

# Enclosures for electrical equipment

## NEMA Types – definitions pertaining to non-hazardous locations

An enclosure is a surrounding case constructed to provide protection from accidental contact with the enclosed equipment and to provide protection to the enclosed equipment from specified environmental conditions. A brief description of the more common types of enclosures used by the electrical industry follows. For more information, see Table 110.28 of the National Electrical Code® and Table 65 from the Canadian Electrical Code.

**Type 1 enclosure:**

Intended for indoor use, primarily to provide protection against contact with enclosed equipment and a degree of protection against falling dirt.

**Type 2 enclosure:**

Intended for indoor use, primarily to provide a degree of protection against limited amounts of falling water and dirt.

**Type 3 enclosure:**

Intended for outdoor use, primarily to provide a degree of protection against wind-blown dust, rain, sleet and external ice formation.

**Type 3R enclosure:**

Intended for outdoor use, primarily to provide a degree of protection against falling rain, sleet and external ice formation.

**Type 3S enclosure:**

Intended for outdoor use, primarily to provide a degree of protection against wind-blown dust, rain and sleet, and to provide for operation of external mechanism when ice laden.

**Type 3X enclosure:**

Intended for outdoor use, primarily to provide a degree of protection against wind-blown dust, rain, sleet, external ice formation and corrosion.

**Type 3SX enclosure:**

Intended for outdoor use, primarily to provide a degree of protection against wind-blown dust, rain, sleet and corrosion, and to provide for operation of external mechanism when ice laden.

**Type 4 enclosure:**

Intended for indoor or outdoor use, primarily to provide a degree of protection against wind-blown dust and rain, splashing water and hose-directed water.

**Type 4X enclosure:**

Intended for indoor or outdoor use, primarily to provide a degree of protection against corrosion, wind-blown dust and rain, splashing water and hose-directed water.

**Type 6 enclosure:**

Intended for indoor or outdoor use, primarily to avoid a degree of protection against contact with enclosed equipment, falling dirt, hose-directed water, entry of water during occasional temporary submersion at a limited depth and external ice formation.

**Type 6P enclosure:**

Intended for indoor or outdoor use, primarily to provide a degree of protection against contact with enclosed equipment, falling dirt, hose-directed water, entry of water during prolonged submersion at a limited depth and external ice formation.

**Type 12 enclosure:**

Intended for indoor use, primarily to provide a degree of protection against dust, falling dirt and dripping non-corrosive liquids.

**Type 13 enclosure:**

Intended for indoor use, primarily to provide a degree of protection against dust, spraying of water, oil and non-corrosive coolant.








# Index of ingress protection

## IEC 60529 IP Rating and NEMA 250 Enclosures

IP suitability ratings are a system for classifying the degree of protection provided by enclosures of electrical equipment.

### Protection against solid bodies










Degree of protection for persons against access to hazardous parts inside the enclosure and/or against the ingress of solid foreign objects.

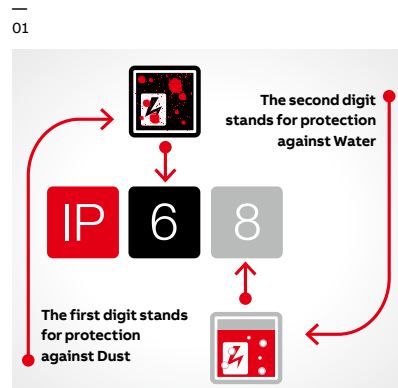
	<b>0</b>	No protection
	<b>1</b>	Objects greater than 50 mm, accidental touch by hands
	<b>2</b>	Objects greater than 12 mm, accidental touch by fingers
	<b>3</b>	Objects greater than 2.5 mm, e.g. tools/wires
	<b>4</b>	Objects greater than 1 mm, e.g. tools/wires/small wires
	<b>5</b>	Protected against dust - limited ingress (no harmful deposits)
	<b>6</b>	Totally protected against dust (Dust-tight)

—  
01 IP Ratings  
The higher the number, the greater the degree of protection; they apply ONLY to properly installed equipment.

### Protection against water

Degree of protection of equipment inside enclosures against damage from the ingress of water.

