



Photovoltaic Fuse Holders

How much do you know about photovoltaic fuse holders?

As the market for solar energy continues to grow, the technology and equipment used to harness and distribute photovoltaic power continues to evolve. Output efficiencies have improved, systems are more reliable, and installations have become safer.

Over these past several years, Mersen has invested countless resources, expertise, and initiative contributing toward developing the proper codes, standards, and products mandated by this emerging industry. Research prepared by Mersen will deliver a higher level of understanding for solar photovoltaic system behavior, potential fault conditions, and how to prevent these same fault conditions from damaging your installation.

Question 1:

In 2007 Underwriters Laboratories (UL) published a new product standard for Photovoltaic fuses, UL 2579. Recently UL published an additional standard for photovoltaic fuse holders to be used in conjunction with UL 2579. What standard was it?

- A. UL 248
- B. UL 1741
- C. **UL4248-18**
- D. UL 489

Explanation of Question 1

UL 4248, section 18, officially titled "Fuseholders - Part 18: Photovoltaic" was first released as an outline of investigation in March 2010. Since its inception, and with the help of many industry experts including Mersen, UL 4248 section 18 is now in its second revision which was released in July 2010. Historically, specifying engineers, integrators, and installers have been using circuit protection components and solutions that were originally designed for AC power and control applications. Although these products performed as needed they were not necessarily the optimal solution for photovoltaic applications. UL 4248 section 18 is a product standard written specifically for fuse holders intended to be used in conjunction with photovoltaic fuses for optimal circuit protection. This standard makes it easier for users to select the proper products quickly and confidently. It also gives fuse holder manufacturers the ability to obtain a UL Listing on fuse holders for voltages up to 1500 Volts DC, which was not possible under prior standards.

Question 2:

USE-2 wire or listed and labeled PV Wire is required per NEC Article 690.31(B) in exposed outdoor locations in photovoltaic source circuits for PV module interconnections within the array. What is the insulation temperature rating of this wire type?

- A. 60°C
- B. 75°C
- C. **90°C or greater**

Explanation of Question 2

Due to the elevated temperatures and exposure to a variety of environmental conditions, the insulation of the PV module interconnection conductors must be sunlight resistant and

rated for wet and dry locations at 90°C. This is required to ensure a safe and reliable installation over the life of the PV installation.

The allowable ampacity of 90°C conductors versus 60° or 75°C conductors is greater. This allows system designers the ability to use smaller, PV-rated wires, saving on system material and labor costs of installation as well as mitigate temperature de-rating coefficients of the conductors.

However, the advantages of 90°C conductors can only be realized if 90°C rated wire terminals are in use. Typical wire terminal temperature ratings of fuse holders, disconnect switches, and power distribution blocks are 75°C, forcing designers to de-rate the ampacity of their conductors to the 75°C allowable ampacity.

Mersen photovoltaic fuse holders not only conform to the requirements of UL standard 4248-18, but offer the additional feature of 90°C wire terminal ratings. Mersen photovoltaic fuse holders optimize your PV installation and eliminate the requirement to de-rate conductor ampacity, saving you material and installation costs.

Question 3:

True or False: When more than three fuse holders are mounted beside each other in a string combiner, a temperature de-rating coefficient must be applied to the string fuse ampere rating?

- A. True
- B. False

Explanation of Question 3

Under normal operating conditions, heat generated by the fuses can be transferred to adjacent fuse holders. Fuse holders in the center of the arrangement will be exposed to heat generated by fuses on both sides, creating a hot spot. This excess heat can cause fuses to open prematurely if not properly sized for the application and installation.

When sizing fuses for photovoltaic string combiner box applications where string fuse holders are mounted beside each other you must take into account an additional temperature de-rating coefficient. The following table represents Mersen's recommended de-rating coefficient for multiple fuse holders:

Number of Poles	Coefficient
1 - 2 - 3	1
4 - 5 - 6	0.8
7 - 8 - 9	0.7
> 10	0.6

If you wish to avoid de-rating the fuse ampere rating due to multiple fuse holders mounted beside each other, simply install the fuse holders with an air gap of 5mm. This air gap will allow for enough heat dissipation between fuse holders, eliminating the need for additional temperature de-rating factors.