Designation: F2249 – 20$^{\varepsilon 1}$

Standard Specification for In-Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-Energized Electric Power Lines and Equipment[1]

This standard is issued under the fixed designation F2249; 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.

ε[1] NOTE—In 7.5.3, reference to Tables X3.2 and X4.2 was removed editorially as these tables were removed in the last edition. In X3.2.1.1, the reference to Specifications F855 Table 2, and in X3.4.2, the reference to Specifications F855 Table 5 were corrected to Specifications F855 Table 1, and in X1.1 and X2.1, the first sentences were corrected from "four acceptable cables" to "two acceptable cables" editorially in January 2021.

1. Scope

1.1 These specifications cover the in-service inspection and electrical testing of temporary protective grounding jumper assemblies which have been used by electrical workers in the field.

1.2 These specifications discuss methods for testing grounding jumper assemblies, which consist of the flexible cables, ferrules, clamps and connectors used in the temporary protective grounding of de-energized circuits.

1.3 Manufacturing specifications for these grounding jumper assemblies are in Specifications F855.

1.4 The application, care, use, and maintenance of this equipment are beyond the scope of this specification.

1.5 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.6 The following safety hazards caveat pertains only to the test portions of this specification. *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.*

1.7 *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]

B172 Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors

B173 Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors

F855 Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

2.2 *IEEE Standards:*[3]

IEEE Standard 80–2013 IEEE Guide for Safety in AC Substation Grounding

IEEE Standard 1048–2016 IEEE Guide for the Protective Grounding of Power Lines

IEEE Standard 1246–2011 IEEE Guide for Temporary Protective Grounding Systems Used in Substations

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *grounding jumper assembly*—grounding cable with connectors and ground clamps attached, also called a *grounding jumper* or a *protective ground assembly* installed temporarily on de-energized electric power circuits for the purpose of

[1] This specification is under the jurisdiction of ASTM Committee F18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.45 on Mechanical Apparatus.

Current edition approved Aug. 1, 2020. Published September 2020. Originally approved in 2003. Last previous edition approved in 2018 as F2249-18. DOI: 10.1520/F2249-20E01.

[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.

[3] Available from the Institute of Electrical and Electronics Engineers, Inc. (IEEE) 1828 L St., NW, Suite 1202, Washington, DC 20036–5104.

potential equalization and to conduct a short circuit current for a specified duration (time).

4. Significance and Use

4.1 Grounding jumper assemblies can be damaged by rough handling, long term usage, weathering, corrosion, or a combination thereof. This deterioration may be both physical and electrical.

4.2 The test procedures in this specification provide an objective means of determining if a grounding jumper assembly meets minimum electrical specifications. These methods permit testing of grounding jumper assemblies under controlled conditions.

4.3 Each responsible entity must determine the required safety margin for their workers during electrical fault conditions. Guidelines for use in the determination of these conditions are beyond the scope of this specification and can be found in such standards as IEEE Standard 80–2013 and IEEE Standard 1048–2016, and IEEE Standard 1246–2011.

4.4 Mechanical damage, other than broken strands, may not significantly affect the cable resistance. Close manual and visual inspection is required to detect some types of mechanical damage.

4.5 The test procedures in this specification should be performed at a time interval established by the user to ensure that defective grounding jumper assemblies are detected and removed from service in a timely manner.

4.6 Retest the grounding jumper assembly after performing any maintenance, in order to ensure its integrity.

5. Inspection of Grounding Jumper Assemblies

5.1 Visual inspection shall be made of all grounding jumper assemblies prior to testing.

5.1.1 If the following defects are evident, the grounding jumpers may be rejected without electrical testing:

5.1.1.1 Cracked or broken ferrules and clamps,

5.1.1.2 Exposed broken strands,

5.1.1.3 Cut or badly mashed or flattened cable,

5.1.1.4 Extensively damaged cable- covering material,

5.1.1.5 Swollen cable jacket or soft spots, indicating internal corrosion, and

5.1.1.6 Cable strands with a black deposit on them.

5.1.2 Grounding jumper assemblies which are visually defective shall be removed from service and permanently marked, tagged or destroyed (if beyond repair) to prevent re-use.

5.1.3 Before the grounding jumper assembly can be placed back in service, it must pass the inspection requirements in 5.1.1, and the electrical requirements in Section 7.

5.1.4 All physical connections should be checked for tightness with specified torque values.

6. Cleaning and Measuring of Grounding Jumper Assembly Prior to Electrical Testing

6.1 Identify the cable gage (AWG) and a make a precise measurement of the cable length. See Fig. 1.

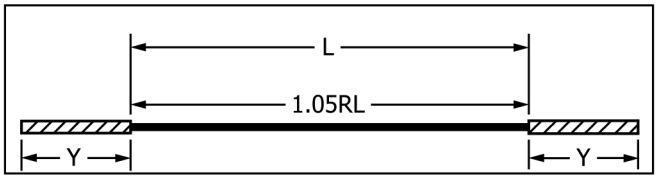

FIG. 1 Resistance and Impedance of Copper Grounding Jumper Assemblies

Y = resistance of clamps, ferrule and portions of the cable inside the ferrule, mΩ

L = cable length expressed in feet (ferrule to ferrule measurement to the nearest inch, not including shrouded portion of some ferrules which cover the cable insulation), and

R = cable resistance from Table 1, mΩ/ft.

6.2 Thoroughly clean the jaws of the clamps with a stiff wire brush.

6.3 Attach the grounding jumper assembly clamps firmly to the test set.

7. Electrical Requirements

7.1 The user must select the test method with the desired precision and repeatability. The test instrument should be sufficiently accurate to detect at least a one foot or less change in cable length to ensure that the cable meets requirements.

7.2 Each method must take into account a precise cable resistance per foot and the length of the cable being tested.

7.3 Electrical tests relative to this standard are:

7.3.1 DC resistance measurements,

7.3.2 AC impedance measurements, and

7.3.3 Temperature rise measurements (supplementary method).

7.4 *DC Resistance or AC Impedance Method*—Equipment required includes:

7.4.1 A minimum 10 A dc source controllable to 5 % of output current, short circuit protected, or

7.4.2 A minimum 10 A ac source controllable to 5 % of output current, short circuit protected.

7.4.3 Measuring method for measurements of cable length calibrated in inches or centimeters.

7.5 *In-Service Electrical Resistance Pass/Fail Criteria*—The pass/fail criterion of a grounding jumper assembly is based on the resistance value of the assembly (cable, ferrules and clamps) which is higher than the established resistance value for new assemblies. This increase in resistance accounts for manufacturing tolerance and the expected normal deterioration of the assembly due to aging, contamination and corrosion, particularly in the contact areas of the cable ferrules and clamps. The allowable increase in resistance is such as to permit the grounding jumper assembly to perform safely during electrical faults. The grounding jumper assembly, when subjected to its rated maximum fault current and duration, must withstand the fault without its components separating, but