

## Branch Circuit Protection for High Density 208V Power Solutions

Over the past two years the power consumption per server has increased an estimated 20-30%. To facilitate the increased power loads, power solutions that were typically rated at 1900 to 4900VA are now regularly rated at 4800 to 8600VA. Because of this, there are new certification requirements that must be employed to ensure the integrity of a mission critical facility.

The following is an overview of 'hidden' issues that some manufacturers are not divulging about the use of Branch Circuit Protection for your high density, mission critical power units:

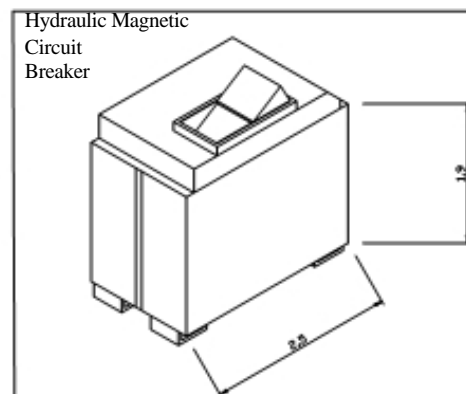
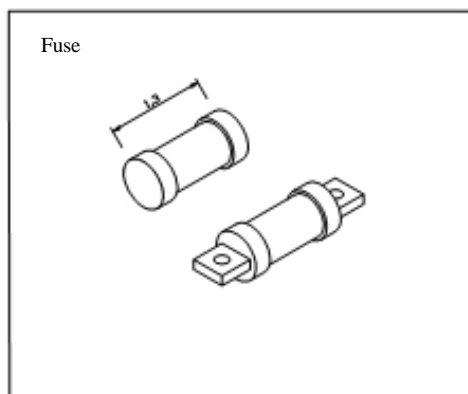
- 1) **Mandated Requirement.** Effective April, 2003, newly certified products with a rating of 30A/208V (and above) are mandated by UL60950 3<sup>rd</sup> Ed. and UL60950-1 [Information Technology Equipment] to be in comply with with National Electrical Code NFPA70:

*Clause 2.7 concerning overcurrent and earth fault protection refers to Annex NAE, which links the standard to the NEC and states that "standard supply outlets and receptacles shall be protected by an overcurrent protective device in either the equipment or the branch circuit, rated not more than the outlet or receptacle. The overcurrent protective device shall be of a type that is suitable for branch circuit protection in accordance with the National Electrical; Code ANSI/NFPA70 ..."*

*Annex P1 specifies that circuit breakers in section 2.7 are UL489 devices.*

QUESTION: *Do your 30A/208V (and above) PDUs comply with the new standards?*

- 2) **Identifying Appropriate Branch Circuit Protection.** Branch circuit protection can be accomplished by either branch circuit breakers or fuses. To identify a UL489 circuit breaker,



there are two general visual indicators. The first indicator is the size of the externally showing rocker switch. The UL489 breaker (above) will range in dimension from 1" wide to 1.5" long. The lower grade rocker switch or reset type are typically very small (less than 1/2"). The second indicator is that the chassis will be expanded to accommodate the higher performing

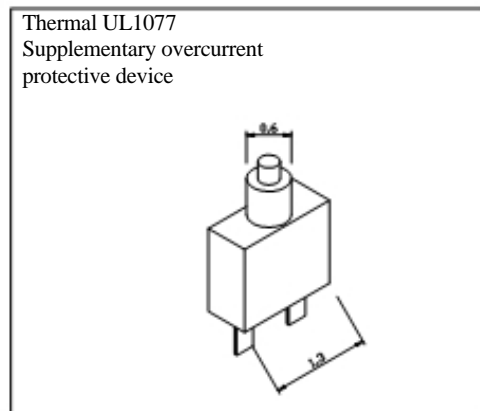
breaker. If your vertical 30A/208V power strip is perfectly symmetrical (2" x 2" or less) across the full length of the power strip, it is highly probable that it DOES NOT comply with the current standards.

