

Australian Standard[®]

**Separable insulated connectors for
power distribution systems above 1 kV**



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-

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Australian Standard[®]

Separable insulated connectors for power distribution systems above 1 kV

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PREFACE

This Standard was reviewed by the Standards Australia Committee EL-007, Power Switchgear to supersede AS 2629—1983.

This Standard is republished from AS 2629—1983, without technical alterations. Referenced documents have been updated.

It applies to a simple and relatively inexpensive method of connection and switching of transformers and other electrical equipment in distribution systems using special flexible cable connectors.

The separable connectors covered by this Standard are intended for use only as a part of a fully protected distribution system.

This Standard illustrates a number of suitable connection interfaces, and users and manufacturers are encouraged to adopt the interface designs shown. However, connectors with interfaces different from those shown in this Standard may be in the course of development.

ANSI/IEEE Standard 386—1977 was used as the basis for this Standard and acknowledgement is made of the assistance received therefrom.

Owing to the fact that separable insulated connectors imported into Australia are manufactured to comply with requirements specified in the country of manufacture and may not be available in a form to comply with all the requirements of AS 1824, *Insulation Coordination*, certain exemptions are permitted in this Standard subject to the agreement of the purchaser.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	4
1.2 REFERENCED DOCUMENTS	4
1.3 SERVICE CONDITIONS.....	4
SECTION 2 DEFINITIONS	
2.1 APPLICATION OF SECTION.....	6
2.2 GENERAL TERMS.....	6
2.3 HARDWARE ITEMS.....	6
2.4 ELECTRICAL CHARACTERISTICS	7
SECTION 3 RATINGS	
3.1 VOLTAGE RATINGS	13
3.2 RATED FREQUENCY	13
3.3 CURRENT RATINGS.....	13
SECTION 4 DESIGN, CONSTRUCTION AND MARKING	
4.1 DESIGN	15
4.2 INTERCHANGEABILITY	15
4.3 OPERATING MEANS.....	15
4.4 SHIELDING.....	15
4.5 TEST POINTS.....	15
4.6 HOLD-DOWN BAILS	15
4.7 MARKING	16
SECTION 5 PERFORMANCE	
5.1 BEHAVIOUR ON TESTAND IN SERVICE	28
5.2 OPERATING TEMPERATURE OF MATERIALS	28
SECTION 6 CLASSIFICATION OF TESTS	
6.1 TYPE TESTS	29
6.2 ROUTINE TESTS	29
6.3 TESTS AT SITE.....	29
SECTION 7 DETAILS OF TYPE TESTS	
7.1 DIELECTRIC TESTS	32
7.2 SHORT-CIRCUIT CURRENT-CARRYING CAPABILITY TEST	33
7.3 SWITCHING CURRENT TESTS (Applicable to load-break connectors only).....	33
7.4 SHORT-CIRCUIT MAKING CURRENT TEST (Applicable to load-break connectors only)	35
7.5 CONNECTOR ELBOW DISTORTION TEST FOR OFF-AXIS FORCE (Applicable only to elbows of the non-bolted type).....	35
7.6 CURRENT CYCLING TEST	38
7.7 CABLE PULL-OUT TEST.....	39
7.8 OPERATING FORCE TEST.....	40
7.9 OPERATING EYE TEST.....	40
7.10 TEST POINT CAP MECHANICAL TEST	40
7.11 TEST POINT ELECTRICAL TESTS.....	41
7.12 SHIELDING TEST.....	41
7.13 ACCELERATED SEALING LIFE TEST	41

STANDARDS AUSTRALIA

Australian Standard

**Separable insulated connectors for power distribution systems
above 1 kV**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for load-break and dead-break separable insulated connectors and ancillary equipment for use on power distribution systems at alternating voltages above 1 kV.

The Standard applies to separable insulated connectors rated at not more than 1250 A.

