

Application Guide

Selection of Type Enclosures



Mission Statement

The purpose of this document is to educate the reader with regard to the definitions, performance, and applicability of various NEMA enclosure types. This will assist the specifier in the selection of the appropriate enclosure for their environment and application. Quick reference tables are included where applicable to consolidate data for straightforward comparisons. The goal is to familiarize users and specifiers with all ASCO enclosure offerings and increase comfort level in making the proper recommendations or purchase decisions. This helps eliminate costly modifications and rework potentially required when an improper enclosure is selected for the intended use of a switch switchgear lineup. It is essential that the reader be aware of the environmental conditions that exist at the site in question, understand the capabilities of each type of enclosure, and available ASCO solutions.

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Industry Standard Terms

Corrosion-Resistant

Constructed to provide a degree of protection against exposure to corrosive agents such as salt spray. Type 3RX and 4X enclosures meet this requirement.

Damp Locations

Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses. Indoor enclosure types with a rating type that fits the specific application are typically acceptable.

Dust – Tight

Constructed to prevent circulating or airborne dust from entering the enclosure under specified test conditions. Type 1A enclosures formerly addressed these conditions, but that classification has become obsolete. Type 12 enclosures are now typically used for this purpose. Type 4 and 4X will also comply, but at a premium cost.

Drip – Tight

Constructed so falling moisture or dirt does not enter the enclosures under specified test conditions. Type 4, 4X, and 12 enclosures meet this requirement.

Indoor

Not to be exposed to weather. Type 1 and 12 enclosures meet this requirement.

Oil – Resistant

Constructed so that oil will not interfere with successful operation of equipment. Type 12 enclosures meet this requirement

Outdoor

Constructed or protected so that exposure to the weather will not interfere with successful operation of equipment. Type 3R, 3RX, 4, and 4X enclosures meet this requirement. Enclosures with these ratings may also be used indoors if desired.

Rainproof

Constructed, protected, or treated to prevent beating rain from interfering with the successful operation of the apparatus, or resulting in wetting of live parts and wiring within the enclosure under specified test conditions. Type 3R and 3RX enclosures meet this requirement.

Rain–Tight

Constructed or protected so beating rain will not result in water entering the enclosure under specified test conditions. Type 4 and 4X enclosures meet this requirement.

Water–Tight

Constructed so moisture will not enter the enclosure when it is subjected to a stream of water under specified test conditions. Type 4 and 4X enclosures meet this requirement.

Weatherproof

Constructed or protected so exposure to the weather will not interfere with successful operation of the equipment. Rainproof, rain–tight, or water–tight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

Wet Locations

Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather. Use weatherproof enclosures with a type rating that fits the specific application.

There are other types of enclosures not covered by this glossary of definitions. The focus of this document is on enclosures applicable to equipment of the types supplied by ASCO.

Definitions

(From UL 50 Twelfth Edition – 2007)

Enclosure definitions are listed in order of their applicability, from the least hazardous environmental conditions to the most severe:

Type 1 – Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dirt.

Type 12 – Constructed (without knockouts) for indoor use to provide protection against falling dirt; against circulating dust, lint, fibers, and flyings; against dripping and light splashing of non-corrosive liquids; and against light splashing and consequent seepage of oil and non-corrosive coolants

Type 12 enclosures are oil-resistant, and constructed so oil will not interfere with successful operation of equipment. They are not oil-tight, which means oil could enter a Type 12 enclosure under certain conditions.

Type 3R – Constructed (with knockouts on the sides and bottom) for either indoor or outdoor use to provide protection against falling dirt, rain, sleet, snow, and windblown dust. Will be undamaged by the external formation of ice on the enclosure.

Type 3R enclosures are rainproof which means they are constructed, protected, or treated to prevent beating rain from interfering with the successful operation of the apparatus or result in wetting of live parts and wiring within the enclosure under specified conditions. They are not rain-tight, which means exposure to beating rain could result in water entering a Type 3R enclosure under certain conditions; nor are they water-tight, which means moisture could enter a Type 3R enclosure when subjected to a stream of water under certain conditions

ASCO standard Type 3R enclosures are fabricated from cold rolled steel, a low - carbon, cold-finished steel produced by passing bar stock through a set of rollers.

