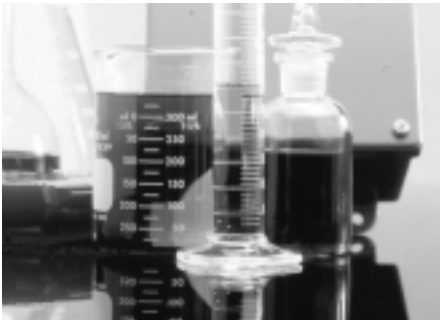


Materials and Paint Finishes

Chemical Resistance



The National Electrical Manufacturers Association (NEMA) and Underwriters Laboratories Inc. (UL) have responded to the costly problem of corrosion by establishing a rating that guarantees an enclosure meets certain minimum conditions of corrosion resistance.

The NEMA 4X rating is applied to materials subjected to two hundred hours of salt spray with no more evidence of corrosive pitting than exhibited by a concurrently run sample of Type 304 stainless steel. One drawback of the NEMA 4X rating, however, is that it does not provide for chemical resistance other than salt spray. The task of selecting enclosures that possess satisfactory corrosion and chemical resistance in actual work settings is still the responsibility of the specifying engineer. To simplify this task Hoffman undertook an extensive materials comparison test program that helped establish the perimeters of relative material acceptability based upon total submersion of test samples. The results of this program are summarized here.

Chemical Resistance

The following chart is offered to our customers as an aid in using our product. Each chemical and substrate has a three number rating system (1-2-3). The order of these numbers represents 30, 60, and 120 days of total submersion of the substrate in each chemical at 72° F (22° C). Each column is also coded according to chemical class. This chart is general in nature and is not intended to apply to a specific situation. The prospective user must determine the application of our product in an environment based upon individual characteristics.

Hoffman offers no guarantee or warranty as to the applicability of this chart for any particular situation as actual conditions of use are beyond our control.

Chemical Resistance Test Results

Tested Enclosure Material	#1 Fuel Oil (Kerosene)	#2 Fuel Oil	Acetic Acid (10% sol.)	Acetone	Aluminum Chloride (10% sol.)	Aluminum Sulfate (10% sol.)	Ammonium Chloride (10% sol.)
Fiberglass, Compression Molded	1-1-1	1-1-1	2-2-2	1-2-4	1-1-1	1-1-2	1-1-1
Fiberglass, Pultruded	1-1-1	1-1-1	2-2-2	3-3-4	1-1-1	1-1-1	1-1-1
Fiberglass, Spray-Up	1-1-1	2-2-2	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1
Acrylic Clear Sheet	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1
Acrylic, Molded	1-1-1	2-2-2	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1
ABS	2-2-2	4-4-4	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1
Polycarbonate Clear Sheet	2-2-2	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1
Polycarbonate, Silicone Coated	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	4-1-1	1-1-1
Polyester (PBT)	1-1-1	1-1-1	1-1-1	3-4-4	1-1-1	1-1-1	1-1-1
Polyester (PBT Glass Reinforced)	1-2-2	1-2-2	1-1-1	2-3-3	1-1-1	1-1-1	1-1-1
Gasket, Rubber Neoprene, Solid 51%	4-4-4	4-4-4	2-2-2	2-3-4	1-1-1	1-1-1	1-1-1
Gasket, Rubber Neoprene, Sponge	4-4-4	4-4-4	4-4-4	3-4-4	1-1-1	3-3-4	1-1-1
Gasket, Rubber Poron, Polyurethane Sponge	1-1-1	4-4-4	1-2-3	4-4-4	1-1-1	1-2-1	1-1-1
Gasket, Rubber Silicone, Sponge	4-4-4	4-4-4	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1
Gasket, Rubber Viton, Sponge	1-1-1	1-1-1	2-3-4	4-4-4	1-1-1	1-1-1	1-1-1
Gasket, foam-in-place	1-2-2	1-2-2	1-2-2	3-3-3		1-1-1	1-1-1
Aluminum, 5052	1-1-1	1-1-1	4-4-4	1-1-1	4-4-4	3-4-4	3-4-4
Monel	1-1-1	1-1-1	1-2-3	1-1-1	1-1-1	1-2-2	1-1-1
Steel, Cadmium Plate with Chromate	1-1-1	1-1-1	4-4-4	1-1-1	4-4-4	4-4-4	4-4-4
Steel, Epoxy Powder Coat, Painted	1-1-1	1-1-1	4-4-4	2-2-2	4-4-4	1-3-4	3-4-4
Steel, Enamel, Machinery, Over Prime, Painted	1-1-1	1-1-2	4-4-4	1-1-3	4-4-4	1-4-4	3-4-4
Steel, Galvanized, G-90	1-1-1	1-1-1	4-4-4	1-1-3	4-4-4	4-4-4	4-4-4
Steel, Grey Prime, Over Phosphate, Painted	1-1-1	1-1-1	4-4-4	1-1-2	4-4-4	3-4-4	3-4-4
Steel, Polyurethane Painted	1-1-1	1-1-1	4-4-4	4-4-4	4-4-4	3-4-4	4-4-4
Steel, Polyester Powder Painted	1-1-1	2-2-2	4-4-4	2-2-3	4-4-4	4-4-4	4-4-4
Steel, Stainless, Type 304	1-1-1	1-1-1	1-1-1	1-1-1	1-1-2	1-1-2	1-1-1
Steel, Stainless, Type 316	1-1-1	1-1-2	1-1-1	1-1-1	1-1-2	1-1-1	1-1-1