NOTE: Load-break connectors are available only for the lower current ratings. The purchaser should obtain information from manufacturers on available current ratings.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

60270 High-voltage test techniques—Partial discharge measurements

1931 High-voltage test techniques

1931.1 Part 1: General definitions and test requirements

AS/NZS

1429 Electric cables—Polymeric insulated

1429.1 Part 1: For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV

IEEE

592 Exposed Semiconducting Shields on High Voltage Cable Joints and Separable Connectors

1.3 SERVICE CONDITIONS**1.3.1 Normal service conditions**

Connectors complying with this Standard are suitable for use in clean air and exposure to direct sunlight, under the following conditions:

- (a) The ambient air temperature does not exceed 40°C, and its average value measured over a period of 24 h does not exceed 35°C.
- (b) The ambient air temperature is not less than –10°C.
- (c) The maximum temperature due to sunlight does not exceed an equivalent black body temperature of 80°C.

NOTE: For practical purposes this is equivalent to 1.1 kW/m².

- (d) The altitude does not exceed 1000 m.
- (e) The ambient air is not materially polluted by dust, smoke, corrosive or flammable gases and vapours or salt.

NOTE: Sudden drops of temperature of up to 20°C in a period of 20 min and the presence of rain and condensation should be taken into account.

1.3.2 Special service conditions

1.3.2.1 General

The use of connectors under special service conditions shall be subject to agreement between the purchaser and manufacturer.

1.3.2.2 Unusual environments

Connectors may become buried in earth or immersed in water. For this reason, an accelerated sealing life test is specified in Clause 7.13.

NOTE: This Clause does not imply that connectors may be opened or closed under conditions where the interfaces could become wet or contaminated.

1.3.2.3 Altitudes above 1000m

Where connectors are required for use at altitudes above 1000 m, one or other of the following procedures shall be adopted:

- (a) The test voltages for such installations shall be determined by multiplying the rated withstand voltages given in Table 3.1 by the appropriate factor given in column 2 of Table 1.1.
- (b) Connectors may be selected having a rated voltage which, when multiplied by the appropriate correction factor given in column 3 of Table 1.1, is not lower than the system voltage.

TABLE 1.1
ALTITUDE CORRECTION FACTOR

1	2	3
Maximum altitude m	Correction factor for test voltages referred to sea level	Correction factor for rated voltages
1000	1.0	1.0
1500	1.05	0.95
3000	1.25	0.80

NOTE: For altitudes between 1000 m and 1500 m, and between 1500 m and 3000 m, the correction factors may be obtained by linear interpolation.

SECTION 2 DEFINITIONS

2.1 APPLICATION OF SECTION

For the purpose of this Standard, the definitions in this Section apply.

2.2 GENERAL TERMS

2.2.1 Dead-break connector

A connector designed to be separated and engaged on de-energized circuits only.

NOTE: Dead-break connectors are not intended to make or break magnetizing or charging currents.

2.2.2 Load-break connector

A connector designed to be capable of closing and interrupting current on energized circuits and closing onto a fault.

2.2.3 Operating interface

The surfaces at which a connector is normally separated. (See Figures 2.1 to 2.4.)

2.2.4 Separable insulated connector (hereinafter referred to as connector)

A fully insulated and shielded system for terminating an insulated power cable and/or electrically connecting the cable to electrical apparatus, other power cables, or both. It is designed to allow the electrical connection to be established or broken readily by engaging or separating the connector at the operating interface.

2.3 HARDWARE ITEMS

2.3.1 Bushing insert

A connector component intended for insertion into a bushing well. (See Figures 2.1 and 2.2.)

2.3.2 Bushing well

An apparatus bushing having a cavity for insertion of a connector component, such as a bushing insert. (See Figures 2.1 and 2.2.)

2.3.3 Earthing (grounding) bushing

An accessory device designed to electrically EARTH (ground) and mechanically seal a de-energized power cable terminated with an elbow.

2.3.4 Earthing elbow

An accessory device designed to electrically EARTH and mechanically seal a bushing.

2.3.5 Earthing rod

An accessory device designed to electrically EARTH a de-energized bushing.

2.3.6 Elbow

A connector component for connecting a power cable to a bushing, designed so that, when assembled with the bushing, the axes of the cable and bushing are at right angles to each other. (See Figures 2.1, 2.2, 2.3, 2.4, 4.4 and 4.9.)

NOTE: Other configurations having the standard operating interface are available, e.g. a straight receptacle used in place of an elbow.

