BS 7019:1989

Specification for

Fully screened 400 A bolted flameproof cable couplers and adaptors for use on systems up to and including 6.6 kV, primarily for use in mines

Confirmed
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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Mining and Quarrying Requisites Standards Policy Committee (MQE/-) to Technical Committee MQE/14 upon which the following bodies were represented:

Association of British Mining Equipment Companies
British Cable Makers' Confederation
British Coal Corporation
Council for Electrical Equipment for Flammable Atmospheres (BEAMA Ltd.)
Health and Safety Executive
Institution of Mining Electrical and Mining Mechanical Engineers
Institution of Mining Engineers
Rotating Electrical Machines Association (BEAMA Ltd.)
Transmission and Distribution Association (BEAMA Ltd.)

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Contents

Foreword

This British Standard has been prepared under the direction of the Mining and Quarrying Requisites Standards Policy Committee. It was devised to rationalize the principal features of fully screened, 400 A bolted flameproof cable couplers and associated adaptors for use on system voltages up to 6.6 kV and designed primarily for equipment used in mines. This standard makes provision for special purpose items such as interface units for connection to adaptors and cable couplers specified in BS 3454 and BS 3905.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations. Attention is drawn to the Health and Safety at Work etc. Act 1974, the Mines and Quarries Act 1954, the Regulations made under these Acts, and also any other appropriate statutory requirements or bye-laws. These place responsibility for complying with certain specific safety requirements on the manufacturer and the user. The address of the recognized certification authority in the UK for Group I (coal mining) apparatus for flameproof purposes is as follows:

Health and Safety Executive,

HSE (M) Certification Support Unit,

Harpur Hill,

Buxton

Derbyshire, SK17 9JN.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 22, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for 400 A bolted flameproof cable couplers and adaptors of the fully screened 3-phase type with a voltage rating of up to and including 6.6 kV primarily for use in mines. The couplers are designed to enable two cables to be coupled together or to enable a cable to be coupled to apparatus by use of adaptors. The dimensional and test requirements for cable coupling units also cover conversion units that enable couplers/adaptors complying with this standard to be connected to couplers/adaptors complying with BS 3454 and BS 3905. In all cases the electrical connections are made by separate connecting elements. Provision is also made for insulated end covers. The use of other forms of intermediate box, with coupling arrangements as specified in this standard are not precluded, provided that all other relevant requirements of this standard are met.

The couplers complying with this standard are primarily intended for use with 3- or 4-core, individually screened, wire armoured cables, where the fourth conductor is earthed.

Couplers and adaptors complying with this standard are not intended to be coupled or uncoupled while the circuit is energized. The dimensions necessary to provide for the connection of couplers of different manufacture and some electrical and mechanical requirements are specified. This standard does not, however, purport to specify a fully detailed design.

Information to be supplied by the purchaser with the enquiry or order is given in Appendix A.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1
cable coupling unit

a detachable cable sealing box utilizing suitable connecting elements to facilitate ready connection to, or disconnection from, a similar unit or other apparatus

2.2
bolted flameproof cable coupler

two cable coupling units complete with suitable contact elements and a sealing ring, that, when bolted together to form a straight-through connecting box, complies with the relevant requirements of BS 4683-2, and BS 5501-5

2.3
cable gland

a device designed to secure the end of the cable to the cable sealing box, by means appropriate to the type of cable, including provision for making electrical connection to the armouring, screens and lead sheath of the cable, where applicable

2.4
cable sealing box

a device designed to receive and protect the end of the cable, with provision for sealing the conductors and the insulating material of the cable with filling medium and having a cable gland for attaching the cable to the box, together with any terminals provided for connection to the conductors of the cable within the box. The box may form part of, or be detachable from, the apparatus with which it is associated

2.5
adaptor

a device used to connect either a cable coupling unit or other types of cable terminations to apparatus. If used to connect a cable coupling unit it may either be separate from or be integral with the enclosure of the apparatus

2.6
insulated end cover

a metal cover, suitably insulated, that when bolted to the coupling face of a cable coupling unit or adaptor (with a suitable sealing ring arrangement), completes the flameproof enclosure of the cable coupling unit or adaptor and enables full working voltage to be applied

2.7
filling medium

a bituminous-based compound or an acceptable cast resin that when used in the coupler/adaptor is suitable for the electrical stresses imposed in service and prevents the ingress of moisture

NOTE For the purpose of certification in the UK, where other than bituminous-based compounds are used as a filling medium, the acceptance procedure will be administered by the Health and Safety Executive until a suitable British Standard is available.

2.8
contact element

a device which comprises a fixed and a separate element allowing an electrical connection between two couplers or a combination of coupler and adaptor

3 Design and construction

3.1 Temperature rise

The temperature rise of the cable coupling unit shall comply with **6.1**.

3.2 Flameproof enclosure

All enclosures and insulated end covers used with couplers and adaptors shall be of a type that has been manufactured to comply with BS 4683-2 or BS 5501-5 or BS 6709.

NOTE 1 Flameproof apparatus complying with this standard and for use in those UK mines where it has to be interfaced with flameproof apparatus complying with other British Standards such as BS 229 or BS 4683-2, should comply with BS 6709.
NOTE 2 Where flameproof apparatus is not interfaced as in note 1, to promote the increasing use of BS 5501-5 in parallel with the progressive phasing out of Group I apparatus in accordance with earlier standards, such apparatus should comply with BS 5501-5.

The external components shall either be of a corrosion resistant ferrous alloy, or of non-ferrous metal other than aluminium, magnesium or titanium or any alloy containing aluminium and/or magnesium and/or titanium unless the total content of these constituents does not exceed 15 % by mass and in which the content of magnesium and titanium together does not exceed 6 % by mass.

No component part shall be painted or coated with preparations containing, in metallic form, aluminium, magnesium or titanium.

NOTE 3 These limits have been imposed to avoid the hazards of incendive sparking due to friction between rusted steel or iron and the metals referred to.
NOTE 4 Where the body of an adaptor forms part of the main flameproof enclosure of other apparatus, it may be of the same metal as that of the main enclosure.

3.3 Cables

Bolted flameproof cable couplers shall be capable of receiving cables with conductors up to a maximum size of 185 mm^2.

3.4 Insulation

3.4.1 *Materials*. Properties of materials for insulating the primary live components shall comply with the values given in Table 1.

3.4.2 *Housing for fixed contact element*. The housing shall comprise a non-ferrous metallic block incorporating the primary insulating tubes, into which the fixed contact elements shall be fitted.

The design of the housing shall be such that full interphase screening, extending from the front face of the housing to a point at least 10 mm beyond the core screen termination is achieved for all phases.

The screen and its earth connections shall withstand a current of 400 A for 500 ms, the maximum temperature rise shall not exceed 50 K.

The material forming the primary insulating tubes shall be free from voids and other defects and shall comply with Table 1 and **7.3**.

3.5 External body features

3.5.1 *Enclosures*. The case of the cable coupling unit, adaptor, or insulated end cover shall be so designed that it does not readily admit water when properly assembled, i.e. with cable coupling units complete with cable. Castings shall comply with **7.1.1**.

3.5.2 *External earthing*. Means shall be provided on the cable gland to enable the fitting of an earthing bond. On coned draw type glands an extra securing nut and washer on one of the draw bolts shall satisfy this requirement.

3.5.3 *Internal earthing*

3.5.3.1 *General*. Provision shall be made within the cable sealing box for bonding to earth the earth core and/or any screens which may be incorporated in the cable as specified in **3.5.3.2** to **3.5.3.4**.

Any support pillar or component used for bonding shall be capable of withstanding the application of a short circuiting current as described in **6.2.2**.

3.5.3.2 *Earth core*. The earth core shall be terminated in either a brass or copper terminal (bored to accept the relevant core) with provision for attachment to either any support pillar, or the box body.

3.5.3.3 *Braided-wire core screens*. The braided-wire core screens shall be terminated in at least three brass or copper terminals (bored to accept the tails formed by unpicking the braid screens) with provision for attachment to either any support pillar, interphase barrier, or the box body.

3.5.3.4 *Copper-tape core screens*. The copper-tape core screens shall be terminated on the face of the cable gland, interphase barrier, or box body by means of a stud or screw terminal.

3.6 Contact element

The contact element shall have an assigned short time rating as described in **6.2.2** and comply with **6.1** for thermal cycling performance.

3.6.1 *Fixed contact element for copper cable*

3.6.1.1 The fixed contact element shall be fitted in the coupler body and if designed for use with copper cables shall comply with **3.6.1.2** and **3.6.1.3**. It shall be manufactured from copper of grade C101 or C102 complying with BS 1433 and the nose profile shall be silver plated, complying with BS 2816:1973:Cu/Ag 2 and shall be generally in accordance with Figure 1.

Table 1 — Properties of primary insulating materials

Property	Value	Test method
Electric strength (90 °C)	8 kV/mm (min.)	BS 2782-2:Method 220 or 221[a]
Volume resistivity	1×10^{13} Ω cm (min.)	BS 2782-2:Method 230A[b]
Tensile strength	34.5 N/mm^2 (MPa) (min.)	BS 2782-3:Method 320D
Flexural strength	60 N/mm^2 (MPa) (min.)	BS 2782-3:Method 335A
Impact strength	10 kJ/m^2 (min.)	BS 2782-3:Method 359
Water absorption[c]	50 mg (max.)	BS 2782-4:Method 430A
Comparative tracking index[c]	CTI 400 (min.)	BS 5901
Oxygen index	28 % (min.)	BS 5734-1:Method 4

[a] Published jointly with BS 903-C4.
[b] Published jointly with BS 903-C2.
[c] Preparatory to any testing for these properties, remove not less than 0.5 mm by machining from all the surfaces of the test specimen and then smoothly finish.

3.6.1.2 The part of the fixed contact element receiving the copper cable shall be so manufactured as to permit compression jointing of the copper conductor onto the element.

The dimensions and tolerances of that part of the element shall be in accordance with the compression tool manufacturer's recommendations. Markings shall be provided to assist in the location of the compression dies. These markings shall not remove or displace material such as could affect the efficacy of the completed compression joint.

