



Standard Specification for Flexible Insulated Temporary By-Pass Jumpers¹

This standard is issued under the fixed designation F 2321; 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 flexible insulated temporary bypass jumpers (bypass 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.

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

1.4 These specifications for a system of bypass jumpers is covered in four parts as follows:

Title	Sections
Clamps for Bypass Jumpers	5-17
Ferrules for Bypass Jumpers	18-31
Cable for Bypass Jumpers	32-40
Bypass Jumpers (complete assembly with clamps, ferrules, and cable)	41-53

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 ASTM SI 10.

1.7 The following precautionary caveat pertains only to the test method portions, Sections 13, 26, and 48 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 and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

B 172 Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electric Conductors

B 173 Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors

D 2768 Specification for General-Purpose Ethylene-Propylene Rubber Jacket for Wire and Cable

D 2770 Specification for Ozone-Resisting Ethylene-Propylene Rubber Integral Insulation and Jacket for Wire and Cable

E 8 Test Methods for Tension Testing of Metallic Materials

F 819 Terminology Relating to Electrical Protective Equipment for Workers

SI 10 Practice for Use of the International System of Units (SI) (the Modernized Metric System)

2.2 ANSI Standard:

ANSI C119.4 American National Standard for Electrical Connectors³

2.3 NEMA Standard:

WC 8 Ethylene-Propylene-Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (formerly ICEA S-68-516)⁴

3. Terminology

3.1 Definitions:

3.1.1 *flexible insulated temporary bypass 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.

3.2 For definitions of other terms, refer to Terminology F 819.

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 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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁴ Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1847, Rosslyn, VA 22209.

4. Significance and Use

4.1 These specifications cover 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 Bypass 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. Bypass 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 bypass 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 BYPASS JUMPERS

5. Scope

5.1 This specification covers clamps used in the assembly of bypass 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 eyes for installation on energized conductors with live line tools. See Figs. 2-4.

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.

TABLE 1 Proof Test/Use Voltage Relationship

Voltage Rating	Maximum Nominal 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



FIG. 1 Style I Clamp



FIG. 2 Style II “C” Shape Clamp

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 (Bypass Jumper Clamp),
- 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 bypass jumpers, at the customer’s request, shall meet ANSI C119.4.



FIG. 3 Style II "C" Shape Clamp



FIG. 4 Style II Duck Bill Shape Clamp

TABLE 2 Clamp Torque Strength, min—Style II Clamps

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

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

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

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 %

accordance with Test Methods E 8.

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:

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 (1/2-in.) wide slot in the head of the stick.

10.2.4 Main contacts shall accept and clamp all conductors or structural members in accordance with the manufacturer’s rating.

11. Workmanship, Finish, and Appearance

11.1 Components shall be free of structural porosity, fins, sharp edges, splits, cracks and other defects that affect handling or performance.

11.2 All parts shall be formed, machined, and assembled with sufficient accuracy for smooth operation by hand, and shall be free of excessive looseness to the extent detrimental to repeated applications at the recommended installing torque.

11.3 Class A (smooth jaw) clamps shall have smooth contact surfaces free of burrs, fins, or other protuberances that would impair performance.

11.4 Class B (serrated jaw) clamps shall have longitudinally level surface, that, with clamp movement as specified by the manufacturer, will provide a cleaning effect on the surface of the conductor.

11.5 Slag grinding marks, depressions, and other surface irregularities that do not affect strength, performance, or handling are not cause for rejection.

12. Sampling

12.1 A product model represents a manufacturer’s design specification standard according to which the production lot is manufactured.

12.2 A production lot shall consist of all clamps of one production model produced at one time.

12.3 A test sample shall consist of two specimens for each different test specified. Specimens are selected at random and shall pass the inspection requirements of Section 14. When a failure occurs in one specimen from the first sample, a second

sample from the same lot shall be selected and tested. If the second sample (two specimens) passes, the lot shall be accepted. If one specimen from the second sample fails, the lot shall be rejected.

13. Design Tests

13.1 The design tests that follow shall be made on test samples of each product model to verify that the requirements of this specification are met.

13.2 *Mechanical Torque Strength:*

13.2.1 Install the clamp on the main conductor of the minimum and maximum size for which the clamp is rated and apply torsion force to the main screw. Force may be applied to other devices designed to secure the clamp on the conductor.

