Designation: F2321 – 23

Standard Specification for Flexible and Rigid Insulated Temporary By-Pass Jumpers[1]

This standard is issued under the fixed designation F2321; 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 the manufacture and testing of flexible insulated temporary By-Pass jumpers (By-Pass jumpers) used on energized power lines and equipment.

1.2 It is common practice for the user of this protective equipment to prepare complete instructions and safety regulations to govern in detail the correct and safe use of such equipment. Also see 4.2.

1.3 The use and maintenance of this equipment are beyond the scope of this specification.

1.4 This specification for a system of By-Pass jumpers is covered in four parts as follows:

Title	Sections
Clamps for By-Pass Jumpers	5 – 17
Ferrules for By-Pass Jumpers	18 – 31
Cable for By-Pass Jumpers	32 – 40
By-Pass Jumpers (complete assembly with clamps, ferrules, and cable)	41 – 55

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 The values stated in SI units are to be regarded as the standard. See IEEE/ASTM SI 10.

1.7 The following precautionary caveat pertains only to the test method portions, Sections 13, 26, 48, and 55 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.*

1.8 *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]

B33 Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes

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

D2768 Specification for General-Purpose Ethylene-Propylene Rubber Jacket for Wire and Cable (Withdrawn 2007)[3]

D2770 Specification for Ozone-Resisting Ethylene-Propylene Rubber Integral Insulation and Jacket for Wire and Cable (Withdrawn 2007)[3]

D2802 Specification for Ozone-Resistant Ethylene-Alkene Polymer Insulation for Wire and Cable (Withdrawn 2020)[3]

D2865 Practice for Calibration of Standards and Equipment for Electrical Insulating Materials Testing

E8/E8M Test Methods for Tension Testing of Metallic Materials

F819 Terminology Relating to Electrical Protective Equipment for Workers

IEEE/ASTM SI 10 American National Standard for Metric Practice

2.2 *ANSI Standards:*[4]

ANSI C39.5 Safety Requirements for Electrical and Electronic Measuring and Controlling Instruments

ANSI C84.1 Voltage Ratings for Electric Power Systems and Equipment (60 Hz)

ANSI C119.4 American National Standard for Electrical Connectors

[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 Feb. 1, 2023. Published March 2023. Originally approved in 2003. Last previous edition approved in 2020 as F2321 – 14 (2020). DOI: 10.1520/F2321-23.

[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.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

2.3 *NEMA Standard:*[5]

WC 8 Ethylene-Propylene-Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (formerly ICEA S-68-516)

3. Terminology

3.1 *Definitions:*

3.1.1 *flexible and rigid insulated temporary By-Pass jumpers*—devices designed and used to keep electric supply circuits effectively continuous (electrically bridged) for short periods of time at work locations when conductors or equipment may otherwise be opened or made electrically discontinuous during work operations.

3.1.1.1 *Discussion*—The devices are normally installed, used, and removed as part of a protective insulating system composed of insulating covers and/or observances of required minimum safe approach distances for workers.

3.1.2 *voltage, normal design*—a nominal value consistent with the latest revision of ANSI C84.1, assigned to the circuit or system for the purpose of conveniently designating its voltage class.

3.1.3 *voltage, maximum use*—the ac voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to phase-to-phase voltage on multiphase circuits.

3.1.3.1 *Discussion*—If there is no multiphase exposure in a system area, and the voltage exposure is limited to phase (polarity on dc systems) to ground potential, the phase (polarity on dc systems) to ground potential shall be considered to be the nominal design voltage.

3.1.3.2 *Discussion*—If electrical equipment and devices are insulated or isolated, or both, such that the multiphase exposure on a grounded wye circuit is removed, then the nominal design voltage may be considered as the phase-to-ground voltage on that circuit.

NOTE 1—The work practices and methods associated with removing multiphase exposures at any given work site are not addressed in this specification.

3.2 For definitions of other terms, refer to Terminology F819.

4. Significance and Use

4.1 This specification covers the minimum electrical and physical properties designated by the manufacturer and the detailed procedures by which such properties are to be determined. The purchaser may at his option perform or have performed any of these tests in order to verify the manufacturer's designation. Claims for failure to meet the specification are subject to verification by the manufacturer.

4.2 By-Pass jumpers are devices designed and used to keep electrical circuits effectively continuous (electrically bridged) for short periods of time at work locations when conductors or equipment may otherwise be opened or made discontinuous during work operations. By-Pass jumpers are insulated to temporarily protect personnel from brush or accidental contact only; therefore, when authorizing their use, a margin of safety should be provided between the maximum voltage used on, and the proof-test voltage at which they are tested. The relationship between proof-test voltage and the maximum voltage at which By-Pass jumpers are used is shown in Table 1. **Warning—**Portions of these devices (clamps and ferrules) are not insulated and offer no protection from accidental contact.

CLAMPS FOR BY-PASS JUMPERS

5. Scope

5.1 This specification covers clamps used in the assembly of By-Pass jumpers.

6. Classification

6.1 Clamps are furnished in, but not limited to, two styles according to their function and method of installation.

6.1.1 *Style I*—Clamps equipped with insulated handles for installation on energized conductors with rubber gloves. See Fig. 1.