3.6.1.3 The contact element shall have:

a) a suitable seal to prevent migration of the filling medium from one side of the insulating tube to the other side;

b) a locking ring that effectively retains the contact element in its correct location in the insulating tube (see Figure 2), (Figure 3 gives outline details of a suitable fastening key); and

c) a device that locates and prevents rotation of the contact element in the insulating tube.

3.6.2 *Fixed contact element for aluminium cable*

3.6.2.1 The fixed contact element shall be fitted in the coupler body and shall be formed by the friction welding of a copper billet onto an aluminium billet. The copper section shall be manufactured from copper of grade C101 or C102 complying with BS 1433, or alternatively of grade C111 complying with BS 2874, and the nose profile shall be silver plated complying with BS 2816:1973:Cu/Ag 2 and shall be generally in accordance with Figure 1. The aluminium section shall be manufactured from aluminium of grade 1050A complying with BS 1474 and shall comply with **3.6.2.2** and **3.6.2.3**. The weld shall comply with **7.2**.

3.6.2.2 The part of the fixed contact element receiving the aluminium cable shall be so manufactured as to permit compression jointing of the aluminium conductor onto the aluminium part of the element. The dimensions and tolerances of that part of the element shall be in accordance with the compression tool manufacturer's recommendations. Markings shall be provided to assist in the location of the compression dies. These markings shall not remove or displace material such as could affect the efficacy of the completed compression joint.

3.6.2.3 The contact element shall have:

a) a suitable seal to prevent migration of the filling medium from one side of the insulating tube to the other side;

b) a locking ring that effectively retains the contact element in its correct location in the insulating tube (see Figure 2), (Figure 3 gives outline details of a suitable fastening key);

c) a device that locates and prevents rotation of the contact element in the insulating tube; and

d) the internal bore of the aluminium sector free from any surface irregularities.

NOTE The development of compression jointing for the termination of cables having aluminium conductors has created the need to provide bimetallic terminal/contact elements. The accepted method of producing the bimetallic (aluminium compression ferrule to copper contact elements) joint is by friction welding.

3.7 Separate contact element

The overall dimensions and interconnecting faces shall be in accordance with Figure 4, affording an electrical connection with the elements described in **3.6.1** and **3.6.2**.

Current transfer shall be achieved by a purpose-designed pressure system which ensures compliance with parameters as given in clause **6**. Any device used to develop the necessary contact pressure shall not be part of the main current carrying element. All principal current-transfer surfaces shall be silver plated, complying with BS 2816:1973:Cu/Ag 2.

3.8 Sealing ring

When any two cable coupling units are bolted together, the coupling faces of the material forming the respective contact tube housings, or contact tube housing and insulated end cover, shall be sealed by the interposition of a suitable resilient insulating material that shall comply with the relevant dimensions shown in Figure 5. The properties of the material of the seal shall comply with Table 2.

3.9 Adaptors

Dimensions of adaptors shall be as shown in Figure 6 and Figure 7.

3.10 Filling holes

Enclosures that are to be filled shall have a minimum of two orifices of not less than 30 mm diameter sited in the same plane and provided with suitable covers, or threaded to receive screwed plugs.

Where angled adaptors are designed to be filled in situ, they shall be provided with at least two filling orifices of not less than 30 mm diameter and provided with suitable covers, or threaded to receive screwed plugs (see Figure 7).

3.11 Insulated end covers

Insulated end covers shall be as shown in Figure 8. The insulation shall comply with Table 1 and **7.3** for solid insulating material, or Table 2 for resilient insulating material.

4 Dimensions

4.1 Components

The dimensions of the components of cable coupling units, typical types of adaptors and typical insulated end covers shall be as shown in Figure 1, Figure 7 and Figure 8. The relative positions of the contact elements and the flange bolt holes shall be as shown in Figure 1.

4.2 Electrical clearances

The clearance and creepage distances shown in Figure 9 shall be not less than those given in Table 3.

Table 2 — Properties of the sealing ring

Property	Value	Test method
Electric strength	100 kV/cm (min.)	BS 2918
Volume resistivity	1×10^{13} Ω cm (min.)	BS 2782-2:Method 230A[a]
Relative permittivity	5.0 (max.)	BS 2782-2:Methods 240A and 240B[b]
Comparative tracking index	CTI 400 (min.)	BS 5901
Water absorption (after 14 days at 23 ± 2 °C)	1 % (max.)	BS 2782-4:Method 430A
Resistance to liquids (after immersion for 7 days at 23 ± 2 °C in transformer oil complying with BS 148)		BS 903-A16
Tensile strength	7.5 N/mm^2 (MPa) (min.)	
Ultimate elongation	250 % (min.)	
Accelerated ageing (168 h at 120 °C)		BS 903-A19
Tensile strength	10 N/mm^2 (MPa) (min.)	
Ultimate elongation	300 % (min.)	
Compression set (70 °C for 24 h)	15 % (max.)	BS 903-A6
Hardness	55 to 65 IRHD[c]	BS 903-A26

[a] Published jointly with BS 903-C2.
[b] Published jointly with BS 903-C3.
[c] International Rubber Hardness Degrees.

Table 3 — Minimum creepage and clearance distances

Description	In air		In filling medium	
	Reference letter (see Figure 9)	Dimension	Reference letter (see Figure 9)	Dimension
		mm		mm
Clearance phase to earth direct	*B*	64	*G*	25
Creepage phase to earth over insulation	*D*	89	*J*	32
Creepage phase to earth over cable surface	*K*	127	*K*	48

Table 4 — Details of coupler glandsets

Type of armour	Cable sheath	Minimum dimensions (see Figure 10 and Figure 11)	
		Support length, *A*	Penetration, *B*
		mm	
Pliable wire armour (PWA)	Polychloroprene (PCP)	30	1.25 times the outside diameter of the cable (90 mm min.)
Single wire armour (SWA) and double wire armour (DWA)	Polyvinylchloride (PVC)	20	0.67 times the outside diameter of the cable (30 mm min.)

4.3 Fasteners

Screws and studs used for attaching parts of the enclosure shall have a strength grade designation of 8.8, as specified for screws in BS 3692 and for studs in BS 4439, with grade 8 nuts as specified in BS 3692. Coupling screws shall be size M10 of length 50 mm.

5 Cable glands and cable sealing boxes

Cable glands and cable sealing boxes forming part of a cable coupling unit shall be so constructed as to comply with the relevant requirements of BS 542 and with the dimensions given in Table 4. Provision shall be made on the cable gland for the fixing of an earth bond.

Cable glands shall be so designed and constructed that when the armour wires of the cable are clamped with a maximum torque of 95 N m applied to each of the armour clamp adjusting studs or bolts, the distortion of the gland mounting flange shall not exceed 0.5 mm.

At 95 N m torque, the bow in the armour clamp shall not exceed 2 mm and no damage shall occur to the gland components or the threads of the adjusting studs or bolts.

Cable glands shall, in all other respects, comply with the relevant requirements of BS 542.

6 Type tests

6.1 Temperature rise test

6.1.1 *Requirement*. When tested as described in **6.1.2**, the temperature rise of the components within the cable coupling units shall not exceed 45 K in a maximum ambient temperature of 25 °C as measured in **6.1.2.1** d). The temperature deviation of the components within the cable coupling units shall be equal to, or less than, that of the average temperature of the cable conductors as measured in **6.1.2.1** c).

NOTE Because of the nature of this test, if a bad reading occurs, the parties concerned might need to reach agreement on, for example, whether to continue the test.

The tests shall be conducted, under draught-free conditions, on two filled cable coupling units, bolted together and complete with three contact elements and a sealing ring that all comply with this standard.

6.1.2 ***Method***

6.1.2.1 *General.* Attach each cable coupling unit to a 2 m length of 3-core 185 mm^2 stranded copper, PVC-insulated, single or double wire armoured, screened cable.

Determine the temperature rise of the components within the cable coupling units and the temperature deviation of the same components from that of the cable core using thermocouples placed as follows.

a) Attach one thermocouple to the conductor socket of each contact element adjacent to the conductor.

b) Attach one thermocouple adjacent to each butt contact connection.

c) Attach one thermocouple to each of the cable conductors in a separate 2 m length of uncut cable at a distance of 1 m from the end of the cable. Either insert the thermocouples through holes in the cable sheath and insulation, and connect this cable in series with the cable coupling units or insert the thermocouples mid-way between the coupler gland and the end of the 2 m length of cable.

NOTE In the event of any dispute, then the test results utilizing the separate cable length in determining the cable core temperature should prevail.

d) To measure the ambient temperature, attach one thermocouple to the body of one of two cable coupling units, bolted together, and not included in the test loop.

6.1.2.2 *Continuous loading sequence*. Conduct this test on two units as initially assembled. Pass a three-phase current of 400 A, 40 Hz to 62 Hz, through the cables and cable coupling units for a period of 30 days. Record the temperature of the selected components at intervals not greater than 24 h.

6.1.2.3 *Intermittent loading sequence*. On completion of the continuous loading sequence, switch off the test current for a period of 24 h and then switch on for a further period of 24 h. Repeat this on/off sequence so that 10 such sequences are completed. Record the temperature of the selected components just prior to the end of each on-load period.

6.1.2.4 *Load cycling sequence*. On completion of the intermittent load cycling sequence, carry out the following load cycling sequence:

a) 520 A for 40 min;

b) 173 A for 10 min;

c) 260 A for 20 min;

d) 173 A for 10 min.

Repeat this sequence 33 times without interruption followed by a continuous load of 400 A for a minimum period of 10 h. Record the temperature of the selected components just prior to the end of the test period. Repeat the test sequence a), b), c), d) and the 10 h continuous load test a further 30 times making a total cycling sequence of 990 (nominally 1 000) cycles.

6.2 Through fault current test

6.2.1 *Requirement*. When tested as described in **6.2.2**, there shall be no visible signs of disturbance to a properly assembled cable coupling unit with each type of adaptor (angled and straight).

