White Paper

Selecting Secure Enclosures to Protect Equipment from Ultraviolet Radiation

ASCO®

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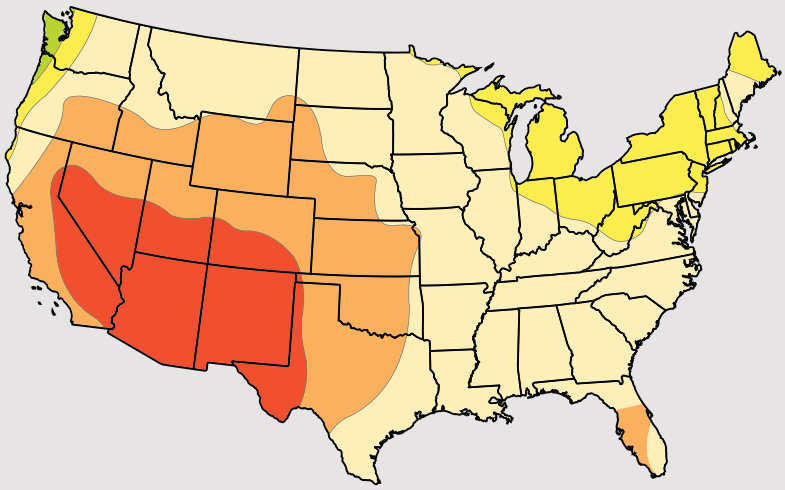
The selection of an enclosure for an Automatic Transfer Switch (ATS) is driven by many factors, including cost, security, and most significantly, the environment in which the switch will operate. When deployed in outdoor environments, transfer switches can be placed in single-door non-secure enclosures with external displays or controls; or in secure, double-door ("door-over-door") enclosures, where controls are mounted behind a locking external door. The following sections describe the advantages offered by each design as well as the materials that can be used to obtain maximum value from each enclosure application.

Prolonged Exposure to Intense Sunlight is Cause for Real Concern

When specifying enclosures, engineers and designers should evaluate the likelihood of exposure to extreme weather such as intense rain, snow storms, and intense sunlight. However, exposures to sunlight and the resulting heat gain are often overlooked when non-secure enclosures are selected. The effects of ultraviolet (UV) radiation and heat from intense sunlight are driven by several variables including:

- Amount of solar radiation received over time
- Enclosure color and/or material type
- User interface design and materials
- Highest sustained atmospheric temperature
- Heat buildup from internal components
- Heat reflected from the surrounding environment



Exposures to solar radiation vary greatly across the United States. Figure 1 shows that the Southwest experiences the greatest solar radiation exposures. In some areas, solar radiation alone can cause ambient air temperatures to exceed 104° F.

High UV radiation levels, extreme temperatures, and conditions such as elevated humidity, high altitude, and air pollution, may increase the rate of degradation of display and control materials. When the integrity of these materials is compromised, water intrusion could occur, impacting reliability.

Figure 1: In the continental United States, solar radiation exposure is greatest in the southwest region.[1]

[1] National Resource Energy Laboratory, United States Department of Energy. Maximum Solar Radiation Per Month.

The key to selecting an appropriate enclosure is proper assessment of environmental conditions at the deployment location, and understanding the various enclosure types and materials that are available.

Non-Secure Enclosures

Non-secure enclosures are constructed with a single door that provides access to the transfer switch (Figure 2). Controls and displays are mounted in the door panel, and thus are exposed directly to sunlight, precipitation, and other environmental conditions. Non-secure enclosures are less expensive than secure enclosures.

When specifying non-secure enclosures, it is important to understand that any controls and displays will be unprotected from sunlight, which could make reading and operation difficult. If a non-secure enclosure is used, a shed-style cover can be added to protect displays and controls and to make viewing and operation easier. These shades are available from accessory manufacturers. However, this solution may not fully protect equipment from other environmental concerns such as wind-blown rain or snow.

Although single-door enclosures may be equipped with locks, they allow unrestricted access to controls and may not prevent unauthorized personnel from tampering with or vandalizing equipment. When non-secure enclosures are deployed, security risks can be reduced by ensuring that controllers are password-protected.

