

## Physical Properties of Nonmetallic Enclosures

Materials Typical Properties	ASTM Test Method	Compression Molded Polyester Fiberglass (SMC)	RTM Molded Polyester Fiberglass	Hand Lay-up Molded Polyester Fiberglass	Polycarbonate
Falling Dart Impact (lb - in)		300	500	450	600
Impact Strength (ft-lb/in) (Notched Izod)	D 256	15	30	30	12
IK Impact Rating (Joules)	IEC 62262	>10	>10	>10	>10
Flexural Strength (psi)	D 790	25,000	33,400	33,400	13,000
Tensile Strength (psi)	D 638	14,000	22,000	22,000	9,000
Compressive Strength (psi)	D 695	28,000	24,900	24,900	11,000
Water Absorption (%)	D 570	0.15	0.25	0.25	0.25
Specific Gravity	D 792	1.75	1.65	1.65	1.20
Shrinkage (in/in)	D 955	0.0016	0.0015	0.0015	0.007
Hardness (Barcol-Rockwell M-Shore A)	D 2583	60	62	62.5	75
Elongation (%)	D 638	2.05	2.07	2.07	7.00
Dielectric Strength (kV/in)	D 149	400	380	380	732
Arc Resistance (sec)	D 495	>180	188	>200	117
Flammability	UL 94	5VA	V-0	V-0	V-0
Heat Deflection (°F at 264 psi)	D 648	>500	428	428	266
Service Temperature (°F)		-40°F to 266°F	-40°F to 266°F	-40°F to 266°F	-31°F to 266°F
K Factor, Thermal Conductivity (BTU/hr/ft <sup>2</sup> /°F)	D 1269E	1.68	1.68	1.68	1.25
Thermal Expansion (10 <sup>-6</sup> in/in °F)	D 696	20	14	12	36
UV Rating	UL 746C	(f1)	(f1)	(f1)	(f1)
FIP Gasket Rating		-31°F to 190°F	-31°F to 190°F	-31°F to 190°F	-31°F to 190°F

### NEMA Type 4X Enclosures

An enclosure is a housing constructed to provide a degree of protection from accidental contact with the enclosed equipment and external environmental conditions. Electrical enclosures are available in metal and nonmetal options.

Standardizing enclosure performance is accomplished by use of rating systems of various organizations (NEMA, UL, CSA, and IEC) identifying an enclosure's ability to resist external environmental influences. These ratings have distinct differences even though they are intended to provide information in order to make a safer and informed product choice.

### MATERIALS

#### Fiberglass Reinforced Polyester (FRP) Enclosures

All FRP enclosures are listed under UL 50, UL 50E, and UL 508A standards, (CSA standard 22.2 No. 14). This type of enclosure is suitable for both indoor and outdoor use in corrosive environments and is resistant to UV degradation. Fiberglass (FRP) material shall meet UL 746C requirements with halogen-free and self-extinguishing characteristics.

Enclosures are constructed using a hot compression-molded process using Allied Moulded's proprietary ULTRAGUARD® material formulation, with a minimum of 20% fiberglass by weight. Fiberglass reinforced polyester exhibits high impact resistance, a superior range of temperature limits, excellent dimensional stability, excellent electrical properties, and excellent moisture and overall chemical resistance.

A cold molded hand lay-up gel-coat fiberglass process and/or resin transfer mold (RTM) process, may be used for larger cabinets, and has a high impact tolerance, with excellent overall strength.

### Polycarbonate Enclosures

All polycarbonate enclosures are listed under UL 50, UL 50E and UL 508A standards, (CSA standard 22.2 No. 94.1-07, 94.2-07). This type of enclosure is suitable for both indoor and outdoor use in corrosive environments and is resistant to UV degradation. Polycarbonate material shall meet UL 746C requirements with halogen-free and self-extinguishing characteristics.

Enclosure is constructed with an injection molded polycarbonate thermoplastic material. Polycarbonate material exhibits an acceptable UV rating, along with minimal shrinkage, and excellent stress rating.

