

IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV

IEEE Power and Energy Society

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Insulated Conductors Committee



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IEEE Std 386™-2016
(Revision of IEEE Std 386-2006)

IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV

Sponsor

**Insulated Conductors Committee
of the
IEEE Power and Energy Society**

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1. ~~Red Text~~ - Red strikethrough text denotes deletions.
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Abstract: Definitions, service conditions, ratings, interchangeable construction features, and tests are established for loadbreak and deadbreak separable insulated connector systems for use on power distribution systems rated 2.5 kV through 35 kV and 900 A or less.

Keywords: deadbreak connector, elbow connector, IEEE 386™, loadbreak connector, power distribution systems, separable conductor, separable insulated connector systems

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Introduction

This introduction is not part of IEEE Std 386-2016, IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV.

This standard was developed in response to a need created by the rapid expansion of underground distribution systems. A key element that allowed this expansion to become a reality is the separable insulated connector. This device provides for simple and inexpensive connection and switching to transformers and other equipment used in underground distribution.

When separable insulated connectors became available, IEEE and the National Electrical Manufacturers Association (NEMA) worked cooperatively to develop a document that defined the interfaces, ratings, and test conditions for the device. The success of that cooperative effort is apparent from both the vast number of these devices now in interchangeable use in the field and their enviable safety record.

This cooperative effort continues due to the ongoing upgrading and changing nature of these underground systems and products. The recent cooperative effort has been provided by the ANSI C119.2 Subcommittee and the IEEE Working Group on Separable Connectors under the auspices of the Insulated Conductors Committee of the IEEE Power Engineering Society.

This revision reflects the following major additions:

- changed the document title to state specific system voltages covered
- defined connector components
- added color coding for 600-A loadbreak connectors
- added 900-A deadbreak connectors
- added 600-A loadbreak connectors
- added 15-, 25-, 28- and 35-kV voltage class designations
- added straight and multi-point (“I,” “H,” and “Y”) connectors
- addressed handling of no-test samples during switching and fault-close testing
- expanded operating interface ac withstand test and made it normative
- added tee connector/cable adaptor interchangeability test
- redrew all figures
- deleted switching test circuit (b), formerly in Figure 19 of IEEE 386-2006, now [Figure 28](#) in this revision of the standard
- removed the requirement for the 15-min dc withstand test (now informative in [Annex C](#))
- removed the requirement for limited interchangeability that was formerly 6.4.2 in IEEE 386-2006
- changed the partial discharge sensitivity from 3 pC to 5 pC
- added that mechanical actuators shall not be used for fault close testing

For information on the application of separable connectors, refer to IEEE Std 1215TM-2013¹

¹For information on references, see [Clause 2](#).

Contents

1. Scope.....	14
2. Normative references	14
3. Definitions, abbreviations, and acronyms	15
3.1 Definitions	15
3.2 Abbreviations and acronyms	19
4. Service conditions	19
4.1 Usual service conditions	19
4.2 Unusual service conditions	19
5. Ratings and characteristics	19
5.1 Voltage ratings and characteristics	19
5.2 Current ratings and characteristics	20
6. Construction	21
6.1 Identification	21
6.2 Operating means	22
6.3 Shielding	23
6.4 Interchangeability	23
6.5 Test point	23
6.6 Hold-down bails	24
6.7 Bushing well stud torque withstand	24
6.8 Thermal cycle withstand	24
7. Testing	24
7.1 Production tests	24
7.2 Design tests	24
7.3 Test conditions	49
7.4 Partial discharge test	49
7.5 Dielectric tests	50
7.6 Short-time current test	53
7.7 Switching test	53
7.8 Fault-closure test	57
7.9 Current-cycling test for uninsulated components of 600-A and 900-A connectors	59
7.10 Current-cycling test for 200-A insulated connectors	60
7.11 Current-cycling test for 600-A and 900-A insulated connectors	62
7.12 Accelerated sealing life test	63
7.13 Cable pull-out test (tensile strength)	64
7.14 Operating-force test for separable connectors with an operating eye	64
7.15 Operating-eye test	64
7.16 Test point cap test	64
7.17 Test point tests	65
7.18 Shielding test	65
7.19 Bushing well stud torque withstand test	65
7.20 Thermal cycle withstand test	65
7.21 Tee separable insulated connector interchangeability test	66
Annex A (informative) Trial use guide for testing of separable connector lubricants	68
Annex B (informative) IEC versus IEEE ratings	71

Annex C (informative) DC withstand test voltage reference	77
Annex D (informative) Bibliography	78