Type 3RX – Similar to Type 3R, except for additional provisions for a degree of protection against corrosion.

ASCO standard Type 3RX enclosures are fabricated from 304 grade stainless steel for both ATS and SEATS products. 316 grade stainless steel, which offers additional corrosion protection for severe environments, is an option.

Type 4 – Constructed for either indoor or outdoor use to provide protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water. Will be undamaged by the external formation of ice on the enclosure.

Type 4X – Same as Type 4 except constructed from corrosion-resistant material. Corrosion-resistant as defined by industry standards is: Constructed to provide a degree of protection against exposure to corrosive agents such as salt spray.

Stainless steel is the strongest of the corrosion resistant materials. It exhibits many of the same resistances attributed to fiberglass materials as well as resistance to highly polar solvents such as acetone and MEK.

316 grade stainless steel is an option that provides improved resistance to salt, some acids, and high temperature. 316 grade is a strongly recommended choice for marine environments which are within 5 miles of salt water or otherwise subject to exposure to salt spray. Note that 316 grade resistance to sulfates and chlorine is less than that provided by 304 grade. .

Fiberglass is also an option that meets Type 4X criteria.

Cautionary note: Stainless steel of any type is not “stain-free”, and while it offers a high degree of performance, under certain environmental conditions it remains susceptible to rust deposits on the surface. These deposits are often created by contamination resulting from rain or marine environments. Periodic cleaning of the surfaces of stainless steel enclosures with a neutral solution is recommended to avoid “tea staining”.

Typical Enclosure Applications

Type 1

Climate Controlled Indoor Shelters
Indoor Security and Fire Applications
Low Contamination Electrical Rooms
Office and Indoor Warehouse Environments

Type 3R / Type 12

Wireless Telecommunications
Security and Fire Applications
Utility Applications

Type 4

Cement Plants
Diaper Manufacturing
Outdoor Plants, Buildings in Dry, Desert, Arid Areas – Military Bases
Rubber Tire Manufacturing and Retreading
Industrial Plants

Type 4X

Marine Duty Applications
Waste Water Treatment Facilities
Bottling Plants
Pulp and Paper Applications
Pharmaceuticals, and Clean – Room Production Rooms
Health and Hospital
Cosmetic Compounding and Manufacturing
Petroleum and Chemical Processing

Reference Tables For Indoor And Outdoor Locations

Comparison of Specific Non-Hazardous Applications in Indoor Locations

Provides a Degree of Protection Against the Following Environmental Conditions	Enclosure Type			
	1 ¹	4	4X	12
Incidental contact with the enclosed equipment	•	•	•	•
Falling Dirt	•	•	•	•
Falling Liquids and Light Splashing		•	•	•
Dust, Lint, Fibers, and Flyings ²		•	•	•
Hose - Down and Splashing Water		•	•	
Oil and Coolant Seepage				•
Oil or Coolant Spraying and Splashing				
Corrosive Agents			•	
Occasional Temporary Submersion				

1. These enclosures may be ventilated, however Type 1 may not provide protection against small particles of falling dirt when ventilation is provided in the enclosure top.
2. These fibers and flyings are non - hazardous materials and are not considered Class II type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings see the National Eletrical Code Section 505.

Reference Tables For Indoor And Outdoor Locations

Comparison of Specific Non-Hazardous Applications in Outdoor Locations

Provides a Degree of Protection Against the Following Environmental Conditions	Enclosure Type			
	3R ¹	3RX ¹	4	4X
Incidental contact with the enclosed equipment	•	•	•	•
Rain, Snow, and Sleet ²	•	•	•	•
Sleet ³				
Windblown Dust			•	•
Hose - Down			•	•
Corrosive Agents		•		•
Occasional Temporary Submersion				

1. These enclosures may be ventilated
2. External operating mechanisms are not required to be operated when the enclosure is ice covered
3. External operating mechanisms are operable when the enclosure is ice covered

The preceding tables are excerpts from the National Electrical Manufacturers Association (NEMA) Standards Publication 250 *“Enclosures for Electrical Equipment (1000 Volts Maximum)”*, and UL 50 Twelfth Edition Dated September 4, 2007 *“Enclosures for Electrical Equipment, Non – Environmental Considerations”*.

