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Standard Guide for In-Service Inspection, Maintenance, and Electrical Testing of Hand-Held Live-Line Insulating Tools (Fiberglass-Reinforced Plastic (FRP))[1]

This standard is issued under the fixed designation F3121/F3121M; 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 This guide provides recommendations for in-service inspection, maintenance, and electrical testing of hand-held insulating live-line tools.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F711 Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools

3. Significance and Use

3.1 Compliance with this guide should confirm known and acceptable quality of hand-held insulating live-line tools manufactured using fiberglass meeting Specification F711. The guidance herein is to be considered as a minimum requirement.

3.2 The user of this type of protective equipment should be knowledgeable of and instructed in the correct and safe inspection and use of this equipment.

4. Job Site Procedures

4.1 *Field Care, Handling, and Storage*—When not in use, hand-held insulating live-line tools should be stored where they will remain dry, clean, and where they are not subject to abuse. Hand-held insulating live-line tools used for energized-line maintenance should not be laid directly on the ground to avoid contamination or wetting. Hand-held insulating live-line tools should be placed on clean, dry tarpaulins, on moisture-proof blankets, on tool racks, or stick bags, or leaned against dry supports. When transporting hand-held insulating live-line tools, ventilated containers should be provided to prevent damage to the surfaces of them, or they should be mounted on racks in trucks or trailers. These racks should be well padded and so constructed that the hand-held insulating live-line tools are held firmly in place to prevent abrasive or bumping action against any surface that would damage the glossy surface.

4.2 *Daily Inspection and Checking*—Hand-held insulating live-line tools should be visually inspected and wiped clean before use each day. Hand-held insulating live-line tools showing evidence of being mechanically or electrically compromised, such as a tingling or fuzzy sensation experienced by the user when the hand-held insulating tool is near or in contact with energized apparatus should be removed from service and evaluated for repair.

4.2.1 If any of the following observations are present, the hand-held insulating live-line tools should be removed from service and returned to the laboratory or shop for repair and electrical testing.

4.2.1.1 *Visual Inspection–Mechanical Stress:*

(1) Cuts, scratches, nicks, gouges, dents (through the finish), or delamination in the stick surface.

(2) Damaged, bent, worn, loose, or cracked components.

(3) Elongated or deformed rivet ends, roll pins or fasteners.

(4) A loss or deterioration of the glossy surface.

[1] This guide is under the jurisdiction of ASTM Committee F18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.35 on Tools & Equipment.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

(5) Improper storage or improper exposure to weather.

4.2.1.2 *Visual Inspection–Electrical Stress:*

(1) Evidence of electrical tracking, burn marks, or blisters caused from heat.

5. Cleaning and Waxing

5.1 Before each use, hand-held insulating live-line tools should be wiped clean with an absorbent paper towel or a clean, absorbent cloth.

5.2 If simple wiping does not remove the contaminant, refer to the manufacturer's cleaning instructions and then follow by waxing (carnauba or manufacturer recommended wax) or wiping with a silicone-treated cloth approved by manufacturer.

5.3 Waxing or use of silicone cloth is not necessary after every use, but rather as needed to maintain a glossy surface that will cause any moisture or water to bead on the surface. Before the hand-held insulating live-line tool is rewaxed, the surface should always be cleaned with a solvent or cleaner recommended by the manufacturer. Hollow tubes should be cleaned on the inside.

5.4 Waxing or use of silicone cloth imparts a glossy finish to the surface of the insulated tool and improves the electrical integrity by providing a protective barrier against contaminants.

6. Periodic Inspection and Testing

6.1 Hand-held insulating live-line tools used for primary employee protection should be removed from service every two years for examination, cleaning, repair, and testing according to this section. Use one of the following sections for the electrical testing: 6.3, 6.4, 6.5, or 6.6. Any hand-held insulating live-line tool that is rejected should be removed from service, repaired and retested, or disposed of.

6.2 *Visual Inspection Procedure*—See 4.2 for inspection procedure.

6.3 *Segmented Test Method Metering Every Segment–(Unguarded Electrodes):*

6.3.1 The test apparatus should be designed to provide the operator full protection in the performance of his duties and provide reliable means of de-energizing and grounding the high-voltage circuit. Isolate the test equipment and specimen to guard against accidental contact by persons in the vicinity.