	<b>0</b>	No protection
	<b>1</b>	Protected against vertically falling drops of water
	<b>2</b>	Protected against direct sprays of water 15° from vertical
	<b>3</b>	Protected against sprays of water to 60° from vertical
	<b>4</b>	Protected against water sprayed from all directions - limited ingress permitted
	<b>5</b>	Protected against low pressure jets of water from all directions - limited ingress permitted
	<b>6</b>	Protected against strong pressure jets of water, heavy seas - limited ingress permitted
	<b>7</b>	Protection against the effects of immersion between 15cm - 1 m
	<b>8</b>	Protection against long periods of immersion under a quoted pressure, e.g. 2 bar at 24 hours
	<b>9</b>	IP69 Automotive standard DIN40050 and signifies resistance to high pressure jets of water (up to 80bar) from any angle



**Conversion of NEMA enclosure type ratings to IEC 60529 enclosure Classification Designations (IP)**  
 (Cannot be used to convert Classification Designations to NEMA type ratings)

IP 1st Character	1		2		3, 3X, 3S, 3SX		3R, 3RX		4, 4X		5		6		6P		12, 12K, 13		IP 2nd Character
IP0_																			IP0_0
IP1_																			IP0_1
IP2_																			IP0_2
IP3_																			IP0_3
IP4_																			IP0_4
IP5_																			IP0_5
IP6_																			IP0_6
																			IP0_7
																			IP0_8
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	

**NEMA 250 to IEC 60529**



## Technical information

### Engineering properties of enclosures

Property	Test method	Opaque polycarbonate covers & boxes	Clear polycarbonate cover	FRP	NORYL
<b>Thermal and mechanical</b>					
Temperature Range (°C)	—	-34° to 110°	-30° to 230°	-50° to 160°	-40° to 80°
Temperature Range (°F)	—	-30° to 230°	-30° to 230°	-58° to 320°	-40° to 185°
Specific Gravity (oz.in <sup>3</sup> )	ASTM D792	1.20	1.20	1.79	.85
Thermal Conductivity (BTU•in/hr•ft <sup>2</sup> •F)	ASTM D177	1.35	1.35	1.68	.86
Heat Deflection Temperature @ 264 PSI (°F)	ASTM D648	265	260	392	180
Tensile Strength (PSI)	ASTM D638	8,800	9,000	13,000	3,400
Flexural Strength (PSI)	ASTM D790	13,500	14,000	19,000	6,800
Compressive Strength @ 10% Deformation (PSI)	ASTM D695	12,500	12,500	24,000	5,200
Impact Strength IZOD Notched (ft.lb/in.)	ASTM D256	12	12	12	—
Water Absorption – 24 hrs. @ 73°F (%)	ASTM D570	.15	.15	.17	.06
UV Rating	UL 746C	F1	F1	F2	—
<b>Electrical</b>					
Dielectric Strength (volts/mil.)	ASTM D149	380	380	467	192
Dielectric Constant	ASTM D150				
60 Hz			3.0	3.0	—
100 Hz			—	—	2.27
106 Hz		2.96	2.96	—	2.18
Volume Resistivity @ 73°F (OHM-CM)	ASTM D257	>10 <sup>16</sup>	>10 <sup>16</sup>	2.0 x 10 <sup>15</sup>	1.0 x 10 <sup>16</sup>
Arc Resistance (sec)	ASTM D495	120	120	200+	67

### Clearance holes for Carflex® fittings or PVC male terminal adapters

Carflex fittings & PVC Male terminal adapters trade sizes	Nominal size (in.)	Actual size (in.)	Actual size (mm)
½	.875	.879	22.4
¾	1.093	1.107	28.2
1	1.344	1.357	34.6
1¼	1.813	1.699	43.2
1½	1.938	1.949	49.6
2	2.375	2.413	61.5
2½	2.875	2.914	74.0
3	3.5	3.539	89.8
3½	4	4.044	102.7
4	4.5	4.544	115.4
5	5.625	5.675	143.7

## Technical information

### Environmental resistance table: E–Excellent, G–Good, L–Limited, U–Unsatisfactory

**Important:** These environmental resistance ratings are based upon tests where the specimens were replaced in complete submergence in the reagent listed. Ratings listed in this chart apply to a 48-hour exposure period. (The information in this chart is to be used ONLY as a guide in selecting equipment for appropriate chemical compatibility. Before permanent installation, test the equipment with the chemicals and under the specific conditions of your application.)