6.2.2 *Method*. Apply a current of 17.5 kA, r.m.s. symmetrical, for 1 s, with an assymetrical peak value of not less than 44,6 kA to a properly assembled cable coupling unit with each type of adaptor at any voltage up to the rated voltage. If light welding of the contacts occurs, check that they can be separated by normal means. If any burning is visible, repeat the temperature rise test described in **6.1** without reconditioning the surfaces.

6.3 Partial discharge test

6.3.1 *Requirement*. When tested as described in **6.3.2** the magnitude of discharge shall not exceed 100 pC.

6.3.2 *Method*. Conduct a test in accordance with BS 4828.

6.4 Drop test

The separate contact element shall be subjected to a drop test; it shall be dropped four times from a height of 1 m on to a horizontal concrete surface. The positions of the sample for the test shall be selected by the testing station. There shall be no cracking of the insulating material.

7 Routine tests

7.1 Pressure test for cable coupler and adaptor body castings

7.1.1 *Requirement*. When tested as described in **7.1.2** or **7.1.3**, no escape of air or water shall be observed to occur from any part of the body casting of cable couplers or adaptors.

NOTE Marking is required to indicate that the body casting complies with this requirement [see clause **8** h)].

7.1.2 *Pneumatic method*. Immerse the body with suitable gaskets, blanking devices and pneumatic connections in a suitably guarded water tank. Pressurize the body casting internally using compressed air, slowly building up the pneumatic pressure to a test pressure of 10.3 bar[1)]. Hold the test pressure for 1 min.

7.1.3 *Hydraulic method*. Place the body with suitable gaskets, blanking devices and hydraulic connections in a test rig which allows full visual inspection of the casting. Check that the external faces of the prepared casting are clean and dry. Pressurize the body castings using water, slowly building up to a test pressure of 10.3 bar. Hold the test pressure for 1 min.

[1)] 1 bar = 10^5 N/m^2 = 0.1 MPa.

7.1.4 *Percentage testing*. For new or modified foundries, alterations to existing casting techniques or introduction of new or modified metals or alloys; 20 % of each of the first five batches of body castings shall be tested in accordance with **7.1.2** or **7.1.3**. If after testing the rejection rate is zero, then it is permissible to reduce the percentage tested to 2 % of each batch and remain at that level.

If any casting fails when being tested as part of the 2 % previously specified, then all the body castings from that batch shall be tested and the test percentage increased back to 20 % until five reject-free batches have been obtained.

7.1.5 ***Vacuum impregnation***

7.1.5.1 If castings showing porosity in the area of the body other than flameproof faces are recovered by vacuum impregnation, they shall all be pressure tested and marked accordingly.

NOTE This procedure is only applicable to specific castings whose certification conditions require them to be filled with compound.

7.1.5.2 Castings that are vacuum impregnated as a normal production routine shall be tested in accordance with **7.1.4**. In the event of failure due to porosity these castings shall not be covered by further impregnation as specified in **7.1.5.1**.

7.2 Bend test for friction welded connectors

7.2.1 *Requirement*. When tested as described in **7.2.2**, all friction welded, bimetallic terminal/contact elements shall reveal no signs of cracks at the weld line visible to the naked eye. All connectors that are not straight within 0.5 mm shall be rectified or rejected.

7.2.2 *Method*. Remove the welding flash at the friction weld interface. Locate the connector in a suitable device so that diametrically opposed mandrels acting, in turn, at right angles to the main axis of the connector can be caused to impose a bending and shearing force on the friction welded joint. The mandrels shall be so designed that small indentations are created on the connector to indicate that the test has been carried out.

Impose the force given in Table 5 at a point on the aluminium portion of the connector, 25 mm from the interface of the two materials forming the connector.

After this test, measure all connectors for straightness and concentricity.

Table 5 — Bending forces

Connectors for cable size	Force
mm^2	N
70	2 220
95	2 890
150	3 110
185	3 550

7.2.3 *Batch testing*. A batch shall be a quantity not less than 100 or greater than 1 000 connectors of any one size produced at any one time.

From every batch so produced there shall be selected at random 1 % of the batch or three connectors whichever is the greater and these shall be tested by bending the aluminium section through 90° at the weld line; there shall be no cracks at the weld line visible to the naked eye.

If any connector shows evidence of cracking a further set of samples shall be selected at random and tested. If any connectors of the second set show evidence of cracking the entire batch shall be rejected.

Failure of any of the second set of connectors shall result in the entire batch being rejected.

7.3 Heat test for insulators

7.3.1 *Requirement*. When tested as described in **7.3.2**, the dimensions of each insulator shall not differ from the original dimensions by more than 0.2 % and there shall be no form of surface cracking or scaling on the insulator.

7.3.2 *Method*. Heat the insulator in an oven at 120 ± 5 °C for a period of 24 h and then allow to cool to ambient temperature. Examine the insulator for surface cracking or scaling.

7.4 High voltage tests

7.4.1 *Requirement*. When each assembly of insulator and contact element and each insulated end cover is tested as described in **7.4.2**, no breakdown shall occur. The tests shall be applied at the manufacturer's premises.

Where couplers are connected to cables, the tests described in appropriate standards shall be applied.

7.4.2 *Method*. Apply an alternating test voltage of 14.2 kV of any frequency between 40 Hz to 62 Hz and of approximately sine-wave form between each contact element and the body of earthed screen of an associated enclosure, including the insulated end cover.

NOTE For this test, a simulated enclosure may be used.

Commence the test at a voltage of about one third the test voltage and increase the test voltage in a period not exceeding 10 s. Maintain the full test voltage for 1 min. During the test to earth, connect one pole of the testing transformer to earth and to the body of the cable coupling unit, adaptor or end cover.

8 Marking

All enclosures and insulated end covers shall be legibly and permanently marked with the following:

a) the registered trade name or trademark of the manufacturer, or his agent, on all principal components forming the complete coupler; other items, such as fasteners and tie rods, need not be so marked;

b) the designation by which the type is identified;

c) voltage and current rating;

d) temperature class T6 when in accordance with BS 4683-1;

e) where applicable, the number of the flameproof certificate and the group number or group numbers, indicating the group of gases and vapours covered by the certificate;

f) a warning prominently placed on the casing, "DO NOT SEPARATE WHEN ENERGIZED";

g) the number and date of this British Standard, i.e. BS 7019:1989[2)];

h) pressure test mark denoted by the letters "PP" stamped on the body casting to indicate that the casting complies with **7.1**.

[2)] Marking BS 7019:1989 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Appendix A Information to be supplied with enquiry or order

A.1 General

When ordering cable couplers and adaptors complying with this British Standard, purchasers should give at least the following information together with that in **A.2** and **A.3**:

a) the number of this British Standard, i.e. BS 7019;

b) the nominal working voltage of the system on which the equipment is to be used;

c) the group number, or group numbers, of the gases or vapours in which the couplers or adaptors are to be used.

A.2 Cable couplers

For cable couplers the following information should be given:

a) nominal size (in mm^2) of conductors, also under-armour diameter and overall diameter of cable;

b) type of cable to be used, number of an appropriate British Standard or other recognized specification should be quoted; for non-standard cables, complete details of the cable's construction and dimensions should be given;

c) number of connecting elements required;

d) number of sealing rings required;

e) type of gland required;

f) whether filling medium and jointing tapes are required.

NOTE Certain types of cable core insulation, notably polyethylene, are liable to exhibit cracking when subjected to prolonged contact with some bituminous filling compounds. The advice of the cable manufacturer should be sought as to the recommended grade of filling medium.

A.3 Adaptors

For adaptors the following information should be given:

a) nominal size (in mm^2) of the conductor in the connecting leads;

b) whether the leads are stranded or flexible (rope-stranded or bunched);

c) number of connecting elements required;

d) where appropriate, the number of adaptor connecting elements required;

e) number of sealing rings required;

f) where appropriate, whether filling medium and jointing tapes are required [see note to **A.2** f)].