- 1 Recommended — Unaffected by chemical; no deterioration
- 2 Satisfactory — Very little effect; reduced aesthetics probable over time
- 3 Limited use — Chemical attack probable with slow deterioration
- 4 Not recommended — Severe attack is imminent; rapid deterioration.

	Solvents	Alkalis	Acids
Recommended	Stainless Steel Type 316 Stainless Steel Type 304 Fiberglass Aluminum Steel, Epoxy Powder Coated	Polyester ABS Stainless Steel Type 316 Stainless Type 304	Polycarbonate Polyester ABS Stainless Steel Type 316 Stainless Steel Type 304
Satisfactory		Fiberglass Polycarbonate	Fiberglass Steel, Epoxy Powder Coated
Limited Use		Steel, Epoxy Powder Coated Aluminum	Aluminum

Corrosion Resistance

A brief, general overview of the chemical resistance of various enclosure materials is presented in the chart on the left. Materials are rated on a scale of "Recommended" to "Limited Use" based on their performance in resisting corrosion from three classes of chemicals — solvents and organics, alkalis and oxidizers, and acids and neutral salts.

This chart is intended to provide a quick overview. It will allow you to make decisions on the feasibility of using certain enclosure materials in your environment. However, note that enclosure materials listed as "Limited Use" will perform well when exposed to certain specific corrosive agents within the three general classes. We recommend that you refer to the detailed Chemical Resistance Charts on the bottom of this page and on the next several pages for specific performance information based on your environmental conditions.