13.2.2 Measure torque by a torque wrench that indicates torque directly or by other manner easily convertible.

13.2.3 The main conductor is defined as the material(s) on which the clamp is rated to be used.

13.2.4 Yield and ultimate strength shall equal or exceed the values shown in Table 2.

13.3 *Continuous Current Rating:*

13.3.1 Test the clamp at the continuous current level for which it is rated. The temperature shall be measured at the warmest spot on clamp and on the metal strand at the midpoint of an attached cable, which is a minimum of 1.5 m (5 ft.) in length. The maximum temperature of the clamp shall be lower than the midpoint temperature of the maximum size copper main or tap cable for which the clamp is rated.

14. Inspection and Product Testing

14.1 The clamps shall be inspected and tested as follows:

14.1.1 Verification of the main contact and cable capacities are in accordance with 10.2.2 and 10.2.3.

14.1.2 Visual inspection and hand operation shall be done to verify workmanship, finish, and appearance, which shall be in accordance with Section 11.

14.1.3 Torque test on a test sample shall be in accordance with 13.2.

15. Acceptance, Rejection and Rehearing

15.1 At the option of the purchaser, a production lot may be subjected to the following:

15.1.1 Inspection in accordance with 14.1 for operation, main contact range, workmanship, and appearance. Individual clamps that do not conform may be rejected.

15.2 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

15.3 If electrical testing, mechanical testing, or both, are required by a user prior to acceptance, it shall be done in accordance with this specification for any part or for all of the tests to be performed.

16. Certification

16.1 When specified in the purchase order or contract, a manufacturer's or supplier's certification shall be furnished to the purchaser that the clamps were manufactured, sampled,

tested, and inspected in accordance with this specification and have been found to meet the requirements. When specified in the purchase order or contract, a report of design test shall be furnished.

17. Packaging and Package Marking

17.1 Clamps shall be marked with the name or logo of the manufacturer, identity number, and date code to indicate year of manufacture.

17.2 A packing list indicating manufacturer's product numbers and quantities of each different clamp shall be provided with each shipment.

17.3 Each shipment shall be packaged to provide protection of the contents appropriate for the mode of transportation.

CABLE FERRULES FOR BYPASS JUMPERS

18. Scope

18.1 This specification covers ferrules used with bypass jumpers.

18.2 Two styles of ferrules are available and are designated as shrouded or unshrouded.

19. Classification

19.1 Ferrules are furnished in four types as follows:

19.1.1 *Type I*—Compression ferrule is cylindrical and made for installation on cable stranding by compression.

19.1.2 *Type III*—Plain stud-shrouded compression ferrule has a stepped bore that accepts entire cable and jacket. (See Fig. 5.)

19.1.3 *Type IV*—Threaded stud shrouded compression ferrule has a stepped bore that accepts entire cable over jacket and has male threads at forward end. (See Fig. 6.)

19.1.4 *Type VI*—Threaded stud compression ferrule has male threads at forward end. (See Fig. 7.)

20. Size

20.1 Ferrule size is the combination of cable capacity, stud description, and size after installation of cable.

21. Ordering Information

21.1 Orders for ferrules under this specification should include this ASTM designation and the following information:

21.1.1 Quantity,

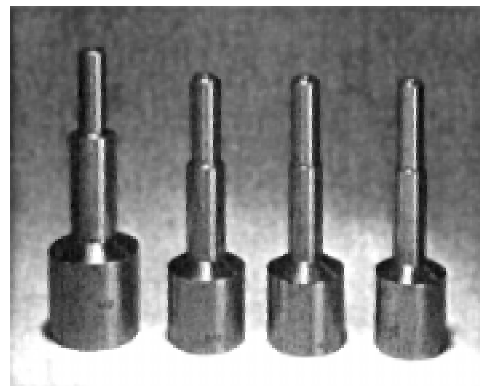


FIG. 5 Type III Plain Stud-Shrouded Compression Ferrule

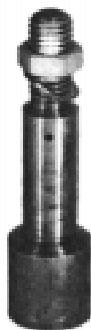


FIG. 6 Type IV Threaded Stud-Shrouded Compression Ferrule



FIG. 7 Type VI Threaded Stud Compression Ferrule

- 21.1.2 Name (Bypass Jumper Cable Ferrules),
- 21.1.3 Description, and material of clamp in which ferrule is to be installed,
- 21.1.4 Cable description to include conductor size, material and outside diameter of insulation on which ferrule is to be installed, and
- 21.1.5 Type (see 19.1).