Chemical	Polycarbonate		FRP (Fiberglass reinforced polyester)	
	PVC Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Noryl Circuit safe medium JIC
Acetaldehyde	U	L	—	—
Acetamide	U	U	—	—
Acetate Solvent	U	—	—	U
Acetic Acid	U	G	E	E
Acetic Acid 20%	U	E	E	E
Acetic Acid 80%	L	G	E	E
Acetic Acid, Glacial	U	G	E	E
Acetic Anhydride	U	U	E	U
Acetone	U	U	U	U
Acetyl Bromide	U	—	—	—
Acetyl Chloride (dry)	L	U	—	U
Acetylene	E	U	—	—
Acrylonitrile	G	U	—	—
Adipic Acid	E	—	—	—
Alcohols: Amyl	E	G	—	L
Alcohols: Benzyl	U	—	—	U
Alcohols: Butyl	E	E	—	E
Alcohols: Diacetone	G	—	—	E
Alcohols: Ethyl	L	G	—	E
Alcohols: Hexyl	E	—	—	E
Alcohols: Isobutyl	E	—	—	E
Alcohols: Isopropyl	E	E	—	E
Alcohols: Methyl	E	G	—	E
Alcohols: Octyl	—	—	—	E
Alcohols: Propyl	E	—	—	E
Aluminum Chloride	E	E	E	E
Aluminum Chloride 20%	E	E	—	E
Aluminum Fluoride	E	—	—	E
Aluminum Hydroxide	E	G	—	E
Aluminum Nitrate	G	E	—	—
Aluminum Potassium Sulfate 10%	E	E	—	E
Aluminum Potassium Sulfate 100%	E	E	—	E
Aluminum Sulfate	E	E	E	E
Amines	U	U	—	U
Ammonia 10%	G	U	—	E
Ammonia Nitrate	G	—	—	E
Ammonia, anhydrous	E	U	—	G
Ammonia, liquid	E	U	L	—
Ammonium Acetate	E	—	—	—
Ammonium Bifluoride	E	—	—	E
Ammonium Carbonate	E	—	L	E
Ammonium Caseinate	—	—	—	E
Ammonium Chloride	E	E	E	E
Ammonium Hydroxide	E	U	L	E
Ammonium Nitrate	E	—	L	E

Chemical	Polycarbonate		FRP (Fiberglass reinforced polyester)	
	PVC Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Noryl Circuit safe medium JIC
Ammonium Oxalate	E	E	—	—
Ammonium Persulfate	E	—	—	E
Ammonium Phosphate, Dibasic	E	E	—	E
Ammonium Phosphate, Monobasic	E	—	—	E
Ammonium Phosphate, Tribasic	E	—	—	E
Ammonium Sulfate	E	E	E	E
Ammonium Sulfite	E	—	E	E
Amyl Acetate	U	U	L	U
Amyl Alcohol	E	G	L	L
Amyl Chloride	U	—	U	U
Aniline	L	U	U	U
Aniline Hydrochloride	G	U	—	—
Antifreeze	E	—	—	E
Antimony Trichloride	E	E	E	E
Aqua Regia (80% HCl, 20% HNO <sub>3</sub> )	L	U	—	U
Aromatic Hydrocarbons	U	—	—	U
Arsenic Acid	E	E	—	E
Arsenic Salts	E	—	—	—
Asphalt	E	U	—	—
Barium Carbonate	E	E	E	E
Barium Chloride	E	E	E	E
Barium Cyanide	U	—	—	—
Barium Hydroxide	E	U	U	E
Barium Nitrate	E	U	—	E
Barium Sulfate	G	U	E	E
Barium Sulfide	E	—	E	E
Beer	E	E	—	E
Beet Sugar Liquids	E	—	—	E
Benzaldehyde	U	U	U	G
Benzene	L	U	L	U
Benzene Sulfonic Acid	E	U	E	E
Benzoic Acid	E	G	—	G
Benzol	—	U	—	G
Benzonitrile	—	E	—	—
Benzyl Chloride	—	—	—	U
Bleaching Liquors	E	—	—	—
Borax (Sodium Borate)	E	—	—	E
Boric Acid	E	—	E	E
Bromine	L	L	—	E
Butadiene	L	U	—	U
Butane	L	U	—	U
Butanol (Butyl Alcohol)	L	G	—	E
Butyl Amine	U	U	—	U
Butyl Ether	E	—	—	U
Butyl Phthalate	—	U	—	E

## Technical information

### Environmental resistance table: E–Excellent, G–Good, L–Limited, U–Unsatisfactory

**Important:** These environmental resistance ratings are based upon tests where the specimens were replaced in complete submergence in the reagent listed. Ratings listed in this chart apply to a 48-hour exposure period. (The information in this chart is to be used ONLY as a guide in selecting equipment for appropriate chemical compatibility. Before permanent installation, test the equipment with the chemicals and under the specific conditions of your application.)