2.3.7 Feed-through device

A multiple bushing device designed for the parallel connection of two or more elbows.

2.3.8 Hold-down bail

An externally mounted device designed to prevent separation, at the operating interface, of an elbow and an apparatus bushing.

2.3.9 Insulated parking bushing

An accessory device designed to electrically INSULATE, shield and mechanically seal a power cable terminated with an elbow.

2.3.10 Insulated cap

An accessory device designed to electrically INSULATE, shield and mechanically seal a bushing.

2.3.11 Integral bushing

An apparatus bushing designed for use with another connector component, such as an elbow. It combines the functions of a bushing well and a bushing insert. (See Figures 2.2 and 2.3.)

2.3.12 Parking stand

A bracket, designed for installation on apparatus, for holding accessory devices, such as an insulated parking bushing or an earthing bushing.

2.3.13 Plug

An accessory device, designed for use with certain elbows to allow the connection of additional connector components or the sealing and insulation of the elbow. (See Figure 2.4.)

2.3.14 Test point

A capacitively coupled terminal for use with voltage sensing devices.

2.4 ELECTRICAL CHARACTERISTICS

2.4.1 Partial discharge (corona) extinction voltage

The r.m.s. voltage at which the partial discharge (corona) level does not exceed a specified value following the application of a specified higher voltage under normal service conditions.

2.4.2 Rated short-circuit making current

The designated maximum r.m.s. short-circuit current which a load-break connector can close under normal service conditions and comply with the requirements of Clause 5.1.3.

2.4.3 Rated lightning impulse withstand voltage

The prescribed peak value of the lightning impulse withstand voltage which characterizes the insulation of a connector in respect of the withstand tests.

2.4.4 Rated normal current

The designated r.m.s. alternating or direct current which a connector can carry continuously under service conditions and comply with the requirements of Clause 5.1.1.

2.4.5 Rated (short duration) power frequency withstand voltage

The prescribed r.m.s. value of sinusoidal power frequency voltage that the insulation of the connector will withstand during tests made under specified conditions.

2.4.6 Rated short-time withstand current

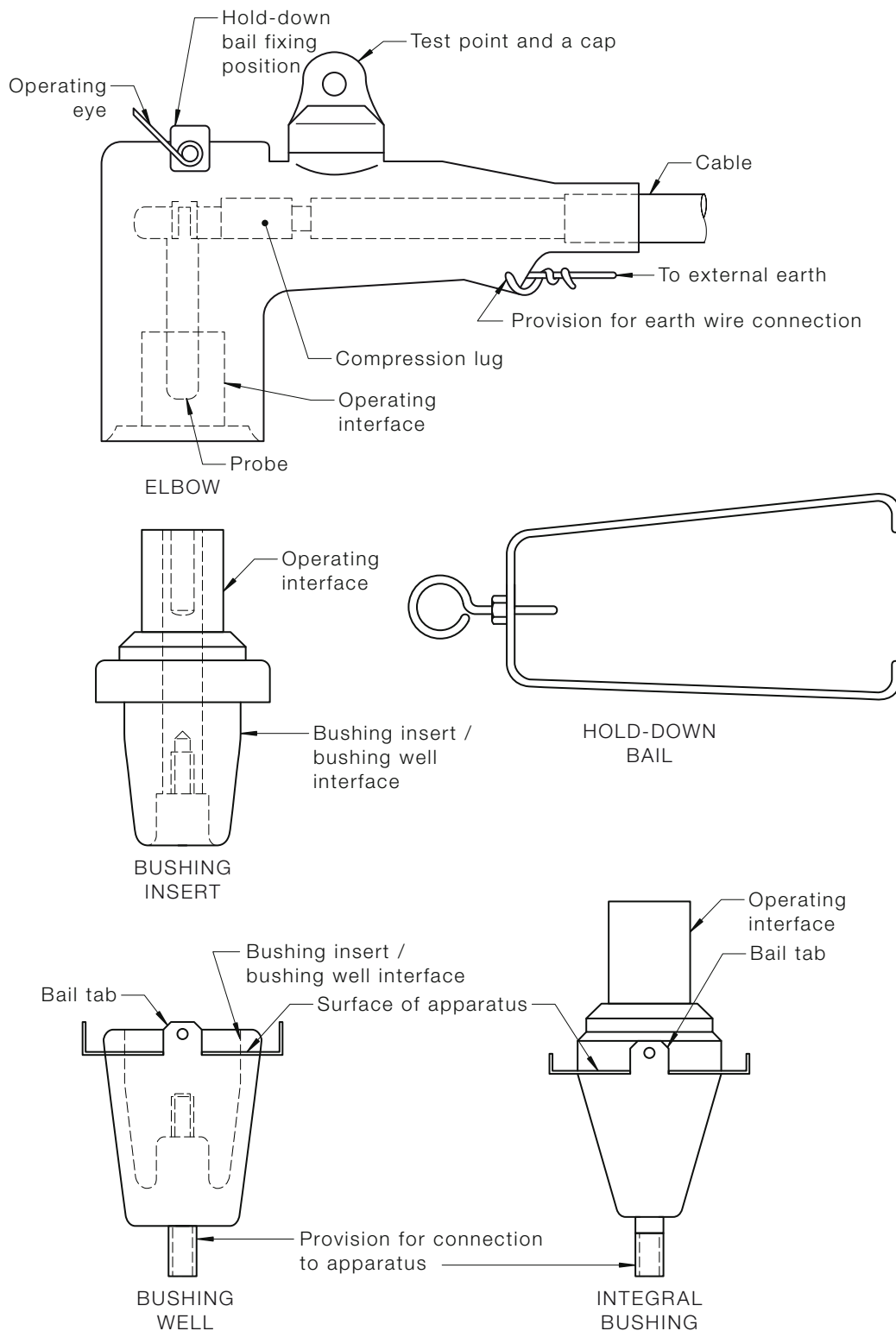
The designated maximum r.m.s. current which a connector can carry for a specified short-time under normal service conditions and comply with the requirements of Clause 5.1.1.

