BRITISH STANDARD

BS 2562:1979

Specification for

Cable boxes for transformers and reactors

UDC 621.315.687:[621.314.2 + 621.318.43]

Cooperating organizations

The Power Electrical Engineering Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices Technical Committee
Association of Short Circuit Testing Authorities
British Electrical and Allied Manufacturers' Association (BEAMA)
British Railways Board*
British Steel Corporation
Department of Energy (Electricity)
Electrical Contractors' Association
Electrical Contractors' Association of Scotland
Electrical Research Association
Electricity Supply industry in England and Wales*
Engineering Equipment Users' Association*
Institute of Purchasing and Supply
Institution of Electrical Engineers
Ministry of Defence
National Coal Board*
National Economic Development Office

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Association of Consulting Engineers
Bureau of Engineer Surveyors
Electric Cable Makers' Confederation
London Transport Executive
Transmission and Distribution Association (BEAMA)

This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Committee, was published under the authority of the Executive Board and comes into effect on
31 December 1979

First published in Parts, as
BS 2562-1:1955
BS 2562-2:1959
First published as one standard
December 1979

The following BSI references relate to the work on this standard:
Committee reference PEL/113
Draft for comment 74/28844 DC

ISBN 0 580 10831 7

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

Foreword

This revision of BS 2562-1:1955 and BS 2562-2:1959 combined has been prepared under the direction of the Power Electrical Engineering Standards Committee. It supersedes BS 2562-1:1955 and BS 2562-2:1959 which are therefore withdrawn. As with the previous edition it is the intention that cable boxes which comply with the requirements of this standard produced by different manufacturers shall be interchangeable. To assist replacements dimensions of certain components are specified.

This standard is the metric version of BS 2562-1:1955 and BS 2562-2:1959. The tolerances on dimensions at that time of publication were expected to be those of normal manufacturing practice, although this was not explicitly stated. The metric dimensions in this revision take this former practice into account.

The metric dimensions given are such that cable boxes to the revised standard are interchangeable with those manufactured to the imperial dimensions of the previous edition.

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.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 62, 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.

Section 1. General

1 Scope

This British Standard specifies requirements for cable boxes in which the cores of cables terminate within the box and are connected to terminals fixed therein.

The boxes are intended for the termination of impregnated-paper-insulated solid-type lead or aluminium sheathed cables having copper or aluminium conductors and for the termination of extruded insulated and sheathed unarmoured cables having copper or aluminium conductors.

The boxes are suitable for operating indoors or outdoors under conditions of ambient temperature, loading, altitude, etc., envisaged by BS 171.

The standard box is arranged for cables approaching vertically from below and is not bi-directional. Where cables approach vertically from above, alternative parts are required (see Figure 28).

Details of the range of boxes are given in Table 3 to Table 11.

The objectives of this standard are to specify standard envelope dimensions and fixing dimensions of cable boxes to achieve interchangeability whatever type of filling medium is to be used, and also to specify dimensions of components, e.g. bushings, glands, for interchangeability of such parts.

The boxes are suitable for rated voltages up to 36 kV and currents up to 2 500 A.

This standard does not purport to specify complete details of design and construction but some observations on these aspects are given in clause **7**.

NOTE This standard does not apply to boxes where the cable cores pass through to the transformer without a joint or are joined to cable tails in the box by sleeves or thimbles.

Section 2 and 3 deal with design principles, general considerations and tests for a range of cable boxes up to and including 36 kV rated voltage.

Section 4 specifies the essential dimensions and component details for the range of cable boxes.

Appendix A lists the information to be given with enquiry and order. Appendix B specifies wiping glands for metallic sheathed cables.

2 References

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

3 Definitions

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

3.1
cable box (Generally referred to in the text as a box.)

a metallic box designed for the purposes of receiving and protecting the end of a cable or cables, and containing a suitable insulating medium where necessary so that the dielectric of the cable may be effectively sealed against the ingress of moisture

a cable box may be arranged for one or more cables of either single or multicore construction and is complete with the requisite number of glands to provide entry for the cable or cables, and the necessary fittings to afford the connection between the cables and the terminals of the transformer

NOTE 1 An unfilled box is a box having air as the insulating medium.
NOTE 2 Boxes are defined by the numbers of poles and glands.

3.2
open-backed cable box

a cable box generally as defined in **3.1** except that the bushing assemblies defined in **3.3** and **3.4** or **3.5**, as appropriate, are detachable

3.3
bushing

a structure carrying one or more conductors through a partition such as a wall or tank and insulating it therefrom, including the means of attachment (flange or other fixing device) to the partition. The conductor may be an integral part of the bushing or be drawn into the central tube of the bushing

3.4
bushing mounting plate

a plate in which the bushings between the cable box and the transformer are mounted. It may be an integral part of the box or it may be a separate plate secured to the transformer tank by screwed studs which can also serve to secure an open-backed box shell

3.5
cast resin bushing assembly

a bushing assembly, employing cast resin instead of porcelain as the insulating medium

NOTE The bushing assembly may be:
a) a bushing only, as referred to in the note to **11.1**;
b) a combined bushing and mounting plate, for one or more poles, cast as a single unit.

3.6
cable box shell

the casing of a box, including the bushing mounting plate and the gland plate, but excluding the bushings, cable glands and armour clamps

3.7
open-backed cable box shell

a cable box shell supplied without a bushing mounting plate

3.8
cable

a length of single insulated conductor (solid or stranded) or two or more such conductors each provided with its own insulation which are laid up together. The insulated conductor or conductors may or may not be provided with an overall mechanical protective covering

3.9
metal sheathed cable

a cable provided with a metal sheath for the purpose of excluding moisture from the conductors and insulation thereof

3.10
armoured cable

a cable provided with a wrapping of metal (usually tape or wire) for the purpose of mechanical protection

3.11
number of poles

the number of insulated conducting paths between the interior of the box and the transformer, which may be one, two, three or four dependent on the number of bushings

3.12
cable gland

a device to seal and secure the sheath and to secure the armour of an electric cable, where provided, to the terminal equipment by means suitable for the type and description of cable for which it is designed, including provision for making electrical connection to the sheath and to the armour

3.13
cable wiping gland

a cable gland having a wiping gland body

3.14
wiping gland body

a non-ferrous metal bush to which the metal sheath of the cable is plumbed, to which the armour is clamped and which seals and secures the cable to the equipment

3.15
insulated wiping gland

a wiping gland with insulation to insulate the metal sheath and armour of the cable from the equipment

3.16
island layer

a metal insert between the cable box shell and the wiping gland body and insulated from both so as to provide an isolated reference point to enable the gland insulation to be tested after cable jointing has been completed

3.17
mechanical (compression) cable gland

a non-ferrous bush which secures and seals the cable to the box by mechanical means

3.18
armour clamp

a fitting for gripping the armour of a cable, at its termination, to the gland body

3.19
box base cleat

an insulating cleat forming the whole or part of the base which secures the cables to an unfilled box

3.20
protrusion (of a cable wiping gland)

the distance by which the gland protrudes outside the equipment casing, when the gland is assembled with the smallest cable for which it is designed, with or without gland insulation and/or island layer as appropriate

Section 2. Performance and design requirements for cable boxes

4 Electrical requirements and clearances

4.1 General. The boxes, when in position on the equipment with which they are to be used, shall be capable of withstanding the high voltage tests specified for the equipment. For the purpose of these tests on filled boxes in the manufacturer's works it is permissible to fill the cable box with insulating oil complying with the requirements of BS 148 and/or insert temporary barriers where necessary in the box in lieu of a filling medium.

The boxes shall also be capable of withstanding, both at the time of the first tests on the cables and at any subsequent time as may be required, the test voltages after installation specified in BS 6480 for impregnated paper-insulated cables in filled boxes or in BS 6346 in the case of unfilled boxes for use with extruded insulated cables.

4.2 Rated voltage. The rated voltage of a cable box is the highest voltage for equipment, and shall be one of the values given in Table 1.

The rated voltage of a cable box is the voltage by which it is designated.

NOTE Definitions relating to voltages may be found in BS 5622-1 [IEC 71-1].

4.3 Clearances. The dimensional standards of components given in this standard ensure that with normal jointing procedures the minimum clearances given in Table 1 can be obtained.

Table 1 — Clearances

1	2	3	4
Rated voltage	**Insulating medium in which clearances in columns 3 and 4 apply**	**Clearance between live metal of different phases**	**Clearance between live metal and earth**
kV	mm	mm	mm
1.1	compound or air	20	20
3.6	compound	20	20
3.6	air	90	65
12	compound	45	32
24	compound or oil	100	75
36	compound or oil	125	100

5 Electromagnetic considerations

Where necessary, steps shall be taken to minimize the effects of eddy currents.

6 Provision for receiving cables

6.1 Solid connections. For 12 mm diameter and 16 mm diameter stems, or when cable connectors M6 or M7 in accordance with Figure 12 or Figure 14 are employed, connection with the cable shall be made by using a socket complying with the requirements of BS 91, and a flexible connection shall not be fitted.