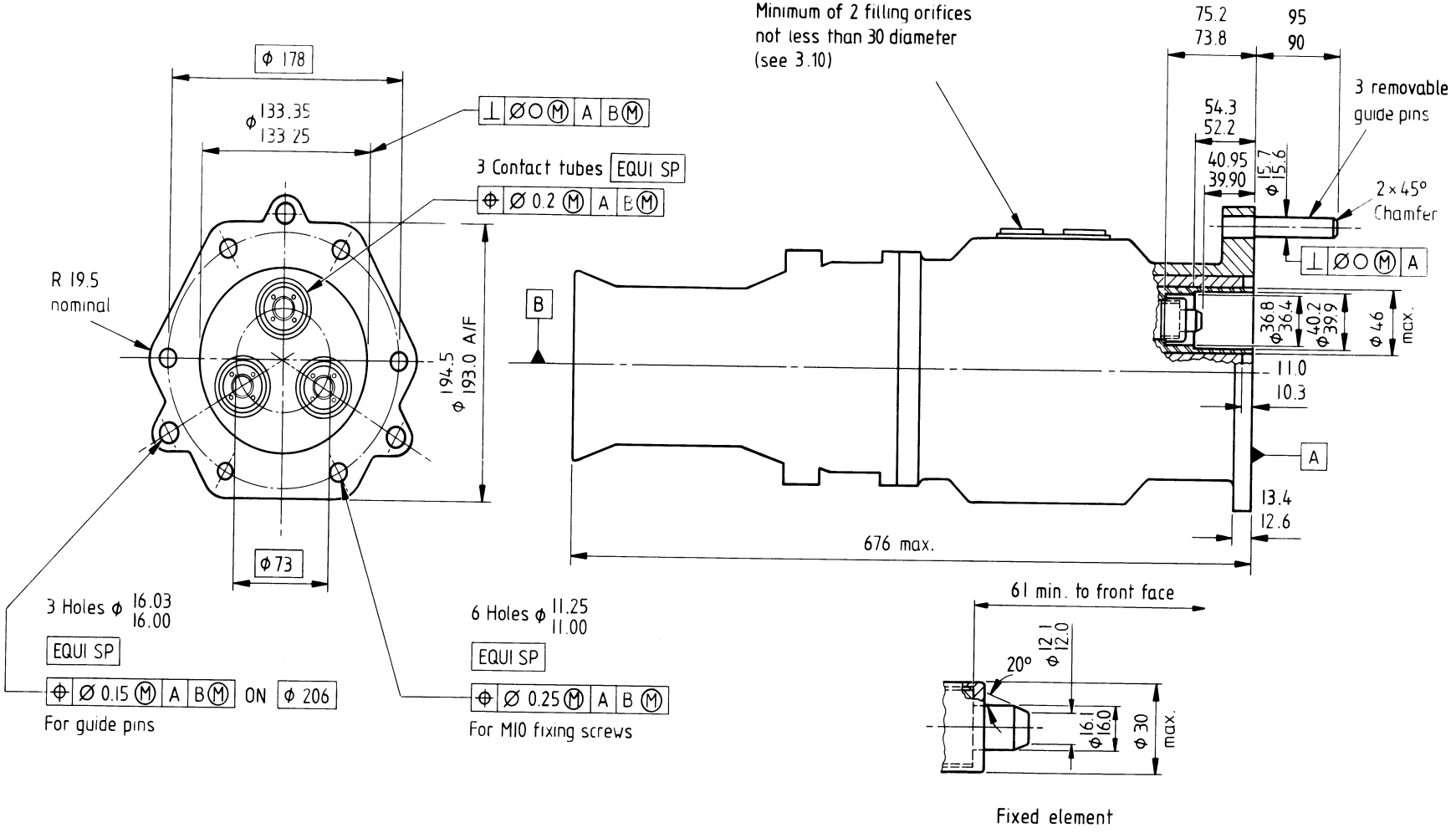
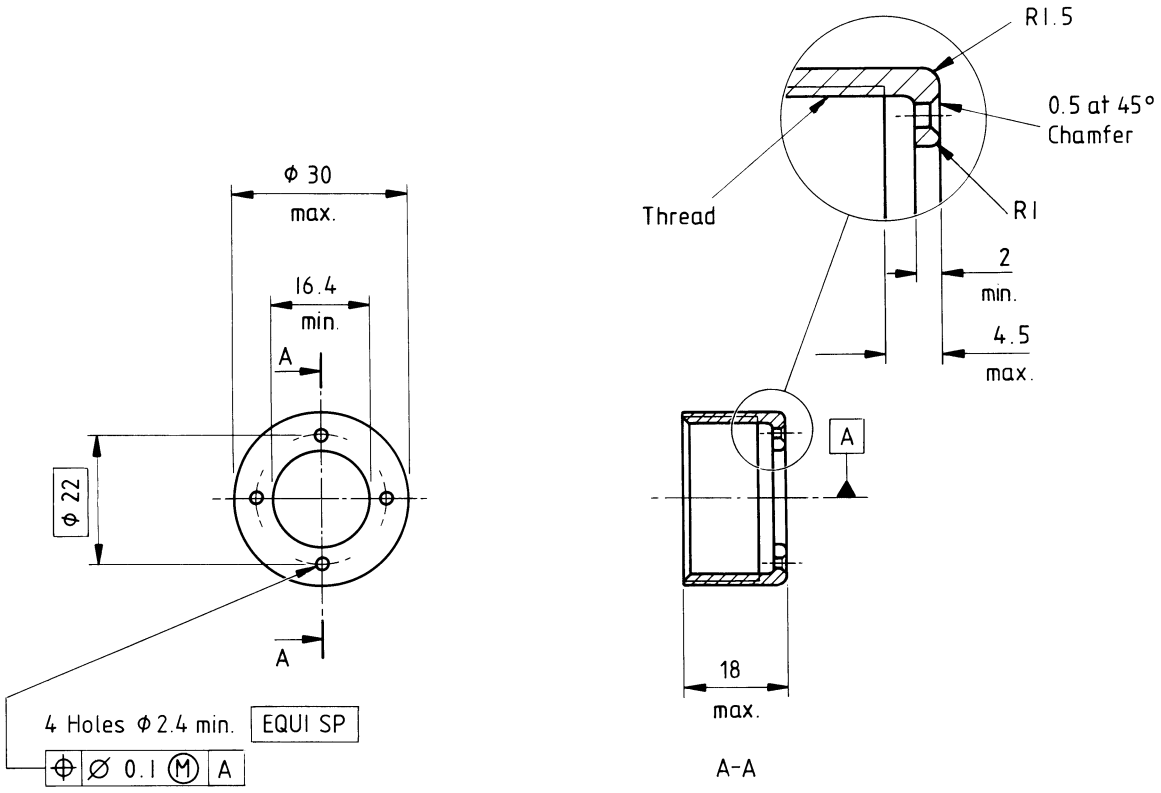
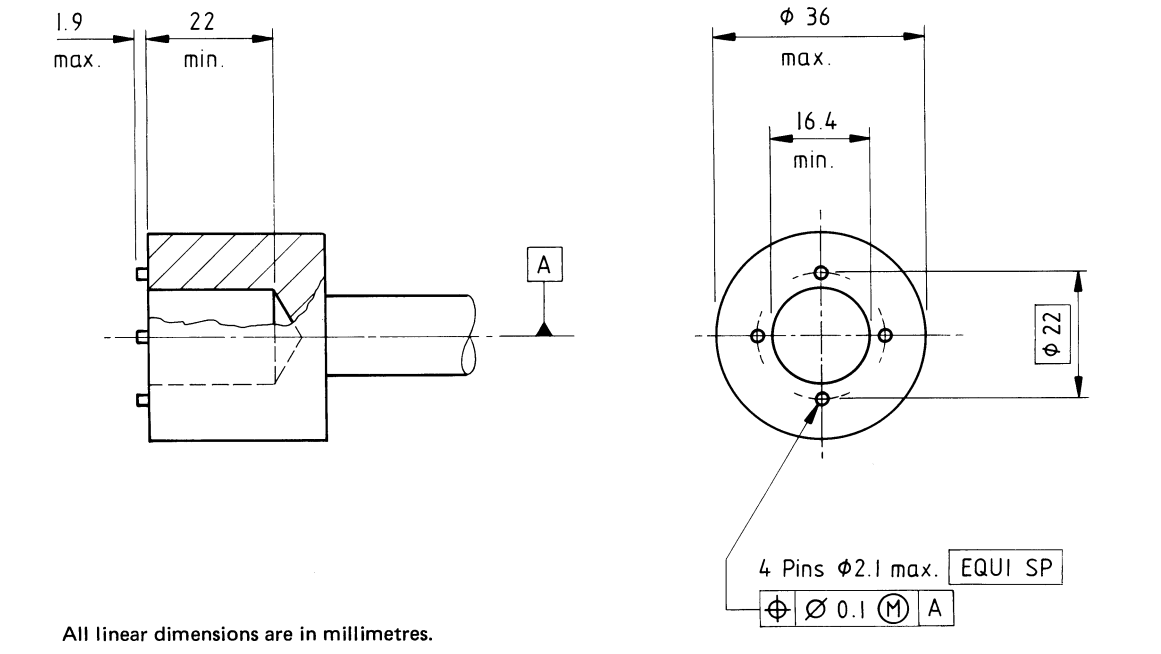


Figure 1 — Coupling dimensions



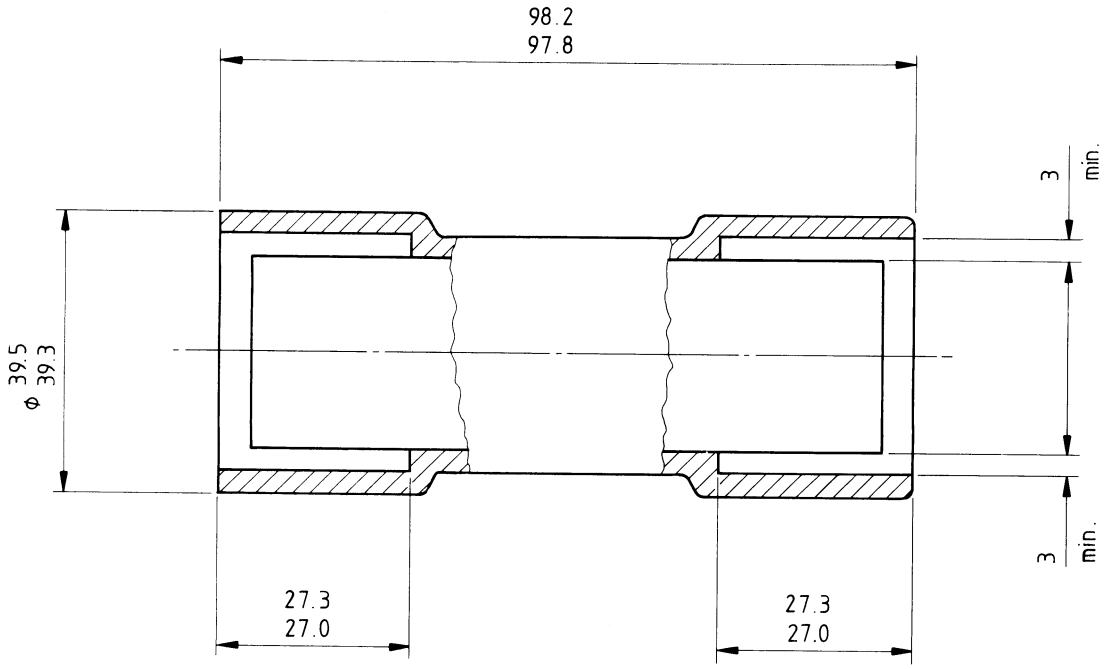
All linear dimensions are in millimetres.