Chemical	PVC	Polycarbonate	FRP	Noryl
	Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Butylacetate	U	U	U	G
Butylene	E	U	—	—
Butyric Acid	G	U	—	U
Calcium Bisulfate	—	U	—	—
Calcium Bisulfide	E	—	—	E
Calcium Bisulfite	G	U	—	E
Calcium Carbonate	E	L	E	E
Calcium Chlorate	G	—	E	—
Calcium Chloride	L	—	E	E
Calcium Hydroxide	G	U	U	E
Calcium Hypochlorite	G	U	L	E
Calcium Nitrate	E	E	E	E
Calcium Oxide	G	—	—	E
Calcium Sulfate	G	E	E	E
Calgon	—	—	—	E
Cane Juice	E	—	—	—
Carbolic Acid (Phenol)	U	U	—	U
Carbon Bisulfide	U	—	L	—
Carbon Dioxide (dry)	E	—	—	E
Carbon Dioxide (wet)	E	—	—	E
Carbon Disulfide	U	U	—	U
Carbon Monoxide	E	—	—	E
Carbon Tetrachloride	U	U	E	U
Carbon Tetrachloride (dry)	—	—	—	U
Carbon Tetrachloride (wet)	—	—	—	U
Carbon Disulfide	U	U	—	U
Carbon Monoxide	E	—	—	E
Carbon Tetrachloride	U	U	E	U
Carbon Tetrachloride (dry)	—	—	—	U
Carbon Tetrachloride (wet)	—	—	—	U
Carbonated Water	E	—	—	E
Carbonic Acid	E	E	—	E
Catsup	E	—	—	E
Chloric Acid	E	—	—	U
Chlorine (dry)	U	—	—	G
Chlorine Water	E	—	E	L
Chlorine, Anhydrous Liquid	U	L	—	G
Chloroacetic Acid	G	U	—	—
Chlorobenzene (Mono)	U	U	U	U
Chlorobromomethane	U	—	—	—
Chloroform	U	U	—	U
Chlorosulfonic Acid	U	L	—	U
Chocolate Syrup	—	E	—	E
Chromic Acid 10%	E	G	E	E
Chromic Acid 30%	E	L	—	U

Chemical	PVC	Polycarbonate	FRP	Noryl
	Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Chromic Acid 5%	E	G	—	E
Chromic Acid 50%	U	U	—	U
Chromium Salts	E	—	—	—
Citric Acid	G	E	E	E
Citric Oils	—	—	—	E
Clorox® (Bleach)	E	—	—	E
Copper Chloride	E	—	—	E
Copper Cyanide	E	U	—	E
Copper Fluoborate	E	—	—	—
Copper Nitrate	E	U	—	E
Copper Sulfate >5%	E	E	—	E
Copper Sulfate 5%	E	E	—	E
Cresols	U	U	U	U
Cresylic Acid	U	U	—	—
Cupric Acid	E	E	—	E
Cyclohexane	U	G	—	U
Cyclohexanone	U	U	—	U
Detergents	E	E	—	E
Diacetone Alcohol	U	U	—	—
Dichlorobenzene	U	U	—	—
Dichloroethane	U	U	—	E
Diesel Fuel	E	E	—	U
Diethyl Ether	U	U	—	—
Diethylamine	U	U	—	—
Diethylene Glycol	L	G	—	E
Dimethyl Aniline	U	U	U	U
Dimethyl Formamide	U	U	—	U
Diphenyl Oxide	U	—	—	—
Dyes	G	—	—	E
Epsom Salts (Magnesium Sulfate)	E	E	—	E
Ethane	E	—	—	—
Ethanol	L	G	—	E
Ethanolamine	U	—	—	E
Ether	U	—	L	U
Ethyl Acetate	U	U	L	E
Ethyl Benzoate	U	U	—	E
Ethyl Chloride	U	U	L	U
Ethyl Ether	U	—	U	U
Ethylene Bromide	U	U	—	—
Ethylene Chloride	U	U	—	U
Ethylene Chlorohydrin	U	U	E	—
Ethylene Diamine	U	E	—	U
Ethylene Dichloride	U	U	U	U
Ethylene Glycol	E	G	E	E
Ethylene Oxide	U	L	—	E