6.2 Flexible connections. For bushings with stems larger than 16 mm diameter and where connectors M6 or M7 in accordance with Figure 12 or Figure 14 are not employed, connection with the cable shall be by means of flexible connections.

The standard connectors, numbers M3, M4 and M5, fitted with ferrules and used with flexible connections are as detailed in Figure 21. The assemblies for bushings up to 12 kV with flexible connections are illustrated in Figure 5 to Figure 10 inclusive. For 24 kV and 36 kV bushings alternative connections are permissible. Where solid connectors are utilized the end connector is illustrated on the bushing assembly drawings, i.e. Figure 12 and Figure 14.

6.3 Open type connections with separate bushing plate. For rated voltages up to 3.6 kV provision has been made for the use of bushings mounted on a separate plate to which connections can be made, without the use of a cable box, by cables which do not require to be sealed with insulating compound, or by bare connections.

6.4 Cable glands and armour clamps. Cable wiping glands and armour clamps shall comply with the requirements of Appendix B, and mechanical (compression) cable glands shall comply with the requirements of BS 6121.

For metallic sheathed cables, cable wiping glands are normally used, but mechanical (compression) cable glands may be used as an alternative.

For extruded insulated cables either a box base cleat or mechanical (compression) cable glands may be used.

7 General design requirements

7.1 Cable box construction. Boxes shall be self-contained, with the bushing mounting plate being an integral part of the box except that, where the voltage does not exceed 3.6 kV for filled and 1.1 kV for unfilled boxes, the construction shown at the bottom of Figure 28 and Figure 30 may be used as an optional alternative embodying bushings mounted on a separate plate arranged to receive the bushings and clamps. In the latter case the box will be an open-backed cable box shell which is mounted on the same studs or bolts as the bushing mounting plate.

Boxes of 1.1 kV, 3.6 kV and 12 kV rated voltages shall be suitable for either bitumen-based filling compound or oil-based compound. Boxes of 24 kV and 36 kV rated voltage shall be suitable for either oil or oil-based compound. In addition, provision is made for unfilled boxes of 1.1 kV and 3.6 kV rated voltage. (See Table 1.)

7.2 Filled boxes. Cable boxes shall be so constructed as to minimize the danger of fragmentation. Cast iron shall not be used.

Boxes designed for filling with bitumen-based compound, oil-based compound or oil shall be capable of withstanding the hydraulic pressure tests specified in **8.5** and **9.2** as appropriate.

The contour of the box and the expansion space shall be so designed that voids are not caused either during filling or due to changes of the filling medium level arising from temperature variations.

A minimum expansion space of 8 % of the volume of the filling medium shall be provided above the level of the filling medium at 15 °C.

The filling level of the cable boxes shall be limited by the design and shall be such that when the cable box is correctly filled, the minimum depth of filling medium above live metal shall be not less than the clearance to earth given in Table 1, column 4, at a temperature of – 10 °C.

A filling orifice in accordance with Figure 27 shall be positioned so that, when the box is being filled, the filling medium shall fall as freely as practicable to the base of the box.

Boxes designed for filling with either oil-based compound or oil shall be provided with a suitable drainage hole and plug.

The cable box assembly shall be of such a design as to prevent leakage of the filling medium and ingress of moisture.

All gasketed joints, except those associated with the filling and venting arrangements, shall be below the level of the filling medium at a temperature of – 10 °C. Cable boxes shall be of such a design as to prevent water from collecting on the box. Where blind tapped holes are provided, studs shall be used, not bolts or set screws. No bolt or stud holes shall penetrate the shell of a box.

All gaskets for oil-immersed transformers shall be of synthetic rubber or synthetic rubber and cork composition.

NOTE For transformers immersed in synthetic insulating liquid not in accordance with BS 148, such materials may not be suitable.

Bitumen-based compound shall comply with the requirements of BS 1858, but shall have a maximum pouring temperature of 160 °C.

7.3 Unfilled boxes. Cable boxes shall be so constructed as to minimize the danger of fragmentation. Cast iron shall not be used.

When unfilled boxes are supplied without mechanical (compression) cable glands, the gland plate shall be drilled with 6 mm diameter pilot holes, each located to position a mechanical (compression) type gland on the same axis as its appropriate cable connector.

To minimize condensation, ventilation shall be provided.

7.4 Connecting up of cables. Boxes shall be designed for ease of access for jointing and connecting up the cables.

This requirement can usually be met by making the gland plates and the front of the box down to the gland plate removable separately (see Figure 26).

7.5 Flange dimensions. The dimensions of flange facings are given in Figure 23 to Figure 25 inclusive.

7.6 Bushing mounting plates. The dimensions of bushing mounting plates are given in Figure 17 to Figure 19 inclusive for use up to maximum rated voltage 3.6 kV.

7.7 Terminal stems and nuts. The dimensions of terminal stems and nuts shall be in accordance with Table 2.

Section 3. Tests for cable boxes

8 Type tests

8.1 General. Unless otherwise specified when inviting tenders, the purchaser shall accept, as evidence of compliance with the requirements of this standard, type tests on a box or bushing similar to the one purchased.

8.2 Rated lightning impulse withstand voltage type test on the complete box. Boxes for 12 kV rated voltage and above shall be subjected to a rated lightning impulse withstand voltage type test. The test is to be made on the box complete with all its fittings but without a cable being attached. The box shall be filled with and immersed in insulating oil complying with the requirements of BS 148.

The test shall be made with a 1.2/50 μs full wave of negative polarity in accordance with BS 923.

Five consecutive waves with a peak value of 75 kV for 12 kV rated voltage, 125 kV for 24 kV rated voltage and 170 kV for 36 kV rated voltage shall be applied without flashover or puncture of the bushing.

The test shall be made separately between each bushing stem and the earthed fixing flange, the bushing stems not under test being solidly earthed to the body of the box.

8.3 Rated lightning impulse withstand voltage type test on the bushings. If the bushing alone is subjected to a rated lightning impulse withstand voltage type test, the voltage applied shall be as specified in **8.2**.

8.4 Rated short duration power frequency withstand voltage type test on the bushings. The tests shall be in accordance with BS 223.

8.5 Mechanical strength type test on boxes having compound filling. A mechanical strength type test shall be made on boxes having bitumen-based compound filling.

The box shall be subjected to a hydraulic type test at a pressure of 1 bar[1)] for 15 min at room temperature. There shall be no permanent distortion when the pressure is released.

[1)] 1 bar = 10^5 N/m^2 = 100 kPa.

9 Routine tests

9.1 Routine voltage tests on insulated glands. Routine voltage tests on insulated glands shall be carried out in accordance with Appendix B.

9.2 Routine leakage test on boxes having oil or oil-based compound filling. All boxes suitable for oil or oil-based compound filling shall be tested with oil complying with the requirements of BS 148 at room temperature at a pressure of 0.7 bar for 12 h, during which time no leakage shall occur into normally oil-free spaces nor shall there be any permanent deflection of the box when the pressure is released.

Section 4. Requirements for a range of single-pole, three-pole and four-pole cable boxes

10 Basis of range of boxes specified

10.1 General. A range of boxes is specified in this section which is based on:

a) rated voltage (highest voltage for equipment);

b) current rating;

c) number of poles;

d) number and size of cables and cable glands;

e) the use of standard items.

NOTE The specified dimensions of each combination ensure mechanical interchangeability between different manufacturers' products. It is essential to adhere strictly to all features (e.g. current rating) which affect interchangeability. It may be necessary to replace the connecting link(s) between the transformer and bushings when changing from porcelains to cast resin assemblies or vice versa.

10.2 2-pole box. Where a 2-pole box is required, the nearest 3-pole combination shall be used, with the centre pole omitted.

10.3 Multi-glands per phase. Where more than two gland entries per pole are required, the nearest appropriate two gland per pole cable box shall be used, with an appropriate increase in the overall depth, (dimension *c*), to take, with the same distance between gland centres, (dimension *b*), such additional glands as may be necessary.

11 Bushings

11.1 General. The bushing assemblies as shown in Figure 3 to Figure 15 inclusive shall be oil tight and shall comply with the requirements, where applicable, of BS 223.

NOTE Porcelain bushings may be replaced by bushings manufactured from cast resin insulation, provided that such bushings have the same electrical performance, meet the same tests and have the same fixing and terminal details as the porcelain bushings they replace.

11.2 Terminals, stems and nuts. The current ratings of stems of hard drawn high conductivity copper shall comply with Table 2.

Bushing end caps, flexible connections, connectors and ferrules shall be electro-tinned in accordance with class Sn 2C of BS 1872, or hot-dipped tinned to give an equivalent coating.