22. Materials

- 22.1 Current carrying parts of copper base or aluminum base ferrules shall meet the following requirements:
 - 22.1.1 *Copper Base Alloy*—Copper content 60 % minimum.
 - 22.1.2 *Aluminum Base Alloy*—Aluminum content 90 % minimum.

23. Electrical and Physical Properties

23.1 Closed end ferrules utilizing the compression method of cable installation may have a 3 mm (0.125 in.) minimum diameter inspection vent hole through one side at the bottom of the (cable) bore. This applies to Types III, IV, and VI.

23.2 Ferrules shall accept cables for which they are rated without alteration of strands, and can be assembled by hand with compatible clamps.

24. Workmanship, Finish and Appearance

- 24.1 Components shall be free of structural defects that affect installation, assembly or performance.
- 24.2 Minor surface irregularities that do not affect strength or performance are not cause for rejection.

25. Sampling

- 25.1 A product model represents a manufacturer’s design specification according to which the production lot is manufactured.
- 25.2 A production lot shall consist of all ferrules of one product model produced at one time.
- 25.3 A test sample shall consist of two specimens selected at random from a production lot for each different test specified. When a failure occurs in one specimen from the first sample, a second sample shall be selected from the same lot and tested. If the second sample (two specimens) passes, the lot shall be acceptable. If one specimen from the second sample fails, the lot shall be rejected.

26. Design Tests

- 26.1 Design tests shall be made on test samples of each product model to verify that the requirements of the specification are met.
- 26.2 *Continuous Current Rating:*
 - 26.2.1 Test the ferrules at the continuous current rating. The temperature shall be measured at the warmest spot on the clamp and on the metal strand at the midpoint of an attached cable, which is a minimum of 1.5 m (5 ft) in length. The maximum temperature of the ferrule shall be lower than the midpoint temperature of the maximum size copper cable for which the ferrule is rated.

27. Inspection

27.1 Visual and gauging inspection shall verify workmanship, finish, and appearance in accordance with Section 24.

28. Acceptance, Rejection, and Rehearing

- 28.1 At the option of the purchaser, a production lot may be subjected to the following:
 - 28.1.1 Gauging inspection in accordance with Section 27. Individual ferrules that do not confirm may be rejected.
 - 28.1.2 A test sample may be tested for continuous current, in accordance with Table 4.
 - 28.1.3 Failure of two specimens from two test samples, which have been properly installed according to the manufacturer’s specifications, shall be cause for rejection of the production lot from which the samples were taken.
 - 28.1.4 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

TABLE 4 Bypass Jumper Cable Design and Ratings

Conductor Size (AWG)	Stranding, (min)	Current Rating A, rms, 60 Hz	Insulation, min. (mils)			Jacketing, min (mils)
			15 kV	25 kV	35 kV	
#2	133	200	175	^A	^A	65
1/0	259	250	175	260	345	65
2/0	259	300	175	260	345	65
4/0	359	400	175	260	345	65

^A Conductor size #2 unavailable for the 25 kV and 35 kV ratings.

29. Certification

29.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the ferrules were manufactured, sampled, tested, and inspected in accordance with this specification and have been found to meet the requirements. When specified in the purchase order or contract, a report of design test shall be furnished.

30. Product Marking

30.1 Ferrules shall be marked with the manufacturer's identity code.

31. Packaging

31.1 Each shipment shall be packaged to provide protection of the contents appropriate for the mode of transportation.

CABLE FOR BYPASS JUMPERS

32. Scope

32.1 This specification covers the material, construction, and testing of the cable used in the manufacture of bypass jumpers.

33. Classification

33.1 Bypass jumper cables have flexible stranded copper conductors, insulated with ethylene-propylene rubber (EPR). A heavy duty polyethylene jacket can be applied directly over the insulation for additional mechanical protection. Cables covered under this specification are designated as Jacketed and Non-Jacketed.