## Technical information

**Environmental resistance table: E-Excellent, G-Good, L-Limited, U-Unsatisfactory**

**Important:** These environmental resistance ratings are based upon tests where the specimens were placed in complete submergence in the reagent listed. Ratings listed in this chart apply to a 48-hour exposure period. (The information in this chart is to be used ONLY as a guide in selecting equipment for appropriate chemical compatibility. Before permanent installation, test the equipment with the chemicals and under the specific conditions of your application.)

Chemical	PVC	Polycarbonate	FRP (Fiberglass reinforced polyester)	Noryl
	Himeline HE Opaque Cover w/Base	Himeline HE clear cover w/base Himeline HS opaque w/clear lids	Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Fatty Acids	E	G	—	E
Ferric Chloride	E	E	E	E
Ferric Nitrate	E	E	E	E
Ferric Sulfate	E	E	E	E
Ferrous Chloride	E	U	E	E
Ferrous Sulfate	E	E	E	E
Fluoboric Acid	E	—	—	E
Fluorine	U	L	—	—
Fluosilicic Acid	U	E	—	E
Formaldehyde 100%	E	E	—	E
Formaldehyde 40%	E	E	E	E
Formic Acid	E	E	L	E
Freon 113	G	G	—	U
Freon 12	E	—	—	U
Freon 22	E	—	—	G
Freon TF	G	—	—	—
Freon <sup>+</sup> 11	E	—	—	G
Fuel Oils	E	G	—	G
Furan Resin	E	—	—	—
Furfural	U	U	L	U
Gallic Acid	G	—	—	E
Gasoline (high-aromatic)	E	E	—	G
Gasoline, leaded, ref.	G	E	E	G
Gasoline, unleaded	L	E	—	U
Gelatin	G	—	—	E
Glucose	E	E	E	E
Glue, P.V.A.	L	—	—	—
Glycerin	E	E	E	E
Glycolic Acid	G	—	—	—
Grease	E	—	—	—
Heptane	L	G	E	G
Hexane	G	U	U	G
Hydraulic Oil (Petro)	E	—	—	—
Hydraulic Oil (Synthetic)	E	—	—	—
Hydrazine	—	U	—	—
Hydrobromic Acid 100%	E	—	—	G
Hydrobromic Acid 20%	G	—	—	G
Hydrochloric Acid 100%	U	U	—	E
Hydrochloric Acid 20%	E	G	E	E
Hydrochloric Acid 37%	G	U	L	E
Hydrochloric Acid, Dry Gas	E	—	—	E
Hydrocyanic Acid	G	—	—	E
Hydrocyanic Acid (Gas 10%)	E	G	—	L
Hydrofluoric Acid 100%	L	U	—	U
Hydrofluoric Acid 20%	G	U	—	L

Chemical	PVC	Polycarbonate	FRP (Fiberglass reinforced polyester)	Noryl
	Himeline HE Opaque Cover w/Base	Himeline HE clear cover w/base Himeline HS opaque w/clear lids	Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Hydrofluoric Acid 50%	G	U	—	U
Hydrofluoric Acid 75%	L	U	—	U
Hydrofluosilicic Acid 100%	G	—	—	G
Hydrofluosilicic Acid 20%	E	—	—	G
Hydrogen Gas	E	E	—	E
Hydrogen Peroxide 10%	E	E	—	E
Hydrogen Peroxide 100%	E	E	—	E
Hydrogen Peroxide 30%	E	E	E	E
Hydrogen Peroxide 50%	E	E	E	—
Hydrogen Sulfide (aqua)	G	E	—	E
Hydrogen Sulfide (dry)	E	—	—	—
Hydroquinone	G	—	—	—
Hydroxyacetic Acid 70%	U	—	—	—
Ink	L	—	—	—
Iodine	E	—	—	L
Iodine (in alcohol)	E	—	—	—
Iodoform	E	—	—	—
Isooctane	E	G	—	U
Isopropyl Acetate	U	U	—	—
Isopropyl Ether	G	U	—	—
Isotane	E	—	—	—
Jet Fuel (JP3, JP4, JP5)	L	E	—	U
Kerosene	E	U	—	U
Ketones	U	U	—	U
Lacquer Thinners	U	G	—	U
Lacquers	U	U	—	U
Lactic Acid	G	G	E	E
Lard	E	E	—	E
Lead Acetate	G	—	—	E
Lead Nitrate	E	—	—	E
Lead Sulfamate	G	E	—	—
Lime	G	—	—	—
Linoleic Acid	E	—	—	—
Lithium Chloride	U	G	—	—
Lithium Hydroxide	—	U	—	—
Lubricants	G	E	—	L
Lye: Ca(OH) <sub>2</sub> Calcium Hydroxide	G	U	—	E
Lye: KOH Potassium Hydroxide	G	U	—	E
Lye: NaOH Sodium Hydroxide	E	U	—	E
Epsom Salts (Magnesium Sulfate)	E	E	—	E
Magnesium Bisulfate	E	E	—	—
Magnesium Carbonate	G	E	E	E
Magnesium Chloride	G	E	E	E
Magnesium Hydroxide	E	E	G	E
Magnesium Nitrate	E	E	—	E