List of Figures

Figure 1—Interface 1: typical components of 200-A separable insulated connector system (previously Figure 1 in IEEE Std 386-2006)	25
Figure 2—Interface 2: a 200-A connection configuration, 15-, 25-, 28-, and 35-kV class.....	26
Figure 3—Interface 3: a 200-A deadbreak bushing well interface, 15-, 25-, 28-, and 35-kV class (previously Figure 3 in IEEE Std 386-2006)	27
Figure 4—Interface 4: a 200-A deadbreak interface, 15-, 25-, and 28-kV class (previously Figure 4 in IEEE Std 386-2006)	28
Figure 5—Interface 5: a 200-A loadbreak interface, 15-kV class (previously Figure 5 in IEEE Std 386-2006).....	29
Figure 6—Interface 7A: a 200-A loadbreak interface, 25- and 28-kV class (previously Figure 7 in IEEE Std 386-2006)	30
Figure 7—Interface 8, a 200-A loadbreak interface, 35-kV class (large interface, previously Figure 8 in IEEE Std 386-2006)	31
Figure 8—Interface 9: a 200-A loadbreak interface, single-phase, 35-kV class (large interface, previously Figure 9 in IEEE Std 386-2006).....	32
Figure 9—Interface 7B, a 200-A loadbreak interface, 35-kV class (small interface, previously Figure 7 in IEEE Std 386-2006).....	33
Figure 10—Interface 10: a 200-A deadbreak interface, 35-kV class (previously Figure 10 in IEEE Std 386-2006).....	34
Figure 11—Typical components of a 600- or 900-A separable insulated connector system (previously Figure 2 in IEEE Std 386-2006)	35
Figure 12—Interface 19: a 600- and 900-A connection configuration, 15-, 25-, 28-, and 35-kV class	36
Figure 13—Interface 11: a 600- and 900-A deadbreak interface, 15- and 25-kV class (previously Figure 11 in IEEE Std 386-2006)	37
Figure 14—Interface 12: a 600- and 900-A deadbreak interface, 15-, 25-, and 28-kV class (previously Figure 12 in IEEE Std 386-2006)	38
Figure 15—Interface 13: a 600- and 900-A deadbreak interface, 35-kV class (previously Figure 13 in IEEE Std 386-2006)	39
Figure 16—Interface 14: a 600- and 900-A deadbreak interface, 35-kV class (previously Figure 14 in IEEE Std 386-2006)	40
Figure 17—Interface 15: a 600-A loadbreak interface 15-, 25-, 28-, and 35-kV class	41
Figure 18—Interface 16: a 600- and 900-A disconnectable joint, 15-, 25-, 28-, and 35-kV class	42
Figure 19—Interface 17: a cable adapter for use with 600- and 900-A 15-, 25-, and 28-kV deadbreak separable insulated connectors and 15-, 25-, 28-, and 35-kV disconnectable buses	43
Figure 20—Interface 18: a cable adapter for use with 600- and 900-A 35-kV deadbreak separable insulated connectors.....	44

Figure 21—Stacking dimensions for a 200-A loadbreak separable insulated connector system, 15-, 25-, 28-, and 35-kV class (previously Figure 16 in IEEE Std 386-2006).....	45
Figure 22—Stacking dimensions for a 200-A deadbreak separable insulated connector system, 15- and 25-kV class (previously Figure 17 in IEEE Std 386-2006)	46
Figure 23—Stacking dimensions for a 600- and 900-A deadbreak separable insulated connector system, 15-, 25-, 28-, and 35-kV class (previously Figure 18 in IEEE Std 386-2006)	47
Figure 24—Typical components, 600- and 900-A, 15-, 25-, 28- and 35-kV deadbreak disconnectable buses	48
Figure 25—Typical connection configuration, disconnectable buses.....	49
Figure 26—Circuit diagram for operating interface ac withstand test	52
Figure 27—Short time-current waveform	54
Figure 28—Circuit diagrams for switching current tests.....	56
Figure 29—Circuit diagrams for fault-closure tests	58
Figure 30—Thermal test with off-axis operation (7.10.2).....	62
Figure 31—Thermal cycle profile	66
Figure B.1—IEC/CENELEC cone-style bushing	76

List of Tables

Table 1—Voltage ratings and characteristics for loadbreak connectors.....	20
Table 2—Voltage ratings and characteristics of deadbreak connectors	20
Table 3—Current ratings and characteristics for loadbreak connectors.....	20
Table 4—Current ratings and characteristics for deadbreak connectors	21
Table 5—200-A loadbreak connector color code	22
Table 6—600-A loadbreak connector color code	22
Table 7—Static operating force.....	23
Table 8—Design tests.....	50
Table 9—Impulse wave shape tolerances.....	53
Table 10—Voltage conditions for switching test.....	54
Table 11—Ground plane spacing for switching and fault-closure tests	55
Table 12—Voltage conditions for fault-closure test	57
Table 13—Cable insulation thickness and conductor definition for 7.10 , 7.11 , and 7.12	60
Table A.1—Lubricant properties.....	70
Table B.1—IEEE versus IEC voltage ratings	72
Table B.2—IEEE 386 versus IEC bushing interface	73
Table B.3—Primary IEC and CENELEC screened (shielded) separable connector test sequence	75
Table C.1—Voltage ratings and reference dc test levels for separable insulated connectors	77

IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV ~~Above 600 V~~

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1. Scope

This standard establishes definitions, service conditions, ratings, interchangeable construction features, and tests for loadbreak and deadbreak separable insulated connector systems rated 900 ~~above 600 V, 600~~ A or less, for use on shielded power distribution systems rated 2.5 kV through 35 kV.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI C119.4, Electric ~~Electrical~~ Connectors—Connectors for Use between Aluminum-to-Aluminum or Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93 °C and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100 °C.² ~~Bare Overhead Connectors.~~¹

ANSI/ASQ ~~ASQC~~ Z1.4-2003 (R2013), Sampling Procedures and Tables for Inspection by Attributes.

ASTM F467, Standard Specification for Nonferrous Nuts for General Use.³²

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³²ASTM publications are available from the American Society for Testing and Materials, ~~100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA~~, <http://www.astm.org/>.

IEEE Std 4TM, IEEE Standard for High-Voltage Testing Techniques^{4,5,4}

IEEE Std 592TM, IEEE Standard for Exposed Semiconducting Shields on High-Voltage Cable Joints and Separable ~~Insulated~~ Connectors.

IEEE Std ~~1215TM-2013, 386-2006~~ IEEE ~~Guide Standard~~ for ~~the Application of~~ Separable Insulated ~~Connectors~~ ~~Connector Systems~~.