Table 2 — Terminal stems and nuts

Stem diameter	Current	Screw thread and pitch	Dimensions of nuts		
			Across flats	Across corners	Thickness
mm	A	M × mm	mm	mm	mm
12	250	12 × 1.75	19	21.9	7
16	400	16 × 2.0	24	27.7	8
20	525	20 × 2.0	30	34.6	9
25	800	24 × 2.0	36	41.6	10
36	1 600	36 × 2.0	55	63.5	14
45	2 500	45 × 2.0	70	80.8	18

The dimensions of hexagonal nuts shall comply with the requirements of BS 3692, for the appropriate bolt diameters. The pitch of the screw thread shall be as in Table 2 above. Thin nuts shall be used and be of brass.

The class of fit for terminal nuts and stems shall be medium fit, class 6H/6g complying with the requirements of BS 3643.

11.3 Porcelains. Porcelains shall be as shown in Figure 1.

The porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed. The finished porcelain shall be of a uniform shade of dark brown, approximately in accordance with colour 412 of BS 381C.

The glaze, which shall not be depended upon for insulation, shall, as far as practicable, cover all surfaces except the flat surfaces of the flange and the ends of the porcelain.

The ends of the porcelains for 1.1 kV, 3.6 kV and 12 kV rated voltage need not be ground.

Each porcelain shall have printed upon it, in a legible and reasonably permanent manner:

a) the name or trade mark of the manufacturer and identification numerals and/or letters to indicate the period of manufacture;

b) the letters CB (6 mm minimum height) followed by the porcelain number as given in the specification, e.g. CB1M, CB2M.

These marks shall be printed, shall be clearly legible after firing and glazing, and shall not appear on the flange faces or end surfaces.

All porcelains shall be subjected to tests in accordance with BS 4963.

11.4 Bushing clamps. Bushing clamps shall be in accordance with Figure 2 as appropriate.

11.5 Mounting and oil-immersion. The bushings shall be secured by studs of material having a strength grade designation not inferior to grade 4.6 and nuts not inferior to grade 4 as specified in BS 3692.

The projection of the studs shall be as shown in Figure 3 to Figure 15 and Figure 17 to Figure 19.

Boxes of 3.6 kV, 12 kV and 36 kV rated voltage shall be mounted with the transformer ends of the bushings immersed in the transformer oil; the bushings of boxes of 1.1 kV rated voltage need not be oil-immersed on the transformer side.

Bushings of 1.1 kV, 3.6 kV and 12 kV rated voltage shall be mounted horizontally and symmetrically disposed relative to the major and minor axes of the flange facings.

To ensure that the transformer oil completely fills the free space between the stems and the porcelain bushings, the 24 kV and 36 kV bushings shall be mounted on the transformer side of the mounting plate, and inclined at an angle of approximately 10° to the horizontal, the transformer side being the higher (see Figure 29).

12 Cast resin bushing assemblies

12.1 General. The dimensions, style and arrangement of the four-pole cast resin combined bushing assemblies shall be in accordance with Figure 16 as appropriate.

Epoxide resin if used shall be in accordance with BS 3816.

Cast resin combined bushing assemblies shall withstand short circuits no less onerous than those of the associated transformer.

Cast resin bushing assemblies shall not be adversely affected by continuous immersion in transformer oil complying with the requirements of BS 148 at 105 °C.

Cast resin bushing assemblies shall not be adversely affected by compounds having a pouring temperature not exceeding 160 °C.

Each cast resin bushing assembly shall be marked in a legible and reasonably permanent manner with the name or trademark of the manufacturer and a suitable type identification symbol.

12.2 Bushing conductors. Bushing conductors for the four-pole combined bushing assemblies in accordance with Figure 16 shall be made from 63 mm × 12.5 mm high conductivity copper bar having fully radiused edges, with the whole of the outer ends electro-tinned in accordance with class Sn 2C of BS 1872, or hot-dipped tinned to give an equivalent coating.

Both ends of any conductor shall be clean and free from resin for the whole of their length from 3 mm clear of the moulding.

12.3 Tests

12.3.1 *Thermal stability type test.* A cast resin bushing assembly of each design shall be subjected to a thermal stability test, each temperature cycle comprising ambient temperature to – 10 °C to + 105 °C to ambient temperature. This cycle shall be repeated ten times and on completion, the casting shall not exhibit signs of cracking and shall withstand the oil leakage, air leakage and over voltage tests detailed.

12.3.2 *Oil leakage sample test.* Each cast resin bushing assembly selected for sample testing shall be subjected to an oil leakage test, the oil complying with the requirements of BS 148 being maintained for 6 h at 75 °C at a pressure of 1 bar on the transformer side of the assembly with the other side exposed to atmosphere. At the conclusion of this test, no leakage or oil ingress into normally oil-free spaces shall have occurred.

Sample tests shall be carried out on at least one assembly from each batch, or 2 % of all units manufactured in each batch, whichever is the greater.

12.3.3 *Air leakage routine test.* Each cast resin bushing assembly shall be subjected to an air leakage test for 1 h at a pressure of 1 bar on the transformer side of the assembly with the other side exposed to atmosphere. At the conclusion of this test no leakage of air shall have occurred.

12.3.4 *Over voltage routine test.* Each cast resin combined bushing assembly shall withstand a power frequency voltage test of 28 kV for 1 min between adjacent conductors and between conductors and earth.

13 Shell dimensions

Table 3 to Table 11 give details of a range of shells for various combinations of number of poles, voltage, current, number of glands and size of cables. The boxes in question are illustrated in Figure 28, Figure 29 and Figure 30.

To select the correct shell for any given conditions, the following information requires to be known:

a) rated voltage;

b) current;

c) number of poles;

d) number, size and type of cables.

With this information the appropriate shell number and its dimensions can be obtained from Table 3 to Table 11.

NOTE The maximum current carrying capacity of a box is dictated by either the bushing rating or the cable rating whichever is the lesser.

Table 3 — Cable box ratings, shell dimensions and general particulars for filled boxes with porcelain bushings; single-pole boxes 1.1 kV to 12 kV

Rated voltage	Glands		Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 28)					Shell no.
	No.	Size		Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*e*	
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	
1.1 and 3.6	1	X	250	185	—	A	—	12	A	1M	160	—	250	200	430	1
1.1 and 3.6	1	X	400	300	380	B	—	16	A	1M	160	—	250	200	430	1
1.1 and 3.6	1	X	800	630	1 200	1	M4	25	A	2M	175	—	265	200	445	2
1.1 and 3.6	1	Y	1 600	1 000	1 200	2	M5	36	A	2M	185	—	300	280	480	3
1.1 and 3.6	2	X	800	630	1 200	3	M4	25	A	2M	175	115	380	200	560	4
1.1 and 3.6	2	X	1 600	630	1 200	3	M4	36	A	2M	175	115	380	200	560	4
12.0	1	X	250	185	—	A	—	12	B	1M	160	—	250	280	430	5
12.0	1	X	400	300	—	B	—	16	B	1M	160	—	250	280	430	5
12.0	1	X	800	630	—	1	M4	25	B	2M	175	—	280	310	460	6
12.0	1	Y	800	1 000	—	2	M5	25	K	2M	185	—	300	310	480	7
12.0	2	X	800	630	—	3	M4	25	B	2M	175	115	395	310	575	8
12.0	2	X	1 600	800	—	4	M5	36	B	2M	185	140	440	310	620	9

Table 4 — Cable box ratings, shell dimensions and general particulars for filled boxes with porcelain bushings; three-pole boxes 1.1 kV to 12 kV

(a) 1.1 kV and 3.6 kV

Rated voltage	Glands		Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 28)					Pole centres	Shell no.
	No.	Size		Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*e*		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
1.1 and 3.6	1	X	250	185	240	A	—	12	D	1M	145	—	235	320	415	92	11
1.1 and 3.6	1	X	400	240	300	B	—	16	D	1M	145	—	235	320	415	92	11
1.1 and 3.6	1	Y	800	400	300	1	M3	25	E	2M	175	—	280	460	460	114	12
1.1 and 3.6	2	Y	800	400	300	4	M3	25	E	2M	185	140	430	460	610	114	13
1.1 and 3.6	2	Y	1 600	400	300	4	M3	36	E	2M	185	140	430	460	610	114	13
1.1 and 3.6	3	X	250	185	—	A	—	12	D	1M	160	—	250	200	430	92	14
1.1 and 3.6	3	X	400	300	380	B	—	16	D	1M	160	—	250	200	430	92	14
1.1 and 3.6	3	X	800	630	1 200	1	M4	25	E	2M	175	—	265	200	445	114	15
1.1 and 3.6	6	X	800	630	1 200	3	M4	25	E	2M	175	115	380	200	560	114	16
1.1 and 3.6	6	X	1 600	630	1 200	3	M4	36	E	2M	175	115	380	200	560	114	16
1.1 and 3.6	6	X	2 500	630	1 200	5	M4	45	L	7M	175	115	380	200	560	146	17

Table 4 — Cable box ratings, shell dimensions and general particulars for filled boxes with porcelain bushings; three-pole boxes 1.1 kV to 12 kV

(b) 12 kV

Rated voltage	Glands		Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 28)					Pole centres	Shell no.
	No.	Size		Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*e*		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
12	1	X	250	185[a]	—	A	—	12	E	1M	145	—	250	420	430	105	20
12	1	X	400	185[a]	—	B	—	16	E	1M	145	—	250	420	430	105	20
12	1	Y	800	400[a]	—	1	M3	25	F	2M	175	—	280	560	460	134	21
12	2	Y	800	400[a]	—	4	M3	25	F	2M	185	140	440	560	620	134	22
12	2	Y	1 600	400[a]	—	4	M3	36	F	2M	185	140	440	560	620	134	22
12	3	X	250	185	—	A	—	12	E	1M	160	—	250	280	430	105	23
12	3	X	400	300	—	B	—	16	E	1M	160	—	250	280	430	105	23
12	3	X	800	630	—	1	M4	25	F	2M	175	—	280	310	460	134	24
12	3	Y	800	1 000	—	2	M5	25	G	2M	185	—	300	310	480	178	25
12	6	X	800	630	—	3	M4	25	F	2M	175	115	395	310	575	134	26
12	6	X	1 600	630	—	3	M4	36	F	2M	175	115	395	310	575	134	26
12	6	Y	1 600	1 000	—	4	M5	36	G	2M	185	140	440	310	620	178	27

[a] Belted type PILC cables.