## Technical Information

### Environmental resistance table: E-Excellent, G-Good, L-Limited, U-Unsatisfactory

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Chemical	PVC	Polycarbonate	FRP	Noryl
	Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Magnesium Oxide	—	—	—	—
Magnesium Sulfate (Epsom Salts)	E	E	E	E
Maleic Acid	E	—	—	E
Malic Acid	E	—	—	—
Manganese Sulfate	L	E	—	E
Mayonnaise	U	—	—	—
Melamine	U	—	—	—
Mercuric Chloride (dilute)	E	E	—	E
Mercuric Cyanide	E	—	—	—
Mercurous Nitrate	E	E	—	E
Mercury	E	U	—	E
Methane	G	—	—	—
Methanol (Methyl Alcohol)	E	G	L	E
Methyl Acetate	U	U	—	—
Methyl Acetone	U	—	—	—
Methyl Alcohol 10%	E	G	—	E
Methyl Bromide	U	—	—	—
Methyl Butyl Ketone	E	U	—	—
Methyl Cellosolve	U	U	—	—
Methyl Chloride	U	U	—	U
Methyl Dichloride	E	—	—	—
Methyl Ethyl Ketone	U	U	E	U
Methyl Isobutyl Ketone	U	U	—	U
Methyl Isopropyl Ketone	U	U	—	U
Methyl Methacrylate	E	—	—	—
Methylamine	U	—	—	—
Methylene Chloride	U	U	U	U
Mineral Spirits	E	L	—	E
Monochloroacetic acid	—	U	—	—
Monoethanolamine	U	—	—	E
Morpholine	—	U	—	U
Motor oil	G	E	—	E
Naphtha	E	G	E	U
Naphthalene	U	—	—	U
Natural Gas	E	—	—	—
Nickel Chloride	E	E	—	E
Nickel Nitrate	E	U	—	E
Nickel Sulfate	E	E	—	E
Nitrating Acid (<15% HNO <sub>3</sub> )	U	—	—	—
Nitrating Acid (>15% H <sub>2</sub> SO <sub>4</sub> )	U	—	—	—
Nitrating Acid (_1% Acid)	U	—	—	—
Nitrating Acid (_15% H <sub>2</sub> SO <sub>4</sub> )	U	—	—	—
Nitric Acid (20%)	E	G	G	G
Nitric Acid (50%)	G	G	—	G
Nitric Acid (50%)	G	G	—	G