Enclosure Type vs. IP Rating

(U.S, Standard vs. European)

Electrical enclosures are rated by type, either (NEMA 250/UL50) and/or IP rated (IEC 60529). Type ratings and IP ratings have only the following in common:

- 1 A degree of protection for persons from hazardous components inside the enclosure
- 2 A degree of protection for equipment inside the enclosure from ingress (entrance/access) of solid foreign objects, including dust
- 3 A degree of protection for equipment inside the enclosure from ingress (entrance/access) of water

NEMA 250 and UL 50 type-rating documentation defines additional requirements a type-rated enclosure must meet. These include:

- Mechanical impact on enclosure walls
- Gasket aging and oil resistance
- Corrosion resistance
- Door and cover latching requirements
- Sheet metal gauge construction requirements (UL 50 only)

Electrical enclosures that carry only an IP rating have not been designed to meet additional type rating requirements. Therefore, a type rating cannot be assigned to an enclosure that has only been IP rated.

ASCO does not provide enclosures designed only to IP rating requirements.

The preceding paragraphs are excerpts from the Industry Standard's section of the Hoffman Enclosure Specifier's Guide, Volume 21.

For more detailed information refer to the Hoffman Specifier's Guide Volume 21, available at <http://www.hoffmanonline.com/>

Material and Paint Finishes

Powder Paint Process Flow

The following describes the powder paint procedure utilized for enclosures fabricated in-house by ASCO and not third party suppliers.

Enclosure parts enter a seven stage washing system consisting of three chemical treatments and four rinsing baths. Stages of chemical treatment are:

First Stage: ParcoCleaner ZX4 4% Solution
Fourth Stage: Bonderite NTI 3% Solution
Seventh Stage: Parcolene 7100 Sealer 5% Solution

A rinse is performed after each above chemical treatment. Upon completion of the wash/chemical treatment the parts go through a dry-off oven, which removes all excess moisture and prepares the parts for the application of powder paint .

Paint can either be applied manually or automatically. ASCO standard ANSI 61 gray is applied on an automated line. For other colors, an operator applies the paint to conveyor-fed parts in a manual spray booth, evenly coating all surfaces. Line speed is dependent upon the oven cure temperature, and can be slowed down to allow the operator to ensure the parts are uniformly coated. There is no re-use of excess powder, so paint color can be changed without the risk of contamination of subsequent parts.

The majority of powder painted parts are treated in an automated paint booth. As conveyor-fed parts proceed through the booth, electric sensors determine the approximate size and shape of the part and select an appropriate paint gun to spray the part, minimizing excess discharge of paint. Based on a timed sequence, the powder paint guns begin to discharge the paint. Discharge remains continuous until the part has completely passed the last gun, ensuring total and uniform coverage.

Parts then enter the curing oven; temperature is set appropriately with the paint manufacturer's specifications. The heat transforms the powder into a semi – liquid state which flows to uniformly coat the parts. Parts air cool before being removed from the conveyor, allowing the paint to completely solidify.

The following quality tests are performed at specified sampling intervals, to assure process qualification and consistency:

Visual Quality	Paint Adhesion
Paint Thickness	Curing Oven Temperature
Impact Test	(Performed by powder paint supplier or manufacturer)
Neutral Salt Spray	(Performed by outside source)


Chemical Resistance Chart




	Solvents	Alkalis	Acid
Recommended	Stainless Steel Grade 316	Polyster	Polycarbonate
	Stainless Steel Grade 304	ABS	ABS
	Aluminum	Stainless Steel Grade 316	Stainless Steel Grade 316
	Steel Epoxy Powder Coated	Stainless Steel Grade 304	Stainless Steel Grade 304
Satisfactory	Polycarbonate	Fiberglass	Fiberglass
	ABS	Polycarbonate	Steel, Epoxy Powder Coated
Limited Use		Steel, Epoxy Powder Coated	
		Aluminum	Aluminum