Table 5 — Cable box ratings, shell dimensions and general particulars for filled boxes with porcelain bushings; four-pole boxes 1.1 kV to 12 kV

(a) 1.1 kV and 3.6 kV

Rated voltage	Glands		Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 28)					Pole centres	Shell no.
	No.	Size		Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*e*		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
1.1	1	X	250	185	240	A	—	12	E	1M	145	—	235	345	415	92	31
1.1	1	Y	400	300	300	B	—	16	E	1M	160	—	260	345	440	92	32
1.1	1	Y	800	400	300	1	M3	25	F	2M	175	—	280	485	460	114	33
1.1	2	Y	800	400	300	4	M3	25	F	2M	185	140	430	485	610	114	38
1.1	2	Y	1 600	400	300	4	M3	36	F	2M	185	140	430	485	610	114	38
1.1 and 3.6	4	X	250	185	—	A	—	12	E	1M	160	—	250	200	430	92	35
1.1 and 3.6	4	X	400	300	380	B	—	16	E	1M	160	—	250	200	430	92	35
1.1 and 3.6	4	X	800	630	1 200	1	M4	25	F	2M	175	—	265	200	445	114	36
1.1 and 3.6	7	X	800(L) 800(N)	630 630	1 200 1 200	3 1	M4 M4	25 25	F F	2M 2M	175	115	380	200	560	114	37
1.1 and 3.6	7	X	1 600(L) 800(N)	630 630	1 200 1 200	3 1	M4 M4	36 25	F F	2M 2M	175	115	380	200	560	114	37
3.6	8	X	1 600	630	1 200	3	M4	36	F	2M	175	115	380	200	560	114	37

Table 5 — Cable box ratings, shell dimensions and general particulars for filled boxes with porcelain bushings; four-pole boxes 1.1 kV to 12 kV

(b) 12 kV

Rated voltage	Glands		Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 28)					Pole centres	Shell no.
	No.	Size		Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*e*		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
12	4	X	250	185	—	A	—	12	F	1M	160	—	250	280	430	105	41
12	4	X	400	300	—	B	—	16	F	1M	160	—	250	280	430	105	41
12	4	X	800	630	—	1	M4	25	M	2M	175	—	280	310	460	134	42
12	7	X	800(L) 800(N)	630 630	— —	3 1	M4 M4	25 25	M M	2M 2M	175	115	395	310	575	134	43
12	7	X	1 600(L) 800(N)	630 630	— —	3 1	M4 M4	36 25	M M	2M 2M	175	115	395	310	575	134	43
12	8	X	1 600	630	—	3	M4	36	M	2M	175	115	395	310	575	134	43
12	4	Y	800	1 000	—	2	M5	25	N	2M	185	—	300	310	480	178	44
12	7	Y	800(L) 800(N)	1 000 1 000	— —	4 2	M5 M5	25 25	N N	2M 2M	185	140	440	310	620	178	45
12	7	Y	1 600(L) 800(N)	1 000 1 000	— —	4 2	M5 M5	36 25	N N	2M 2M	185	140	440	310	620	178	45
12	8	Y	1 600	1 000	—	4	M5	36	N	2M	185	140	440	310	620	178	45

Table 6 — Cable box ratings, shell dimensions and general particulars for filled boxes with porcelain bushings; single-pole and three-pole boxes 24 kV and 36 kV

Rated voltage	No. of poles	Glands		Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 29)					Pole centres	Shell no.
		No.	Size		Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c* (max.)	*d* (min.)	*e*		
kV				A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
24	1	1	X	250	300	—	C	—	12	K	6M	240	150	450	520	60	—	50
24	1	1	X	525	400	—	6	M3	20	K	6M	240	150	405	520	60	—	50
24	3	1	Y	250	120	—	C	—	12	J	6M	210	150	345	585	60	172	51
24	3	1	Z	525	400	—	6	M3 or M6	20	J	6M	240	150	405	670	60	172	52
24	3	3	X	525	400	—	6	M3	20	J	6M	240	150	405	520	60	172	53
24	3	3	Y	800	630	—	1	M4	25	J	6M	240	150	405	520	60	172	53
36	1	1	Y	800	630	—	7	M4	25	C	3M	290	180	500	610	70	—	60
36	1	1	Y	250	300	—	D	—	12	C	3M	290	180	500	610	70	—	60
36	3	1	Z	800	400	—	7	M4 or M7	25	H	3M	290	180	500	900	70	228	61
36	3	1	Y	250	240	—	D	—	12	H	3M	290	180	500	900	70	228	61
36	3	3	Y	800	630	—	7	M4	25	H	3M	290	180	500	610	70	228	62

Table 7 — Cable box ratings, shell dimensions and general particulars for filled boxes with cast resin bushing assemblies; four-pole boxes 1.1 kV

Rated voltage	Glands		Bushing assembly rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation	Cast resin bushing assembly	Shell dimensions (see Figure 28)					Pole centres	Shell no.
	No.	Size		Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange		*a*	*b*	*c*	*d*	*e*		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
1.1	1	Y	800	400	300	—	M3	—	F	Figure 16	175	—	280	485	460	114	33
1.1	2	X	1 400(L) 800(N)	240	240	—	M3	—	F	Figure 16	175	115	420	485	600	114	34
1.1	4	X	800	630	1 200	—	M4	—	F	Figure 16	175	—	265	200	445	114	36
1.1	7	X	1 400(L) 800(N)	630	1 200	—	M4	—	F	Figure 16	175	115	380	200	560	114	37

Table 8 — Cable box ratings, shell dimensions and general particulars for unfilled boxes with porcelain bushings; single-pole boxes 1.1 kV

Rated voltage	No. of poles	No. of cables	Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 30)					Pole centres	Shell no.
				Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*f* (max.)		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
1.1	1	1	250	185	—	A	—	12	A	1M	160	—	235	200	210	—	71
1.1	1	1	400	300	380	B	—	16	A	1M	160	—	235	200	210	—	71
1.1	1	1	800	630	1 200	1	M4	25	A	2M	175	—	380	280	210	—	72
1.1	1	1	1 600	1 000	1 200	2	M5	36	A	2M	185	—	285	280	210	—	73
1.1	1	2	800	630	1 200	3	M4	25	A	2M	175	115	380	280	210	—	74
1.1	1	2	1 600	630	1 200	3	M4	36	A	2M	175	115	380	280	210	—	74

Table 9 — Cable box ratings, shell dimensions and general particulars for unfilled boxes with porcelain bushings; three-pole boxes 1.1 kV and 3,6 kV

(a) 1.1 kV

Rated voltage	No. of poles	No. of cables	Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 30)					Pole centres	Shell no.
				Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*f* (max.)		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
1.1	3	1	250	185	240	A	—	12	D	1M	160	—	265	320	400	92	81
1.1	3	1	400	240	300	B	—	16	D	1M	160	—	265	320	400	92	81
1.1	3	1	800	400	300	1	M3	25	E	2M	175	—	280	460	500	114	82
1.1	3	2	800	400	300	3	M3	25	E	2M	175	115	395	460	500	114	83
1.1	3	2	1 600	400	300	3	M3	36	E	2M	175	115	395	460	500	114	83
1.1	3	3	250	185	—	A	—	12	D	1M	160	—	235	200	400	92	84
1.1	3	3	400	300	380	B	—	16	D	1M	160	—	235	200	400	92	84
1.1	3	3	800	630	1 200	1	M4	25	E	2M	175	—	265	260	500	114	85
1.1	3	6	800	630	1 200	3	M4	25	E	2M	175	115	380	260	500	114	86
1.1	3	6	1 600	630	1 200	3	M4	36	E	2M	175	115	380	260	500	114	86

Table 9 — Cable box ratings, shell dimensions and general particulars for unfilled boxes with porcelain bushings; three-pole boxes 1.1 kV and 3,6 kV