~~[B-10]~~ IEEE Std C37.09TM~~1999,~~ IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

IEEE Std C37.60TM-2012, IEEE/IEC high-voltage switchgear and controlgear—Part 111: Automatic circuit reclosers and fault interrupters for alternating current systems up to 38 kV

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3. Definitions, abbreviations, and acronyms

3.1 Definitions

For the purposes of this document ~~standard~~, the following terms and definitions apply. The IEEE Standards ~~Authoritative~~ Dictionary Online ~~of IEEE Standards Terms [B7]~~⁵ should be consulted ~~referenced~~ for terms not defined in this clause.⁶

The following definitions are the intended meanings of terms used in this standard or associated with separable insulated connector systems. Figure 1, Figure 112, Figure 2146, Figure 22, Figure 2317, and Figure 2418 show typical components of separable insulated connectors. The term *connector* as used in this standard means separable insulated connector.

access port: An interface on a separable connector that provides a path to the interior for the temporary insertion of a voltage testing device or injection of cable rejuvenation fluids.

access port cap: A semi-conductive shielded cover with an insulated probe for an access port.

⁶IEEE Standards Dictionary Online subscription is available at: <http://ieeexplore.ieee.org/xpls/dictionary.jsp>.

arc quenching rod: An ablative material added to the end of a probe that serves to pressurize and cool the arc and help deionize the arc by-products while approaching current zero, assisting in the arc interruption process.

arc ring: Material inserted between the metal contact area of a loadbreak probe and the arc quenching rod for the purpose of limiting arc damage to the probe metal.

NOTE—See Figure [7](#) ⁸ and Figure [8](#) ⁷ ~~9~~ ⁶.

bushing extender: A connector that provides two in-line elbow interfaces.

[NOTE—See Figure 23](#)

bushing insert: A connector component intended for insertion into a bushing well designed for use with another connector component, such as an elbow.

NOTE—See Figure 1, [Figure 21](#), and [Figure 22](#).

bushing well: An apparatus bushing having a cavity for insertion of [a](#) connector component, such as a bushing insert.

^{z6}Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

NOTE—See Figure 1, [Figure 21](#), and [Figure 22](#).

bushing well plug: An accessory device designed to electrically insulate, electrically shield, and mechanically seal a bushing well.

NOTE—See [Figure 21](#) and [Figure 22](#).

cable adaptor: A connector component that fits over the insulation of the cable increasing its diameter to properly mate with the cable [entrance interface](#) ~~accessory~~.

cable entrance interface: The portion of the separable insulated connector where the shielded cable is installed, typically where the insulation shield cutback and electrical stress control occurs. There are two interface types, with or without adaptor. Interfaces that do not require an adaptor can be either push-on or shrinkable.

compression lug: The internal current carrying part of [a separable insulated connector designed for an elbow designed for the transition of](#) the transition of the current path from the cable conductor to the connector.

connecting plug: A connector that provides two in-line bushing interfaces.

continuous current rating: The designated rms alternating ~~or direct~~ current that the connector can carry continuously under specified conditions.

dead-end separable insulated connector: A device with a single interface, used to terminate, electrically shield, electrically insulate and seal an interface. Typical devices include insulated caps, insulated parking bushings, and insulated plugs.

NOTE—See Figure 1, Figure 21, Figure 22, Figure 23, and Figure 24.

~~**3.11 dead-front bushing arrester:** An insulated and shielded surge protective device with a bushing operating interface.~~

dead-front separable insulated connector elbow arrester: An insulated and shielded surge protective electrical device. These devices have an arrester and one or more interfaces. Typical devices include bushing arresters, bushing well arresters, elbow arresters, tee arresters, and parking stand arresters ~~device with an elbow operating interface.~~

NOTE—See Figure 21.

deadbreak connector: A separable insulated connector designed to be separated and engaged on de-energized circuits only. This includes disconnectable buses.

NOTE—See Figure 22, Figure 23, and Figure 24.

drain wire (grounding) tab: A projection on the outer surface of a connector component or accessory device designed for placement of a wire to bond the outer shield of the device to ground. The tab and the wire are not rated for carrying fault current.

elbow: See [elbow separable insulated](#) ~~A connector component for connecting a power cable to a bushing, so designed that when assembled with the bushing, the axes of the cable and bushing are perpendicular.~~

elbow separable insulated connector: A device with two interconnected interfaces used to electrically insulate, electrically shield and seal the interfaces where the two interfaces are at a right angle to each other. One of the interfaces is a cable interface and the other is a bushing interface. Typical devices include 200 A loadbreak elbows and 200 A deadbreak elbows.

NOTE—See Figure 1, [Figure 21](#), and Figure [22](#).

feed-thru bushing insert: An accessory device with two electrically interconnected bushing interfaces that can be installed into a bushing well.

NOTE—See Figure 21.

feed-thru parking bushing: An accessory device with two electrically interconnected bushing interfaces that can be installed into a parking stand.

NOTE—See Figure 21.

grounding parking bushing: See [grounding separable insulated connector](#) ~~An accessory device designed to electrically ground and mechanically seal a de-energized power cable terminated with an elbow and to be installed into a parking stand.~~

grounding separable insulated connector: A device that grounds and seals a de-energized cable, cable system or apparatus. All have short-time current ratings. Those for loadbreak systems also have a fault-closure rating. Typical devices include grounding elbows, grounding bushings, and grounding caps.

NOTE—See Figure 21, Figure 22, Figure 23, and Figure 24.

grounding tab: ~~See A projection on a connector component or accessory device designed for the placement of a drain wire for the purpose of (grounding) tab the outer shield of the device.~~

insulated cap: An accessory device designed to electrically insulate, electrically shield, and mechanically seal a bushing insert or integral bushing.

NOTE—See Figure 1, Figure 21, Figure 22, Figure 23, and Figure 24.

insulated parking bushing: An accessory device designed to electrically insulate, electrically shield, and mechanically seal a power cable terminated with an elbow and to be installed into a parking stand.