Figure 2: A non-secure, single-door, Type 3R enclosure. The controls are exposed to the environment and accessible to anyone.

Secure Enclosures

Secure enclosures feature door-over-door construction (Figure 3). The controls and displays are mounted on the inner door secured by an outer door. This configuration protects the controls and displays from direct exposure to precipitation and sunlight, limiting degradation of control and display materials.

Figure 3: These views show the double-door construction of a secure Type 3R cabinet. When fully closed and secured, the controls are protected from UV exposure and unauthorized access.

The outer door is lockable to prevent unauthorized personnel from accessing controls and displays. While the cost of a secure enclosure is incrementally higher than the cost of a non-secure enclosure, secure enclosures can enhance equipment security and extend service life, especially where levels of solar radiation are greatest.

Other Aspects of Equipment Protection

In addition to UV exposure and equipment security, other factors must also be considered when selecting ATS enclosures. Equipment is routinely deployed in settings ranging from protected indoor locations with controlled environments to outdoor locations subject to extreme conditions. These conditions include wind-blown dust and wind-driven rain as well as snowfall, ice formation, and exposure to corrosive substances.

Enclosures Types

In order to ensure reliable equipment operation, enclosures are available in a range of types. Underwriters Laboratories (UL) has issued enclosure standards. Of the 16 enclosure types described in UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations, six types cover the most common ATS applications. These are summarized in the following table.

Select Enclosure Types - UL 50

Type	Description
1	Indoor. Protects people from hazardous parts and equipment from foreign objects.
3R	Indoor or outdoor. Protects people from hazardous parts and equipment from foreign objects such as falling dirt, rain, sleet, and snow. Equipment will remain undamaged by the formation of ice on the exterior surfaces.
3RX	Type 3R characteristics plus an extra measure of protection against corrosion.
4	Indoor or outdoor applications. Protects people from hazardous parts and equipment from foreign objects such as falling dirt, windblown dust, rain, sleet, snow. Protects against splashing water and hose-directed water. Equipment will remain undamaged by the formation of ice on the exterior.
4X	Type 4 characteristics plus an extra measure of protection against corrosion.
12	Indoor, without knockouts. Protects people from hazardous parts and equipment from foreign objects such as falling dirt and circulating dust, lint, fibers, and flyings. Also protects from ingress of water due to dripping and light splashing as well as light splashing and consequent seepage of oil and non-corrosive coolants.

Proper assessment of environmental conditions at planned equipment locations facilitates the selection of appropriate ATS enclosures. The six types described in the table cover the majority of weather and usage conditions to which ATSs could be subject. Additional information about less common enclosure types may be found in the UL 50 standard.

Enclosure Materials

While the listed enclosure types address most applications, manufacturers offer models in more than one material. While steel is suited for several enclosure types, Type 3RX and Type 4X (Stainless Steel) enclosures are available in both Type 304 and Type 316 grade steel. The less expensive Type 304 steel is suited for many outdoor applications. Because it contains molybdenum, Type 316 provides additional protection against corrosive salts and chemicals. Type 316 stainless steel can provide the best protection when ATSs will be located in coastal marine environments, at sites near roadways where seasonal deicing salts are used, and at industrial facilities where corrosive chemicals are used.

Summary

Non-secure enclosures provide basic protection for ATSs. However, non-secure enclosures leave displays and controls exposed to the surrounding environment and to unauthorized access. In areas of intense sunlight, exposure to high levels of ultraviolet radiation can degrade displays and control interfaces.

When significant solar exposure is likely, secure double-door enclosures should be specified to protect displays and controls, enhance reliability, and extend service life. Double-door enclosures also provide additional protection from access by unauthorized personnel.

Enclosures are available in design types that mitigate risk from weather conditions, and in materials that resist corrosion. Engineers and designers should fully understand potential equipment exposures to select the best enclosure for the equipment location.

ASCO Power Technologies - Global Headquarters
160 Park Avenue
Florham Park, NJ 07932
Tel: 800 800 ASCO
customercare@ascopower.com

www.ascopower.com

www.ascoapu.com

ASCO. Innovative Solutions.