® C-276 Acceptable
Magnesium Nitrate				B	B		B	B	C	B	B	B	B	B	B	X	B	B	A	A	A	A	
Magnesium Sulfate				B	B	B	B	B	A	A	A	B	B	A/B	B	A	A/B				A	A	
MacDermid™ M629																					A	A	Note 1 TM: MacDermid, Inc., Acid Salt-Contains Fluoride
Mercuric Chloride	579			X	X	X	X	X	X	X	X	X	B/X	X	X	X	B	X	X	A	A	A	
Mercury	674			A	A	A	X	X	X	B	B	B	A	A	A	B	X	B	A	A	A	A	Hastelloy® C-276 Acceptable
Methyl Alcohol (Methanol)	149	52	867	B	B		C	B	B	A	A	B	A/B	A/B	B	A	A	A	A	A	A	A	Note 2 Hastelloy® C-276 Acceptable
Methyl Bromide	38	None	998	C	C		X	B	B	B	B	A	A	A	B	B	A			A	A	A	
Methyl Chloride	-11	<32	1170	C	C		X	A	C	C	C	C	C	C	C	C	A	B	A	A	A	A	Carpenter 20 Acceptable
Methylene Chloride	104		1224	X	C		C	C	B	C	B	C	B	A	C	B	A	C	A	A	A	A	Carpenter 20 Acceptable
Mineral Oil		500		A	A		A/B	A	A	A	A	A	A/B	A	A	A	A	A	A	A	A	A	
Muriato																					A	A	Note 1
Naptha	300 421	100	900 950	A	B	B	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	
Napthalene	424	176	979	A	A	A	B	B	A	B	B	A	A	A	B	B	A	B			A	A	
Nickel Acetate Seal													A										Note 1

CONTINUED

# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments
	B.P. °F	F.P. °F	A.I. °F																			
Nickel Chloride	1808			X	X	X	X	X	C	C	X	X	C	C	C	B	B	C	A	A	A	Notes 1, 5
Nickel Plate–Bright									A								A		A	A	Notes 1, 5	
Nickel Plate–Dull									A										A	A	Notes 1, 5	
Nickel Plate–Watts Solution																	A		A	A	Notes 1, 5	
Nickel Sulfate				X	X	X	X	B	B	C	B	B	B	B	C	B	C	X	A	A	A	
Nickel Copper Strike (Cyanide Free)												A	A									Note 1
Nitric Acid	187			X	X	X	X	X	X	X	X	C	C	B	X	X	B	X	A	X	A	
Nitric Hydrochloric Acid				X	X		X	X	X	X	X	X	X	X	X	X	X		A	A	A	
Nitric 6% Phosphoric Acid													C						A	A	Notes 1, 5	
Nitric Sodium Chromate													A						A	A	Notes 1, 5	
Nitrobenzene	412	190	900	A	A	A	A	B	X	A	A	A	A	A	A	A	A	X	A	A	A	Note 2
Oakite™ #67												A										Note 1 TM: Oakite Products Inc., Compounds for cleaning surface heating.
Oakite™ #20, 23, 24, 30, 51, 90				A																		
Oleic Acid	680	372	685	C	C	C	C	C	X	B	B	C	B	A	B	A	B	B	A	A	A	Carpenter 20 Acceptable
Oxalic Acid				X	X	X	B	B	X	C	B	X	X	B	X	B	X	B	A	A	A	Cupro Nickel Acceptable
Paint Stripper (High Alkaline Type)				A																		Note 1
Paint Stripper (Solvent Type)													A									Notes 1, 2
Paraffin				A	A		A	A		B		A	A	A				B		A	A	Notes 2, 7
Parkerizing™ (See Iron Phosphate)																						TM: Parker Div., OMI Corp., Corrosion Res. Coating
Perchloroethylene	250	None		B	B		C	B	B	A	A	B	B	B	B	A	A	B	A	A	A	
Perm-A-Chlor™												A										TM: Detrex Chemical Industries Inc., Degreasing solvent and cleaning compound.
Petroleum–Crude < 500°F				B	B	A	A	C	C	A	C	A	A	A					A	A		Notes 2, 3, 7
> 500°F				A		A	A	X	X	X	X	A										
>1000°F				X			X	X	X	X	X	A										
Phenol (See Carboic Acid)																						
Phosphate													A								X	Notes 1, 5, 9
Phosphate Cleaner												A									X	Notes 1, 5, 9
Phosphatizing													A								X	Notes 1, 5, 9
Phosphoric Acid																						
Crude				C			X	X	C	X	X	C										
Pure <45%				X	X	X	C	C	C	B	C	C	C	B	A	A	X	C		A	A	
>45% Cold				X	X	X	X	B	C	B	C	A	B	B	A		X	A		A	A	
>45% Hot				X	X	X	X	C	X	C	X	X	X	B	A	B	X	C		A	A	Tantalum Acceptable