The chart above is intended to provide a brief overview of enclosure performance in resisting corrosion from three classes of chemicals, solvents and organics, alkalis, and oxidizers, and acids and neutral salts. Materials are rated on a scale from “Recommended” to ‘Limited Use”. For detailed chemical resistance charts refer to the Hoffman enclosure catalog under Technical Information, pages T1 -11 found at www.hoffmanonline.com

The preceding chart is excerpted from the Hoffman Enclosure Specifier’s Guide, Volume 2

ASCO Enclosure Solutions

Product	Enclosure Type				
	Indoor		Outdoor		
	1	12	3R	4	4X
 <p style="text-align: center;">185</p>	14 Gauge Steel Finish: RAL 7035 Light Gray Polyester Powder Coat	N/A	12 Gauge Aluminum Alloy for 100 – 230A 0.102" thick for 260–400A. Finish: RAL 7035 Light Gray Polyester Powder Coat	N/A	N/A
 <p style="text-align: center;">185SE</p>	14 Gauge Steel Finish: RAL 7035 Light Gray Polyester Powder Coat	N/A	0.10" thick Aluminum Alloy for 200A 0.102" thick for 400A Finish: RAL 7035 Light Gray Polyester Powder Coat	N/A	N/A
 <p style="text-align: center;">300</p>	12/14 Gauge Steel for 600A 12 Gauge Steel for 800–2000A Code Gauge Steel For Switch Ampere Sizes 30–230, 260–400, 2600–3000A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge Steel for 600A 12 Gauge Steel for 800–1600A N/A for 2000 – 3000A Code Gauge Steel For Switch Ampere Sizes 30–230, 260–400A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge Steel for 600A 12 Gauge Steel for 800–2000A N/A for 2600 – 3000A Code Gauge Steel For Switch Ampere Sizes 30–230, 260–400A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge Steel for 600A 12 Gauge Steel for 800–1200A N/A for 2000 – 3000A Code Gauge Steel For Switch Ampere Sizes 30–230, 260–400, and 1600A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge 304 Stainless Steel for 230–400A, 600A 12 Gauge 304 Stainless Steel for 800–1000A. N/A for 1200 – 3000A Code Gauge 304 Stainless Steel For Switch Ampere Sizes 30–230A 316 Grade Stainless Steel optional Finish: Polish

Product	Enclosure Type				
	Indoor		Outdoor		
	1	12	3R	4	4X
 <p>300SE</p>	Code Gauge Steel for 70–3000A Finish: ANSI 61 Gray Polyester Semi Gloss Electrostatic Powder Coat	N/A (Use Type 3R)	Code Gauge Steel for 70–3000A Finish: ANSI 61 Gray Polyester Semi Gloss Electrostatic Powder Coat	Code Gauge Steel for 70–1000A N/A 1200–3000A Finish: ANSI 61 Gray Polyester Semi Gloss Electrostatic Powder Coat	Code Gauge 316 ¹ Stainless Steel for 70–1000A N/A 1200–3000A Finish: Polish
 <p>4000/7000</p>	12 Gauge Steel for 1200A Code Gauge Steel for 30–1000 & 1600–4000A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge Steel for 260–600A 12 Gauge Steel for 800–1000A Code Gauge Steel for 30–230, 1200, & 1600A N/A 2000–4000A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge Steel for 260–600A 12 Gauge for 800–1000A Code Gauge Steel for 30–230 & 1200–4000A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge Steel for 260–600A 12 Gauge Steel for 800–1000A Code Gauge Steel for 30–230, 1200, & 1600A N/A 2000–4000A Finish: Light Gray (ANSI 61) Powder Coat	14 Gauge 304 Stainless Steel for 260–600A 12 Gauge 304 Stainless Steel for 800–1000A Code Gauge 304 Stainless for 30–230, 1200, & 1600A N/A 2000–4000A 316 Stainless is Optional Finish: Polish
 <p>7000SE</p>	Code Gauge Steel for 70–4000A Finish: ANSI 61 Gray Polyester Semi Gloss Electrostatic Powder Coat	N/A (Use Type 3R)	Code Gauge Steel for 70–4000A Finish: ANSI 61 Gray Polyester Semi Gloss Electrostatic Powder Coat	Code Gauge Steel for 70–1000A N/A 1200–4000A Finish: ANSI 61 Gray Polyester Semi Gloss Electrostatic Powder Coat	Code Gauge 316 ¹ Stainless Steel for 70–1000A N/A 1200–3000A Finish: Polish

Note 1: The ASCO standard Type 4X enclosures are fabricated from 304 stainless steel. This is a Corrosion resistant iron – based alloy containing between 18% and 20% chromium.

