Designation: F 712 – 88 (Reapproved 1995)

Standard Test Methods for Electrically Insulating Plastic Guard Equipment for Protection of Workers [1]

This standard is issued under the fixed designation F 712; 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. Scope

1.1 These test methods cover three electrical tests on plastic guards and assembled guard systems. They are:

1.1.1 *Method A*—Withstand voltage proof test,

1.1.2 *Method B*—Flashover voltage, and

1.1.3 *Method C*—Leakage current.

1.2 These methods cover, but are not limited to, the following typical guards:

1.2.1 *Conductor Guards and Connecting Covers*:

1.2.1.1 Line guards,

1.2.1.2 Line guard connectors,

1.2.1.3 Insulator covers, and

1.2.1.4 Deadend covers.

1.2.2 *Structure and Apparatus Covers*:

1.2.2.1 Pole guards,

1.2.2.2 Ridge pin covers,

1.2.2.3 Switch blade covers,

1.2.2.4 Arm guards,

1.2.2.5 Cutout covers, and

1.2.2.6 Structural barriers,

1.3 It is common practice for the user of this equipment to prepare instructions for the correct use and maintenance.

1.4 The use and maintenance of this equipment is beyond the scope of these test methods.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies[2]

2.2 *ANSI Standard:*

C39.5 Safety Requirements for Electrical and Electronic Measuring and Controlling Instrumentation[3]

3. Significance and Use

3.1 All three tests may be used for product design qualification.

4. Apparatus

4.1 *Voltage Source and Test Techniques*—See Test Method D 149. The test equipment shall have adequate power and provide relatively stepless variable test voltage that can be raised at a rate of approximately 1000 V/s ac or 3000 V/s dc.

4.2 *Energized Inner Electrodes,* in accordance with Table 1 and Table 2. The length should be sufficient to extend past the ends of the guard or guard assemblies where appropriate.

4.3 *Outer Ground Electrode*—A conductive material with size and location as indicated in Table 1.

4.4 *Shielded Cable*— To reduce the "room influence" when conducting ac leakage tests, the cable from the pickup electrode to the current-measuring device should be a shielded cable with the cable shield grounded.

5. Sampling

5.1 *Design Tests*— Samples shall consist of sufficient specimens of each product used in a specific guard system to form one of each assembly intended for field use.

5.1.1 The design tests will be used to qualify a specific product model and normally will not be repeated during production.

5.2 *Acceptance Tests*— A test sample shall consist of one or more specimens dependent on the percentage of the lot being tested.

5.2.1 A lot is represented either by all the guards produced in one production run or in one shipment.

5.2.2 Lots of new or unused guards shall have test specimens selected at random.

6. Installation of Assembled Guard System

6.1 The guard or assembled guard system is installed on a conductive electrode (Table 1) to be energized at various voltages in accordance with the rating of the guard and the type of test being conducted. The ground electrode shall be a

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[2] *Annual Book o0f ASTM Standards*, Vol 10.01.

[3] Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

TABLE 1 Typical Electrodes for Testing Plastic Guard Equipment

Type of Guards	Energized Inner Electrode for All Tests [A]	Outer Ground Electrode [A]	
		Proof Test Withstand Voltage	Flashover Leakage Tests
Line guards and line guard connectors	Round metal tube or bar.	Complete electode [B] shall be spaced back from openings through which the energized electrode protrudes during the test only as necessary to avoid flashover. Therefore, the entire area of each cover shall be tested as nearly as practical.	4 by 6-in. flexible conductive pad placed alternately on all exterior surfaces and across conductor opening of guard and assembled guard system joints spaced back from openings through which the energized electrode protrudes during the test only as necessary to avoid flashover at outer ends.
Insulator covers and deadened covers	Maximum conductor, hardware and insulator assembly for which rated or similar mock-up including mandrel [C] of conductive material approximate. [D] [E]		
Pole guards, ridge pin and switch blade covers	Round metal tube, fabricated mandrel [C] or cluster small metal tubes. [D]		
Arm guards	Round or rectangular metal tube or fabricated mandrel. [D] [C]		
Cutout covers	Largest cutout with bare leads covered with equal rated line hose. Or similar mock-up including mandrel [C] of conductive material. [D]		
Structural barrier	Rectangular metal sheets approximately 3 mm (0.06 in.) thick, having smoothly rounded edges and corners, have been found to be satisfactory for this purpose. Also satisfactory are wet felt or sponge-top electodes.		

[A]Moistened electrodes may be secured with rubber straps or blanket pins. Pressure-sensitive tape is helpful in securing dry metal foil electrodes.
[B]Suitable materials include: metal foil or screen; tap water-moistened sponge sheeting, or blanket made of wool, or similar material including synthetics.
[C]Thin metal sheet or screen wire secured on wood frames make suitable electrodes. Carved synthetic sponge moistened with tap water is suitable for small forms.
[D]The dimensions of the mandrel are to approximate the maximum size of equipment to which the guard system is to be applied.
[E]Metal canisters made for storing rubber blankets make suitable electrodes for pole guard tests.