Reference Data

CONTINUED



# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments	
	B.P. °F	F.P. °F	A.I. °F																				
Photo Fixing Bath										C		A											
Picric Acid	>572 Ex- plodes	302	572	X	X		X	X	X	X	X	B	B	B	C	C				A	A	A	
Potassium Acid Sulfate																				A	A	Note 1	
Potassium Bichromate (Potassium Dichromate)				C	B	B	B		B	B	B	A	A	A	B		B	A	A	A	A		
Potassium Chloride				C	X	B	X	C	C	B	B	C	B	A	C	B	A	C	A	A	A	Carpenter 20 Acceptable	
Potassium Cyanide				C	X	B	X	X	X	C	B	B	B	B	B	B	X	B	A	C	A		
Potassium Hydrochloric																				A	A	Note 1	
Potassium Hydroxide	2408			X	X		X	C	X	B	A	C	C	C	C	B	X	B	X	A	A		
Potassium Nitrate (Salt Peter)				B	B	B	A	B	B	B	B	B	B	B	B	B	A	X	A	A	A		
Potassium Sulfate				C	C	C	A	B	A	A	B	A	A	A	B	B	A	C	A	A	A		
Prestone™ 350°F				A						A												TM: Union Carbide Corp., Anti-freeze/coolant	
R5 Bright Dip for Copper Polish at 180°F																							
Reynolds Brightener																				A	A	Note 1	
Rhodium Hydroxide																				A	A		
Rochelle Salt Cyanide				A								A										Note 1	
Ruthenium Plating																				A	A	Note 1	
Sea Water				X	X	A	X	X	A	A		C	C	A	B	B	A	C	A	A	A		
Silver Bromide				X	X		X	X		C	C	X	X	C			A		A	A	A		
Silver Cyanide				C	C		X	X		B		A	A	A	A		A	A	A	A	A		
Silver Lume												A										Note 1	
Silver Nitrate	831			X	X		X	X	X	X	X	C	C	B	C	C	A	C	A	A	A	Hastelloy® C276 Acceptable	
Soap Solutions				A	A	A	X	C	A	A		A/B	A/B	A/B		A	A			X	X	Note 3	
Sodium-Liquid Metal				C	X	X	X	X	B	A	A	A			A	A				X	X		
Sodium Bisulfate				X	X	X	C	B	C	C	B	X	X	A		B	C	B		A	A	Carpenter 20 Acceptable	
Sodium Bromide	2534			B	C		X	B	B	B	B	C	B	B	B	B	B	C	A	A	A		
Sodium Carbonate				C	C		X	A	X	B	B	B	B	A	B	B	A	B	C	A	A		
Sodium Chlorate				X	X		B	A	B	A	A	B	B	B	B	A	A	X	A	A	A	Cupro-Nickel Acceptable	
Sodium Chloride	2575			C	X	B	X	B	B	A	B	X	X	C	B	A	C	C	A	A	A	Cupro-Nickel Acceptable	
Sodium Citrate				X	X		X	X	X		C	B	B	B			A	B	A	A	A		
Sodium Cyanide	2725			A	B	C	X	X	X	C	C	A	A	A	A	A	C	B	A	C	A		
Sodium Dichromate (Sodium Bichromate)				B	B	B	C	X				B	B	B			C	X	A	A	A		
Sodium Disulfate				X	X		C		C	C	C	X	X	B		C	C		A	A			
Sodium Hydroxide (See Caustic Soda)																							
Sodium Hypochlorite				X	X	X	X	X	X	X	X	X	X	B	X	X	A	A/X	A	C/A	A	A	Hastelloy® C276 Acceptable
Sodium Nitrate				B	B	A	C	C	C	B	B	A	A	A	A	A	A	C	A	A	A		
Sodium Peroxide				B	A	B	C	X	X	B	B	B	B	B				C			A		