2.4.7 Rated switching current

The designated maximum r.m.s. current which a load-break connector can connect and disconnect for a specified number of times under normal service conditions and comply with the requirements of Clause 5.1.2.

2.4.8 Rated voltage

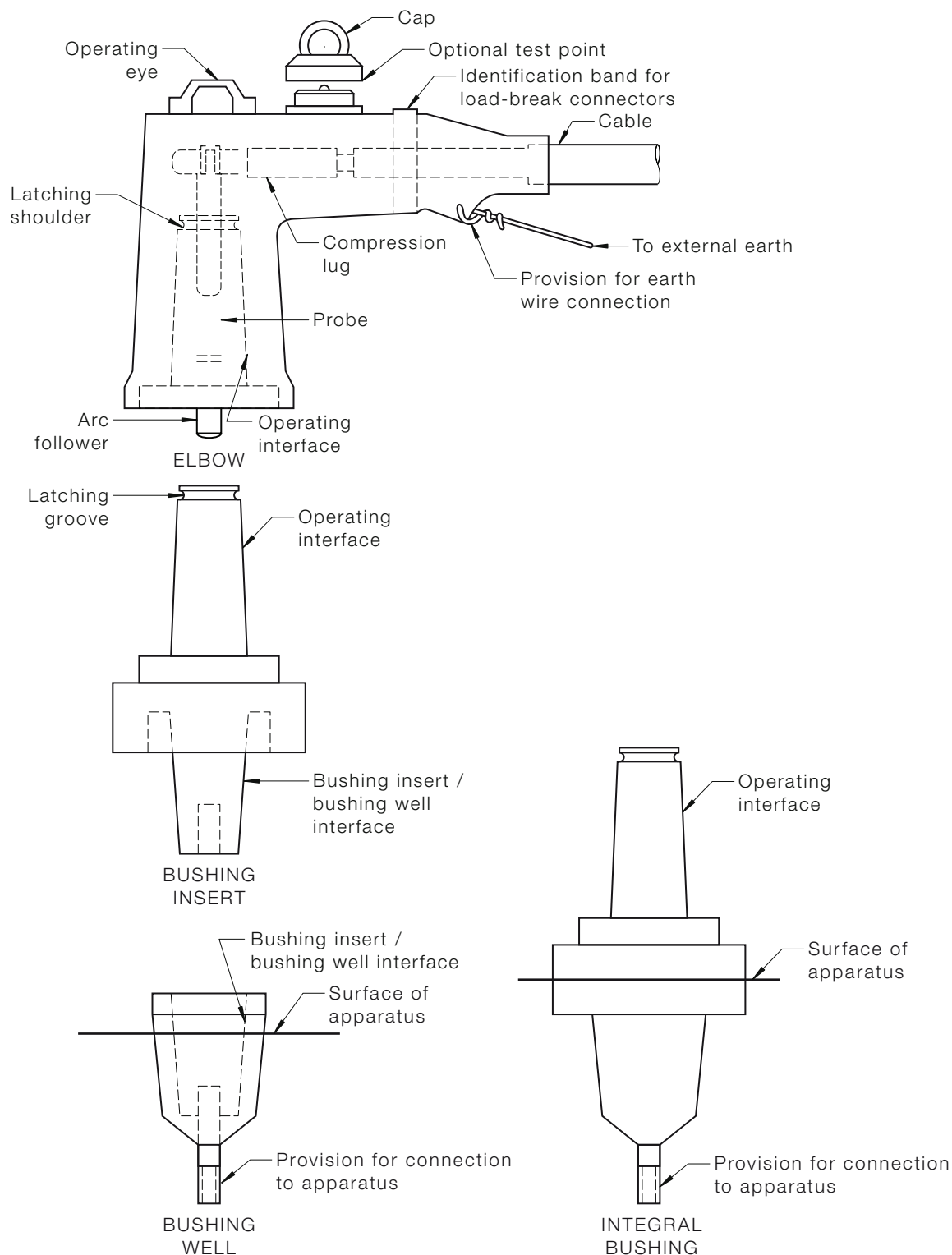
The upper limit of the highest voltage of systems for which the connector is intended.