	Ammonium Hydroxide (25% sol.)	Ammonium Nitrate (10% sol.)	Ammonium Phosphate (10% sol.)	ASTM #1 Oil	ASTM #3 Oil	Axle Grease	Boric Acid (10% sol.)	Bromine Water	Calcium Chloride (10% sol.)	Calcium Hydroxide (10% sol.)	Calcium Sulfate (10% sol.)	Calcium Hypochlorite (10% sol.)	Carbolic Acid (25% sol.)	Carbon Tetrachloride	Tested Enclosure Material
4-4-4	1-1-4	2-4-4	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	3-3-3	1-1-1	1-1-3	1-1-1	1-1-3	3-3-3	1-1-1	Fiberglass, Compression Molded
4-4-4	1-2-4	1-2-2	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	3-4-4	1-1-1	2-3-4	4-4-4	1-1-1	Fiberglass, Pultruded
4-4-4	1-2-4	1-1-2	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	3-3-3	1-1-1	1-3-4	4-4-4	1-1-2	Fiberglass, Spray-Up
1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	3-3-3	1-1-1	1-1-1	1-1-1	1-2-2	4-4-4	4-4-4	Acrylic, Clear Sheet
1-1-1	1-1-1	1-1-1	1-2-2	1-1-1	1-1-1	1-1-1	1-1-1	3-3-3	2-2-2	1-1-1	1-1-1	1-1-3	4-4-4	4-4-4	Acrylic, Molded
1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	3-3-3	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	4-4-4	ABS
4-4-4	1-2-4	1-1-1	2-2-2	2-2-2	2-2-2	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	4-4-4	Polycarbonate Clear Sheet
4-4-4	1-1-4	1-1-1	1-2-2	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	3-4-4	1-1-1	4-4-4	4-4-4	4-4-4	Polycarbonate, Silicone Coated
1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-2-2	Polyester (PBT)
1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	2-2-2	1-1-1	1-1-2	1-1-1	1-2-2	4-4-4	1-1-4	Polyester (PBT Glass Reinforced)
3-3-3	1-1-1	1-1-2	3-3-3	4-4-4	1-3-3	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	3-3-3	2-4-4	Gasket, Rubber Neoprene, Solid 51%
3-3-4	1-1-4	4-4-4	1-1-2	4-4-4	1-2-3	1-1-1	1-1-1	4-4-4	1-1-1	4-4-4	1-1-1	4-4-4	4-4-4	4-4-4	Gasket, Rubber Neoprene, Sponge
1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	1-1-4	1-1-1	4-4-4	4-4-4	4-4-4	Gasket, Rubber Piron, Polyurethane Sponge
3-3-3	1-1-1	1-1-1	1-1-1	3-3-3	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	1-1-2	1-1-1	1-1-1	4-4-4	4-4-4	Gasket, Rubber Silicone, Sponge
4-4-4	1-1-4	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	3-3-3	Gasket, Rubber Viton, Sponge
1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-2-2	1-1-1	1-1-1	1-1-1	4-4-4	2-2-3	3-3-3	Gasket, foam-in-place
4-4-4	2-2-2	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	1-2-2	4-4-4	2-2-3	4-4-4	1-2-2	3-4-4	1-2-2	1-1-1	Aluminum, 5052
1-1-1	1-1-1	1-1-2	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1	2-2-2	1-1-1	1-1-1	Monel
4-4-4	4-4-4	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	4-4-4	1-2-2	2-4-4	2-2-3	4-4-4	3-4-4	1-1-1	Steel, Cadmium Plate with Chromate
4-4-4	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-2	1-1-4	2-2-4	4-4-4	4-4-4	1-1-1	Steel, Epoxy Powder Coat, Painted
4-4-4	3-4-4	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-4-4	2-2-3	2-2-4	4-4-4	4-4-4	1-1-4	Steel, Enamel, Machinery, Over Prime, Painted
4-4-4	4-4-4	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	4-4-4	4-4-4	4-4-4	4-4-4	4-4-4	4-4-4	1-1-1	Steel, Galvanized, G-90
4-4-4	3-4-4	2-2-4	1-1-1	1-1-1	1-1-1	1-4-4	4-4-4	4-4-4	4-4-4	1-4-4	4-4-4	4-4-4	4-4-4	4-4-4	Steel, Grey Prime, Over Phosphate, Painted
4-4-4	4-4-4	1-2-4	1-1-1	1-1-1	1-1-1	4-4-4	4-4-4	4-4-4	3-4-4	1-4-4	4-4-4	4-4-4	4-4-4	1-1-1	Steel, Polyurethane Painted
4-4-4	4-4-4	1-1-1	1-1-1	1-1-1	1-1-1	1-4-4	4-4-4	4-4-4	1-4-4	4-4-4	2-2-4	4-4-4	4-4-4	3-4-4	Steel, Polyester Powder Painted
1-1-1	1-1-1	1-2-2	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	4-4-4	1-1-1	1-1-1	1-1-1	2-2-2	1-1-1	Steel, Stainless, Type 304
1-1-1	1-1-1	1-2-2	1-1-1	1-1-1	1-1-1	1-1-1	1-1-1	4-4-4	1-1-1	1-1-1	1-1-1	2-2-2	1-1-1	1-1-1	Steel, Stainless, Type 316

Each chemical is also coded according to class.
The following code is located at the top of each chemical column.

- Solvents and organics
- Alkalis and oxidizers
- Acids and neutral salts