FACT: it is now common practice for consultants to open power units to identify comply with to code. Eaton® uses the highest quality hydraulic-magnetic circuit breakers to ensure maximum overload protection as well as comply with to mandated code requirements.

The "lower grade" thermal circuit breaker is in fact approved to a different UL standard, UL1077. A UL1077 device is a Supplementary Over-current Protective device. Its marking will show a UR symbol (i.e., it is UL Recognized). A UL489 device is a Branch Circuit breaker, and the marking on it is "UL listed".

QUESTION: *are the circuit breakers employed in your power unit UL489?*

- 3) **Key Issues of Lower Capability Thermal Breakers.** Compared to higher capability circuit breakers, thermal breakers have several subtle issues and capability limitations:



a). No Disconnect Capability - Many thermal breakers can only be reset after a fault and can not be used to manually disconnect the power supply. The only methods to disconnect a power unit is to either pull the power cord out from the power source or open the upstream circuit breaker at the power panel.

b). Heat Susceptibility - thermal breakers are by their nature susceptible to enclosure heat. The typical derating factor for a thermal circuit breaker for a temperature increase from 73°F to 104°F is 8%.

d). Lower Overload / Overcurrent Protection - a thermal breaker is often a UL1077 device, and it can break prospective fault currents up to 1 or 2kA. This is far less than the capability of a UL489 branch breaker which must be able to break fault currents of 5kA. *The use of inappropriate devices is not only against the regulations but can be hazardous and will cause extended down time due to device failure.*

QUESTION #1: *How much risk are you personally willing to assume by deploying products that don't comply with the new requirements.*

- 4) **Key Issues of Fuses.** While fuses are generally accepted for certain products, they are not considered a 'best practice' for mission critical facilities:
- a). Increased Points of Failure - current market specifications employ as many as twelve fuses. For a Datacenter with 100 enclosures, that would equal 2400 additional points of failure.
  - b). Reduced Safety to Personnel - for double pole applications (208V) it is possible for only one fuse to blow and the second leg to remain 'hot.'
  - c). Higher MTTR (Mean Time to Repair) - while a branch circuit breaker can be quickly reset, the replacement of a fuse can take as long as one hour or more depending on the specific model.
  - d). Higher Repair and Replacement Costs - unlike a circuit breaker which can be quickly reset, it costs significantly more to replace a fuse. Depending on the marketplace, both an Electrician and Apprentice may be required. A full remediation plan may also be required in the Maintenance budget to facilitate 'off-hour' replacement.
  - e). Voided Warranty and/or Product Certification. Any time a power unit is physically opened, it presents a number of issues. Not only is there concern as to whether the correct fuse is replaced, but whether the product requires re-qualification for safety performance (e.g. hipot, ground continuity, and functional tests).

QUESTION #1: *How much risk can be assumed not knowing whether a fault (e.g. line-to-line short, or line-to-neutral short) has been isolated and that the power has been completely isolated from the user?*

QUESTION #2: *In the event of a failure, how long can you wait to replace a fuse?*

QUESTION #3: *Can the risk be financially quantified when a mission critical load is only supported by one source for an extended period of time?*

QUESTION #4: *What is the financial penalty if a customer's contractually agreed 'Uptime' is not achieved?*

QUESTION #5: *If the unit fails and the failure is subsequently linked to a previous fuse replacement, who is liable for the damages?*

- 5) **Applicable Products.** UL60950-1 requires the use of branch circuit protection for configurations greater than 20 Amp.
- 6) **Certification Exceptions.** UL60950-1 permits products rated at 15 or 20 Amps to be supplied with no breakers at all.
- 7) **Grand-fathered Products.** UL60950-1 allows existing, thermally fused products (certified prior to April 2003) to continue to be sold, but strongly recommends against it. Keep in mind, UL changed this code for a reason and circumventing it only increases your risk.

***FACT: if your power product does not meet the above requirements, it DOES NOT Comply with the most current regulations.***

In conclusion, the fundamental issue is how much risk the end-user is willing to assume, including financial, functional and safety. The proper application of UL60590-1 Edition and the employment of UL489 branch circuit breakers is best suited to mitigate these issues.