(b) 3.6 kV

Rated voltage	No. of poles	No. of cables	Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 30)					Pole centres	Shell no.
				Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*f* (max.)		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
3.6	3	1	250	185	240	A	—	12	F	1M	160	—	285	320	600	150	91
3.6	3	1	400	240	300	B	—	16	F	1M	160	—	285	320	600	150	91
3.6	3	1	800	400	300	1	M3	25	G	2M	175	—	315	460	720	220	92
3.6	3	2	800	400	300	3	M3	25	G	2M	175	115	430	460	720	220	93
3.6	3	2	1 600	400	300	3	M3	36	G	2M	175	115	430	460	720	220	93
3.6	3	3	250	185	—	A	—	12	F	1M	160	—	285	320	600	150	94
3.6	3	3	400	300	380	B	—	16	F	1M	160	—	285	320	600	150	94
3.6	3	3	800	630	1 200	1	M4	25	G	2M	175	—	315	320	720	220	95
3.6	3	3	1 600	1 000	1 200	2	M5	36	G	2M	185	—	335	320	720	220	96
3.6	3	6	800	630	1 200	3	M4	25	G	2M	175	115	430	320	720	220	97
3.6	3	6	1 600	630	1 200	3	M4	36	G	2M	175	115	430	320	720	220	97

Table 10 — Cable box ratings, shell dimensions and general particulars for unfilled boxes with porcelain bushings; four-pole boxes 1.1 kV and 3.6 kV

(a) 1.1 kV

Rated voltage	No. of poles	No. of cables	Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 30)					Pole centres	Shell no.
				Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*f* (max.)		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
1.1	4	1	250	185	240	A	—	12	E	1M	175	—	285	345	500	92	101
1.1	4	1	400	300	300	B	—	16	E	1M	175	—	285	345	500	92	101
1.1	4	1	800	400	300	1	M3	25	F	2M	175	—	285	485	600	114	102
1.1	4	2	800	400	300	3	M3	25	F	2M	175	115	400	485	600	114	103
1.1	4	2	1 600	400	300	3	M3	36	F	2M	175	115	400	485	600	114	103
1.1	4	4	250	185	—	A	—	12	E	1M	160	—	235	200	500	92	104
1.1	4	4	400	300	380	B	—	16	E	1M	160	—	235	200	500	92	104
1.1	4	4	800	630	1 200	1	M4	25	F	2M	175	—	265	260	600	114	105
1.1	4	7	800(L) 800(N)	630 630	1 200 1 200	3 1	M4 M4	25 25	F F	2M 2M	175	115	380	260	600	114	106
1.1	4	7	1 600(L) 800(N)	630 630	1 200 1 200	3 1	M4 M4	36 25	F F	2M 2M	175	115	380	260	600	114	106
1.1	4	8	1 600	630	1 200	3	M4	36	F	2M	175	115	380	260	600	114	106

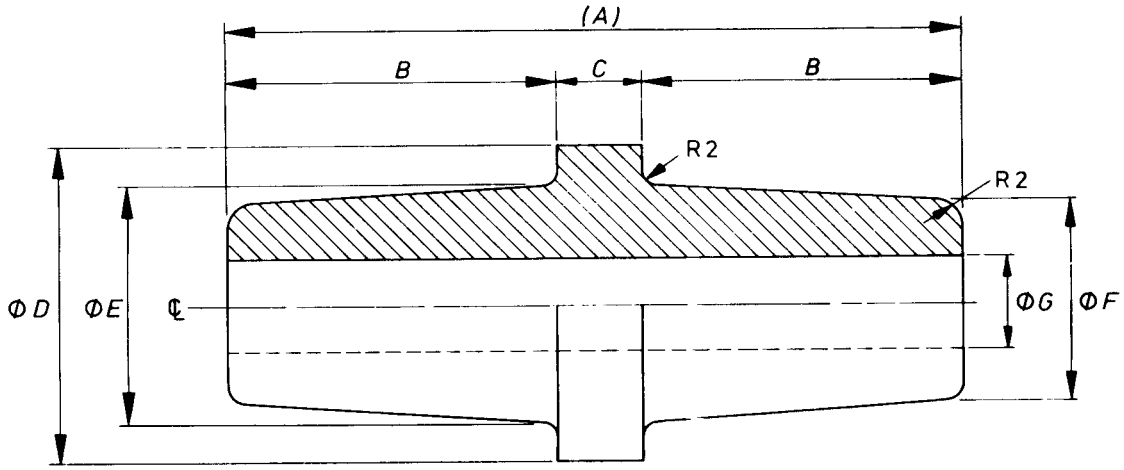
Table 10 — Cable box ratings, shell dimensions and general particulars for unfilled boxes with porcelain bushings; four-pole boxes 1.1 kV and 3.6 kV

(b) 3.6 kV

Rated voltage	No. of poles	No. of cables	Bushing rating	Max. cross-sectional area of cable		Designation		Stem diameter	Designation		Shell dimensions (see Figure 30)					Pole centres	Shell no.
				Stranded	Solid circular, solid sectoral or solid sector shaped	Bushing end cap	Cable connector		Flange	Porcelain CB	*a*	*b*	*c*	*d*	*f* (max.)		
kV			A	mm^2	mm^2			mm			mm	mm	mm	mm	mm	mm	
3.6	4	4	250	185	—	A	—	12	M	1M	160	—	285	260	750	150	121
3.6	4	4	400	300	380	B	—	16	M	1M	160	—	285	260	750	150	121
3.6	4	4	800	630	1 200	1	M4	25	N	2M	175	—	315	320	950	220	122
3.6	4	4	1 600	1 000	1 200	2	M5	36	N	2M	185	—	335	320	950	220	123
3.6	4	7	800(L) 800(N)	630 630	1 200 1 200	3 1	M4 M4	25 25	N N	2M 2M	175	115	430	320	950	220	124
3.6	4	7	1 600(L) 800(N)	630 630	1 200 1 200	3 1	M4 M4	36 25	N N	2M 2M	175	115	430	320	950	220	124
3.6	4	8	1 600	630	1 200	3	M4	36	N	2M	175	115	430	320	950	220	124

Table 11 — Cable box ratings shell dimensions and general particulars for unfilled boxes with cast resin bushing assemblies; four-pole boxes 1.1 kV

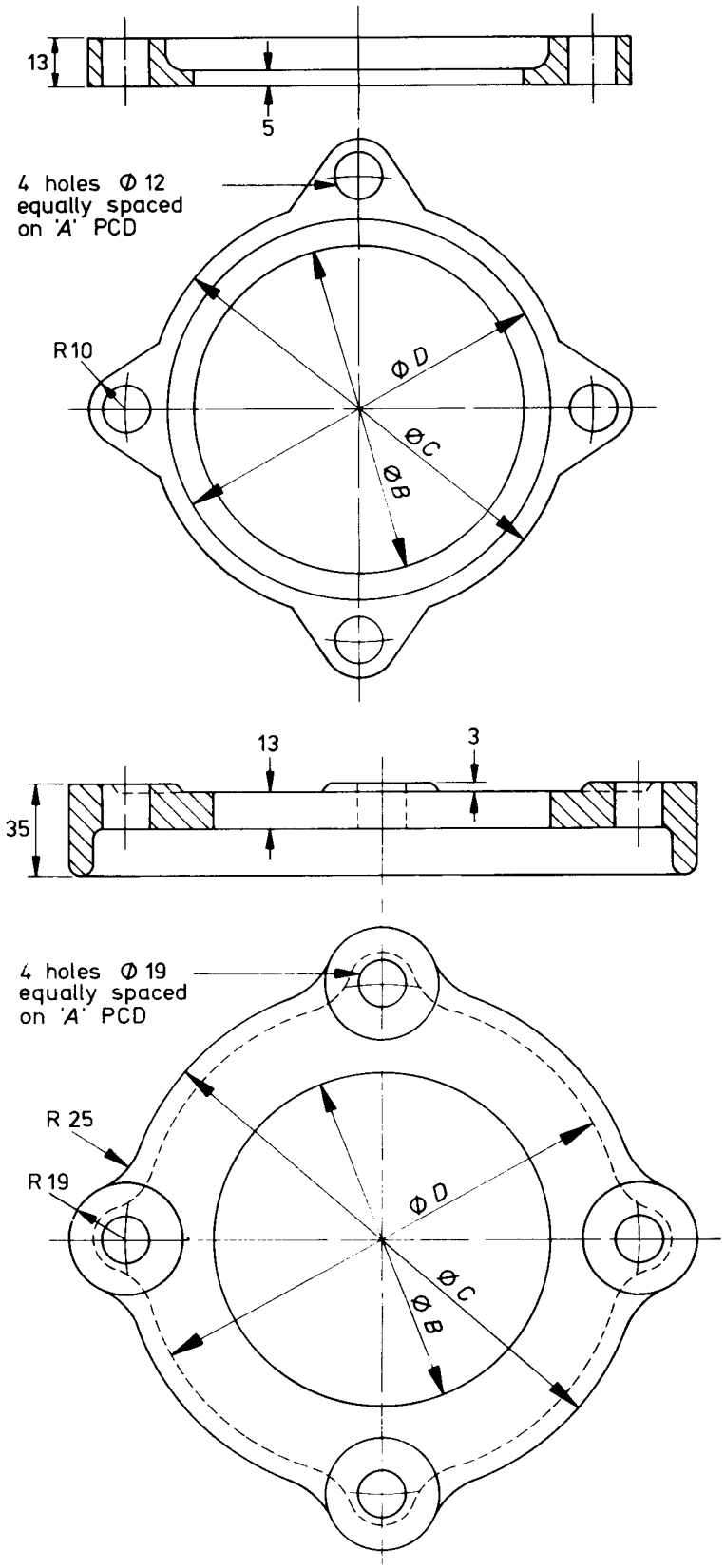
Rated voltage	No. of poles	No. of cables	Bushing rating	Max. cross-sectional area of cable		Designation		Cast resin bushing assembly	Shell dimensions (see Figure 30)					Pole centres	Shell no.
				Stranded	Solid circular, solid sectoral or solid sector shaped	Cable connector	Flange		*a*	*b*	*c*	*d*	*f* (max.)		
kV			A	mm^2	mm^2			mm	mm	mm	mm	mm	mm	mm	
1.1	4	1	800	400	300	M3	F	Figure 16	175	—	285	485	600	114	111
1.1	4	4	800	630	1 200	M4	F	Figure 16	175	—	265	260	600	114	112
1.1	4	2	1 400(L) 800(N)	400	300	M3	F	Figure 16	175	115	400	485	600	114	113
1.1	4	7	1 400(L) 800(N)	630	1 200	M4	F	Figure 16	175	115	380	260	600	114	114



