GUIDELINE 45

CORONA AND ELECTRICAL BREAKDOWN PREVENTION

1. Purpose. This guideline establishes criteria for the prevention of corona and electrical breakdown.

2. Applicable Documents

ASTM D 149	Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D 1868	Detection and Measurement of Partial Discharge (Corona) Pulses in Evaluation of Insulation Systems

3. Definitions.

3.1 Corona (air). A luminous discharge due to ionization of the air surrounding a conductor caused by a voltage gradient exceeding a certain critical value, called the partial discharge (Corona) Inception Voltage (CIV).

3.2 Partial discharge (corona) inception voltage (CIV). The lowest rms voltage at which continuous partial discharges above some stated magnitude (which may define the limit of permissible background noise) occur as the applied voltage is gradually increased.

3.3 Partial discharge (corona) extinction voltage (CEV). The highest rms voltage at which partial discharges above some stated magnitude no longer occur as the applied voltage is gradually decreased from above the inception voltage.

3.4 Breakdown. A disruptive discharge through insulation, involving a sudden and large increase in current through the insulation because of complete failure under electrostatic stress, also called puncture.

4. General Guidelines.

4.1 Corona prevention. The CEV should be at least 150 percent of the peak circuit voltage, corresponding to the maximum specified steady-state rms supply voltage. This guideline applies:

a. When the equipment is terminated with the cabling or other accessory equipment with which it is intended to be used and;

b. When the equipment is operated under the specified environmental service conditions and;

c. When the equipment is supplied with the specified power source frequencies and voltages including commonly recurring transients.

4.2 Electrical breakdown prevention. The equipment should be designed and manufactured with electrical clearance spacing, leakage (creepage) distances, and insulation characteristics adequate to prevent electrical breakdown. This guideline applies under all specified environmental service conditions including service life and using the specified operating voltages (including transients). Liquid dielectrics, gases other than air, or pressurization to prevent electrical breakdown should not be used unless approved by the procuring activity.

5. Detail Guidelines.

5.1 Effects of corona. Corona occurring at the interface of an insulator and a metal can damage or reduce the life of an insulating system. In general, inorganic insulating materials are more resistant to the damaging effects of corona than organic insulating materials. Corona also generates electromagnetic interference and liberates ozone, a toxic, oxidant gas.

5.2 Insulation systems. Corona can occur within cavities between an insulating material and a metal surface which are in contact. Therefore, care should be exercised to avoid cavities at such interfaces where high voltages are encountered.

5.3 Metal parts. Sharp edges and points should be avoided on metal parts which are included in high intensity electric fields.

5.4 Corona testing. There are many factors which determine whether or not corona will occur, including temperature, humidity, ambient pressure, test specimen shape, rate of voltage change and the previous history of the applied voltage. Test methods such as ASTM D 1868 may be used but the test results lack accuracy and repeatability and require great care due to the personnel hazards involved.

5.5 Electrical breakdown testing. The breakdown voltage of a given insulating material is dependent upon electrode size and shape, insulator thickness, temperature, humidity, rate of voltage application, voltage waveform and voltage frequency. When testing, care must be exercised to assure that the insulating material is evaluated under the actual environmental conditions which apply to the equipment and that the occurrence of corona or localized heating does not mask the true breakdown voltage. Provides a test usable at power frequencies, 25 to 800 Hz ASTM D 149.