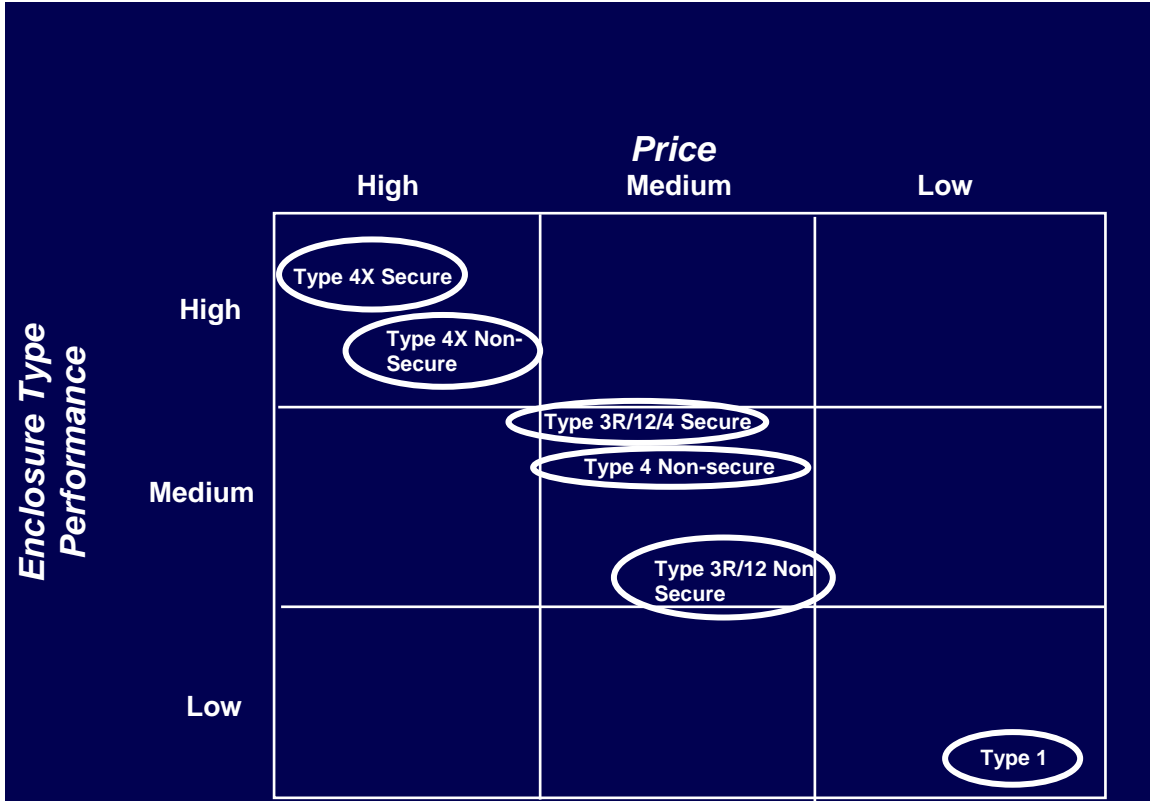
316 grade stainless steel is the ASCO standard for 4X enclosures for 3AUS and 7AUS Service Entrance switches. 316 grade stainless steel has a higher chemical composition of nickel, chromium, and molybdenum than 304 grade, providing increased corrosion resistance to chlorides and many common industrial chemicals. It is frequently specified by customers, especially for waste water treatment plant requirements. 316 grade stainless steel is ideal for wet locations, and in areas where caustic elements are present, since it is a superior material choice for these types of environments and ideal for marine applications. It is strongly recommended for any outdoor application which is within 5 miles of salt water or otherwise subject to salt spray.

