



Integrated vs. Sidemount Surge Protective Devices – Dispelling the Hoaxes

Application Note

Introduction

There has been a recent increase in the number of false and misleading marketing documents that imply or state that surge protection integrated into distribution equipment such as panelboards or switchboards is dangerous or ineffective. This document is designed to dispel the many hoaxes and false statements relating to this claim with responses containing factual information. The truth is that integrated versions of surge protective devices (SPDs) provide many performance and functional advantages over their sidemount counterparts.

Hoax – The IEEE recommends against using integrated SPDs.

Fact – The IEEE specifically points out the performance advantage that integrated units offer in the latest version of the Emerald Book, IEEE Std. 1100-2005. Article 8.2.4.5 of IEEE Std. 1100-2005 (The Emerald Book) states: “These devices (referring to SPDs) may be installed externally or internally to the switchboard or panelboard. **Panelboards are available that contain integrally-mounted SPDs that minimize the lead length of the SPD conductors, thus optimizing the effectiveness of the device.**”

Some SPD manufacturers that cannot or do not manufacture SPDs capable of being integrated into distribution equipment twist the intent of one outdated statement in the 2005 Emerald Book. The Emerald Book contains the following statement: “However, as pointed out in IEEE Std. PC62.72 (Draft 1, 1 November 2005) [B2], when an SPD is located inside switchboards or panelboards, there is a concern that failure of the SPD **can** cause collateral damage to the switchboard or panelboard.”

This statement does not specifically ban, forbid or recommend that integrated SPDs not be used, it simply points out that, as a design concern, a designer should consider the quality of the SPDs that they install or recommend. The statement as it appeared in the 2005 Emerald Book no longer has

any validity and will be removed from future Emerald Book publications.

The version of IEEE C62.72 referred to in the 2005 Emerald Book was a first draft which received extensive review and correction. The published version of IEEE C62.72 was released on August 3, 2007. In the approved, published version, there is no statement regarding a concern that potential collateral damage to the switchboard or panelboard exists when an integrated SPD fails. The referenced section of IEEE C62.72 refers to thermal runaway of metal oxide varistors (MOVs) that are commonly used in both sidemount and integral SPDs. The statement of potential concern for integrated SPDs was found by the writers of IEEE C62.72 to have no valid technical merit and was removed from the document. Some SPD manufacturers fail to mention in their marketing literature that the IEEE statement quoted in the Emerald Book is now obsolete and no longer valid. This fact is omitted, and these SPD manufacturers continue to quote false and misleading information.

In addition, there have been major changes to UL 1449, 2nd Edition that became mandatory in February 2007, long after the referenced first draft of IEEE C62.72 in November 2005. SPDs manufactured after February 2007 must be compliant with the UL 1449 2nd edition update, which included many new tests designed to mitigate the thermal runaway condition described in IEEE C62.72 in both integral and sidemount SPDs.

Hoax – When an integrated SPD fails, the whole electrical panel fails, including the breakers and wiring terminations.

Fact – High-quality SPDs, including the Cutler-Hammer[®] Visor and CVL product families from Eaton[®], employ methods recommended in IEEE C62.72 in order to mitigate the potential harmful effects that can occur as a result of a thermal runaway condition caused by a temporary overvoltage condition. Section 14.1 of IEEE Std. C62.72-2007

points out the common methods employed to reduce the effect of SPD thermal runaway conditions. They are as follows:

- a) Enclosure of SPD within a suitable enclosure
- b) Encasement of the MOV arrays within appropriate sealing compound or sand, or both
- c) The use of integral or external overcurrent protection device
- d) The use of integral thermal, cut-off devices as fuse links, solder wire, or thermal squibs
- e) Avoid or limit the use of flammable materials in the enclosure
- f) Any combination of any or all of the above

Eaton's Cutler-Hammer integrated SPDs employ all of the above methods except for b) encasement of MOV arrays. As a result of taking these measures, the failure of an SPD is unlikely to cause collateral damage.

Hoax – Sidemount units connected with low impedance cabling / wiring outperform integrated units.

Fact – Recall the statement found in section 8.2.4.5 the IEEE Emerald Book: “These devices (referring to SPDs) may be installed externally or internally to the switchboard or panelboard. **Panelboards are available that contain integrally-mounted SPDs that minimize the lead length of the SPD conductors, thus optimizing the effectiveness of the device.**”

Most integrated SPDs are connected directly to the electrical panel's bus bars. This mounting method provides the shortest lead length and lowest possible impedance path between the unit and its phase connections. The effective lead length of an integrated unit is approximately 3 inches as compared to sidemount units, which typically utilize lead lengths of at least 18 to 24 inches when installed. Shorter lead length equals lower impedance. The net result is increased SPD performance and effectiveness as compared to a sidemount unit.

In addition to the statement in the Emerald Book that points out the superior effectiveness of integrated SPDs, IEEE Std. C62.72, Section 16.2 contains the following related statement: “**Connecting conductors of SPDs should be as short as possible to achieve optimal SPD performance. Long lead lengths will add to the measured limiting voltage of the SPDs, and it could be necessary to select an SPD with a lower measured limiting voltage for use in that location.**”

The IEEE makes no mention of any installation practice or additional hardware utilization (such as low impedance wiring / cabling) that would result in a sidemount SPD providing performance that is superior to an integrated unit.

Hoax – Sidemount SPDs are safer than integrated units because users are forced to work on integrated units in a live, powered condition every time a part is replaced or maintained.

Fact – High-quality SPDs such as the Eaton's Cutler-Hammer Visor and CVL product families require no user intervention after installation. When the electrical panel is mounted and the main breaker is switched on, the units are ready to provide protection for their entire life with no user intervention, maintenance, or service required. High-quality SPDs, whether integrated or sidemount, contain no replaceable parts such as surge modules or fuses, or items that require periodic replacement or service such as batteries for alarms or surge counters.

Specifying engineers and users should pay close attention to an SPD's attributes when selecting a unit. It is important to make sure the unit contains no items that require maintenance or periodic service. If there are any doubts or questions concerning these matters, you should always consult with a product applications engineer.

Hoax – Sidemount SPDs are UL listed devices and integrated units are UL recognized components. This means sidemount units are better and safer.

Fact – An integrated SPD is not a stand-alone device. It is a component that must be installed in a UL listed electrical assembly. It is important to note that although integrated SPDs are UL recognized components, they are subjected to the same tests as listed sidemount units when undergoing UL testing and certification.

An integrated SPD's UL file contains conditions of use that must be followed in order to ensure it maintains its status as a UL recognized component. These conditions of use include things such as installing the unit within a suitable enclosure (the electrical panel) to avoid a shock hazard due to exposed terminals and ensuring the unit is wired at the factory. The conditions of use are always followed when an integrated SPD is installed within a UL listed electrical assembly such as a panelboard or switchboard, ensuring its safety and performance is optimized and maintaining its status as a UL recognized component.

Conclusion

Integrated SPDs offer many performance and functional advantages over their sidemount counterparts. Integrated SPDs offer superior performance and provide the most effective means of protecting equipment from damage caused by surge events. Choosing a high-quality, integrated SPD when possible will ensure a facility is being protected by the best possible choice in surge protection.

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