



Designation: F2973 – 21

Standard Specification for Insulating Lifting Links for Load Lifting Equipment Working Near Energized Power Lines¹

This standard is issued under the fixed designation F2973; 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 specification covers insulating lifting links used for protection of workers positioning a load from accidental contact of the load lifting equipment with live electrical conductors, apparatus, and circuits.

1.2 This specification includes design, material, and testing requirements for the manufacturer and in-service inspection, testing and care requirements for the user or the agent of the user.

1.3 Insulating links whose primary application does not pertain to power line electrical safety are not within the scope of this specification.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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

1.6 *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

[E4 Practices for Force Verification of Testing Machines](#)

¹ This specification is under the jurisdiction of ASTM Committee F18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.55 on Inspection and Non-Destructive Test Methods for Aerial Devices.

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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.

[F819 Terminology Relating to Electrical Protective Equipment for Workers](#)

2.2 *IEEE Standard:*³

[IEEE 4 Standard Techniques for High-Voltage Testing](#)

2.3 *ISO Standard:*⁴

[ISO 7500-1 Metallic Materials—Verification of Static Uniaxial Testing Machines—Part 1: Tensile Testing Machines—Corrigendum](#)

3. Terminology

3.1 *Definitions*—Terminology used in this specification is in accordance with Terminology [F819](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *design verification test, n*—test made on a sample treated as representative of an industrial product.

3.2.2 *electrical test, n*—a test ensuring that a product meets the minimum electrical requirements of the standard.

3.2.3 *flashover, n*—a disruptive discharge over the surface of the insulating link.

3.2.4 *mechanical test, n*—a test confirming that a product meets the minimum mechanical requirements of a standard.

3.2.5 *proof load, n*—specific mechanical load applied in the performance of the proof load test.

3.2.6 *proof test, n*—mechanical and electrical tests performed by the manufacturer on all production units.

3.2.7 *puncture, n*—disruptive discharge through an insulator.

3.2.8 *qualified personnel, n*—personnel who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, have demonstrated the ability to deal with problems relating to the subject matter, the work, or the project.

3.2.9 *rated load, n*—the maximum working load.

3.2.10 *visual inspection, n*—visual check made to detect defects that impede the performance of a product(s).

³ Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., Piscataway, NJ 08854, <http://www.ieee.org>.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

4. Materials and Manufacture

4.1 The mechanical design factor shall not be less than 5.0 times its rated load for ratings up to 100 tons and 4.0 times rated load for ratings 100 tons and up.

4.2 The electrical design factor of the link shall not be less than 2 times its rated use voltage.

4.3 The insulation system shall not absorb water and shall have a water repellent surface.

4.4 Weather shields shall be made of impact resistant nonconductive material.

4.5 UV resistant polymers should be employed by the manufacturer if, without them, electrical performance may be affected.

4.6 Steel used shall meet ASTM or AISI standards.

5. Workmanship and Finish

5.1 The insulating surface of the links shall be free of cracks, nicks, gouges, damage to the insulating surface that would affect its insulating properties in both dry and wet conditions.

5.2 *Markings*—Each link should bear permanent, accessible, and readily visible markings that include, at a minimum, the manufacturer’s mark, ASTM XXX, unit serial number, rated voltage, and rated load.

5.3 *Manuals*—The manufacturer shall provide a manual with each link. The manual shall contain:

5.3.1 Descriptions, specifications, and ratings of the link.

5.3.2 Ambient temperature range for which the link is designed.

5.3.3 Precautions concerning weather.

5.3.4 Instructions regarding routine and frequency of inspections and maintenance.

6. General Test Requirements

6.1 Personnel responsible for the tests outlined in this document shall be qualified individuals in accordance with 3.2.8, knowledgeable in the use of the test equipment used for tensile loading and high-voltage testing.

6.2 The electrical test equipment shall meet the requirements of IEEE 4-1995. The metering systems including measurement cable used to measure AC current shall have a system error of 5 % or less.

6.3 The electrical test set up shall provide the operator protection in the performance of his duties and isolate the specimen to guard against accidental contact by persons in the vicinity.

6.4 The ambient temperature for the test location shall not be lower than 15.5 °C.

6.5 Electrical discharge characteristics and measured current of a test object can be affected by its general arrangement, such as the clearance from other energized or grounded structures, the height above ground level, or the arrangement of the high-voltage lead that may affect flashover voltages. For that reason, the general arrangement should be as shown in Fig. 1 for testing links that are not installed on load lifting equipment.

6.6 Clearance to nearby structures that are equal to or greater than two times the length of the shortest possible electrical discharge path on the test object should make any proximity effects negligible.

7. Design Verification Tests

7.1 Design verification tests are to be performed on at least one representative unit from each class of insulating link, and this will qualify that class of link models of variable rated loads for a given rated voltage. A test unit is considered to be representative of its group if it meets the following requirements:

7.1.1 The same structural and dielectric materials, structural designs, manufacturing, and assembly methods apply to all links in the group,

7.1.2 The same structural stress and loading analysis can be applied to all the links in the group,

7.1.3 The test unit has the same or smaller electrical creepage and arcing distances per kV of rating.

7.2 *Mechanical Design Verification Test Procedure:*

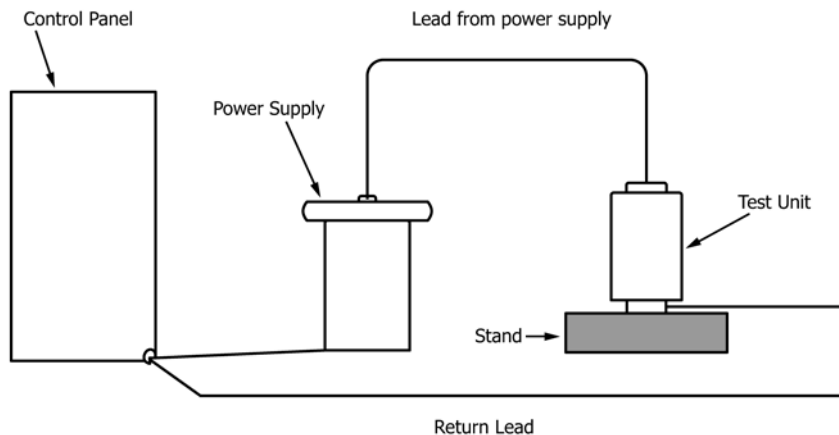


FIG. 1 Suggested Test Set Up for Insulated Links