AC Outlet Module with Circuit Breaker and the Overall Interrupting Rating of a Control Cabinet

NEW

Control cabinets have an overall interrupting capacity rating. The rating refers to the maximum fault current that can be interrupted safely. The process of determining this rating needs some detailed explanation.

Individual devices with interrupting ratings include circuit breakers, fuses, contactors, motor starters, etc. The manufacturer of each device provides an interrupting rating in amps or kilo-amps. Branch circuit breakers are rated 10kA at 600Vac while 13/32" x 1 ½" midget fuses are rated 100kA or 200kA for the CC versions. The supplemental breaker used on 9915480001 is rated 1000A.

Unfortunately the overall rating of the cabinet is often equal to the lowest individual component rating. For example, even if a motor control circuit uses 100kA rated fuses and a contactor rated 10kA the overall rating might be 1000A if the cabinet contains 9915480001. Since the AC outlet is used for non-permanently connected devices such as a laptop computer or test equipment and is not in the actual motor control circuit this does not seem to make sense but the standard used by inspection authorities such as CSA and the Electrical Safety Authority (typically CSA 22.2 No. 14 - Industrial Control Equipment)

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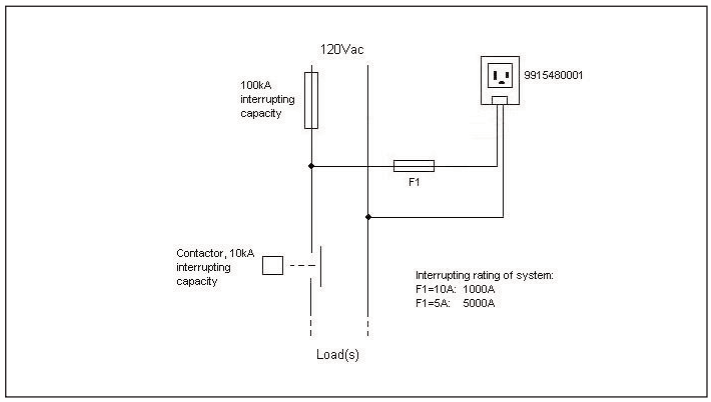

Figure 1
Overall interrupting rating based on F1 (5000A max.)

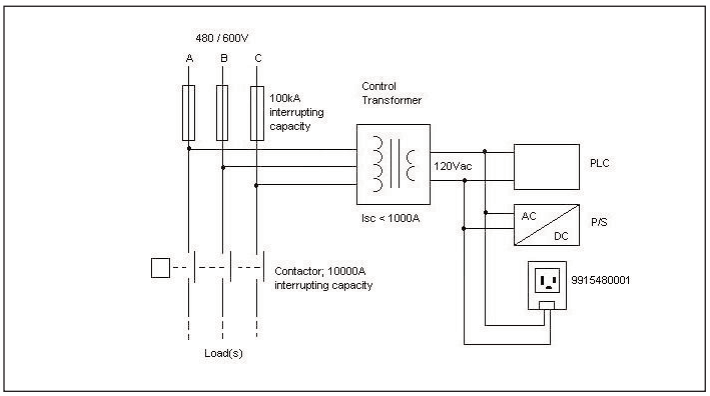

Figure 2
Overall interrupting rating: 10000A

does not distinguish between different portions of the cabinet. In the example above a 1000A rating will not likely be acceptable for a motor control application.

There are two possible ways to increase the overall cabinet rating. One solution is referred to as a "series tested pair" and is included in the Supplemental Protection standard (CSA 22.2 No. 235, section 6.8.1.3). In this situation the 9915480001 would be tested with an external fuse or circuit breaker and an available fault current of more than 1000A. As long as the external device interrupts the fault current before the supplemental breaker opens the combination can be approved for an interrupting rating equal to the fault current.

9915480001 was tested by CSA with external 5A and 10A branch rated fuses. When tested with the 5A fuse and an available fault current of 5000A the fuse failed and interrupted the current before the supplemental breaker on the module tripped. Therefore this combination would allow the overall cabinet interrupting capacity to be rated 5000A (assuming there are no other devices rated less than 5000A in the cabinet). When the external fuse was increased to 10A the supplemental breaker on the module tripped before the fuse failed so the interrupting capacity of this combination would be that of the supplemental breaker - 1000A.

In this situation if an overall rating for the cabinet of 5000A is not sufficient the AC outlet module would have to be changed to the duplex version without the supplemental breaker 9915490000.

Another method of increasing the overall interrupting capacity rating could be used if the cabinet includes a control transformer. For example, many motor control cabinets use 3 phase 480V or 600V power for the motors and 120V for the PLC and control components. The 120V powers the PLC and 24Vdc power supplies and maybe some interposing relays used to interface PLC outputs to contractors. In this situation the available fault current is equal to the short circuit current of the control transformer and may be less than 1000A. If this is the case the rating of the supplemental breaker on 9915480001 is sufficient and no external fusing is required.

The short circuit current of a control transformer is calculated as follows:
Isc = (VAt x 100) / (Zt x 1.73 x Vsec)
where:

VAt = transformer power rating
Zt = transformer impedance in %
Vsec = transformer secondary voltage

For a 1kVA control transformer with 5% impedance and a 120V secondary the short circuit current (i.e. available fault current) at the secondary would be 96.3A. This is well below the interrupting rating of the supplemental breaker used on 9915480001 so no additional fusing is required. If the control transformer was rated 10kVA the short circuit current would be 963.3A (still acceptable). If the transformer impedance was 3% and the power rating was 10kVA the short circuit current would be 1605.7A so an external branch rated fuse or circuit breaker would be required between the transformer secondary and the 9915480001 module.

As long as the 9915480001 is installed on the secondary of a control transformer and the available short circuit current does not exceed 1000A then the 9915480001 does not affect the overall interrupting rating of the cabinet. The overall rating will now be determined based on the individual component ratings in the 480V or 600V motor control circuitry.