### ALLIED ADVANTAGES

- Any external metal parts shall be 316 stainless steel. NEMA Type 4X enclosures are fabricated and rated specifically for resistance to corrosive elements.
- Advantages of nonmetallic enclosures:
  - (1) Unlike metals, fiberglass reinforced polyester (FRP) and polycarbonate are non-corrosive.
  - (2) Enclosures are very similar, thus they require little maintenance.
  - (3) Due to their light weight, nonmetallic enclosures can be very easily handled, installed and modified.
- Fiberglass reinforced polyester (FRP) and polycarbonate enclosures are the material of choice in applications where physical strength and excellent corrosion resistance is required.

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- Junction and Control enclosures may have either screw, hinged or latched covers. All cover screws and hardware; including hinges, latches and mounting feet are constructed of 316 stainless steel material. Gasket system shall be a Formed-In-Place (FIP) polyurethane for toughness and resistance to tear while maintaining a NEMA 4X and IP66 seal. All gaskets are seated in a molded channel and not glued or poured onto a flat cover surface.
- Cabinets and larger style enclosures are always provided with hinged doors. The closure systems on these cabinets will either

be a three point latching system or stainless steel twist-turn type latches. Door closure systems using a single external handle will also have three internal latch points. This handle may be key lockable or pad lockable. When using the alternative closure method of external stainless steel twist turn latches, no more than four latches shall be required to maintain NEMA Type 4X integrity. At least one latch must have a padlock provision.

## 316 Stainless Steel Hardware

*316 Stainless Steel Hardware Standard for all Enclosures*

Allied Moulded understands that not all stainless steel hardware is created equally. To endure harsh environments, a robust nonmetallic enclosure must also utilize hardware that exhibits the same corrosion-resistant properties. Many enclosure manufacturers have standardized the use of 300 series stainless steel hardware in their products, with 304 stainless steel being the most common. Allied Moulded has made the use of 316 stainless steel standard for all of its enclosure products' external hardware.

### What is Stainless Steel?

According to the Specialty Steel Industry of North America (SSINA)<sup>1</sup>, the term stainless steel applies to a group of iron based alloys containing a minimum 10.5% chromium. Other elements are added to the alloys to make different grades of stainless steel. There are many different grades that have varying corrosion resistance and other properties based on the ratio of elements used in the alloy. There are more than 50 grades of stainless steel.

### Corrosion Resistant Properties

The science behind the corrosion resistant properties of the various grades of stainless steel lies in the mixture and ratios of the different elements contained in the alloys. The chromium contained in the mixture alters the oxidation process that would make raw iron rust. Instead, the chromium forms a protective layer on the surface that resists oxidation. The added nickel (Grade 304 and 316) enhances this resistance. Alloys are made even stronger by the addition of molybdenum (Grade 316), which are used in applications where acetic, sulfuric and sulfurous acids may be present.

### Grade 304

Grade 304 is considered the basic stainless steel alloy. It is made up of 10% chromium and 8% nickel. As previously mentioned, it is the most common of the 300 series alloys. It has good corrosion resistance properties in most applications.

### Grade 316

Grade 316 also contains chromium (18%) and nickel (10%); however, it also contains at least 2% molybdenum. The addition of this element significantly increases its pitting and corrosion resistance properties, specifically with regard to chloride (salt) pollutants, which are found in coastal areas and de-icing applications, and potash which is found in agricultural fertilizer and chemical manufacturing. It also has wide application in water/waste water treatment plants, pulp and paper mills, and other environments with aggressive corrosive agents.



## FIP Gasket System

Allied Moulded's automated Formed-In-Place (FIP) polyurethane gasket system was designed to replace cord gaskets and is applied directly to the enclosure cover in a continuous channel. The new gasket provides protection from outdoor elements such as dirt, dust, oil, and water while providing a reliable seal from cover to base. The gasket will adhere to a variety of surfaces and cover finishes, allowing for a better seal and overall protection for your most critical electrical components.



