

Photovoltaic Fuseholders

How much do you know about photovoltaic fuseholders?

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 fuseholders 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

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 fuseholders 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 fuseholder manufacturers the ability to obtain a UL Listing on fuseholders for voltages up to 1500 Volts DC, which was not possible under prior standards.

Mersen offers UL Listed Photovoltaic fuseholders, rated up to 1000 Volts DC for both photovoltaic string and array protection applications. The UltraSafe HEL series accommodates Midget class photovoltaic fuses rated up to 32A, 1000 Volts DC maximum. The HPJ series accommodates Class J type photovoltaic fuses rated up to 600A, 1000 Volts DC maximum.

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

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 fuseholders, 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 fuseholders not only conform to the requirements of UL standard 4248-18, but offer the additional feature of 90°C wire terminal ratings. Mersen photovoltaic fuseholders 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 fuseholders 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

Under normal operating conditions, heat generated by the fuses can be transferred to adjacent fuseholders. Fuseholders 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.

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Photovoltaic Fuseholders (continued)

When sizing fuses for photovoltaic string combiner box applications where string fuseholders 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 fuseholders:

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 fuseholders mounted beside each other, simply install the fuseholders with an air gap of 5mm. This air gap will allow for enough heat dissipation between fuseholders, eliminating the need for additional temperature de-rating factors.

Additional Resources

- Photovoltaic Protection Note 1: Ground Fault Analysis and Protection in PV Arrays
- Photovoltaic Protection Note 2: Line-Line Fault Analysis and Protection in PV Arrays
- Photovoltaic Protection Note 4: UL 2579 Fuses of Photovoltaic Systems
- Photovoltaic Protection Note 5: Sizing Fuses for Photovoltaic Systems per the National Electrical Code
- Solar Power Product Solutions Guide
- Solar Power Product Overview Brochure
- Solar Power Protection PIQ Quiz
- New Standards in Solar Power Protection PIQ Quiz