porcelain no.	*A*	*B*	*C*	*D* max.	*E* max.	*F*	*G* min.	*H*
CB1M	223	102	19	82	57	47	18	61
CB2M	225	102	21	107	80	70	39	86
CB3M	381	178	25	159	114	102	64	121
CB6M	291	135	21	107	80	70	39	86
CB7M	225	102	21	117	89	80	48	95

NOTE 1 The end faces are to be free from glaze and perpendicular to porcelain axis.
NOTE 2 For porcelains CB3M and CB6M the end faces are to be ground perpendicular to porcelain axis.
NOTE 3 The seating flange faces are to be free from glaze and ground perpendicular to porcelain axis outside a diameter of "*H*".
Material: glazed porcelain
Tests and tolerances to BS 4963 except where otherwise stated
All dimensions are in millimetres.

Figure 1 — Standard porcelains



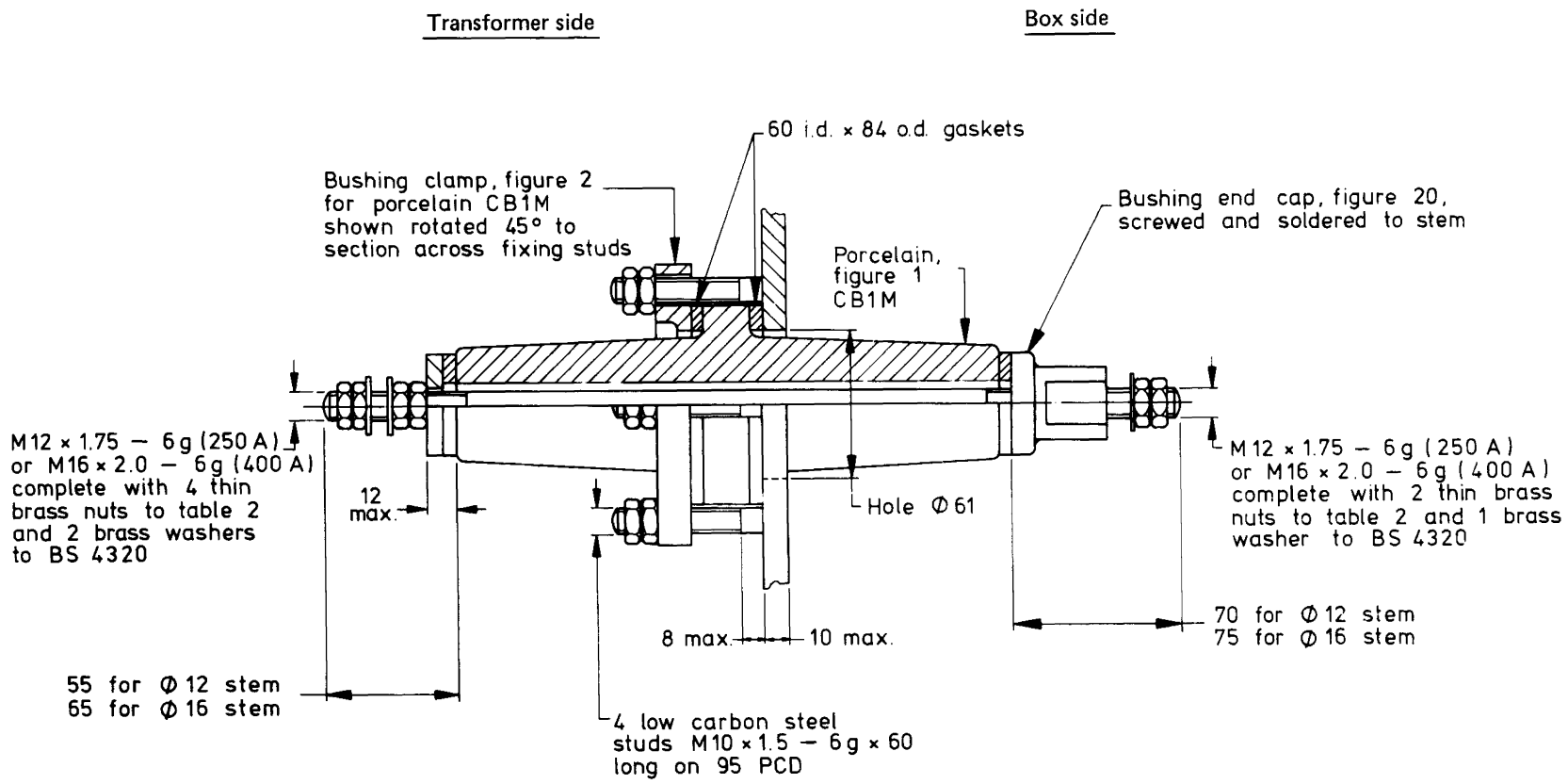
Clamp for porcelain no.	*A*	*B*	*C*	*D*
CB1M	95	61	82	73
CB2M & CB6M	120	86	108	98
CB7M	130	95	118	108

Clamp for porcelain no.	*A*	*B*	*C*	*D*
CB3M	181	121	181	165

NOTE The designs illustrated are based on the use of hot brass pressings or die castings in copper base alloy. Providing mechanical interchangeability is achieved, alternative constructions and materials are permitted.

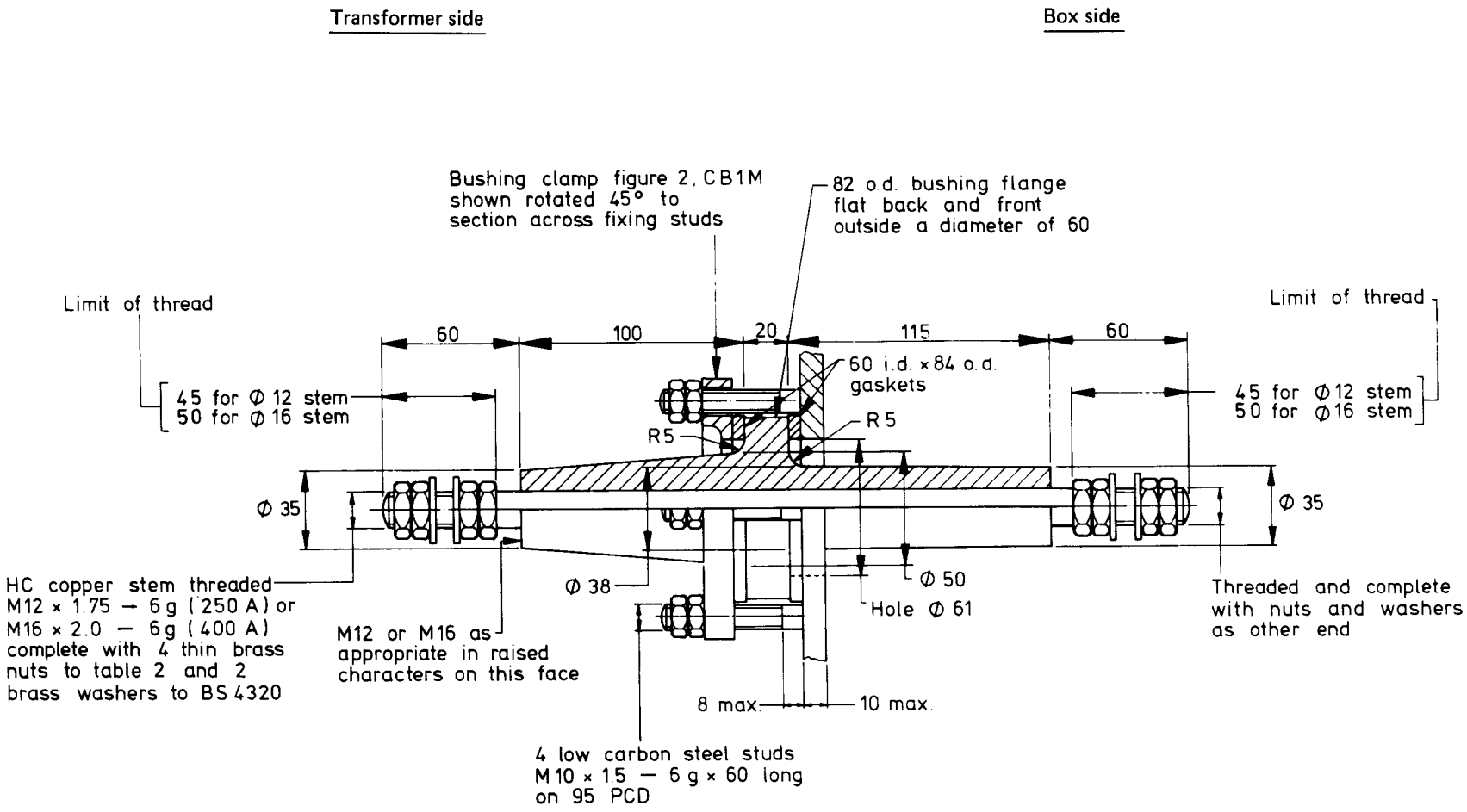
All dimensions are in millimetres.