6.3.2 Test the entire insulating length of the hand-held insulating live-line tool in accordance with Table 1.

6.3.3 Ensure that the test contacts (electrodes) are of any conductive material that will provide contact around the circumference of the test specimen (see Fig. 1). If parallel testing is performed the electrodes around the hand-held insulating live-line tool should maintain contact on the circumference of the tool. Bundle testing is not permitted.

TABLE 1 Hand-Held Insulating Live-Line Tool Testing – Single meter for multiple segments

Fiberglass-Reinforced Plastic (FRP)		
Segment Length	AC/DC Test Voltage, kV	Test Time
152.4-mm [6-in.] segments	37.5	5 min
304.8-mm [12-in.] segments	75	3 min

6.3.4 Before installing a test specimen into the apparatus, a baseline leakage test should be performed that takes into account the capacitive coupling between electrodes (tester geometry) and the specific atmospheric conditions at the testing location. Baseline leakage of more than 150 µA is cause to check and repair your test apparatus. This baseline test establishes the leakage level that is inherent in the test apparatus. Repeat this procedure at least every 4 h.

6.3.5 Spray the test segment with distilled water to wet its surface thoroughly. Conductivity of the water should be 3.0 micromhos/cm or less. A clean spray applicator, adjusted to a fine mist, is suitable for this purpose.

6.3.6 Spray water uniformly on the hand-held insulating live-line tool until droplets just begin to roll down the surface. Water should be sprayed perpendicular to the surface (axis). Avoid spraying water under the operating rod guides and handguard (if applicable), avoid bridging the gap between the operating rod and the tube (if applicable), and avoid bridging the insulation between the pickup electrode and the ground. As an alternate method of wetting, the sticks may be submerged in water then positioned at a 30° angle with end cap removed for 2 min to allow water to run out. Use caution when using this method for extend/telescoping sticks. Ensure all water is drained prior to the electrical test.

6.3.7 Suspend the hand-held insulating live-line tool in a horizontal position using insulated supports. The test specimen should be mounted to prevent flashover to the cabinet frame or floor.

6.3.8 Wrap the electrodes around the hand-held insulating live-line tool so contact is maintained on the circumference.

6.3.9 Using the installed metal hardware as the electrode connection (either high voltage or ground return) is acceptable.

6.3.10 Attach the meter leads to the pick-up (ground return) electrode.

6.3.11 Apply potential to each test segment within 15 min after wetting. Increase the voltage gradually at not more than 10 kV/s [50/60 Hz] alternating current (ac) or direct current (dc) to the appropriate voltage and duration specified in Table 1.

6.3.12 Measure the maximum leakage current in the ground return meter. Subtract the baseline leakage measured earlier and record the corrected leakage value. A corrected leakage in excess of 75 µA per segment signifies a failure.

6.3.13 During the course of testing, if there is a sign of flashover, tracking, or puncture on any segment, the hand-held insulating live-line tool should be rejected.

6.4 *Segmented Test Method Metering Every Segment–(Guarded Electrodes):*

6.4.1 The test apparatus should be designed to provide the operator full protection in the performance of his duties and provide reliable means of de-energizing and grounding the high-voltage circuit. Isolate the test equipment and specimen to guard against accidental contact by persons in the vicinity.

6.4.2 Test the entire insulating length of the hand-held insulating live-line tool in accordance with Table 2.

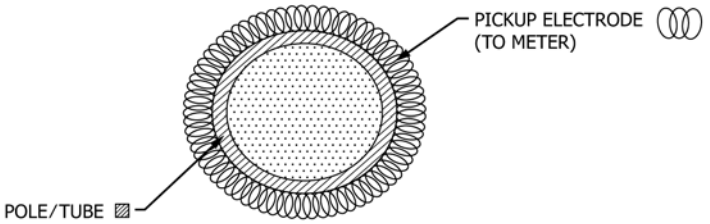

FIG. 1 Test Setup Example – Unguarded Energized Source Electrode

TABLE 2 Hand-Held Insulating Live-Line Tool Testing – Metering every segment with guarded electrodes

Segment Length	AC/DC Test Voltage, kV	Test Time
152.4-mm [6-in.] segments	37.5	1 min
304.8-mm [12-in.] segments	75	1 min

6.4.3 Ensure that the test contacts (electrodes) are of any conductive material that will provide contact around the circumference of the test specimen, as shown in Fig. 2. If parallel testing is performed, the electrodes around the hand-held insulating live-line tool should maintain contact on the circumference. Bundle testing is not permitted.

