



Designation: D 3509 - 76 (Reapproved 1982)¹

Standard Test Method for ELECTROSTATIC FIELD STRENGTH DUE TO SURFACE CHARGES¹

This standard is issued under the fixed designation D 3509; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

¹ Note—Editorial changes were made throughout in August 1982.

1. Scope

1.1 This method covers the determination of the value of electric field strength at and near a variety of objects such as metal surfaces at high voltage and insulating bodies with electrostatic charge.

1.2 The chargeability of an insulating body, and therefore the electrostatic charge on it, are influenced by the moisture content of the material and the surrounding ambient. Moisture content depends on the humidity exposure history.

2. Applicable Documents

2.1 *ASTM Standards:*

D 2679 Test for Electrostatic Charge²

D 2865 Recommended Practice for Calibration of Standards and Equipment for Electrical Insulating Materials Testing²

3. Summary of Method

3.1 The electrostatic field strength (electric field strength) is determined by a measurement of the induced surface-charge density on a probe exposed to the field.

4. Significance

4.1 High electrostatic fields can lead to air breakdown (sparking) and result in explosions, fires, and other hazards. The electrostatic field can often be used as a measurement of electrostatically charged objects for which the total charge cannot be determined by Method D 2679.

5. Definitions

5.1 *electric field strength (unit kV/mm)*—vec-

tor force on a point charge of unit magnitude.

5.2 *electrostatic field strength*—electric field intensity of very slowly varying or non-varying magnitude and direction.

5.3 *electrostatic surface charge density*—the algebraic sum of all positive and negative charges present on a unit area of surface element.

6. Apparatus

6.1 Figure 1 illustrates diagrammatically the major parts of a typical commercially available field meter and the setup required for calibration. The electrostatic field between the calibration plate and the sensor has a value $E = V_0/d$ (here d = distance; V_0 = bias voltage). This field induces on the sensor a surface charge density $S = \epsilon E$ (ϵ = absolute permittivity of the medium F/m) and a total charge $Q = AS$ (A = area of the sensor). Although some instruments measure this charge Q directly, the most sensitive meters modulate the charge and thereby establish an alternating current which is measured by the electrometer amplifier and recorded on a display unit. Modulation can take a variety of forms, one of which (shown) is a motor-driven rotating metal vane, with one or more apertures, that periodically exposes and shields the sensor. Other modulation techniques employ vibrating reeds, tuning forks, etc.

¹ This method is under the jurisdiction of Committee D-9 on Electrical Insulating Materials and is the direct responsibility of Subcommittee D09.12 on Electrical Tests.

Current edition approved June 25, 1976. Published October 1976.

² 1983 Annual Book of ASTM Standards, Vol 10.02.