Figure 2 — Bushing clamps



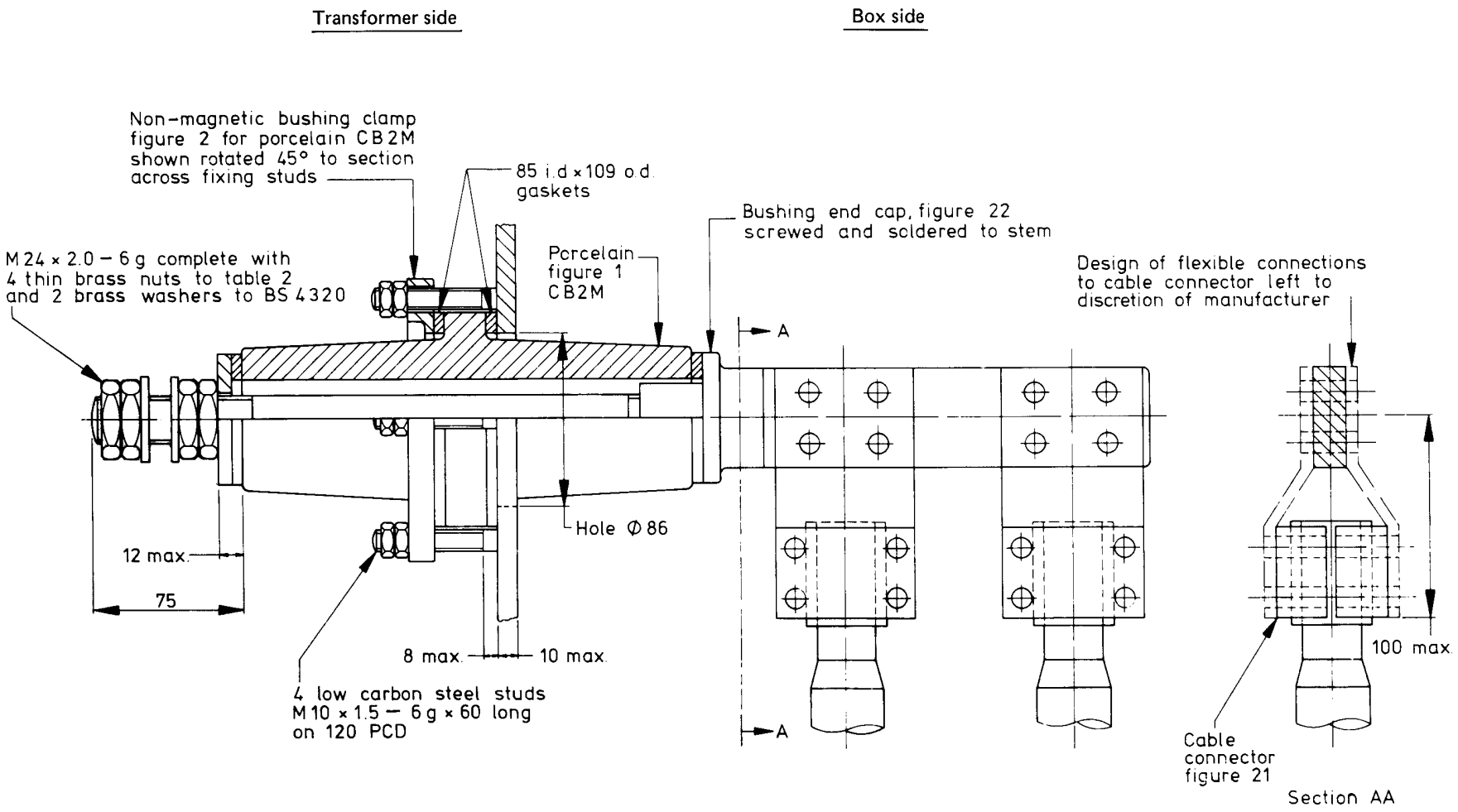
All dimensions are in millimetres.

Figure 3 — Assembly of 250 A and 400 A porcelain bushings for use up to 12 kV rated voltage



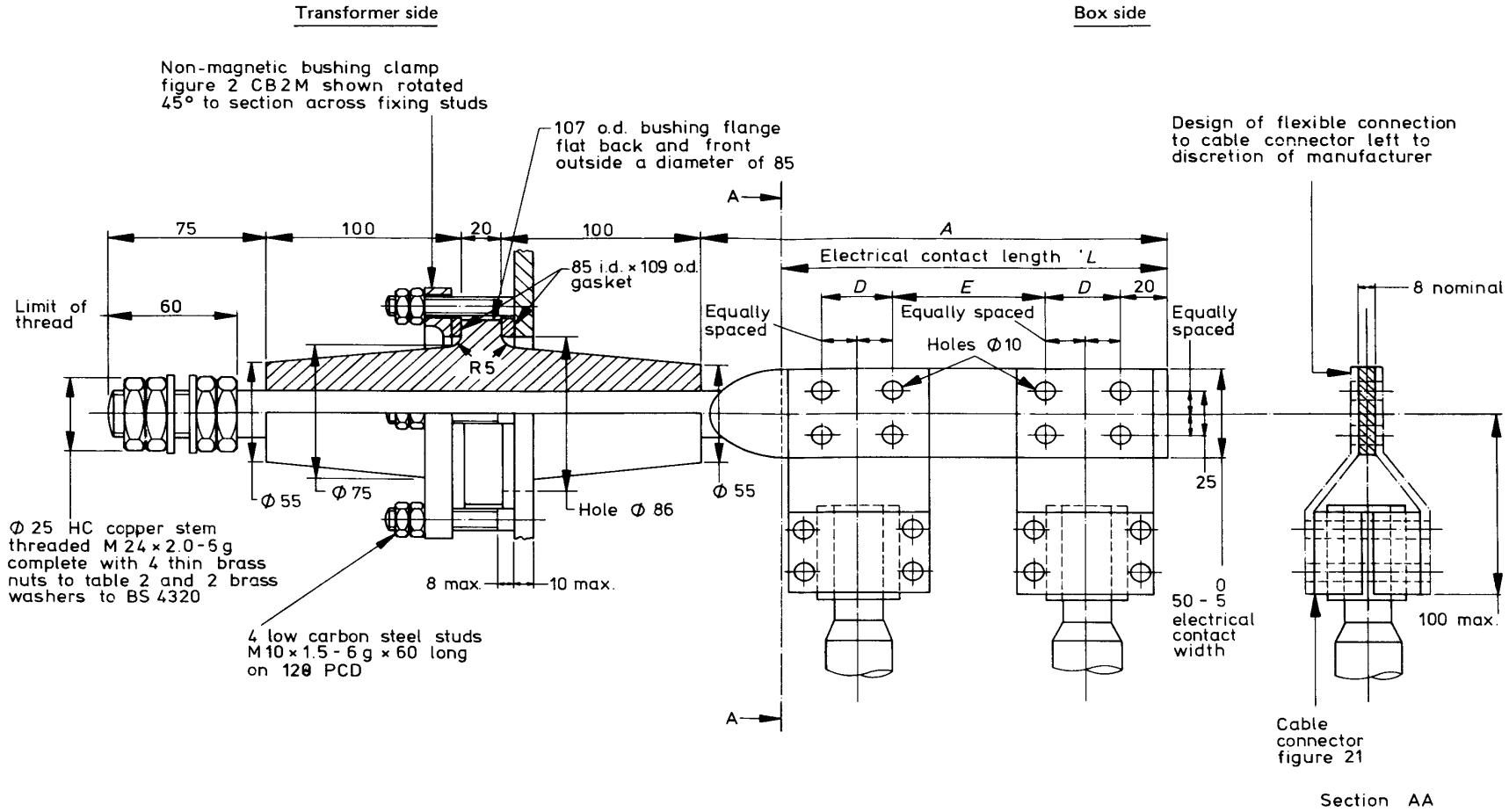
All dimensions are in millimetres.