CONTINUED 

# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments	
	B.P. °F	F.P. °F	A.I. °F																				
Sodium Phosphate				C	C	B	X	B	B	A	C	B	A	B	B	A	A	B	A	A	A		
Sodium Salicylate				B	C	B		B	B	B	B	B	B	B	B	B			A	A	A		
Sodium Silicate				A	B	A	X	B	X	A	A	A	A	A	A	A	A	C	A	A	A	Note 4	
Sodium Stannate				C	C	C				B	B	B	B	B	B	B			A	A	A		
Sodium Sulfate				B	C	C/B	B	B	B	B	B	C/X	A/B	B	B	B	C	B	A	A	A		
Sodium Sulfide				C	X	C	C	X	A	B	B	X	C	C	C	C	C	C	C	A	A		
Solder Bath				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	Note 4
Soybean Oil	540	833					B	A				A/B	B	B			A	A			A		
Stannostar™																				A	A	Note 1 TM: The Udylyte Co., OMI Corp., Bright acid tin plating process.	
Steam <500°F				A/B			A/B	A/B	C	A	A	A/B	B	B	A	A	B	A			A		
500–1000°F				C			C	C	X	C	C	A			A	A							
>1000°F				X			X	X		X	X	A			A	A							
Stearic Acid	721	385	743	C	C	C	C	X	X	B	B	C	A	A/B	B	B	B	A	A	A	A	Hastelloy® C-276 Acceptable	
Sugar Solution				A	A		A	A	A	A	A	A	A	A	A	A	A		A	A	A	Note 7	
Sulfamate Nickel																	A	A	A	A	A	Note 1	
Sulfur	832	405	450	C	X	C	A	X	X	B	C	C	B	B	A	A	A	X	A	A	A		
Sulfur Chloride	280	245	453	X	X	C	X	X	B	X	C	C	X	C	C	B	X	B	A	X	A		
Sulfur Dioxide	14			C	C		C	C	B	X	X	C	B	B	C	C	A	X	A	A	A		
Sulfuric Acid	626																						
<10% Cold				X		X	C	A	B	B	C	X	C	B	C	X	X	A		A	A		
Hot				X	X	X	C	X	X	X	X	X	X	X	X	B	X	B		A	A		
10–75% Cold				X			X	B	B	C	C	X	X	B	B	X	X	A		A	A		
Hot				X			X	X	B	C	X	X	X	C	X	X	X	C		A	A		
75–95% Cold				B	B	B	X	B	B	X	X	B	B	B			X	C		A	A		
Hot				X	X	X	X	X	C	X	X	X	X	X			X	X		C	A		
Fuming Sulfurous Acid				C	X	C	X	X	X	X	X	B	C	C	C	C		C					
Tannic Acid		390	980	C	C	C	C/X	C	X	C	C	C	C	A	A	B	A	A	B	A	A		
Tar				A/B			A/B	B				A/B	B	B	A	A							
Tartaric Acid		410	802		X	B	C	X	C	B	C	C	A	B	A	B	B	B		A	A		
Tetrachlorethylene (See Perchloroethylene)																							
Thermoil Granodine™				B																		TM: Amchem Products, Inc. Chemical to produce anti-galling coatings.	
Therminol™ FR1–Non Flowing				A																		TM: Monsanto Co., Heat transfer fluid.	
Tin (Molten)				B	B		X	X	X	X	X	B	B	X		X	A			X	X	Note 4	
Tin-Nickel Plating																			A		A	Note 1	
Tin Plating–Acid																				A	A	Note 1	
Tin Plating–Alkaline				A								A										Note 1	

Reference Data

CONTINUED

# Application Guide

## Reference Data

Corrodant	Boiling Point	Flash Point	Auto Ignition	Iron Steel	Cast Iron Grey	Cast Iron NI Resist	Aluminum	Copper	Lead	Monel® 400	Nickel 200	304, 321, 347 Stainless Steel	316 Stainless Steel	Type 20 Stainless Steel	Incoloy® 800	Inconel® 600	Titanium	Hastelloy® B	Quartz	Graphite	Teflon®	Comments	
	B.P. °F	F.P. °F	A.I. °F																				
Toluene	231	40	947	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A		A	A	Hastelloy® C-276 Acceptable	
Triad Solvent				C																			
Trichloroethane				A	C	C	B	B	B	B	B	A	B	B	B	B	A			A	A		
Trichloroethylene	165	None		B	C	C	B	C	X	C	C	B	B	B	B	A	A	A	A	A	A	Hastelloy® C-276 Acceptable	
Triethylene Glycol	556	350	700	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A	A		
Trioxide (Pickle)																				A	A	Note 1	
Trisodium Phosphate				A	A		X	C	X	C	C	C	C	C						C	X	B	X
Turco™ 2623				A																			TM: Turco Products, Div., Purex Corp., Ltd.
Turco™ 4008, 4181, 4338													A										Note 1
Turco™ Ultrasonic Solution													A										Note 1
Turpentine Oil	309 -338	95	488	C	C	C	A	B	A	A	A	A	A	A		A	B	B			A	A	
Ubac™																					A		Note 1 TM: The Udylite Co., OMI Corp., High leveling acid copper bath.
Udylite #66																	A			A	A		Notes 1, 5
Unichrome™ CR-110																					A	A	Note 1 TM: M & T Chemicals Inc., Plating Process, supplies and equipment.
Unichrome™ 5RHS																					A	A	Note 1
Vegetable Oil		610		C		C	B	X	X	A	A	A	A	A	A		A	B			A	A	
Vinegar				C			C			A		B	A/B	B			A	B			A	A	
Water (Fresh)				X	C	A	A	A	A	A	A	C	C	A	A	A	A				A	A	
Water (Deionized) (See Deionized Water)																							
Water (Sea) (See Sea Water)																							
Watt's Nickel Strike																					A		Note 1
Whiskey and Wines				X		C		A		A	A	A	A	A	A	A	A	A				A	A
Wood's Nickel Strike																					A		Note 1
Yellow Dichromate													A								A		Note 1
X-Ray Solution												A											
Zinc (Molten)	1664						X	X	X	X	X	X	X	X	X	X	X	X					X
Zinc Chloride	1350			C	C	C	X	X	B	B	B	X	X	B	X	B	C	B		A	A	A	
Zinc Phosphate													A									X	Notes 1, 5
Zinc Plating Acid																					A		
Zinc Plating Cyanide				A								A											Note 1
Zinc Sulfate				C	X	A	C	B	A	B	C	C	C	C		B	A	C			A	A	
Zincate™				A								A											Note 1 TM: Ashland Chemical, Alkaline salt for immersion zinc plating aluminum.