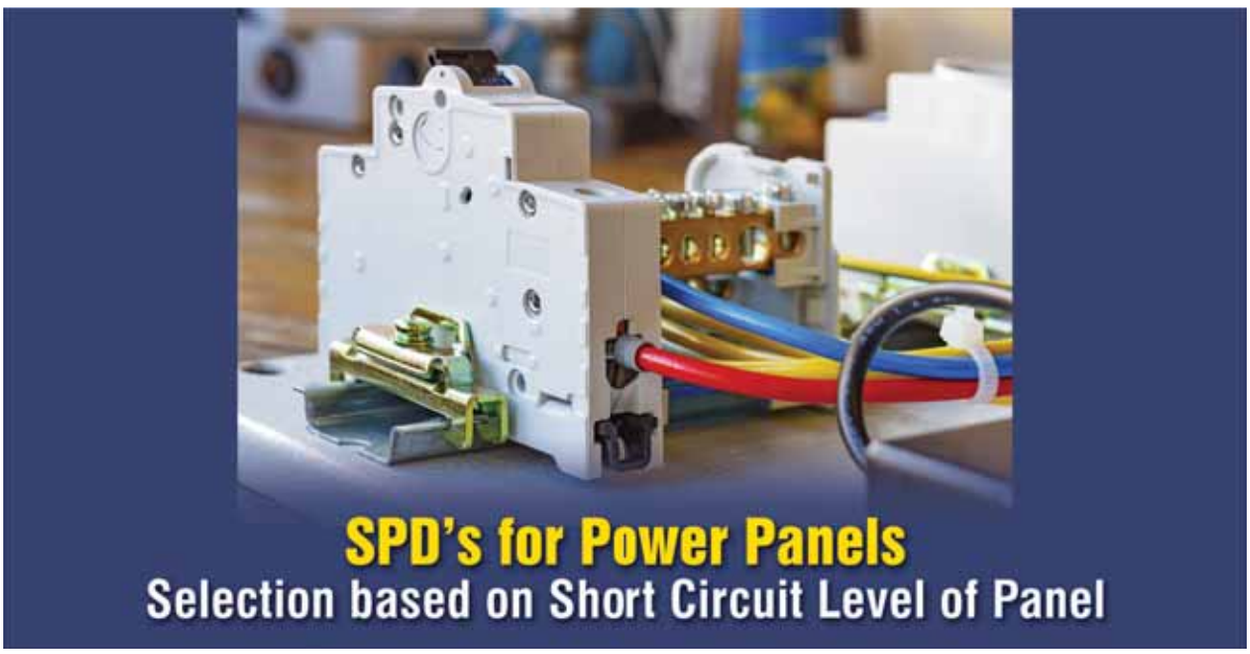

SPD's for Power Panels

Selection based on Short Circuit Level of Panel

Surge Protective Devices are the most sensitive components in a power panel with response time in nano seconds. The protective components such as MOV/ GD tubes / Spark Gaps in SPD are always connected in parallel to the line. These voltage operated devices create a very low resistance path between the connected lines in order to create equipotentialisation and to discharge transient current. This characteristic makes SPD the most dangerous component in a power panel.

Maximum continuous operating voltage MCOV is the continuous voltage which an SPD can withstand. If the voltage across the connected lines go more than this level, current through MOV will heats it up and as a result MOV will be short circuited.

Any fault in HV systems as well as Neutral Breaking in a TT network can create Temporary Over Voltage (TOV). The TOV levels are always more than MCOV of an SPD and as a result the SPD can get shorted.

In case of a SPARK GAP based SPD, the short circuit network follow current will flow due to the operation of Spark Gap, which need to be handled properly to avoid catastrophic situation.

These short circuiting problems can create dangerous explosion and fire in the connected places if not selected and installed properly.

SPD's are fitted with internal fuses, these thermal fuses are generally spring loaded silver soldered tips which can handle very low Isc and have less breaking capacity. Hence an additional HRC backup fuse is required for the SPD to make it safe. Manufacturers recommended backup fuse is a must to be installed along with the SPD if possible a lower rating and for all applications. The purpose of this backup fuse is to isolate a faulty SPD from the line as well as to protect it from heavy short circuit current flow.

Figure 1

Figure 2

Figure 3

Figure 1 – SPD (also called as TVSS) for low power application such as Residential application with 4, 7 and 10 mode protection confirming to IEEE / UL Standards. These SPD's employ multiple MOV's inside with internal fuses. Breaking capacity of the internal as well as external fuses are generally not provided. In most cases it is about 3 to 5 KA. Long connecting wires can lead to increases residual voltage to the equipment to be protected. Connecting wires are so small in cross sectional area which can cause fire in case of a high short circuit current flow.

Figure 2 – DIN Rail mounted SPD's for use along with DIN RAIL mountable devices such as MCB's RCD's. Typical breaking capacity of internal fuse is 5 to 10 KA. Need HRC fuse for back up protection in networks more than 5 KA. The connecting wire length shall be according to figure 5.