2. The ASCO standard Type 3R enclosures are fabricated from cold rolled steel, a low carbon, cold – finished steel produced by passing bar stock through a set of rollers.

The ASCO standard Type 3RX enclosures are fabricated from 304 grade steel for both ATS, and SEATS products. 316 grade stainless steel, which offers additional corrosion protection for severe environments, is an option.

Performance Matrix

Price vs. Performance Enclosure Type Matrix



Enclosure Selection Fast Facts

Examples Of Answers To Frequently Asked Specification Questions

Example 1

Question: Is the enclosure intended to be mounted in an **indoor** location?

Answer: Yes

Question: What type of environmental conditions exist?

Answer:

- Incidental contact with the enclosed equipment
- Falling dirt

Enclosure Recommendation: **Specify Type 1**

Note: Type 4, 4X, and 12 will also meet these requirements, but are not necessary since they exceed the environmental conditions indicated..

Example 2

Question: Is the enclosure intended to be mounted in an **indoor** location?

Answer: Yes

Question: What type of environmental conditions exist?

Answer:

- Incidental contact with the enclosed equipment
- Falling Dirt
- Falling Liquids and Light Splashing
- Dust, Lint, Fibers, and Fyings
- Hose-Down and Splashing Water

Enclosure Recommendation: **Specify Type 4**

*Note: Type 4X (Stainless Steel) will also meet the requirements and provide additional protection against "**Corrosive Agents**". Type 12 will also meet the requirements **except** for the **Hose – Down and Splashing Water**, but will provide added protection against "**Oil and Coolant Seepage**".*

Example 3

Question: Is the enclosure intended to be mounted in an **indoor** location?

Answer: Yes

Question: What type of environmental conditions exist?

Answer:

- Incidental contact with the enclosed equipment
- Falling Dirt
- Falling Liquids and Light Splashing
- Dust, Lint, Fibers, and Fyings
- Hose-Down and Splashing Water
- **Corrosive Agents**

Enclosure Recommendation: **Specify Type 4X (304 Grade Stainless Steel)**

Note: The ASCO standard grade of stainless steel is 304. 316 is optional but not necessarily required for indoor applications, except where exposure to harsh chemical, acid, or alkali conditions may apply.

Example 4

Question: Is the enclosure intended to be mounted in an **indoor** location?

Answer: Yes

Question: What type of environmental conditions exist?

Answer:

- Incidental contact with the enclosed equipment
- Falling Dirt
- Falling Liquids and Light Splashing
- Dust, Lint, Fibers, and Fyings
- **Oil and Coolant Seepage**

Enclosure Recommendation: **Specify Type 12**

Example 5

Question: Is the enclosure intended to be mounted in an **outdoor** location?

Answer: Yes

Question: What type of environmental conditions exist?

Answer:

- Incidental Contact with the Enclosed Equipment
- Rain, snow, and sleet

Enclosure Recommendation: **Specify Type 3R**

Note: Type 3RX, 4, and 4X will also meet the requirements, but not are necessary since they exceed the environmental conditions indicated.

Example 6

Question: Is the enclosure going to be mounted in an **outdoor** location?

Answer: Yes

Question: What type of environmental conditions exist?

Answer:

- Incidental Contact with the Enclosed Equipment
- Rain, snow, and sleet
- Windblown Dust
- Hose Down

Enclosure Recommendation: **Specify Type 4**

*Note: Type 4X (Stainless Steel) will also meet these requirements, and provide additional protection against “**Corrosive Agents**”*

Example 7

Question: Is the enclosure going to be mounted in an **outdoor** location?

Answer: Yes

Question: What type of environmental conditions exist?

Answer:

- Incidental Contact with the Enclosed Equipment
- Rain, snow, and sleet
- Windblown Dust
- Hose Down
- Located 4 Miles From Salt Marsh Shoreline

Enclosure Recommendation: **Specify Type 4X (316 Grade Stainless Steel)**

Note: The ASCO standard grade of stainless steel is 304. 316 is optional but highly recommended for outdoor applications where exposure to marine air may be present, to avoid discoloration.