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.

Designation: F855 – 23

Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment [1]

This standard is issued under the fixed designation F855; 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 specifications cover the equipment making up the temporary grounding system used on de-energized electric power lines, electric supply stations, and equipment.

1.2 It is common practice for the users of protective grounding equipment to prepare complete instructions and regulations to govern in detail the correct use and maintenance of such equipment.

1.3 The uses and maintenance of this equipment are beyond the scope of these specifications.

1.4 These specifications for a system of protective grounding utilizing copper cables are covered in four parts, as follows:

	Sections
Clamps for Temporary Protective Grounds	4 – 16
Ferrules for Temporary Protective Grounds	17 – 30
Cables for Temporary Protective Grounds	31 – 39
Protective Grounds (Complete Assembly With Clamps, Ferrules, and Cable)	40 – 52

1.5 Each of the four parts is an entity of itself, but is listed as a part of the system for completeness and clarification.

1.6 Currents presented in Table 1 are based upon cable melting times, as determined from equations by I. M. Onderdonk and are to used in situations involving an asymmetry value less than 20 % ($X/R \leq 1.8$). See Appendix X1.

1.6.1 Currents presented in Table 2 are based upon the values from EPRI Project RP2446 Computer Program RTGC "A Desktop Computer Program for Calculating Rating of Temporary Grounding Cables" and are to be used in situations involving an asymmetry value greater than 20 % ($X/R \geqq 1.8$), see Appendix X2.

NOTE 1—Table 1 represents the clamp and assembly ratings that existed prior to this revision. Table 2 represents new ratings now required for high *X/R* situations.

1.6.2 See Appendix X1 and Appendix X2 for a discussion of these topics.

1.7 The values stated in Newton-Meter units are to be regarded as the standard. The values in parentheses are the inch-pound units.

1.8 The following precautionary caveat pertains to the test method portions, Sections 12 and 25 of these specifications: *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.*

1.9 *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

D470 Test Methods for Crosslinked Insulations and Jackets for Wire and Cable

D753 Specification for General Purpose Polychloroprene Jacket for Wire and Cable (Withdrawn 1984)[3]

D2219 Specification for Poly(Vinyl Chloride) Insulation for Wire and Cable, 60 °C Operation

D2633 Test Methods for Thermoplastic Insulations and Jackets for Wire and Cable

D2768 Specification for General-Purpose Ethylene-Propylene Rubber Jacket for Wire and Cable (Withdrawn 2007)[3]

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

Current edition approved Feb. 1, 2023. Published February 2023. Originally approved in 1983. Last previous edition approved in 2020 as F855 – 20. DOI: 10.1520/F0855-23.

[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] The last approved version of this historical standard is referenced on www.astm.org.

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TABLE 1 Protective Ground Cable, Ferrule, Clamp and Assembly Ratings for Symmetrical Current

Grade	Grounding Clamp Torque Strength, min				Short Circuit Properties[A]							Continuous Current Rating, A RMS, 60 Hz
	Yield[B]		Ultimate		Withstand Rating, Symmetrical kA RMS, 60 Hz			Ultimate Rating Capacity[CD], Symmetrical kA RMS, 60 Hz				
	lbf·in.	n·m	lbf·in.	n·m	15 cycles (250 ms)	30 cycles (500 ms)	Copper Cable Size	15 cycles (250 ms)	30 cycles (500 ms)	60 cycles (1 s)	Maximum Copper Test Cable Size	
1	280	32	330	37	14	10	#2	18	13	9	2/0	200
2	280	32	330	37	21	15	1/0	29	21	14	4/0	250
3	280	32	330	37	27	20	2/0	37	26	18	4/0	300
4	330	37	400	45	34	25	3/0	47	33	23	250 kcmil	350
5	330	37	400	45	43	30	4/0	59	42	29	250 kcmil	400
6	330	37	400	45	54	39	250 kcmil or 2 2/0	70	49	35	350 kcmil	450
7	330	37	400	45	74	54	350 kcmil or 2 4/0	98	69	48	550 kcmil	550

[A] Withstand and ultimate short circuit properties are based on performance with surges not exceeding 20 % asymmetry factor (see 9.1 and 12.3.4.2).
[B] Yield shall mean no permanent deformation such that the clamp cannot be reused throughout its entire range of application.
[C] Ultimate rating represents a symmetrical current which the assembly or individual components shall carry for the specified time.
[D] Ultimate values are based upon application of Onderdonk's equation to 98 % of nominal circular mil area allowed by Specifications B172 and B173.

NOTE 1—TPG testing is done on complete assemblies. Assembly ratings assume the grade of lowest graded component (see 43.1.6).

D2770 Specification for Ozone-Resisting Ethylene-Propylene Rubber Integral Insulation and Jacket for Wire and Cable (Withdrawn 2007)[3]
E8/E8M Test Methods for Tension Testing of Metallic Materials

2.2 *ANSI/IEEE Standard:*[4]
C 37.09 Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Basis

2.3 *ICEA/NEMA Standard:*[5]
ICEA S-19-81/NEMA WC 3-80 (R 1986) Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

2.4 *IEC Standard:*[6]
IEC 61230 Ed. 2, 2008, Portable Equipment for Earthing or Earthing and Short-Circuiting

2.5 *IEEE Standard:*[7]
IEEE 386 Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE 1048 Guide for Protective Grounding of Power Lines
IEEE 1246 Guide for Temporary Protective Grounding Systems Used in Substations

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *continuous current rating*—designated RMS current which can be carried continuously under specified conditions.

3.1.2 *protective ground assembly*—a temporary electrical connection between a source of potential energization and the earth, rated for the maximum anticipated fault current or continuous induced current, or both.

3.1.2.1 *Discussion*—Throughout this specification, kc mil = 1000 circular mils.

3.1.3 *protective grounding equipment*—devices installed temporarily on de-energized electric power circuits for the purposes of potential equalization and to conduct a short circuit current for a specified duration (time).

3.1.4 *time to failure*—failure time of the cable is the time between the initiation of current flow and the instant at which arcing begins.

3.1.5 *ultimate capacity*—this represents a current which it is calculated the component is capable of conducting for the specified time. It is expected that component damage may result. The component shall not be reused, except in test situations.

3.1.6 *withstand rating*—this represents a near symmetrical current which shall be conducted without any component being damaged sufficiently to prevent being operable and reusable. The protective ground shall be capable of passing a second test at this current after being cooled to ambient temperature.

CLAMPS FOR TEMPORARY PROTECTIVE GROUNDS

4. Scope

4.1 This specification covers clamps used with ferrules and elastomer or thermoplastic covered flexible cable in the manufacture of protective grounds installed temporarily for protective grounding of de-energized circuits.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.
[5] Available from The Insulated Cable Engineers Association, Inc. (ICEA), P.O. Box 2694, Alpharetta, GA 30023, http://www.icea.net.
[6] Available from International Electrotechnical Commission (IEC), 3 rue de Varembé, Case postale 131, CH-1211, Geneva 20, Switzerland, http://www.iec.ch.
[7] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., P.O. Box 1331, Piscataway, NJ 08854-1331, http://www.ieee.org.