## EMI/RFI Specifications

- Standards governing electromagnetic compatibility commonly refer to EMI/RFI, or electromagnetic interference/radio frequency interference.
- Applicable standards used are based on MIL-STD-285 to perform attenuation measurements of EMI/RFI shielded enclosures. The applicable North American standards for the overall assembly, including internal electronics, can vary with the application in which the product is intended to be installed.
- For a complete list of applicable standards, your local testing authority (for example, UL, CSA) should be contacted.
- Such interference is caused by stray voltages and/or currents coupling between electronic systems creating undesirable effects. These undesirable effects can vary between a brief annoyance, to more serious situations, such as a phone interfering with the controls of a machine tool. With the increased emphasis on electronic technology, electromagnetic interference/radio frequency interference is a growing concern.
- Electromagnetic pulses (EMPS) may adversely affect electronic and other control systems. These disturbances may cause erratic operation, and either component failure or a reduction in component life.
- Allied Moulded can provide custom EMI/RFI shielded enclosures to meet many applications. Requests for EMI/RFI shielded enclosures should be directed to the Allied Moulded customer support group.

## Properties

Shielding Material..... Copper Conductive Coating  
Attenuation..... 75 dB

## Sheet Resistance <.025 Ohms/Square @ 2 Mil Thick

The probes of an ohmmeter shall be placed on any area of the surface and the measured resistance shall not exceed .025 ohms.

## Attenuation 75 dB

A measure of the shielding effectiveness shall be confirmed by an EMI/RFI test. Actual test data confirmed an average attenuation of 75 dB over the frequency range from .01 to 1000 Mhz.

## MIL.SPEC>285

MIL.SPEC>285 is used as a general EMI/RFI test guide. A transmitting antenna is placed inside the enclosure and a receiving antenna is positioned outside. The attenuation is the dB difference between the enclosure OPEN and CLOSE FR power levels.

## Weathering/UV Information

Allied Moulded's FRP enclosures are hot compression-molded using Allied Moulded's proprietary ULTRAGUARD® material formulation. All products of this type, regardless of manufacturer, are exposed to erosion when used outdoors. Due to the combined effects of environmental elements such as rain, wind and UV rays, the polyester matrix is only superficially eroded and as glass fibers become apparent, the degree of the erosion is microscopic. Please note that this superficial erosion has no effect on the physical characteristics of the enclosure whether electrical, mechanical or chemical. The slight erosion can be avoided if a surface coating such as varnish is applied.

Allied Moulded's fiberglass enclosures have been successfully used outdoors and tests on field samples support above results. (F1 rated material—suitable for outdoor use)

## Painting Information

Good surface preparation is critical in painting fiberglass enclosures, since the mold release agents must be removed before painting. It is recommended that the surface be roughed by lightly rubbing with sandpaper before applying the proper primer. Degreasing the surface with an organic solvent such as alcohol or other domestic cleaning agent is required. The surface must be clean and dry prior to applying the appropriate primer and top coat (polyurethane or epoxy).

\*Should you feel the need to paint polycarbonate enclosures, please check for compatibility as polycarbonate material can be attacked by industrial solvents.

Allied Moulded has the capabilities to custom mold color matches specific to your requirements.

## Heat Dissipation

Information available upon request.

# Reduce Arc Flash Safety Hazards

## What is Arc Flash?

Arc flash explosion is often referred to as a flash of electrical current leaving its intended path, traveling from one conductor to another. Arc flash can be caused by dust, corrosion, faulty installation, condensation, and many other factors. Blast pressures can reach upwards of 2,000 lbs. / sq. ft, reach sounds of up to 140 dB, and high temperatures of up to 35,000 degrees F.

## What are we doing to help?

Allied Moulded wants to ensure the safe and proper use of enclosures, and to reduce the risk and eliminate damages caused by arc flash. Our engineers developed accessories to meet these requirements when an enclosure must be accessed for maintenance or monitoring. Often, enclosures are opened to check equipment, read gauges, or perform preventive maintenance. The use of Allied Moulded's HMI Cover Kits and Inspection Windows reduces the risk of arc flash. The use of these products allows access to components without opening the enclosure.