NOTE—See Figure 21, Figure 22, and Figure 23.

insulated plug: An accessory device designed to electrically insulate, electrically shield, and mechanically seal an elbow interface.

NOTE—See Figure 23 and Figure 24.

integral bushing: An apparatus bushing designed for use with another connector component, such as an elbow.

NOTE—See Figure 1, [Figure 21](#), [Figure 22](#), and [Figure 23](#).

live break connector: [A separable insulated connector designed to be separated and engaged on energized circuits under the condition of no-load. These connectors do not have a fault close rating.](#)

loadbreak connector: A [separable insulated](#) connector designed to close and interrupt rated load current or less on energized circuits under specified conditions. [These connectors also have a fault close rating.](#)

maximum voltage rating: The highest phase-to-ground voltage (rms) for single phase systems or phase-to-ground and phase-to-phase voltage (rms) for three phase systems at which a connector is designed to operate.

multi-point separable insulated connector: [A device with two or more interconnected interfaces that electrically insulate, electrically shield and seal the interfaces where the interfaces are not in an elbow, straight, nor tee configuration. Typical devices include multi-point junctions, portable feedthrus, feedthru inserts, load-break link connectors, deadbreak link connectors, and "H" and "Y" disconnectable bus connectors.](#)

NOTE—See [Figure 21](#), [Figure 22](#), [Figure 23](#), and [Figure 24](#).

multi-way junction: [See multi-point separable insulated connector](#) ~~An accessory device with two or more interconnected bushing and/or bushing well interfaces.~~

operating eye: An integral part of an elbow or other accessory device designed for the attachment of a live-line tool used to handle or operate the device.

operating interface: The surfaces at which a connector is normally separated.

NOTE—See Figure 1, [Figure 21](#), [Figure 22](#), [Figure 23](#), and Figure [24.2](#)

parking stand feed-thru well: A multi-way junction device consisting of interconnected bushing wells that can be mounted in a parking stand.

probe: The internal, separable, current carrying part of an elbow, ~~tee connector~~, or insulated cap (usually in the form of a metal rod or bolt) that connects the conductor compression lug to the bushing portion of the separable connector.

reducing tap plug: An accessory device designed for the transition of a 600-[A or 900-A](#) deadbreak system to a 200 A deadbreak or loadbreak system.

[NOTE—See Figure 23.](#)

reducing tap well: A connector that provides a transition from a 600-[A or 900-A](#) elbow to a 200 A bushing well.

[NOTE—See Figure 23.](#)

separable insulated connector: A fully insulated and shielded [component used to a\) terminate system for terminating](#) and [insulate a power cable, b\) terminate or insulate another electrical component, or c\) connect electricallyconnecting](#) an insulated power cable to electrical apparatus, other power cables, or both, ~~so designed that~~. The electrical connection can be readily established or broken by engaging or separating ~~connector~~ at the operating interface.

[NOTE—There are various types of separable connectors; see Figure 1, Figure 21, Figure 22, Figure 23, and Figure 24.](#)

short-time current rating: The designated rms current that a connector can carry for a specified, limited period of time under specified conditions.

straight plug: An in-line connector that provides a transition from a cable to a bushing interface.

~~**3.32 straight receptacle:** An in-line connector that provides a transition from a cable to an elbow interface.~~

~~**3.33 tee connector:** A receptacle connector component for connecting a power cable to two in-line bushing interfaces, so designed that the axes of the cable and bushing interfaces are perpendicular.~~

[NOTE—See Figure 22.](#)

straight separable insulated connector: A device with two interconnected interfaces that electrically insulate, electrically shield and seal the interfaces where the two interfaces are in-line with each other. Typical devices include bushing inserts, tap wells, tap plugs, connecting plugs, bushing extenders, "T" disconnectable bus connectors and straight connectors.

NOTE—See Figure 1, Figure 21, Figure 22, Figure 23, and Figure 24.

tee separable insulated connector: A device with three interconnected interfaces that electrically insulate, electrically shield and seal the interfaces where two interfaces are in-line with each other and the third interface is at a right angle to the first two. Typical devices include tees, tap plug tees, and tap well tees.

NOTE—See Figure 22 and Figure 23.

test point: A capacitively coupled terminal for use with voltage sensing devices.