Figure 3 – BUSBAR mountable SPD's. Can withstand up to 65 KA (or more) short circuit current in case of failure. Some time No backup fuse required. Very strong connecting wires (generally BUSBARS) are required.

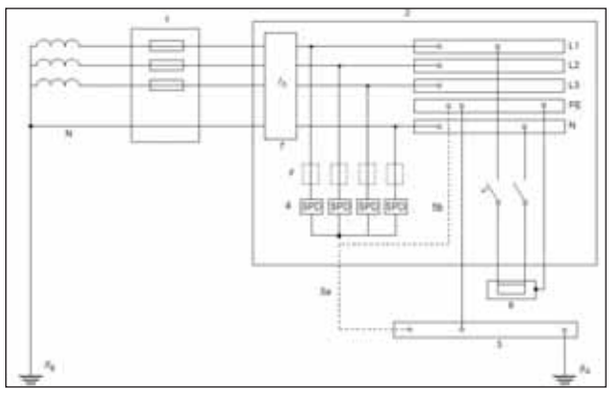

Figure 4

1 Origin of the installation
2 Distribution board
3 Main earthing terminal or bar
4 Surge protective devices
5 Earthing connection of surge protective devices, either location 5a or 5b
6 Equipment to be protected
7 Residual current protective device (RCD)
8 Protective device indicated by the manufacturer of the SPD (for example, fuse, circuit-breaker, RCD)

*R*A Earthing electrode (earthing resistance) of the installation *R*g Earthing electrode (earthing resistance) of the supply system

Figure 4 Recommended Connection diagram of an SPD in a panel board as per IEC standards

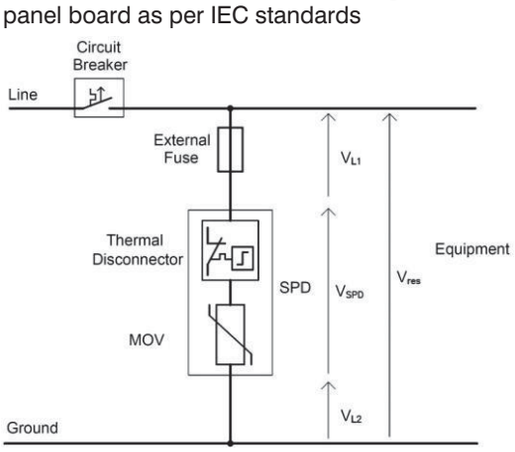

Figure 5

Figure 5 Recommended Connecting wire length of an SPD and various backup protections. Maximum recommended wire length is 250 mm

IEC recommend typical way of connecting SPD in a power line. It is based on the type of network such as TN / TT / IT etc as well as whether the SPD is before RCD or after RCD. Typical connection diagram of an SPD after RCD is shown in figure 4. Different kind of backup fuse protections are shown in figure 5.

Using long wire to connect SPD will create high residual voltage to the equipment and hence lower the protection. Maximum recommended wire length is 250 mm each (VL1 / VL2) or 500 mm (VL1+VL2). How ever the usage of a backup fuse in between SPD and connected line make it difficult to maintain this wire length. As a result increased wire length decreases the effectiveness of SPD and hence lower the protection.

SPD's in boxes, (figure 1) some time uses number of MOV's or other discharge devices in addition to the connection shown in figure 4. (Eg 7 mode protection, 10 mode protection). Such connections increases the chance of short circuits between Lines as well during an MOV failure. Erratic power supply situations and Over voltages in power supply network in India increases the chance of MOV shorting and hence invite problems

Figure 6 Busbar mounted SPD's with high Isc withstand – Typically 50 / 65 KA

In case of BUSBAR mounted SPD's, problems associated with connecting wires are solved and hence these SPD's can provide the best voltage protection levels. The usage of BUSBARS for interconnections (note – select bus bar size based on Isc level) also ensure mechanically strong connection during Short Circuit current flow.

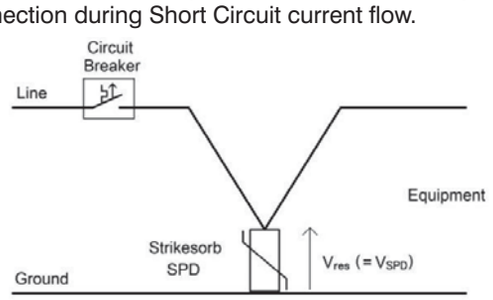

Figure 7 Busbar mounted SPD's and line circuit breaker

SPD's which doesn't need additional back fuse, which can withstand high short circuit currents are the best suited products to be used in Power panels. Ensure that these SPD's are tested together with Circuit breakers instead of HRC fuses if they are installed in a fuse less panel board

Conclusion

Without understanding the danger behind, SPD's are used without HRC backup fuse as recommended by the SPD manufacturer. In several cases MCB's and MCCB's are used for backup, whose tripping characteristics are different to a HRC fuse.

Improper backup fuse usage will increase the chance of fire and explosion during an SPD failure. In some cases small interconnecting wires also create trouble. ■

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