33.2 Flexible portions of bypass jumpers should remain suitably flexible for application and removal in temperatures down to -29°C (-20°F).

33.3 *Type I*—Insulated cable without a protective jacket.

33.4 *Type II*—Insulated cable with a protective jacket.

33.5 *Voltage Ratings*—There are three voltage ratings for bypass jumpers, 15kV, 25kV, and 35kV. (See Table 1.)

34. Size

34.1 Cable conductor sizes shall be stated in American Wires Gage numbers (AWG) #2, 1/0, 2/0, and 4/0.

35. Ordering Information

35.1 Orders for cables under this specification shall include this ASTM designation and the following information:

35.1.1 Quantity,

35.1.2 Unit of measure, (meters or feet),

35.1.3 Conductor size (see 34.1),

35.1.4 Type (see 33.3 and 33.4), and

35.1.5 Voltage Ratings (see 33.5).

36. Materials

36.1 *Copper Conductor*:

36.1.1 Rope-Lay-Stranded Copper Conductors Having Bunch Stranded or Concentric Stranded Members—Specifications B 172, or B 173.

36.2 *Conductor Shielding*:

36.2.1 Conductor shield (stress control layer)—conductor—NEMA WC 8, Part 2, paragraph 2.7.

36.3 *Insulation*:

36.3.1 Insulation shall be Ethylene-Propylene-rubber (EPR)—NEMA WC 8, Part 3 at test voltage for 100 % insulation level.

36.3.2 Ethylene-Propylene-rubber shall meet the specifications of Specification D 2768 or Specification D 2770.

36.3.3 The insulation thickness for the cable used in bypass jumpers is listed in Table 4.

36.3.4 For jacketed cable, the jacket shall be extruded directly over the insulation and shall be Neoprene or Chloro-sulfonated Polyethylene—NEMA WC 8, Part 4.

37. Workmanship, Finish, and Appearance

37.1 Cable shall be free of structural defects that affect installation, assembly, or performance.

37.2 Minor surface irregularities that do not affect strength or performance are not cause for rejection.

38. Design and Current Ratings

38.1 The design and current ratings for the cable used in bypass jumpers are listed in Table 4.

39. Certification

39.1 When specified in the purchase order or contract, a producer or supplier's certification shall be furnished to the purchaser that the cable was manufactured and tested in accordance with NEMA WC 8.

40. Cable Marking and Packaging

40.1 Cable shall be clearly marked at 4-ft intervals with the AWG conductor size and voltage rating.

40.2 In the placing of individual orders, package size shall be agreed upon by the manufacturer and the purchaser. The cable shall be protected against damage from ordinary handling and shipping.

ASSEMBLED BYPASS JUMPERS

41. Scope

41.1 This specification covers the complete assembly of bypass jumpers for temporary use of electrical systems.

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

42. Classification

42.1 Assembled bypass jumpers are furnished in two styles according to their function and method of application.

42.1.1 *Style I*—Assembled bypass jumpers designed and manufactured to be installed with rubber gloves (see Fig. 8).

42.1.2 *Style II*—Assembled bypass jumpers designed and manufactured to be installed with live line tools (see Fig. 9).

42.2 Assembled bypass jumpers are furnished in three voltage ratings according to the electrical characteristics, as indicated in Table 5.

42.3 Assembled bypass jumpers are furnished in two types according to the characteristics of the cable:

42.3.1 *Type I*—Insulated cable without a protective jacket.



FIG. 8 Style I—Assembled By-pass Jumper, Designed and Manufactured to be Installed with Rubber Gloves

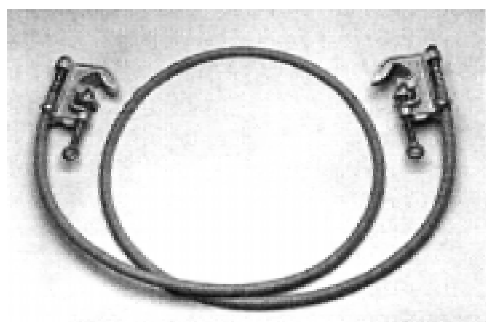


FIG. 9 Style II—Assembled By-pass Jumper Designed and Manufactured to be Installed with Live Line Tools

TABLE 5 Assembled By-Pass Jumper Ratings

Voltage Rating	Maximum Nominal Use Voltage (rms) V	AC Proof Test Voltage (rms) V	DC Proof Test Voltage (avg) V	Current Rating A (rms) 60Hz			
				#2	1/0	2/0	4/0
15 kV	15 000	20 000	50 kV	200	250	300	400
25 kV	25 000	30 000	60 kV	200	250	300	400
35 kV	35 000	40 000	70 kV	200	250	300	400

42.3.2 *Type II*—Insulated cable with a protective jacket.