TABLE 2 Inner Electrode Sizes

Class [A]	Rating—Max Use		Inner Electrode Diameter, in. (mm)	
	kV	60 Hz	Min	Max
	$\phi - \phi$	$\phi -$ Gr.		
2	14.6	8.4		
3	26.4	15.3	0.25 (6.4)	0.75 (19.1)
4	36.6	21.1		
5	48.3	27.0	0.50 (12.7)	1.50 (38.1)
6	72.5	41.8	0.75 (19.1)	2.00 (50.8)

[A]Cover-up materials are tested at values greater than the maximum use phase to ground values. The maximum use phase to phase values relate to guarded phase to guarded phase. The units are not rated for bare phase to guarded phase potentials.

conductive flexible cover or pad as specified in Table 1.

6.1.1 *Method A, Withstand Voltage Proof Test*—The withstand voltage is determined by energizing, at test voltage, the electrode (Table 1) for a predetermined period of time.

6.1.2 *Method B, Flashover Voltage Test*—The flashover voltage is established by energizing the electrode (Table 1) to the point of flashover.

6.1.3 *Method C, Leakage Current Test*—The leakage current (7.10) is the current between the ground electrode (Table 1) and the energized electrode with the specimen energized at test voltage.

7. Procedure

7.1 **Caution:** The test apparatus shall be designed to afford the operators full protection in the performance of their duties. A reliable means of de-energizing and grounding the high-voltage circuit shall be provided. It is particularly important to incorporate a positive means of grounding the high-voltage section of d-c test apparatus due to the likely presence of high-voltage capacitance charges at the conclusion of the test (see ANSI C39.5).

7.2 Contaminated specimens shall be cleaned in accordance with the manufacturers' recommendations.

7.3 When testing multiple or identical specimens, or both, identify each specimen tested.

7.4 Refer to Table 1 and Table 2 to determine the electrodes appropriate for the guard and type of test to be run.

7.5 Connect a safety ground to the de-energized bus. Set up the inner electrode of size and type indicated in Table 1 and Table 2 and install a specimen on it.

7.6 Install the outer electrode as indicated in Table 1 and connect to ground.

7.7 Remove the safety ground and apply voltage at a rate of approximately 1000 V/s ac or 3000 V/s dc.

7.8 At the termination of the test period decrease the voltage approximately 1000 V/s ac or 3000 V/s dc until 50 % of test value is reached at which point the power supply may be de-energized.

7.9 Connect a safety ground, remove the outer electrode, and examine the specimen.

7.10 Maximum leakage tests require additional procedures as follows:

7.10.1 The proof test specimen may be elevated at least momentarily to a higher voltage than specified for the leakage test before connecting a current-measuring device.

7.10.2 Series connect the microammeter at the grounded end of the lead from the outer electrode.

7.10.3 Record the test room interference current, μA(1), with the power supply and lead energized at the test voltage. The lead from the power supply should not be connected to the inner electrode during this measurement.

7.10.4 Connect the inner electrode to the test bus, apply the voltage, and record the gross μA(2).

7.10.5 Subtract μA(1) from μA(2) to determine the net μA(3), which is the test value.

7.11 Unless instructions to the contrary are included with the test order, guards that fail shall be indelibly marked REJECTED.

7.12 When included in the test order, guards that pass shall be marked PASSED. Marking shall include the ASTM designation number (see 1.1) and whether Methods A, B, or C were used.

7.13 The marking shall be nonconducting and noninjurious to the insulation system.

8. Report

8.1 The report, if required, shall include:

8.1.1 Type of test as indicated in 1.1,

8.1.2 Identification and description of the test specimens ratings and conditions,

8.1.3 Size, material, and locations of the test electrodes with voltage used, results for each location, and whether the ASTM specifications are met,

8.1.4 In maximum leakage test reports, three values in accordance with 7.10.3 through 7.10.5 or µA(3) net leakage at each electrode location and µA(1) correction factor that was applied,

8.1.5 Organization test facility and address, test date, and person or persons conducting the test and writing the report, and

8.1.6 Atmospheric data of room temperature, barometric pressure, and dry- and wet-bulb temperatures at the test site during these tests.

9. Precision and Bias

9.1 Each testing agency has the responsibility of judging the acceptability of its own results. The precision of the results is a function of the procedures, facilities utilized, as well as compliance to the recommended industry state-of-the-art practices. Reproducible analysis determinations by different users can be achieved only with identical facilities and trained conscientious personnel.

9.2 The test equipment shall be of such a quality that the applied voltage shall be within ±5 % of the specified test voltage.

9.3 The current-measuring device shall be of such a quality that the current measured shall be accurate to within ±3 % of full scale.