NOTES:

1. 200 A connectors also are available in load-break (see Figure 2.2).
2. Typical 12 kV components are illustrated.

FIGURE 2.1 TYPICAL COMPONENTS OF 200 A DEAD-BREAK SEPARABLE INSULATED CONNECTOR SYSTEM



NOTES:

1. 200 A connectors also are available in dead-break (see Figure 2.1).
2. Typical 12 kV components are illustrated.

FIGURE 2.2 TYPICAL COMPONENTS OF 200 A LOAD-BREAK SEPARABLE INSULATED CONNECTOR SYSTEM

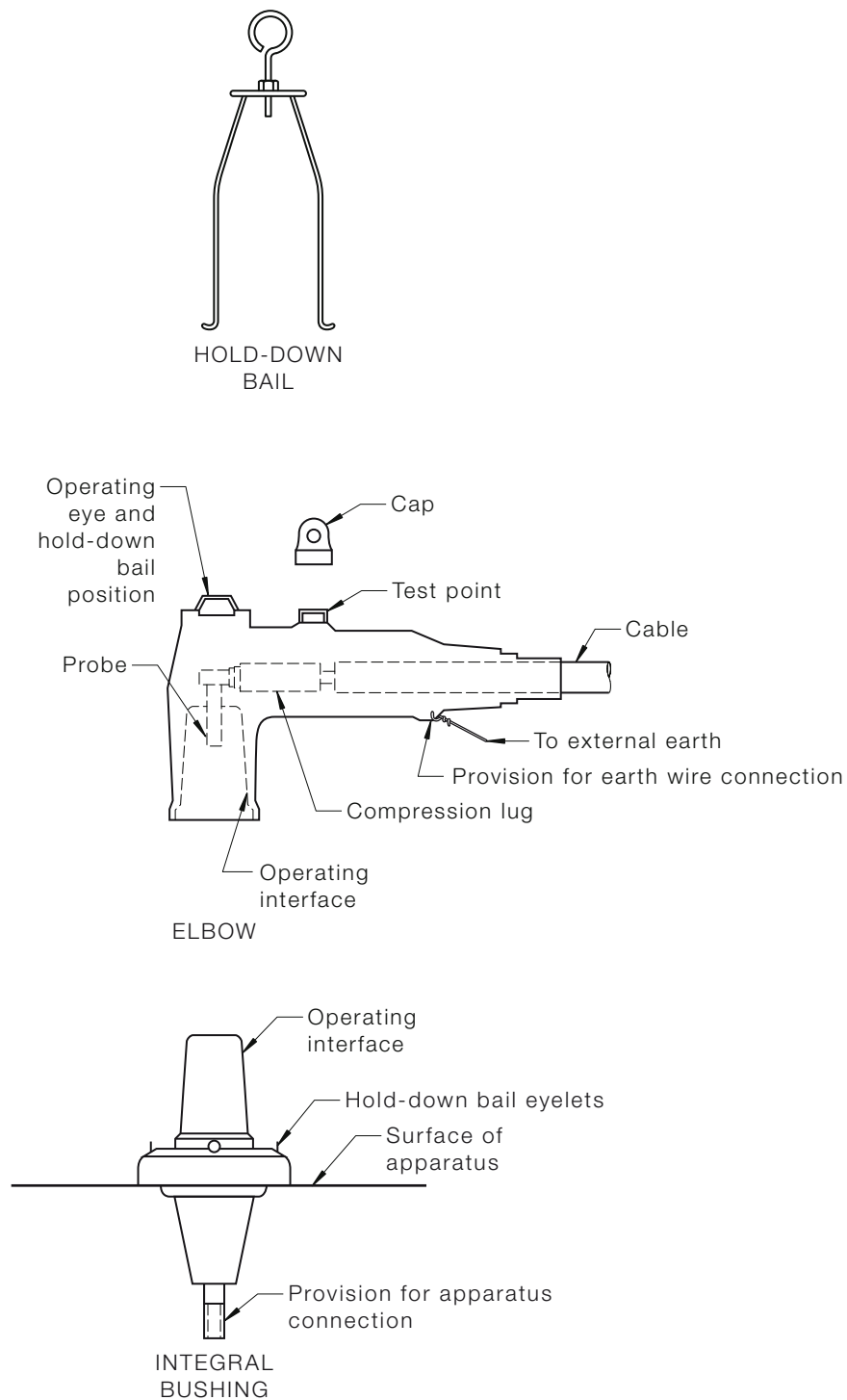


FIGURE 2.3 TYPICAL COMPONENTS OF 400 A SEPARABLE INSULATED CONNECTOR SYSTEM

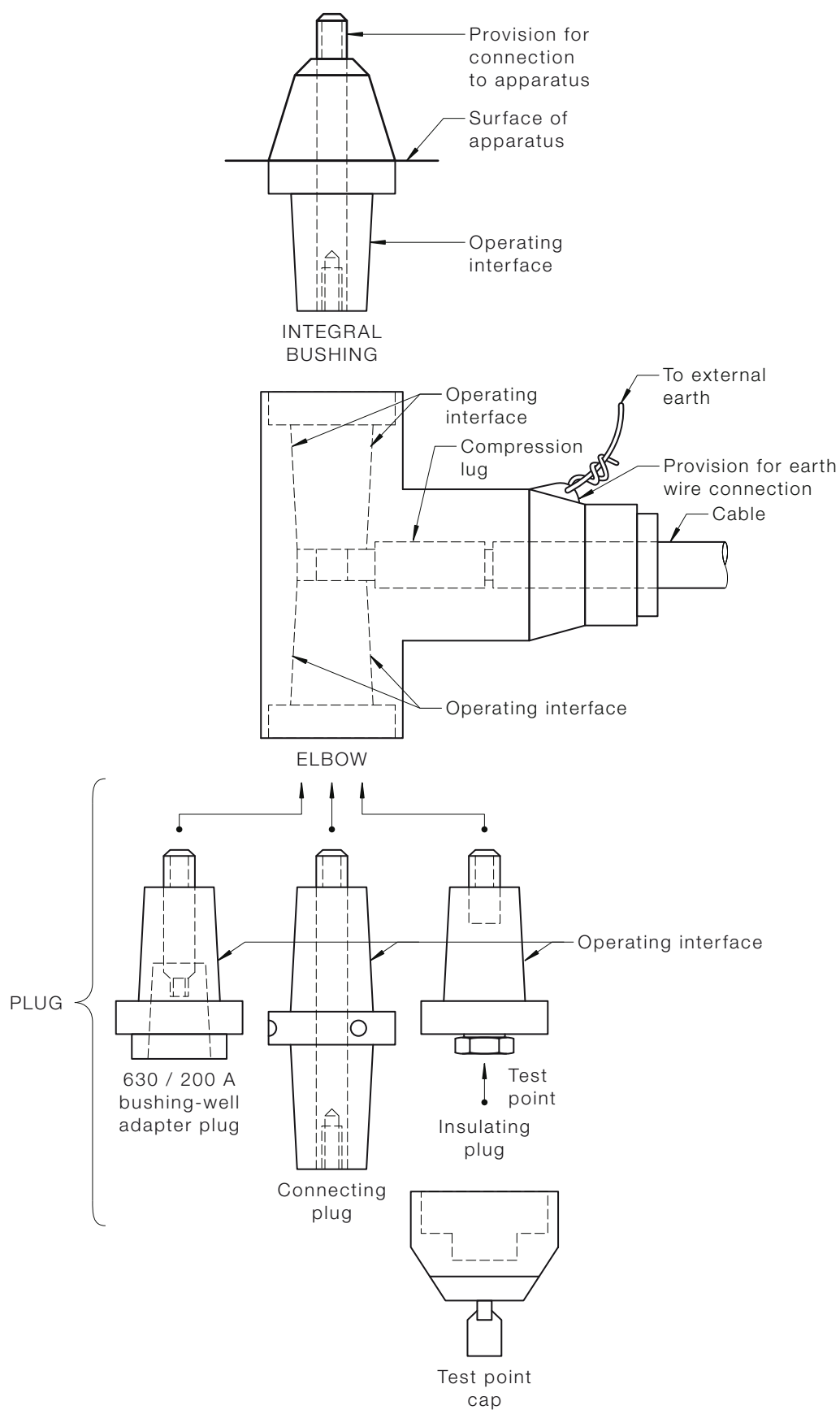


FIGURE 2.4 TYPICAL COMPONENTS OF 630/1250 A SEPARABLE INSULATED CONNECTOR SYSTEM

SECTION 3 RATINGS

3.1 VOLTAGE RATINGS

3.1.1 Rated voltage

The rated phase-to-phase voltage of connectors shall be suitable for the following standard r.m.s. values:

12, 24 and 36 kV.

The rated phase-to-neutral voltage of connectors shall be suitable for the following standard r.m.s. values:

