

SURGE PROTECTION 102 : SPECIFICATION GUIDELINES

(Sources include a review of recent documents cited in Section 5 below.)

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1. Caveat: SPD products and performance, pricing and quality range from Very Good to Very Poor. A few examples of sub-standard SPDs include falsified testing statements, plastic enclosures, low grade components, internal encapsulation, aluminum wiring, poor quality control and exaggerated (boastful) claims of perfection. Conduct your *Due Diligence*.
2. Why install SPDs? Voltage irregularities originate from internal motor and compressor startups, from power company switching activities and from lightning strikes --- in that order. In most cases, without a tiered system of high quality SPDs the operational performance of critical systems cannot be assured. Codes and Standards (ex. NFPA-780, 4.20) require the adoption of SPDs for a complete lightning protection system (LPS). No SPDs? The LPS will not be approved.
3. We recommend the below SPDs performance specifications. These may vary according to site location, lightning density, altitude, type of facility, nature of the mission, etc.
 - 3.1 All steel enclosures: NEMA 4 or NEMA 4X. Enclosures shall be made inaccessible to unqualified persons. No internal potting compounds or encapsulations per UL 1449. Interior components must be visible.
 - 3.2 Protection element (SPD) connections should be direct to L-N, L-G, L-L, N-G. Direct clamping L-N and L-L is required.
 - 3.3 Internally-fused disconnects. This allows for a safely open circuit so facility power need not be shut down. Only the SPD is disconnected from the facility power source.
 - 3.4 Bi-polar protection. Clamping is the same for internal or external transients.
 - 3.5 Nominal discharge current test 15 impulses at UL 8/20 us at 20kA.
 - 3.7 No power consumption. No follow on current. Self-restoring response.
 - 3.8 Diagnostics = Externally-visible LED indicator lamps. An audible alarm and a surge counter are suggested options.
 - 3.9 Operating temperature -50C to +85C.

3.10 Manufacturing defects Warranty for 10 years when installed per factory recommendations. Note: Should the surge “kill” the SPD but the downstream equipment be “saved”, this is not a warrantable condition. SPD self-sacrific may occur under some extreme conditions.

3.11 Standards Compliance to latest UL 1449 (Classes 1 & 2).

3.12 Surge Current Suggested Ratings (Civilian Applications): Service Entrance 250kA; Distribution Locations 125-180kA; Branch Locations 50-120kA; Wall Outlet or Plug-In Locations minimum 4000 Joules.

3.13 Surge Current Minimum Ratings (Defense Applications per USAF AFI 32-1065). 180 kA at ECMs up to 60A service; 180 kA at Maintenance Facilities for 400-600A service; 200 kA at Communications Facilities for up to 1800A service.

4. SPD Locations. IEEE, NFPA and OSHA requirements apply. In most cases a tiered or layered defense is required for redundant defenses.

4.1 SPDs at the Mains or the supply side or building disconnect means (IEEE Cat. C/NEC Type 1).

4.2 SPDs at the Secondary or Branch or load side (IEEE Cat. B/or NEC Type 2).

4.3 SPD at the standby generator secondary panel. Install at the common of the transfer switch so that operation is continuous regardless of whether facility power or generator power is on.

4.4 SPDs at all communication, data, security and other signal circuits per Codes.

4.5 SPD installation may be indoors or outdoors. NEC and OSHA safety requirements shall apply.

4.6 SPD installation only by a licensed and qualified electrician.

5. References:

5.1 National Electrical Code, Section 285 Surge Protection Devices, 2014

5.2 IEEE 1100, Powering and Grounding Electronic Equipment, 2006

5.3 <http://pes-spdc.org/> (IEEE website specific to SPDs.)

5.4 CIGRE 549 “Lightning Parameters for Engineering Applications”, 2013.

5.5 International Conference on Lightning Protection, Shanghai China Oct. 2014.

5.6 Motorola R-56, Standards and Guidelines for Communications Sites, 2005.

5.7 NFPA-780 Annex A.4.20.1 to A.4.20.8 (Essential background of the topic.)