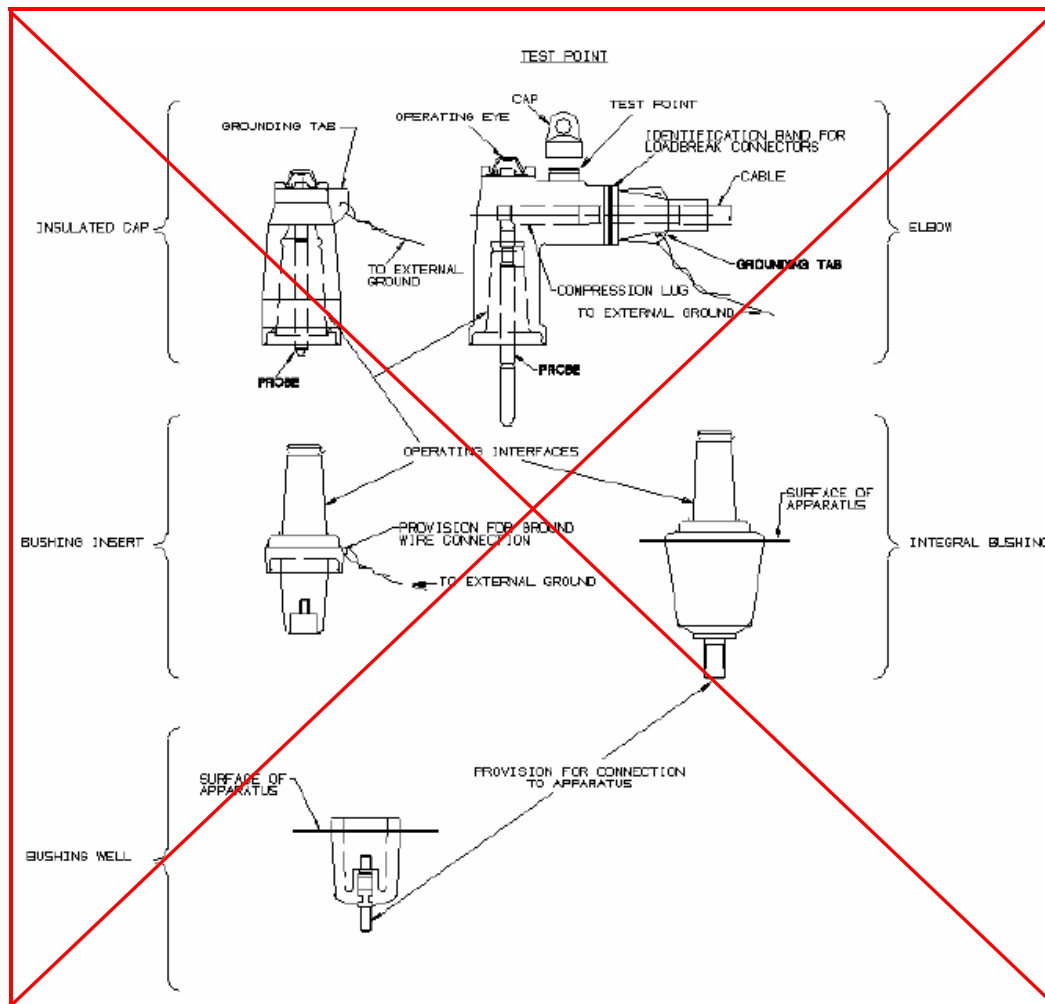
NOTE—See Figure 1. ~~and Figure 2.~~

test point cap: A shielded cover for the capacitive test point.

withstand voltage: The specified voltage that, under specified conditions, can be applied to insulation without causing flashover or puncture.

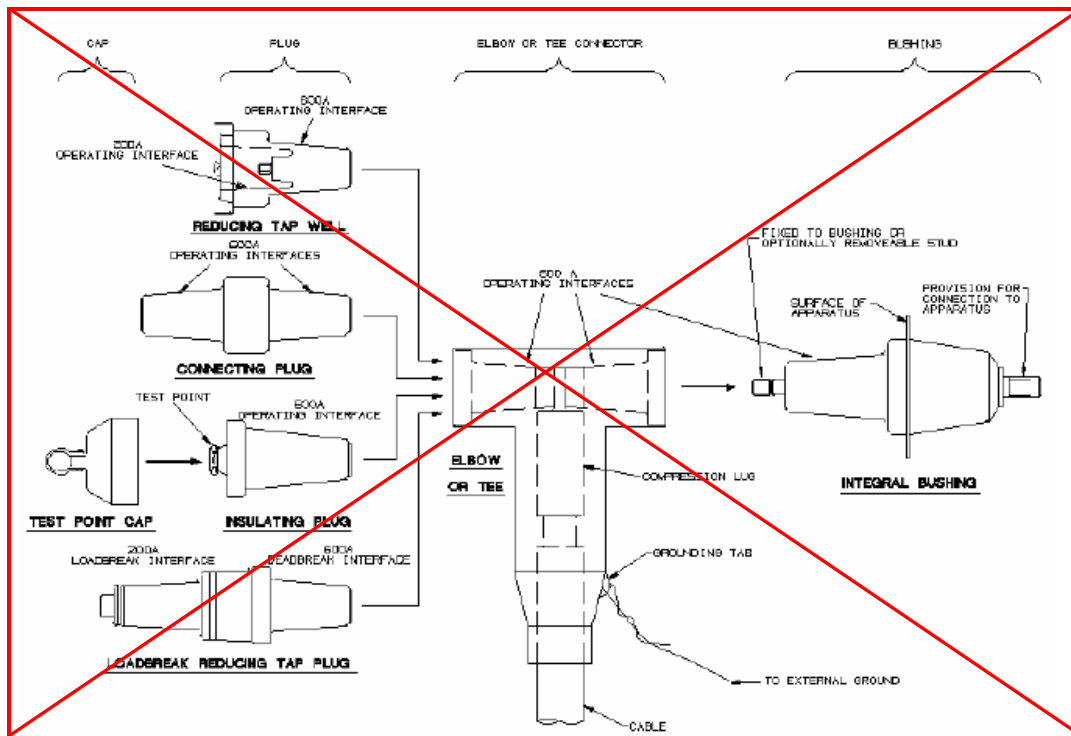
3.2 Abbreviations and acronyms

OIACW operating interface ac withstand



(Deleted)

Figure 1 Typical components of 200 A separable insulated connector system



(Deleted)

Figure 2—Typical components of 600 A separable insulated connector-system

4. Service conditions

4.1 Usual service conditions

Connectors shall be suitable for use under the following service conditions:

- a) In air, including exposure to direct sunlight
- b) Buried in earth
- c) Intermittently or continuously submerged in water at a depth not exceeding 1.8 m (6 ft)
- d) Environmental temperatures within the range of -40 °C to +65 °C (loadbreak connectors can be closed and separated within the range of -20 °C to +65 °C)
- e) Altitudes not exceeding 1800 m (6000 ft) above sea level (applicable to loadbreak connectors only)
- f) AC voltages with a frequency of 49 Hz to 61 Hz nominal

g) Loadbreak connectors are designed, tested, and rated for use on grounded WYE systems. For applications on ungrounded WYE or delta systems, the next higher voltage class product is recommended. They are not recommended for loadbreak applications on 35-kV ungrounded systems. For example: 5-kV ungrounded systems use 15-kV class products, 15-kV ungrounded systems use 25-kV class products, and 25-/28-kV ungrounded systems, use 35-kV class products.