6.9, 13.9 and 20.8 kV.

3.1.2 Insulation level

The rated insulation level of connectors is designated by two rated withstand voltages. These are the rated lightning impulse and the rated (short duration) power frequency withstand voltages as specified in Table 3.1.

3.1.3 Partial discharge extinction voltage

The partial discharge extinction voltage when measured in accordance with Clause 7.1.5 shall be not less than the values specified in Table 3.1.

3.2 RATED FREQUENCY

Connectors shall be suitable for operation at 50 Hz.

3.3 CURRENT RATINGS

3.3.1 Normal current

Connectors shall be suitable for operation at normal r.m.s. currents selected from the following standard values:

200, 400, 630 and 1250 A.

Under certain conditions, higher currents may be carried than the standard values indicated above, as the current-carrying capability of connectors varies with environmental conditions, cable sizes, etc. The connector manufacturer's recommendations should be obtained for the particular combination of conditions involved.

3.3.2 Switching current (load-break connectors)

The rated switching current of load-break type connectors shall be equal to the rated normal current.

3.3.3 Short-time withstand current

In general, the rated short-time withstand current of the connectors shall be chosen from the following standard r.m.s. values:

3.15, 4, 5.0, 6.3, 8.0, 10.0, 12.5, 16.0, 20.0, 25.0, 31.5 and 40.0 kA.

Where connectors are directly associated with a circuit-breaker or a switch, the rated short-time withstand current of the connectors shall be not less than the corresponding rating of the circuit-breaker or switch for the same duration.

Unless otherwise specified, the duration of the short-time withstand current shall be 1 s; however, a value of 3 s is recommended if a duration of more than 1 s is necessary.