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Investigation of Low Amplitude Lighting Strikes On Low Voltage Electrical Systems

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This study serves to investigate the voltage and current development in commercial electrical systems and the impact of various protection schemes. Various tests are conducted on miniature mock electrical systems to determine breakdown thresholds and mechanisms. The area of interest includes low current amplitude lightning impulses in the range of 2 kA to 5 kA peak. The test setup is constructed from a 4 stage, 44 kJ Marx generator capable of 400 kV impulses. To further control the testing, a low inductance ground path is used along with a variable resistor, inductor circuit to control the impulse characteristics. The risetime is adjusted from 500 ns to 5 µs with peak current from 2 kA to 5 kA. Under test are small sections of conduit systems of 10 ft to 50 ft with various junctions and connections to mimic commercial electrical systems. These flaws or lack thereof are evaluated for breakdown threshold and current flow direction. Common wires under test are 10 and 12 AWG both stranded and solid core THHN along with different types of MOVs placed at various points in the system to mimic typical lightning protection schemes. Voltage and current measurements are taken at the entry and exit points in the conduit system under test. A photomultiplier tube (PMT) is used for diagnostic measurement of arc characteristics inside the conduit during lightning impulses. Resulting voltage and current waveforms are presented for different various risetime impulses and setups ups along with MOV effects.

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