4.2 Unusual service conditions

Conditions other than those listed in 4.1 are considered to be unusual. The manufacturer should be consulted for recommendations. (See IEEE Std 1215-2013.)

5. Ratings and characteristics

5.1 Voltage ratings and characteristics

The voltage ratings and characteristics of connectors shall be in accordance with Table 1 or Table 2.

Table 1— Voltage ratings and characteristics [for loadbreak connectors](#)

Voltage class	Maximum voltage rating (kV rms) ^a	Withstand voltages		
		BIL and full wave (kV crest)	AC 60 Hz for 1 min (kV rms)	Partial discharge minimum extinction voltage (kV rms) ^b
15 kV	8.3 ^c	95	34	11
15 kV	8.3/14.4 ^d	95	34	11
25 kV	15.2 ^c	125	40	19
25 kV	15.2/26.3 ^d	125	40	19
28 kV	16.2/28.0 ^d	125	45	21.5
35 kV	21.1 ^c	150	50	26
35 kV	21.1/36.6 ^d	150	50	26

(New)

Maximum voltage rating (kV rms) ^a	Withstand voltages			
	BIL and full wave (kV crest)	AC 60 Hz for 1 min (kV rms)	DC for 15 min (kV)	Partial discharge minimum extinction voltage (kV rms) ^b
8.3 ^c	95	34	53	11
8.3/14.4 ^d	95	34	53	11
15.2 ^c	125	40	78	19
15.2/26.3 ^d	125	40	78	19
21.1 ^c	150	50	103	26
21.1/36.6 ^d	150	50	103	26

(Deleted)

^a The highest steady-state voltage across the open contacts that a loadbreak connector is rated to switch is the maximum phase-to-ground rms voltage for phase-to-ground rated devices or the maximum phase-to-phase rms voltage for phase-to-ground/phase-to-phase rated devices.

^bBased on a sensitivity of 5 $\pm$ 3 pC (see 7.4).

^cPhase-to-ground.

^dPhase-to-ground/phase-to-phase.

Table 2— Voltage ratings and characteristics of deadbreak connectors

Voltage class	Maximum voltage rating (kV rms) ^a	Withstand voltages		
		BIL and full wave (kV crest)	AC 60 Hz for 1 min (kV rms)	Partial discharge minimum extinction voltage (kV rms) ^b
15 kV	8.3	95	34	11
25 kV	15.2	125	40	19
28 kV	16.2	125	45	21.5
35 kV	21.1	150	50	26

[\(New\)](#)

Maximum voltage rating (kV rms) ^a	Withstand voltages			
	BIL and full wave (kV crest)	AC 60 Hz for 1 min (kV rms)	DC for 15 min (kV)	Partial discharge minimum extinction voltage (kV rms) ^b
8.3 ^c	95	34	53	11
8.3/14.4 ^d	95	34	53	11
15.2 ^c	125	40	78	19
15.2/26.3 ^d	125	40	78	19
21.1 ^c	150	50	103	26
21.1/36.6 ^d	150	50	103	26

(Deleted)

^aPhase-to-ground.

^bBased on a sensitivity of 5.3pC (see 7.4).

5.2 Current ratings and characteristics

The current ratings and characteristics of connectors shall be in accordance with Table 3 or Table 4 2.

Table 3—Current ratings and characteristics for loadbreak connectors

Continuous current rating (Arms)	Voltage class	Switching current rating		Fault-closure current rating ^b			Short-time current rating ^a		
		Arms, sym ^a	Number of operations	Arms, sym	Duration (seconds)	x/r	Arms, sym	Duration (seconds)	x/r
200	All	200	10	10 000	0.17	6	10 000	0.17	6
							3 500	3.00	6
600	15 kV	600	10	16 000	0.17	20	16 000	0.17	20
							10 000	3.00	20
600	25, 28 kV	600	5	10 000	0.17	20	10 000	0.17	20

(New)

Table continues

Table 3—Current ratings and characteristics for loadbreak connectors

(continued)

Continuous current rating (Arms)	Voltage class	Switching current rating		Fault-closure current rating ^b			Short-time current rating ^a		
		Arms, sym ^a	Number of operations	Arms, sym	Duration (seconds)	x/r	Arms, sym	Duration (seconds)	x/r
							10 000	3.00	20
600	35 kV	600	1	10 000	0.17	20	10 000	0.17	20
							10 000	3.00	20

(New)

^aConsult the manufacturer for ratings that exceed those listed in Table 3.

^bEquipment to which these assemblies are affixed may have lower safe limits of current performance.

Table 4—Current ratings and characteristics [for deadbreak connectors](#)

Continuous current rating (A rms ^a)	Voltage class	Overload current ^{a, b, c} 4 h rating (A rms)	Short-time current rating		
			A rms, sym	Duration (seconds)	x/r
200	All	300	10 000	0.17	6
			3 500	3.00	6
600	All	900	25 000	0.17	20
			10 000	3.00	20
900	All	1200	40 000	0.17	20
			10 000	3.00	20

[\(New\)](#)

Connector type	Continuous current rating (A rms ^a)	Switching current rating (A rms)	Overload current ^{a, b, c} 4 hour rating (A rms)	Fault-closure current rating ^d			Short-time current rating		
				A rms, sym	Duration (s)	Min x/r	A rms, sym	Duration (s)	Min x/r
Loadbreak	200	200	—	10 000	0.17	6	10 000	0.17	6
							3 500	3.00	6
Deadbreak	200	—	300	—	—	—	10 000	0.17	6
							3 500	3.00	6
Deadbreak	600	—	900	—	—	—	25 000	0.17	20
							10 000	3.00	20

[\(Deleted\)](#)

^a [In](#) general, the overload capability of a connector exceeds its continuous current rating. Overload capability varies with environment, cable sizes, etc. The connector manufacturer's recommendations should be obtained for the particular combination involved.