Figure 2 — Nut for fixed contact element



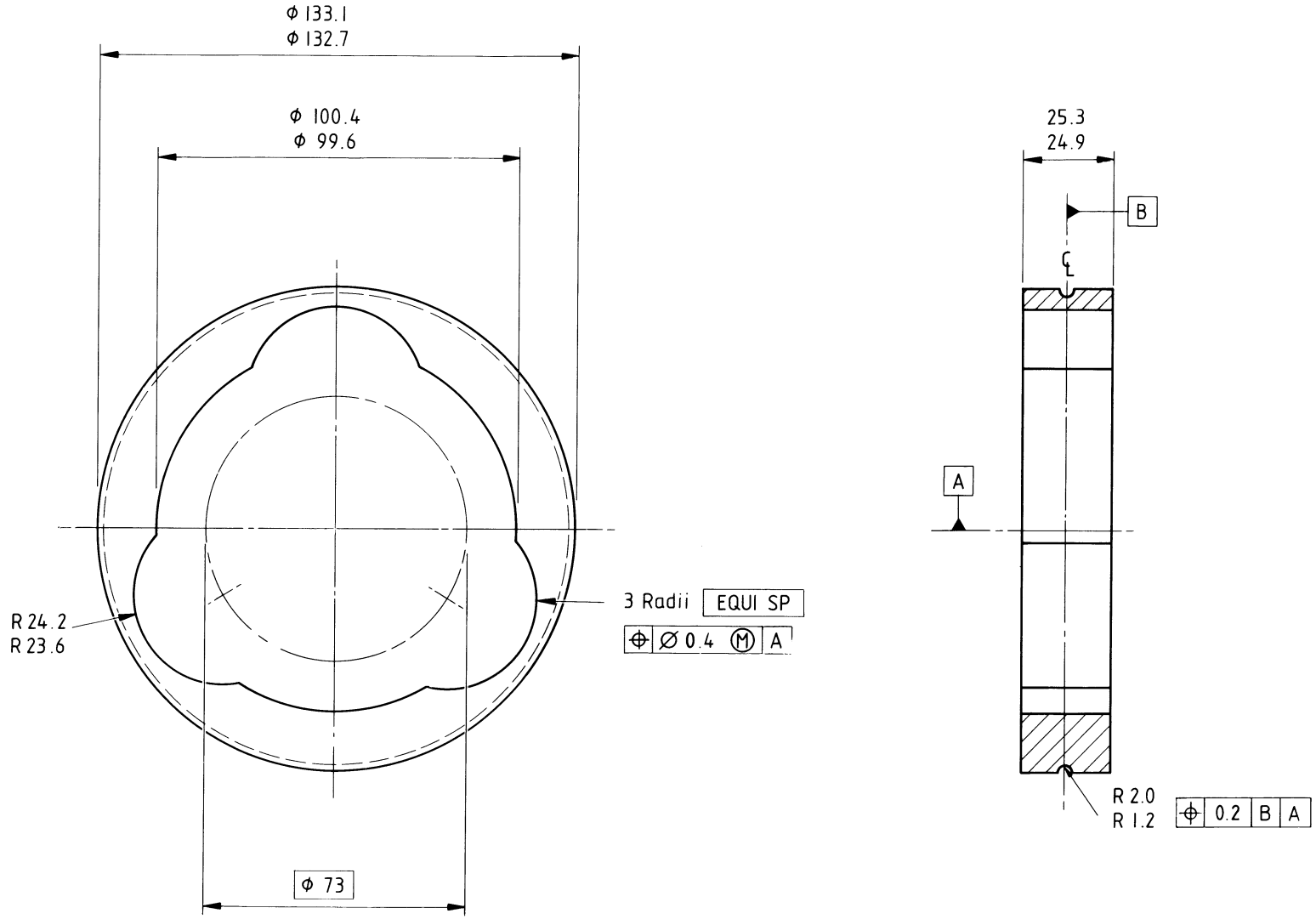
All linear dimensions are in millimetres.

Figure 3 — Key for fixed contact element nut



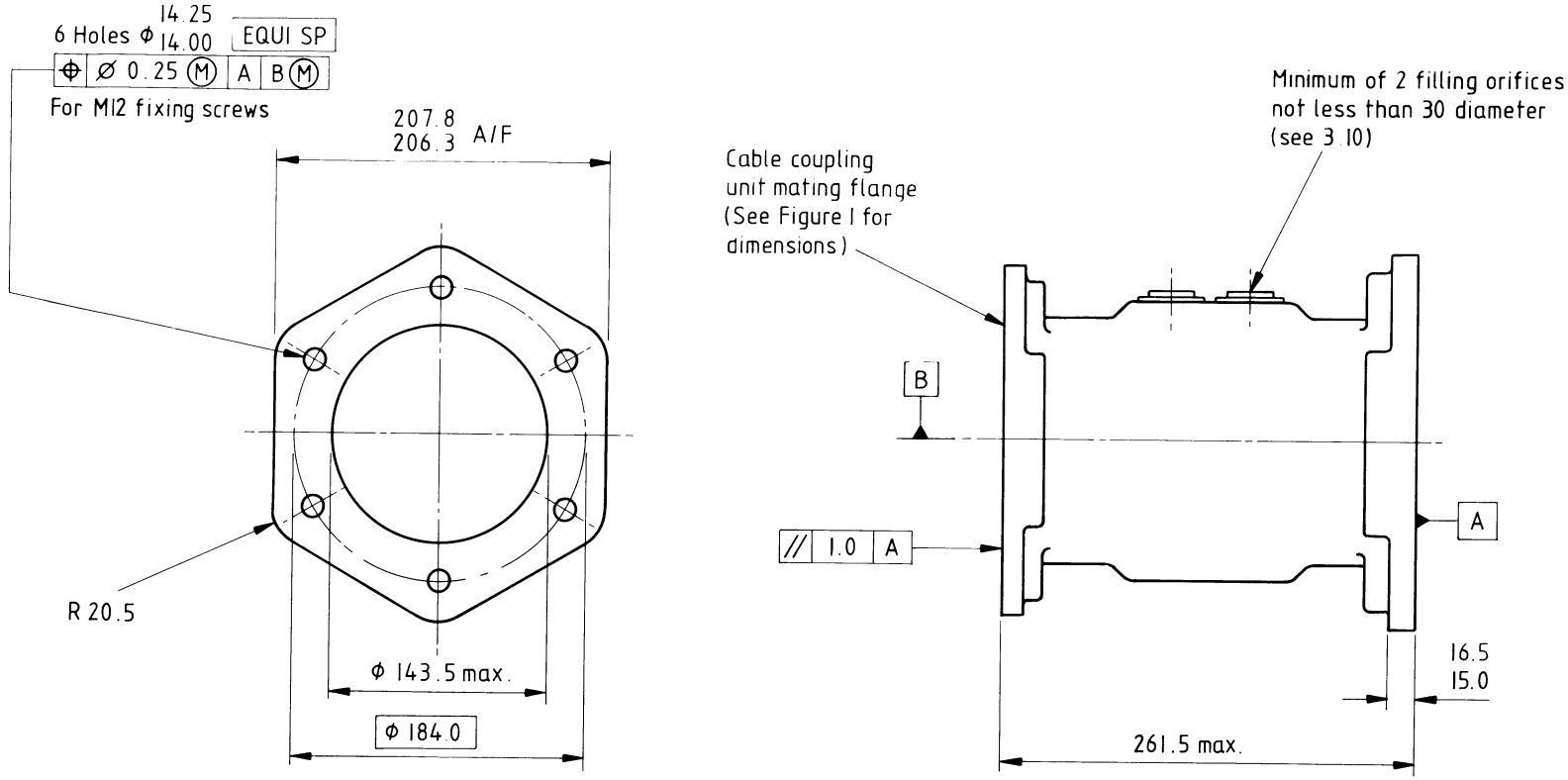
All linear dimensions are in millimetres.

Figure 4 — Separate contact unit



All linear dimensions are in millimetres.

Figure 5 — Dimension of sealing ring



All linear dimensions are in millimetres.

NOTE The external profile of the associated mounting flange may be of any convenient shape, provided that the external profile of the adaptor mounting end lies within it at all points.