6.4.4 Spray the test segment with distilled water to wet its surface thoroughly. Conductivity of the water should be 3.0 micromhos/cm or less. A clean spray applicator, adjusted to a fine mist, is suitable for this purpose.

6.4.5 Spray water uniformly on the hand-held insulating live-line tool until droplets just begin to roll down the surface. Water should be sprayed perpendicular to the surface (axis). Avoid spraying water under the operating rod guides and hand guard (if applicable), avoid bridging the gap between the operating rod and the tube (if applicable), and avoid bridging the insulation between the pickup electrode and the guard (shield). As an alternate method of wetting, the sticks may be submerged in water then positioned at a 30° angle with end cap removed for 2 min to allow water to run out. Use caution when using this method for extend/telescoping sticks. Ensure all water is drained prior to the electrical test.

6.4.6 Suspend or support the hand-held insulating live-line tool as shown in Fig. 3. The support insulators should provide adequate clearance to prevent flashover to the cabinet frame or floor.

6.4.7 Wrap the guarded portion of the shielded electrode around the hand-held insulating live-line tool so contact is maintained on the circumference. The guarded electrode is only required on the grounded end where leakage current measurement is being acquired.

6.4.8 Using the installed metal hardware as the electrode connection (either high voltage or ground return) is acceptable.

6.4.9 Attach the meter leads to the pick-up (ground return) electrode. Attach the guard (shield) to the ground.

6.4.10 Apply potential to each test segment within 15 min after wetting. Increase the voltage gradually at not more than 10 kV/s [50/60 Hz] alternating current (ac) or direct current (dc) to the appropriate voltage and duration specified in Table 2.

6.4.11 Measure the maximum leakage current in the ground return meter. (The leakage current should not exceed 1 µA per kV per foot at 60 Hz or 0.83 µA per foot at 50 Hz.)

6.4.12 During the course of testing, if there is a sign of flashover, tracking, or puncture on any segment, the hand-held insulating live-line tool should be rejected.

6.5 *Segmented Test Method Using a Single Meter for Multiple Segments:*

6.5.1 The test apparatus should be designed to provide the operator full protection in the performance of his duties and provide reliable means of de-energizing and grounding the high-voltage circuit. Isolate the test equipment and specimen to guard against accidental contact by persons in the vicinity.

6.5.2 Test the entire insulating length of the hand-held insulating live-line tool in accordance with Table 1.

6.5.3 Ensure that the test contacts (electrodes) are of any conductive material that will provide contact around the circumference of the test specimen (see Fig. 1). If parallel testing is performed the electrodes around the hand-held insulating live-line tool should maintain contact on the circumference. Bundle testing is not permitted.

6.5.4 Before installing a test specimen into the apparatus, a baseline leakage test shall be performed that takes into account the capacitive coupling between electrodes (tester geometry) and the specific atmospheric conditions at the test location.

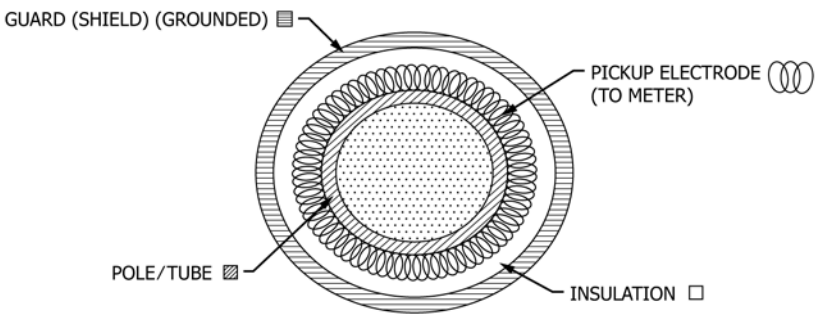

FIG. 2 Test Setup Example – Guarded Ground Return Electrode