^b Consult the manufacturer for ratings that exceed those listed in Table [4](#), [2](#).

^cOne overload cycle during a 24 h period [not to exceed 1500 h cumulative over the life of the connector](#).

6. Construction

6.1 Identification

Mating components of a separable insulated connector shall be permanently and legibly identified (for example: ink stamped, branded, or molded in) with the following information:

a) Manufacturer's identification

1) Company name or logo

2) Part identification

3) Date of manufacture

b) Continuous current rating (when applicable)

c) Maximum voltage rating

1) *200-A, 600-A, and 900 ~~600~~-A deadbreak connectors:* Identify with the maximum phase-to-ground voltage rating

2) *200-A and 600-A loadbreak connectors:*

- i) *Three-phase*: Identify with the maximum phase-to-ground/phase-to-phase voltage rating
 - ii) *Single-phase*: Identify with the maximum phase-to-ground voltage rating.
- d) Cable insulation diameter range (when applicable)
- e) Whether loadbreak or deadbreak (when applicable), in addition to the word "LOADBREAK," elbows of loadbreak connectors shall have the following markings:
- 1) Connectors with a phase-to-ground voltage rating shall be identified with a removable white band from 13-mm to 32-mm (0.5-in to 1.25-in) wide, located on the cable entrance portion of the connector not less than 25 mm (1.00 in) from the cable entrance. The removable band shall be clearly visible from the normal operating position, and affixed to minimize its accidental dislodgment.
 - 2) Connectors with both phase-to-ground and phase-to-phase voltage ratings shall be identified with a removable white band from 13-mm to 32-mm (0.5-in to 1.25-in) wide, having a centered black stripe 4.8 mm $\pm$ 1.6 mm (0.188 in $\pm$ 0.062 in) in width located on the cable entrance portion of the connector not less than 25 mm (1.00 in) from the cable entrance. The removable band shall be clearly visible from the normal operating position, and affixed to minimize its accidental dislodgment.

- f) *Color-coding*: In addition to the white bands of Item e ~~this subclause, 200-A~~), at the option of the manufacturer, the bushing nose piece, bushing interface, and/or cuff of loadbreak connectors may be identified by a color as specified in Table 5 or Table 6 ~~3~~.

Table 5—200-A loadbreak connector color code ~~(optional)~~

Voltage class	Reference figure	Color
15 kV	Figure 5	Red
25 kV	Figure 6	Blue
28 kV	Figure 6	Blue
35 kV 1-PH	Figure 9	Off white
35 kV 1-PH	Figure 8	Tan
35 kV	Figure 9	Gold
35 kV	Figure 7	Purple

(New)

Voltage rating (kV rms)	Reference figure	Color
8.3/14.4	5	Red
15.2/26.3	7	Blue
21.1	7	Off White
21.1	9	Tan
21.1/36.6	7	Gold
21.1/36.6	8	Purple

(Deleted)

Table 6— 600-A loadbreak connector color code

Voltage class	Reference figure	Color
15 kV	Figure 17	Green
25 kV	Figure 17	Maroon
28 kV	Figure 17	Maroon
35 kV	Figure 17	Brown

(New)

6.2 Operating means

Separable connectors with an operating eye shall be operable by means of a suitable live-line tool that clamps the device elbow so that operation is along the probe axis. The required operating force over the environmental range of -20 °C to +65 °C shall be as follows (see 7.14).

- a) 222 N to 890 N (50 lbf to 200 lbf) for connectors without hold-down bails
- b) 44 N to 890 N (10 lbf to 200 lbf) for connectors with hold-down bails

If an operating eye is provided, it shall support a 14 N·m (120 lbf·in) rotational force and shall support a static operating force as shown in Table 7 4:

Table 7—Static operating force

Connector type	Force	
	N	lbf
Deadbreak elbow	1334	300
Loadbreak connector	2224	500
Grounding elbow	1779	400
Insulated cap	2224	500

6.3 Shielding

Connectors shall have an electrically conductive shield and, where required, shall have provision for connecting an external ground to the shield. Except for non-elastomeric components, connectors shall meet the requirements of IEEE Std 592.⁷

6.4 Interchangeability

~~6.4.1 Complete interchangeability~~

~~Complete~~ interchangeability implies that parts from one manufacturer when mated with parts of another manufacturer meet all the applicable requirements of this standard.

~~⁷For information on references, see Clause 2.~~

Interchangeability is demonstrated when:

- a) A part meets the design [tests and the dimensional](#) ~~test~~ requirements, [as illustrated in](#) ~~when tested with any mating part meeting the dimensional requirements of~~ this standard, [where applicable](#).
- b) In addition, 200-[A](#) and 600-[A](#) loadbreak connectors [shall](#) ~~must~~ demonstrate conformance with switching(7.7) and fault close (7.8) test requirements when tested with intermixed bushings and elbows of different manufacturers.

~~6.4.2 Limited interchangeability~~

~~Limited interchangeability applies only to 200 A loadbreak connectors and shall be demonstrated by compliance with all the requirements in 6.4.1, complete interchangeability, except for the switching (7.7) and fault close (7.8) test requirements.~~

6.4.1 Interface dimensions

The dimensions of operating and bushing well interfaces shall be in accordance with [Figure 2](#), [Figure 3](#), [Figure 4](#), [Figure 5](#), [Figure 6](#), [Figure 7](#), [Figure 8](#), [Figure 9](#), [Figure 10](#), [Figure 13](#), [Figure 14](#), ~~3~~ ~~through~~ [Figure 15](#), [Figure 16](#), [Figure 17](#), and [Figure 18](#).