Figure 6 — Straight adaptor

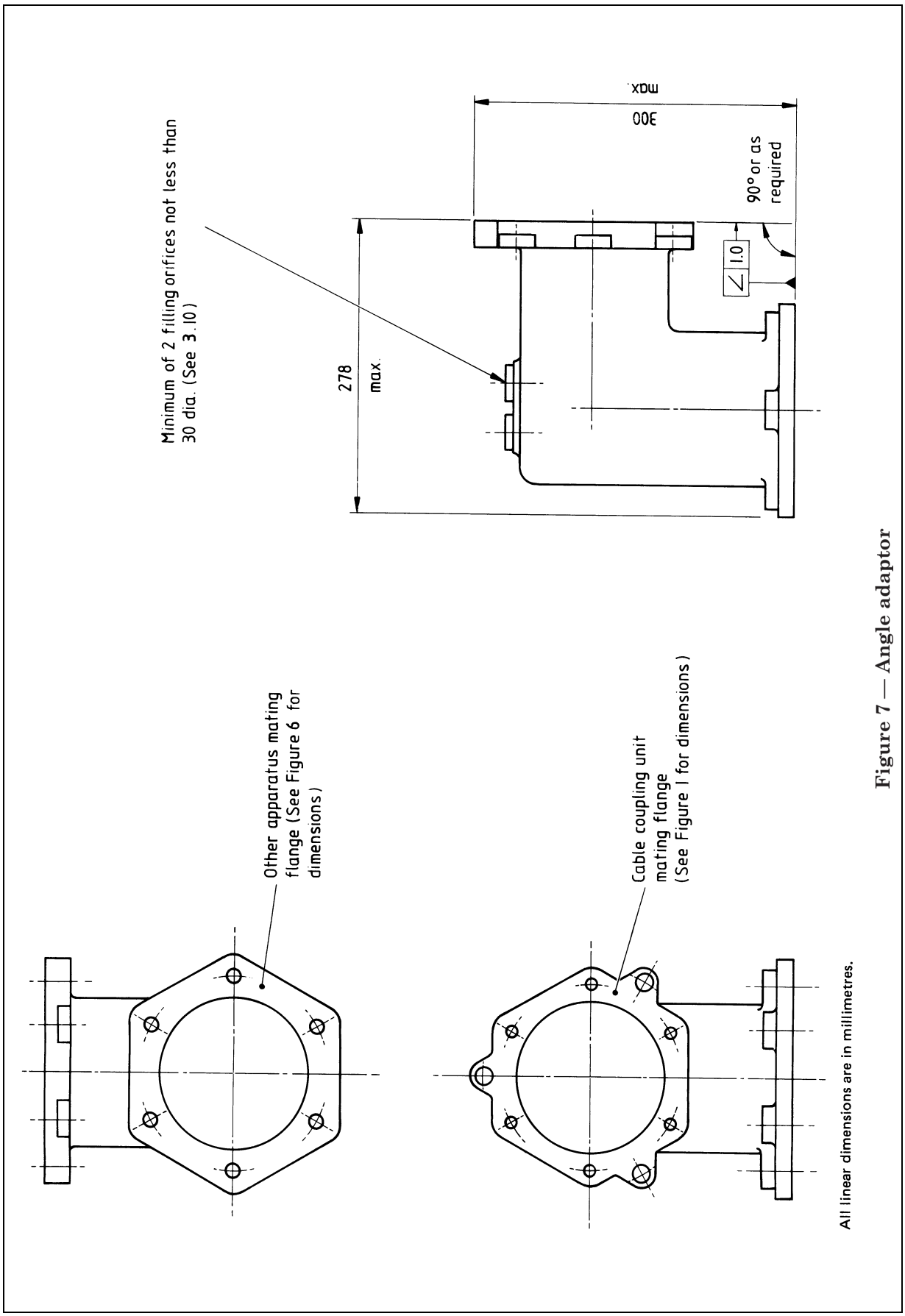
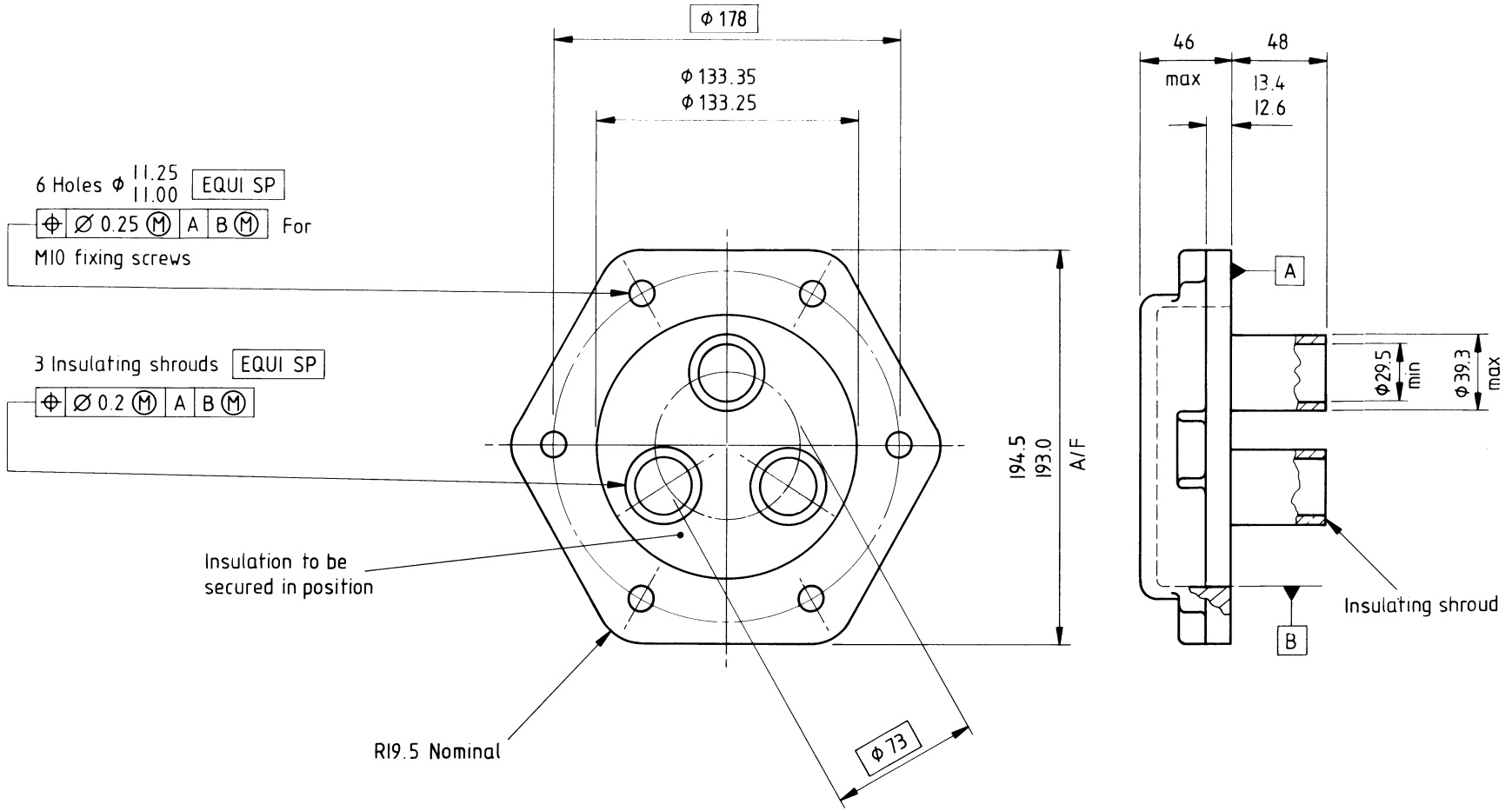
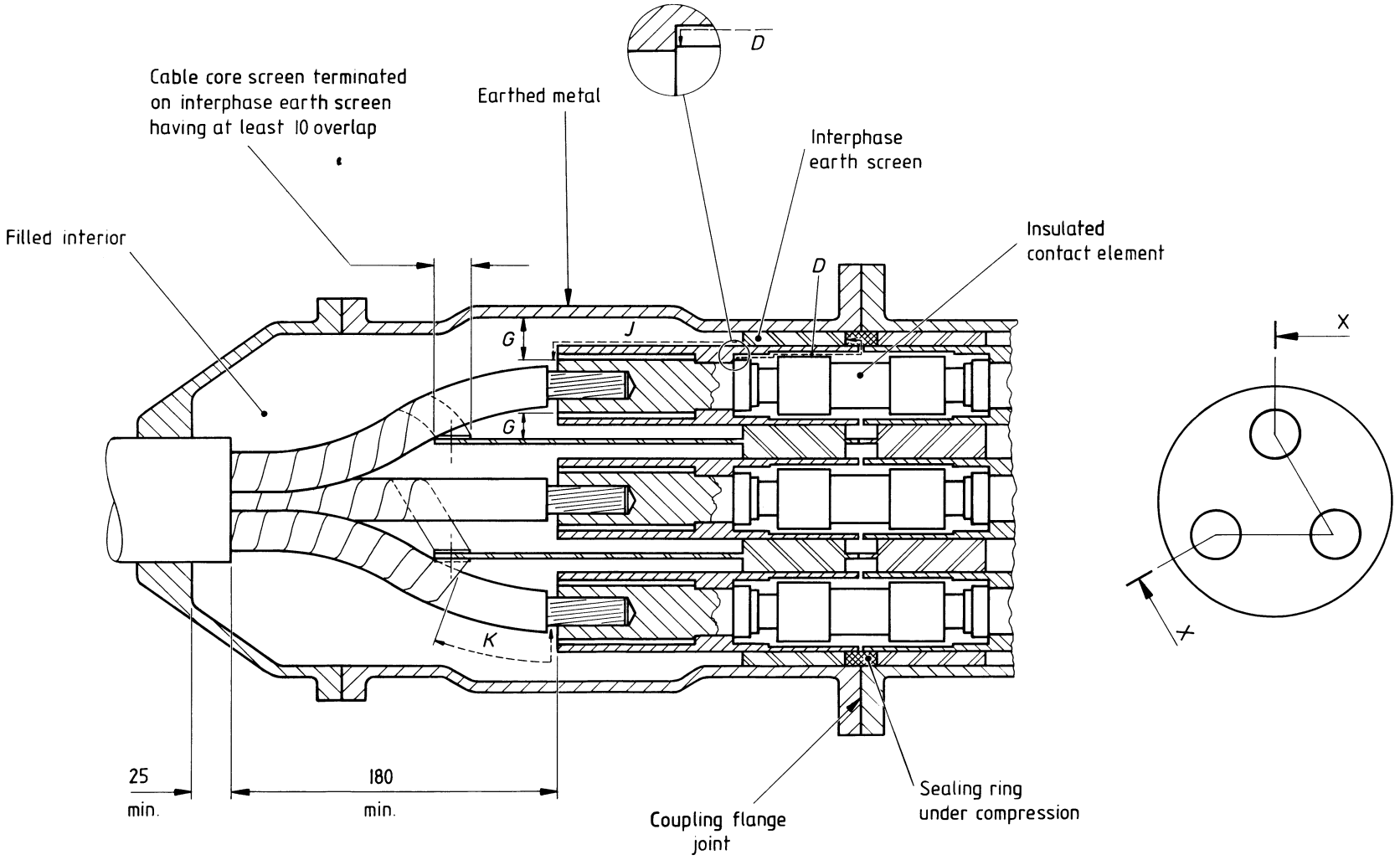


Figure 7 — Angle adaptor



All linear dimensions are in millimetres.