Chemical	PVC	Polycarbonate	FRP	Noryl
	Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Nitric Acid (5–10%)	E	E	—	E
Nitric Acid (Concentrated)	G	L	—	G
Nitrobenzene	U	U	L	U
Nitromethane	G	U	—	U
Nitrous Acid	E	—	—	—
Nitrous Oxide	E	—	—	—
Oil: Aniline	U	—	—	U
Oil: Citric	G	E	—	E
Oil: Creosote	L	—	—	U
Oil: Diesel Fuel (20, 30, 40, 50)	G	—	—	U
Oils: Fuel (1, 2, 3, 5A, 5B, 6)	E	G	—	E
Oil: Hydraulic Oil (Petro)	E	—	—	—
Oil: Hydraulic Oil (Synthetic)	E	—	—	—
Oil: Mineral	G	G	—	E
Oil: Olive	L	E	—	E
Oil: Orange	L	L	—	—
Oil: Pine	U	E	—	—
Oil: Rosin	L	—	—	—
Oil: Silicone	E	—	—	E
Oil: Transformer	G	—	—	—
Oil: Turbine	E	—	—	—
Oleic Acid	L	—	E	E
Oleum 100%	U	—	—	E
Oleum 25%	U	—	—	—
Oxalic Acid (cold)	G	—	E	E
Ozone	G	E	—	—
Palmitic Acid	G	—	—	—
Paraffin	G	E	—	E
Pentane	E	E	—	—
Perchloric Acid	L	—	—	—
Perchloroethylene	L	U	—	U
Petrolatum	G	—	—	—
Petroleum	—	—	—	U
Phenol (10%)	L	G	L	U
Phenol (Carbolic Acid)	U	U	—	U
Phosphoric Acid (>40%)	G	E	—	E
Phosphoric Acid (crude)	G	E	—	E
Phosphoric Acid (molten)	U	—	—	—
Phosphoric Acid (_40%)	G	E	—	E
Phosphoric Acid Anhydride	—	U	—	—
Phosphorus	E	—	—	—
Phosphorus Trichloride	U	L	—	—
Photographic Developer	E	E	—	E
Photographic Solutions	E	E	—	E
Phthalic Anhydride	U	E	—	—



## Technical Information

### Environmental resistance table: E-Excellent, G-Good, L-Limited, U-Unsatisfactory

**Important:** These environmental resistance ratings are based upon tests where the specimens were placed in complete submergence in the reagent listed. Ratings listed in this chart apply to a 48-hour exposure period. (The information in this chart is to be used ONLY as a guide in selecting equipment for appropriate chemical compatibility. Before permanent installation, test the equipment with the chemicals and under the specific conditions of your application.)

Chemical	PVC	Polycarbonate	FRP	Noryl
	Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Picric Acid	U	U	—	—
Potash (Potassium Carbonate)	E	—	L	E
Potassium Bicarbonate	E	—	—	E
Potassium Bromide	E	E	—	E
Potassium Chlorate	E	E	—	E
Potassium Chloride	E	E	E	E
Potassium Chromate	E	—	E	E
Potassium Cyanide Solutions	E	—	—	E
Potassium Dichromate	E	E	—	E
Potassium Ferricyanide	E	—	E	E
Potassium Ferrocyanide	E	—	E	E
Potassium Hydroxide (Caustic Potash)	E	U	L	E
Potassium Hypochlorite	G	—	—	—
Potassium Iodide	E	—	—	—
Potassium Nitrate	E	E	E	E
Potassium Oxalate	—	—	—	—
Potassium Permanganate	E	E	E	E
Potassium Sulfate	E	E	E	E
Potassium Sulfide	E	—	—	E
Propane (liquefied)	E	L	—	E
Propylene	G	—	—	—
Propylene Glycol	L	G	—	—
Pyridine	U	U	—	G
Pyrogalllic Acid	E	—	—	—
Resorcinol	L	G	—	—
Rosins	L	—	—	—
Salicylic Acid	G	E	—	—
Salt Brine (NaCl saturated)	E	E	—	E
Sea Water	E	E	—	E
Silicone	E	E	—	E
Silver Bromide	—	—	—	E
Silver Nitrate	E	E	—	E
Soap Solutions	E	E	—	E
Soda Ash (see Sodium Carbonate)	E	E	—	E
Sodium Acetate	G	E	E	E
Sodium Aluminate	—	—	—	E
Sodium Benzoate	G	E	—	—
Sodium Bicarbonate	E	E	E	E
Sodium Bisulfate	E	E	—	E
Sodium Bisulfite	E	E	—	E
Sodium Borate (Borax)	E	E	—	E
Sodium Bromide	G	—	E	E
Sodium Carbonate	E	E	—	E
Sodium Chlorate	E	E	E	E
Sodium Chloride	E	E	E	E

