Surge Protective Devices are intended to limit surge voltages and divert surge current and there by protect the equipment and the installation from insulation failures and insulation degradation. SPD contains at least one nonlinear component that is connected in parallel to the lines where the surge voltage needs to be limited. For 230/400 volt power line application SPD's are generally installed inside the power distribution boards as well as in electrical and electronic equipment.

Now, manufacturers of SPDs no longer get away with this problem blaming the failure is due to abnormal conditions. IEC 61643-11 precisely addresses this issue along with several other safety issues.

When it comes to safety devices, it is all the more important to adhere to latest standards because more & more safety features are getting added to ensure that safety devices- in this case, SPDs act & save the electronic equipment. In case of failure due to SPD's are connected to power line based on the recommended wiring practices and system earthing. Different kind of connections are recommended based on the network (such as TN-C, TN-S, TT, IT etc.) as well as the place of installation. However in all cases the nonlinear device inside SPD is always in parallel. SPD's are the fastest and most sensitive device in an electrical network. Any abnormal increase in voltage across this nonlinear device will have an impact. Eg. an MOV rated for a continuous operating voltage of 275 volt, once when the voltage crosses 275 volt, leakage current flows through the MOV will burn the MOV and create short circuit due to the heat dissipated by the leakage current.

Unstable voltage and network conditions existing in India possess a serious threat to the life and safety of SPD's. Eg Neutral isolation in a 3 phase network brings continuous over voltages of up to 400 volt in 2 phases.

SPD's using MOV's shall use an inbuilt fusing device to protect the complete electrical network from the short circuiting of MOV. However the short circuit breaking capacity of this inbuilt fuse is less in several applications. For such networks, the SPD manufacturer recommends an external series fuse in addition. Here comes the next challenge, improper use of external fuse will not ensure safety and the chance of fire and explosion persists.

SPD's are widely used in India now as the awareness increase. More and more industries find SPD's useful in protecting the electronics and install it without thinking about the risks behind.

Any one would expect a safety device like SPD to "fail safely" in case of any common abnormalities in the network above the SPD's limit. There were few incidences of SPD explosion & fire accidents in India.

abnormalities in the incoming supply, shall "FAIL SAFE" without causing fire hazards, if not withstanding such conditions.

All SPDs manufactured now, shall have valid Test Certificate as per IEC 61643-11 Ed. 1 which has been published in March 2011. It deals with "Low Voltage SPDs- Part 11- SPDs connected to Low Voltage power systems- Requirements and test methods". It supersedes IEC 61643- 1 Ed 2, published in 2005. IEC 61643-1 Ed 2 supersedes Ed 1(1998).

Major up gradations in these standards are – from 1998 to 2005 the voltage protection level declaration method for a spark gap SPD is changed from average value of 10 test impulses to Maximum values of 10 test cycles. The result is spark gap SPD with a declared protection level of 1.25 KV as per ed1 (1998) become an SPD of more than 3 to 5 KV as per Ed2. There are chances that manufacturers still use the old test results and claim false values. We will discuss this matter in detail in our next tutorial.

SPDs tested as per IEC 61643 -1 (ed.2) needs to undergo few safety tests to get qualified. IEC 61643-1 talks only about “PERFORMANCE TESTS” whereas IEC 61643-11 talks about “SAFETY & PERFORMANCE TESTS”.

Significant additions in IEC 61643-11 related to safety of SPDs especially applicable for India is TOVs (Temporary Over Voltage) caused by “faults” in Low and high voltage system. It is 120 minutes TOV test recommended for LV system faults in distribution system and loss of neutral. SPD shall withstand this stress of high voltage or “fail safe” without causing fire or explosion hazards.

According to IEC 61643-11, whenever there is LV system fault or loss of neutral, either the SPD shall withstand this abnormal condition or “fail safely” without causing explosion or fire. It is obvious that, an SPD designed to withstand this abnormal condition is best suited for Indian conditions.

TOV test values as per IEC applicable for India are as below:

Application	TOV test parameters		
	TOV of 5 Sec. (LV system	TOV = 120 min (LV system	TOV = 200 m
	faults in consumer	faults in distribution system	sec (HV system
	installation)	and loss of neutral)	faults)
	Withstand mode required	Withstand or safe failure mode acceptable	
System Earthing	TOV test values U_T (V)	(U_{REF} = 230 +10% = 253 V)	
TN system - Connected L to N or L to PE	334 V	438 V	
TT system - Connected L to N	334 V	438 V	
TT system - Connected L to PE	438 V	334 V	1453 V
TT system – Connected N to PE			1200 V

Conclusion

Un-predictable system earthing used all over India by various utilities and improper usage of protective disconnection devices calls for a safe selection of SPD. It is always better to use an SPD which can withstand TOV of 120 minutes. ■

Mr S Gopakumar

Managing Director of CAPE electric pvt ltd. Member of National Building Code (electrical committee)