6.1.1.1 Insulated handles may be either clear or opaque.

6.1.1.2 Insulating materials used in this specification include thermo-set plastic, elastomers, elastomer compounds, thermoplastic polymers or any combination, regardless of origin.

6.1.2 *Style II*—Clamps equipped with provisions for installation on energized conductors with live line tools. See Fig. 2 and Fig. 3.

6.1.2.1 Clamps are furnished according to mechanical strength and current rating. See Table 2.

6.2 Clamps are furnished in two classes according to the characteristics of the main contact jaws.

6.2.1 *Class A*—Clamp jaws with smooth contact surfaces.

6.2.2 *Class B*—Clamp jaws with serrations, crosshatching or other means intended to abrade or bite through corrosion products on the surface of the conductor being clamped.

7. Sizes

7.1 Clamp size is the combination of the main contact and cable size ranges as listed by the manufacturers.

8. Ordering Information

8.1 Orders for clamps under this specification shall include this ASTM designation and the following information:

8.1.1 Quantity,

8.1.2 Name (By-Pass Jumper Clamp),

TABLE 1 Proof Test/Use Voltage Relationship

Voltage Rating	Maximum Use Voltage (rms) V	AC Proof Test Voltage (rms) V	DC Proof Test Voltage (avg) V
15 kV	15 000	20 000	50 000
25 kV	25 000	30 000	60 000
35 kV	35 000	40 000	70 000
69 kV	69 000	74 000	

[5] Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1847, Rosslyn, VA 22209.

FIG. 1 Style I Clamp

FIG. 2 Style II "C" Shape Clamp

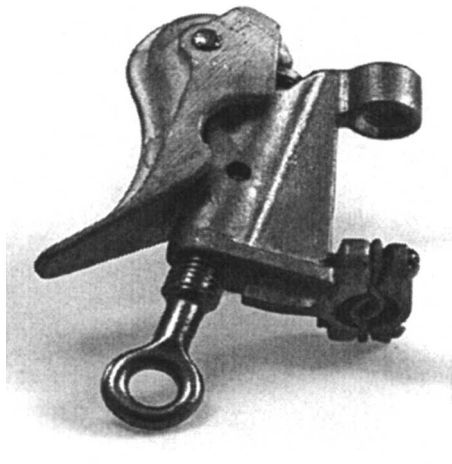

FIG. 3 Style II Duck Bill Shape Clamp

TABLE 2 Clamp Torque Strength, min—Style II Clamps

Cable Size	Continuous Current	Yield[A]	Ultimate
(AWG)	A, rms, 60 Hz	N-m (lbf in.)	N-m (lbf in.)
#2	200A	32 (280)	37 (330)
1/0	250A	32 (280)	37 (330)
2/0	300A	32 (280)	37 (330)
4/0	400A	37 (330)	45 (400)

[A] Yield shall mean no permanent deformation such that the clamp cannot be reused throughout its entire range of application.

TABLE 3 Material Properties

	Copper Base Alloy	Aluminum Base Alloy
Tensile Strength, min.	207 Mpa (30 000 psi)	207 Mpa (30 000 psi)
Yield Strength, min.	90 Mpa (13 000 psi)	138 Mpa (20 000 psi)
Elongation, min	6 %	3 %

8.1.3 Main contact size ranges, conductor descriptions, and type of materials which are to be clamped,

8.1.4 Cable size, material, and description by which clamps are to be assembled,

8.1.5 Style (see 6.1),

8.1.6 Class (see 6.2), and

8.1.7 Clamps for By-Pass jumpers, at the customer's request, shall meet ANSI C119.4.

9. Materials

9.1 Current carrying parts of copper base or aluminum base alloy shall meet the material properties shown in Table 3 and in accordance with Test Methods E8/E8M.

10. Electrical and Mechanical Properties

10.1 Materials used shall meet the requirements of 9.1.

10.2 Electrical and mechanical properties shall conform to the requirements prescribed in Tables 1-3 and with the following:

NOTE 2—Style II clamps are uninsulated and do not require conformance with the electrical requirements of Table 1.

10.2.1 Clamps shall accept hand assembly of all cables fitted with compatible ferrules as rated per Table 2.

10.2.2 Main contacts shall accept and clamp all conductors according to the manufacturer's recommendation.

10.2.3 Style II clamps shall have the following properties:

10.2.3.1 In the event the clamp is over-torqued during installation, normal fracture shall be such that the attached cable remains under control by being retained with the live line tool. Clamps with an ultimate torque strength exceeding 45 N-m (400 lbf in.) are exempt from this provision.

10.2.3.2 Cable termination shall include a cable support or shall be made to accept a cable supporting ferrule compatible with the clamp. This support shall secure the entire cable over the jacket and is provided in addition to the electrical connection to the strand.

10.2.3.3 Clamps shall be compatible with clamp sticks and shall fit securely inside the 13 mm (½-in.) wide slot in the head of the stick.