Figure 8 — Insulated end cover

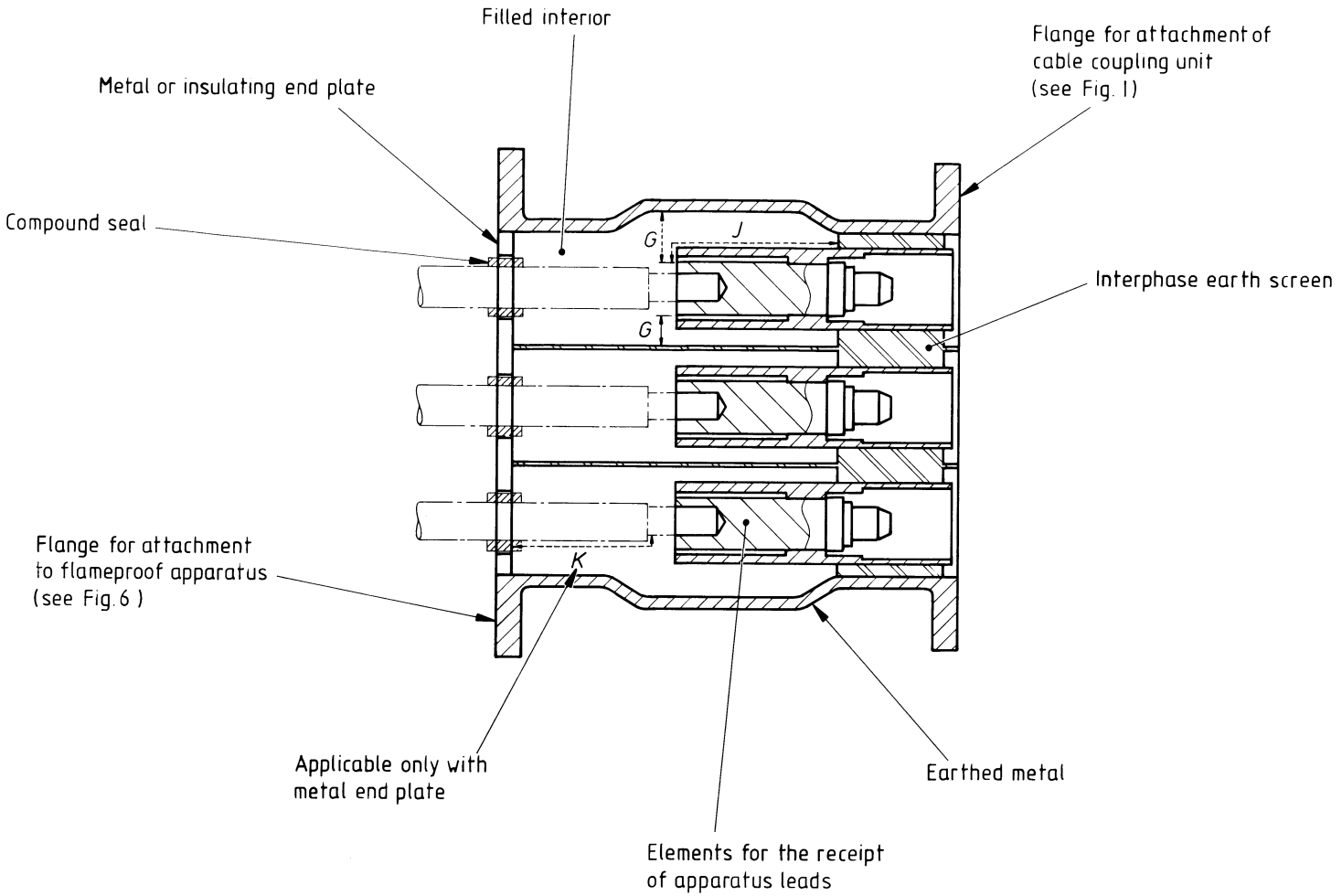


(a) Cable coupler

All linear dimensions are in millimetres.

NOTE For dimensions corresponding to the reference letters, see Table 3.

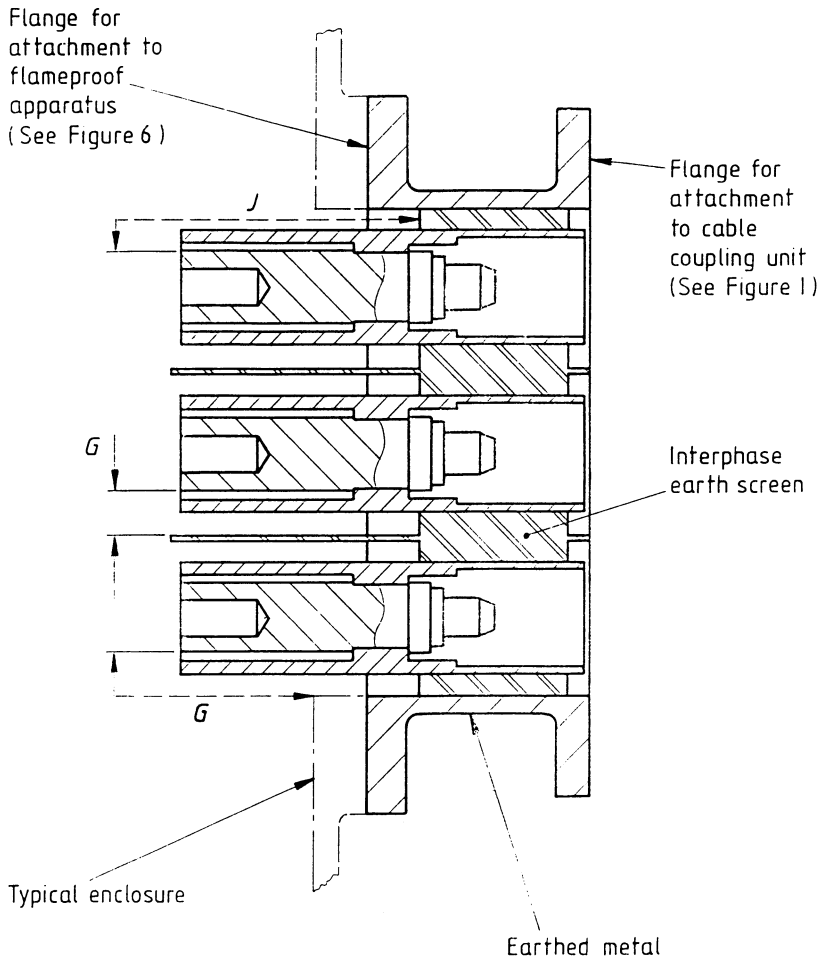
Figure 9 — Methods of measuring electrical clearances



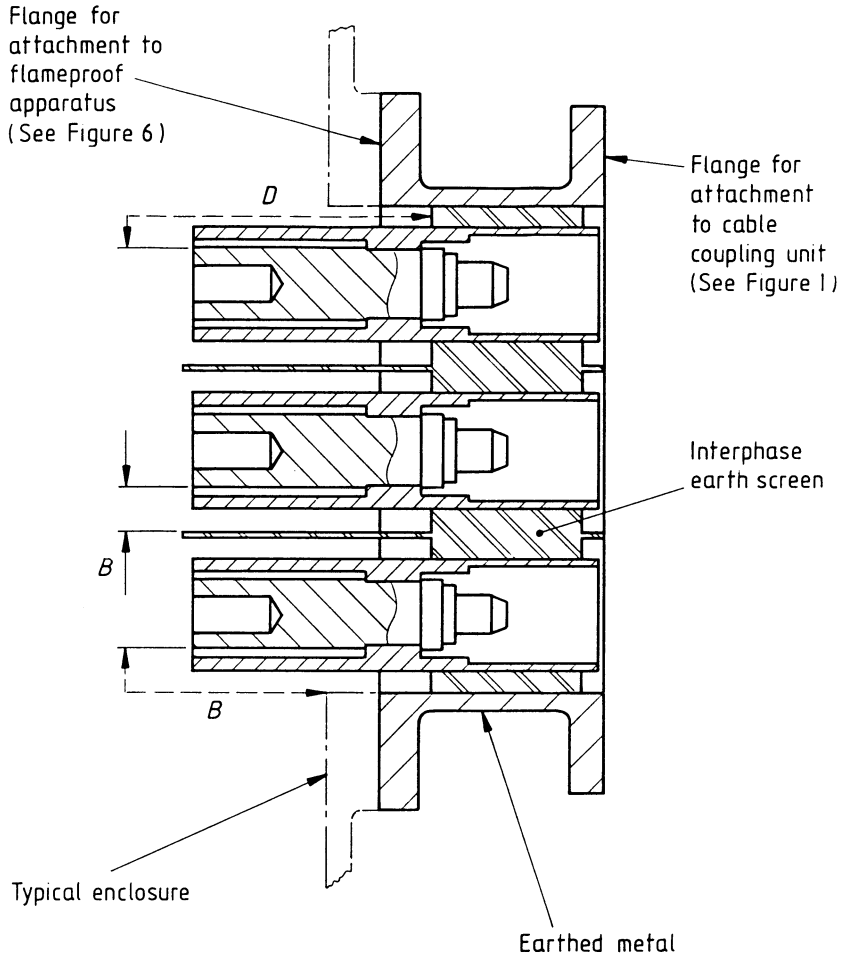
(b) Filled straight adaptor for attachment to air or filled enclosure

NOTE For dimensions corresponding to the reference letters, see Table 3.

Figure 9 — Methods of measuring electrical clearances *(continued)*



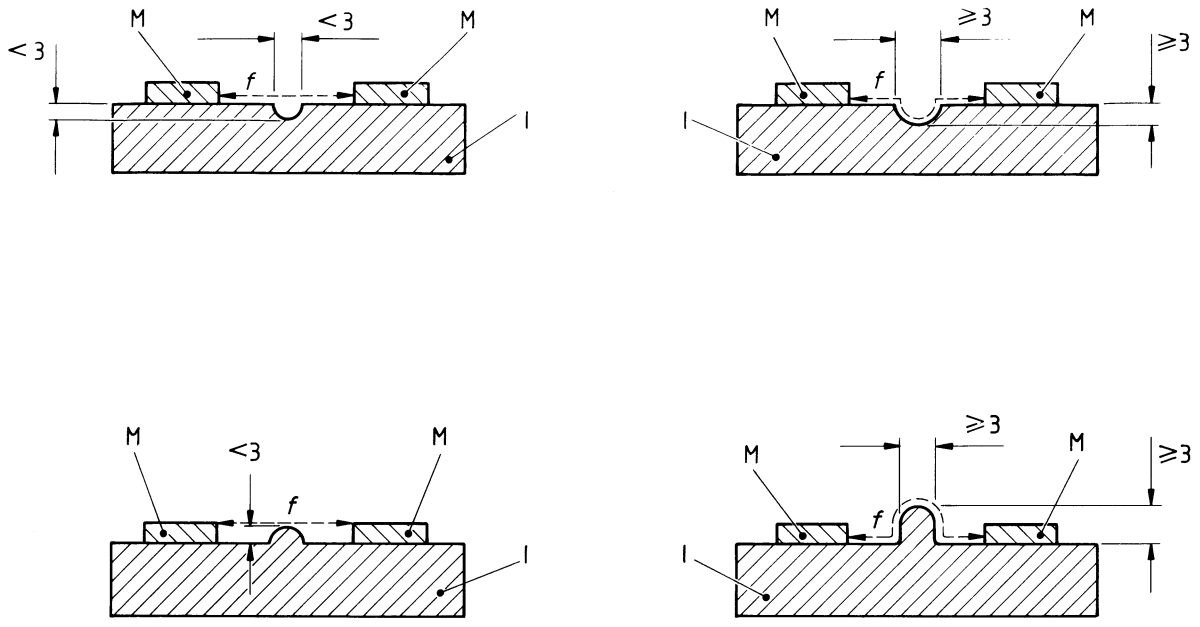
(c) Straight adaptor for attachment to filled enclosure



(d) Straight adaptor for attachment to air filled enclosure

NOTE For dimensions corresponding to the reference letters, see Table 3.