42.4 Assembled bypass jumpers are furnished in two classes according to the characteristics of the clamp main contact jaws:

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

42.4.2 *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.

43. Ordering Information

43.1 Ordering assembled bypass jumpers under this specification shall include this ASTM designation and the following information:

- 43.1.1 Style (see 42.1.1),
- 43.1.2 Voltage Ratings (see 42.2),
- 43.1.3 Type (see 42.3), and
- 43.1.4 Class (see 42.4).

44. Materials

44.1 Clamps, cables, and ferrules shall meet the requirements prescribed in these specifications.

45. Electrical and Mechanical Properties

45.1 Electrical and mechanical properties shall conform to the requirements prescribed in Table 1, Table 2, Table 3, and Table 4 as appropriate.

46. Workmanship, Finish, and Appearance

46.1 All components of the assembled bypass jumpers shall be free of structural porosity, fins, sharp edges, splits, cracks, and other defects that affect their handling and performance.

46.2 All components of the assembled bypass jumper shall be formed, machined, and assembled with sufficient accuracy for smooth operation by hand. Clamps shall be free of excessive looseness to the extent detrimental to repeated applications at recommended installing torque.

46.3 Clamps, cables, and ferrules shall be assembled tightly and securely.

46.4 Nonharmful physical irregularities that do not affect strength or performance of the assembled bypass jumpers are not cause for rejection.

47. Sampling

47.1 A complete assembled bypass jumper product model represents a manufacturer’s design specification standard according to which the product model is manufactured.

47.2 A production lot shall consist of all assembled bypass jumpers of one product model produced at one time.

47.3 A test sample consists of two specimens of assembled bypass jumpers selected at random from a production lot for the specified test. When a failure occurs in one specimen from the first sample, a second sample shall be selected from the same lot and tested. If the second sample (two specimens) passes, the lot shall be accepted. If one specimen from the second sample fails, the lot shall be rejected.

48. Design Tests

48.1 Test samples of each component product model shall have been made by the manufacturer or supplier to verify conformance with the performance requirements of these specifications.

49. Bypass Jumper Ratings

49.1 The rating of the assembled bypass jumpers is governed by the ratings of the individual components.

50. Inspection and Production Testing

50.1 Inspection and production tests shall include the following:

50.1.1 All assembled bypass jumpers shall be inspected and tested to verify workmanship, finish, appearance, secure assembly, and integrity of the product in accordance with Section 46.

50.1.2 Verification that the clamps, ferrules, cable sizes, and lengths are as specified by the purchaser.

51. Acceptance, Rejection and Rehearing

51.1 At the option of the purchaser a production lot may be subject to the following:

51.1.1 Inspection in accordance with Section 50, for operation, safe use, workmanship, and appearance. Individual components or permanent assemblies that do not conform may be rejected.

51.1.2 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the manufacturer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the manufacturer or supplier may make claim for a rehearing.

51.1.3 If electrical testing or mechanical testing, or both, is required by a user, prior to acceptance, it shall be done in accordance with this specification for the assembled bypass jumpers.

52. Certification

52.1 When specified in the purchase order or contract, a manufacturer's or supplier's certification shall be furnished to

the purchaser that the assembled bypass jumpers were manufactured, sampled, tested, or inspected in accordance with this specification and have been found to meet the requirements. When specified in the purchase order or contract, a report of design tests shall be furnished.

53. Packaging and Product Marking

53.1 Assembled bypass jumpers shall be marked with the name or logo of the manufacturer, and identity number.

53.2 A packaging list indicating manufacturer's product numbers and quantities of each different assembled bypass jumper ordered shall be provided.

53.3 Each shipment shall be packaged to provide protection of the contents appropriate for the mode of transportation.

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