6.4.2 Stacking dimensions

Upon request, each manufacturer shall supply the dimensions in Figure [21 16](#), Figure [22 17](#), and Figure [23 18](#). The stacking, "S," dimensions enable users to determine the dimensional effect of stacking components. The mounting, "M," dimensions enable users to determine the depth that a bushing well or integral bushing projects into the apparatus on which it is mounted. A mounting, "M," dimension is also provided for multi-way junction brackets.

6.5 Test point

Test points are optional and may be specified on [any connector](#) ~~either loadbreak or deadbreak elbows~~.

6.5.1 Capacitance

Test points shall be capacitively coupled to the conductor system and shield of the connector.

The capacitance between the test point and the conductor system shall be at least 1.0 pF. The ratio of the capacitance between test point and shield to the capacitance between test point and conductor system shall not exceed 12.0. These values shall be verified by tests when conducted in accordance with [7.17.1](#).

6.5.2 Cap removal force

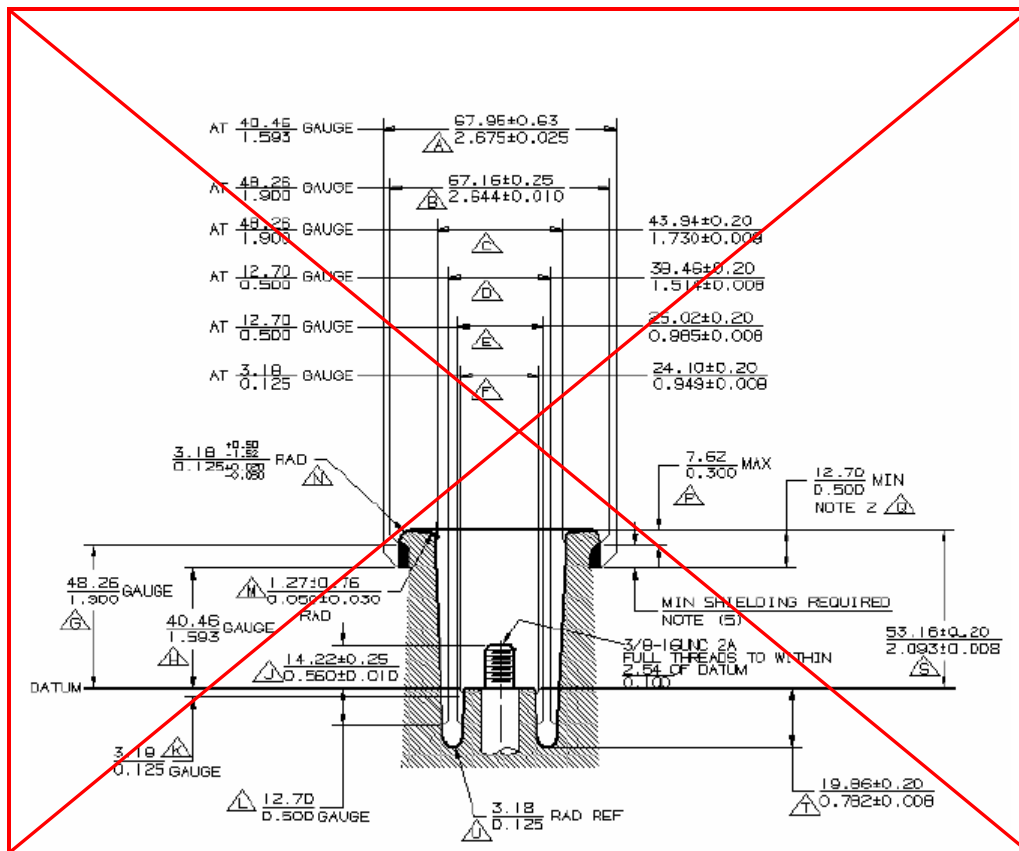
The force required to remove the test-point cap shall be within the range of 36 N to 218 N (8 lbf to 49 lbf). The cap operating eye shall be capable of withstanding a static operating force of 445 N (100 lbf) over the environmental temperature range of -20 °C to +65 °C (see 7.16.1).

6.6 Hold-down bails

Dimensions and, materials, ~~and performance criteria~~ are not specified in this standard.

6.7 Bushing well stud torque withstand

The 3/8"-16 threaded stud in the bushing well shall withstand a minimum torque of 23 N•m (17 ft•lbf) without stripping or fracturing (see 7.19).



(Deleted)

NOTE 1— Diameters C, D, E, and F to be concentric with pitch diameter of threads on stud within 0.25/0.010 TIR (total indicator reading):

NOTE 2— Clearance for mating parts:

NOTE 3— Dimensions: mm/in;



NOTE 4— A— Alphabetical dimensional identification.

~~NOTE 5—The diameter of the shielded portion shall at no point be less than the largest diameter of the insulation portion, except for bushing wells that have internal shielding.~~

~~Figure 3-200 A busing well interface, 8.3 kV, 15.2 kV, and 21.1 kV~~

6.8 Thermal cycle withstand

Non-elastomeric connector components shall withstand temperature cycling from -40 °C to +130 °C without cracking, breaking, or impairing the ability to meet the other requirements of this standard when tested according to the procedure in 7.20.

7. Testing

7.1 Production tests

The following production tests shall be performed by the manufacturer on all connector components except grounding devices ~~ground bushings and grounding elbows~~:

- a) Partial discharge test (see 7.4)
- b) AC withstand or full-wave impulse withstand voltage (see 7.5.1 and 7.5.3)