Figure 9 — Methods of measuring electrical clearances *(continued)*

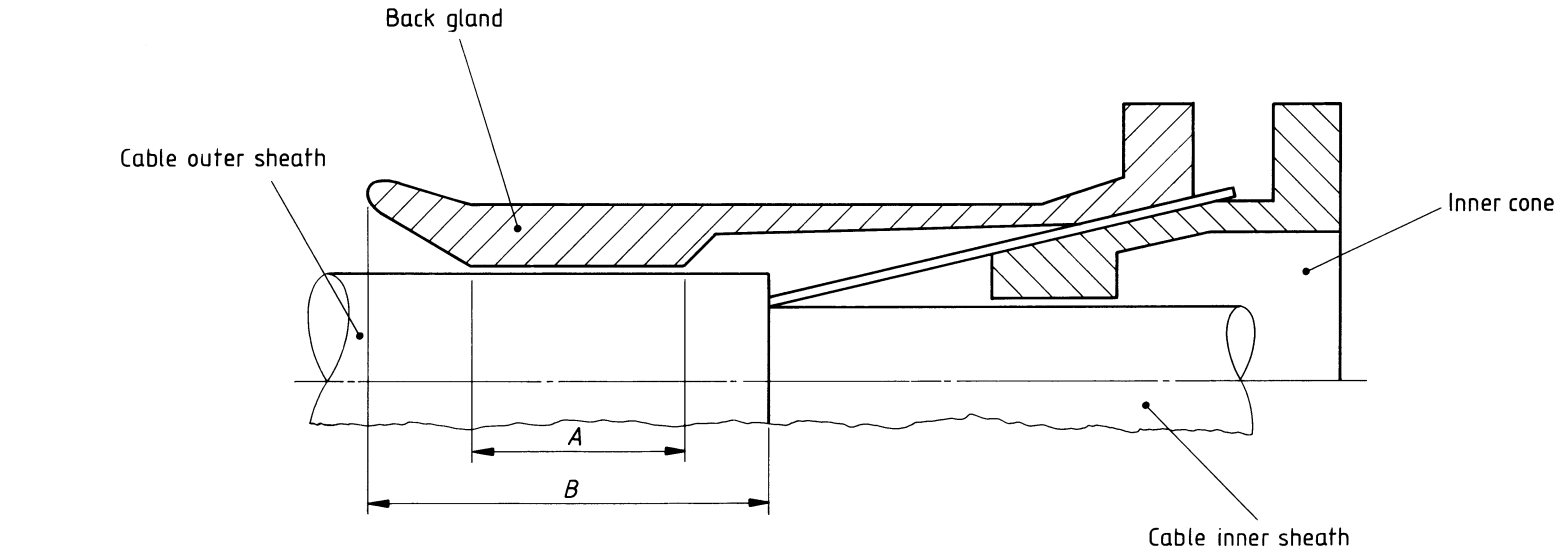


(e) Creepage distances and clearances

f is the creepage distance or clearance
M is the metal
I is the insulation material

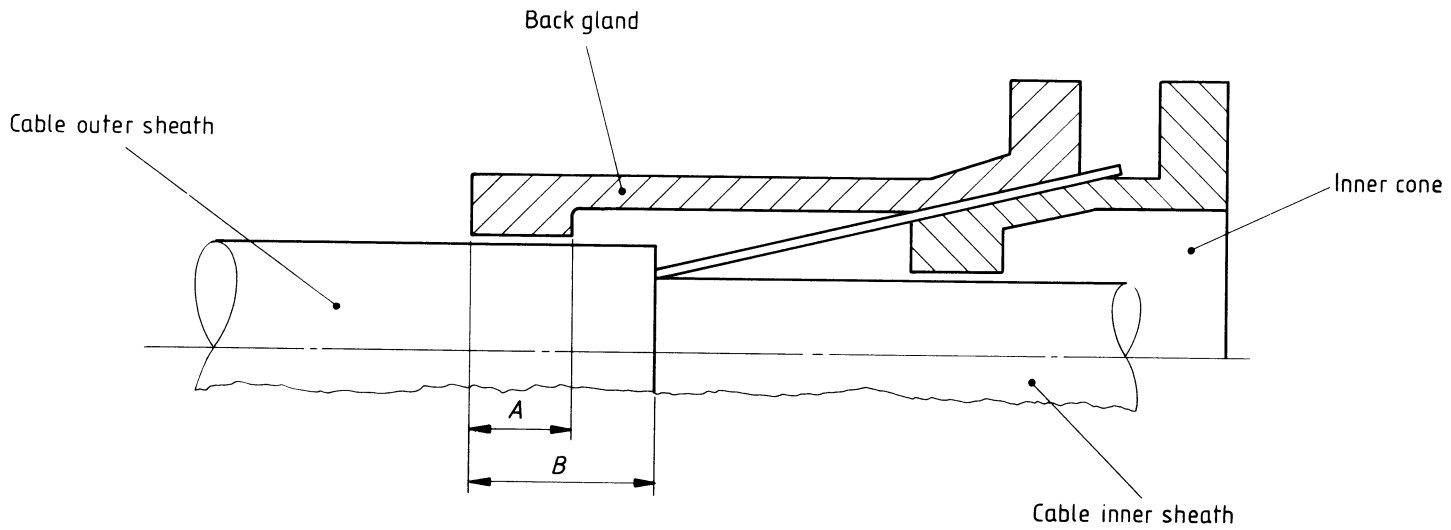
All dimensions are in millimetres.

Figure 9 — Methods of measuring electrical clearances *(concluded)*



NOTE For dimensions corresponding to the reference letters, see Table 4.

Figure 10 — Coupler glandsets for pliable wire armoured cables



NOTE For dimensions corresponding to the reference letters, see Table 4.

Figure 11 — Coupler glandsets for single and double wire armoured cables (SWA illustrated)

Publications referred to

BS 148, *Specification for unused mineral insulating oils for transformers and switchgear.*

BS 229, *Specification. Flameproof enclosure of electrical apparatus (obsolescent).*

BS 542, *Specification for cable glands and sealing boxes for association with apparatus for use at mines and quarries.*

BS 903, *Methods of testing vulcanized rubber.*

BS 903-A6, *Determination of compression set after constant strain.*

BS 903-A16, *Determination of the effect of liquids.*

BS 903-A19, *Heat resistance and accelerated ageing tests.*

BS 903-A26, *Determination of hardness.*

BS 903-C2, *Determination of volume resistivity.*

BS 903-C3, *Determination of loss tangent and permittivity at power and audio frequencies.*

BS 903-C4, *Determination of electric strength.*

BS 1433, *Specification for copper for electrical purposes. Rod and bar.*

BS 1474, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: bars, extruded round tubes and sections.*

BS 2782, *Methods of testing plastics.*

BS 2782-2, *Electrical properties.*

BS 2782:Method 230A, *Determination of volume resistivity.*

BS 2782:Method 240A and 240B, *Determination of loss tangent and permittivity at power and audio frequencies.*

BS 2782-3, *Mechanical properties.*

BS 2782:Method 320A to 320F, *Tensile strength, elongation and elastic modulus.*

BS 2782:Method 335A, *Determination of flexural properties of rigid plastics.*

BS 2782:Method 359, *Determination of Charpy impact strength of rigid materials (Charpy impact flexural test).*

BS 2782-4, *Chemical properties.*

BS 2782:Method 430A to 430D, *Determination of water absorption at 23 °C. Determination of water absorption at 23 °C with allowance for water-soluble matter. Determination of boiling water absorption. Determination of boiling water absorption for water-soluble matter.*

BS 2816, *Specification for electroplated coatings of silver for engineering purposes.*

BS 2874, *Specification for copper and copper alloy rods and sections (other than forging stock).*

BS 2918, *Determination of electric strength of solid insulating materials at power frequencies (obsolescent).*

BS 3454, *Specification for 1.9/3.3 kV, 300 A bolted flameproof cable couplers and adaptors (including 380/660 V and 640/1 100 V, 300 A adaptors), primarily for use in mines.*

BS 3692, *Specification for ISO metric precision hexagon bolts, screws and nuts. Metric units.*

BS 3905, *Specification for 3.8/6.6 kV, 300 A bolted flameproof cable couplers and adaptors, primarily for use in mines.*

BS 4439, *Specification for screwed studs for general purposes. Metric series.*

BS 4683, *Specification for electrical apparatus for explosive atmospheres.*

BS 4683-1, *Classification of maximum surface temperatures.*

BS 4683-2, *The construction and testing of flameproof enclosures of electrical apparatus.*

BS 4828, *Guide for partial discharge measurements.*

BS 5501, *Electrical apparatus for potentially explosive atmospheres.*

BS 5501-5, *Flameproof enclosure "d".*

BS 5734, *Polyester moulding compounds for electrical and other purposes.*

BS 5734-1, *Methods of test.*

BS 5901, *Method of test for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.*

BS 6709, *Specification for interconnection of electrical apparatus, constructed to two or more British Standards, for use in mines susceptible to firedamp.*

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