Chemical	PVC	Polycarbonate	FRP	Noryl
	Himeline HE opaque cover w/ base	Himeline HE clear cover w/ base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	Circuit safe medium JIC
Sodium Chromate	—	E	—	E
Sodium Cyanide	E	—	—	E
Sodium Ferrocyanide	E	—	E	E
Sodium Fluoride	E	—	—	E
Sodium Hydrosulfite	L	—	—	—
Sodium Hydroxide (20%)	E	E	U	E
Sodium Hydroxide (50%)	E	U	U	E
Sodium Hydroxide (80%)	E	U	U	E
Sodium Hypochlorite (<20%)	E	L	L	E
Sodium Hypochlorite (100%)	G	—	—	E
Sodium Metaphosphate	E	—	—	—
Sodium Metasilicate	E	—	—	—
Sodium Nitrate	E	—	U	E
Sodium Perborate	E	—	—	E
Sodium Peroxide	G	E	—	—
Sodium Polyphosphate	E	—	—	E
Sodium Silicate	E	—	—	E
Sodium Sulfate	E	E	E	E
Sodium Sulfide	E	U	U	E
Sodium Sulfite	E	—	E	E
Sodium Tetraborate	E	—	—	E
Sodium Thiosulfate (hypo)	E	U	—	E
Stannic Chloride	E	E	—	E
Stannic Fluoborate	—	—	—	E
Stannous Chloride	E	—	—	E
Stearic Acid	G	E	—	E
Stoddard Solvent	L	E	—	U
Styrene	U	U	—	E
Sulfate (Liquors)	G	—	—	—
Sulfur Chloride	L	—	—	E
Sulfur Dioxide	E	—	—	E
Sulfur Dioxide (dry)	E	E	—	E
Sulfur Hexafluoride	G	—	—	—
Sulfur Trioxide	E	—	—	U
Sulfur Trioxide (dry)	E	—	—	U
Sulfuric Acid (<10%)	E	E	E	E
Sulfuric Acid (10–75%)	E	G	U	E
Sulfuric Acid (75–100%)	U	U	—	E
Sulfuric Acid (cold concentrated)	U	—	—	E
Sulfuric Acid (hot concentrated)	U	U	—	U
Sulfurous Acid	E	—	—	E
Tallow	—	—	—	E
Tannic Acid	E	L	—	E
Tanning Liquors	E	—	—	E
Tartaric Acid	E	—	E	E

## Technical information

### Environmental Resistance Table: E–Excellent, G–Good, L–Limited, U–Unsatisfactory

**Important:** These environmental resistance ratings are based upon tests where the specimens were placed in complete submergence in the reagent listed. Ratings listed in this chart apply to a 48-hour exposure period. (The information in this chart is to be used ONLY as a guide in selecting equipment for appropriate chemical compatibility. Before permanent installation, test the equipment with the chemicals and under the specific conditions of your application.)

Chemical	Polycarbonate		FRP	Noryl
	PVC Himeline HE opaque cover w/base	Circuit Safe NEMA JIC Himeline HE base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	
Tetrachloroethane	L	—	—	U
Tetrachloroethylene	U	U	—	U
Tetrahydrofuran	U	U	L	U
Tin Salts	E	—	—	—
Toluene (Toluol)	U	U	—	U
Trichloroacetic Acid	G	U	—	—
Trichloroethane	L	U	—	U
Trichloroethylene	U	—	U	U
Trichloropropane	—	—	—	U
Tricresylphosphate	U	—	—	E
Triethylamine	G	—	—	G
Trisodium Phosphate	E	—	—	E
Turpentine	U	U	E	U
Urea	U	U	L	E
Uric Acid	E	—	—	—
Varnish	U	—	—	U

Chemical	Polycarbonate		FRP	Noryl
	PVC Himeline HE opaque cover w/base	Circuit Safe NEMA JIC Himeline HE clear cover w/base Himeline HS opaque w/clear lids	(Fiberglass reinforced polyester) Himeline HS – bases Himeline HP Himeline HLA/HLS Himeline HLP	
Vinegar	G	E	E	E
Vinyl Acetate	U	—	—	—
Vinyl Chloride	U	—	—	—
Water, Acid, Mine	G	G	—	—
Water, Deionized	E	—	—	E
Water, Distilled	E	E	—	E
Water, Fresh	G	E	—	E
Water, Salt	G	E	—	E
Whiskey & Wines	E	E	—	E
White Liquor (Pulp Mill)	E	—	—	E
White Water (Paper Mill)	E	—	—	U
Xylene	U	U	E	G
Zinc Chloride	G	E	E	E
Zinc Hydrosulfite	—	—	—	E
Zinc Sulfate	E	E	E	E