Figure 4 — Assembly of 250 A and 400 A epoxide resin bushings for use up to 12 kV rated voltage



All dimensions are in millimetres.

Figure 5 — Assembly of 800 A porcelain bushing for use up to 12 kV rated voltage (one or two cables per terminal)



End cap drilling no.	No of cables per terminal	*A*	*D*	*E*	*L*
1	1	115	35	—	75
2	1	130	45	—	85
3	2	230	35	80	190
4	2	270	45	95	225

All dimensions are in millimetres.

Figure 6 — Assembly of 800 A epoxide resin bushing for use up to 12 kV rated voltage (one or two cables per term)

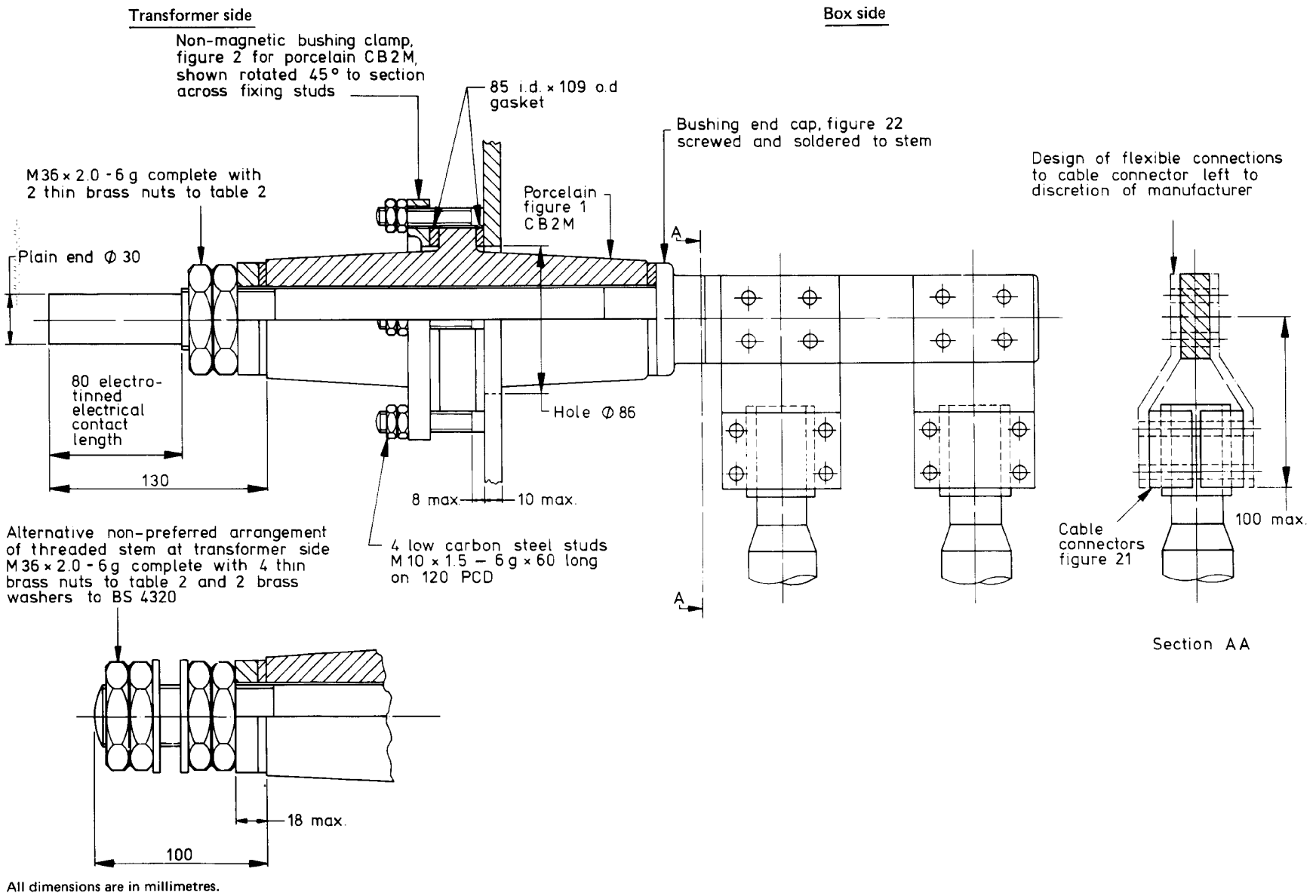
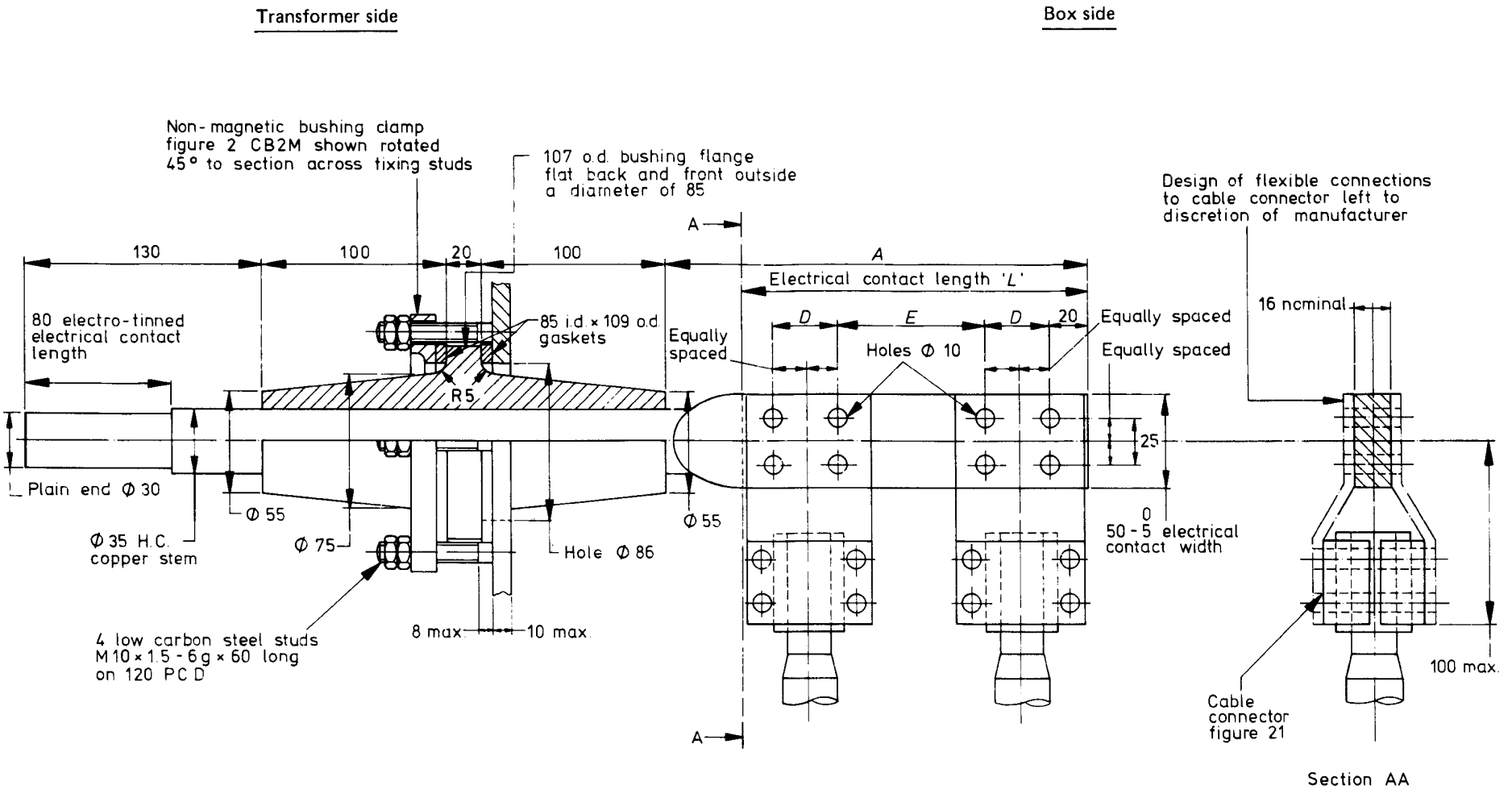


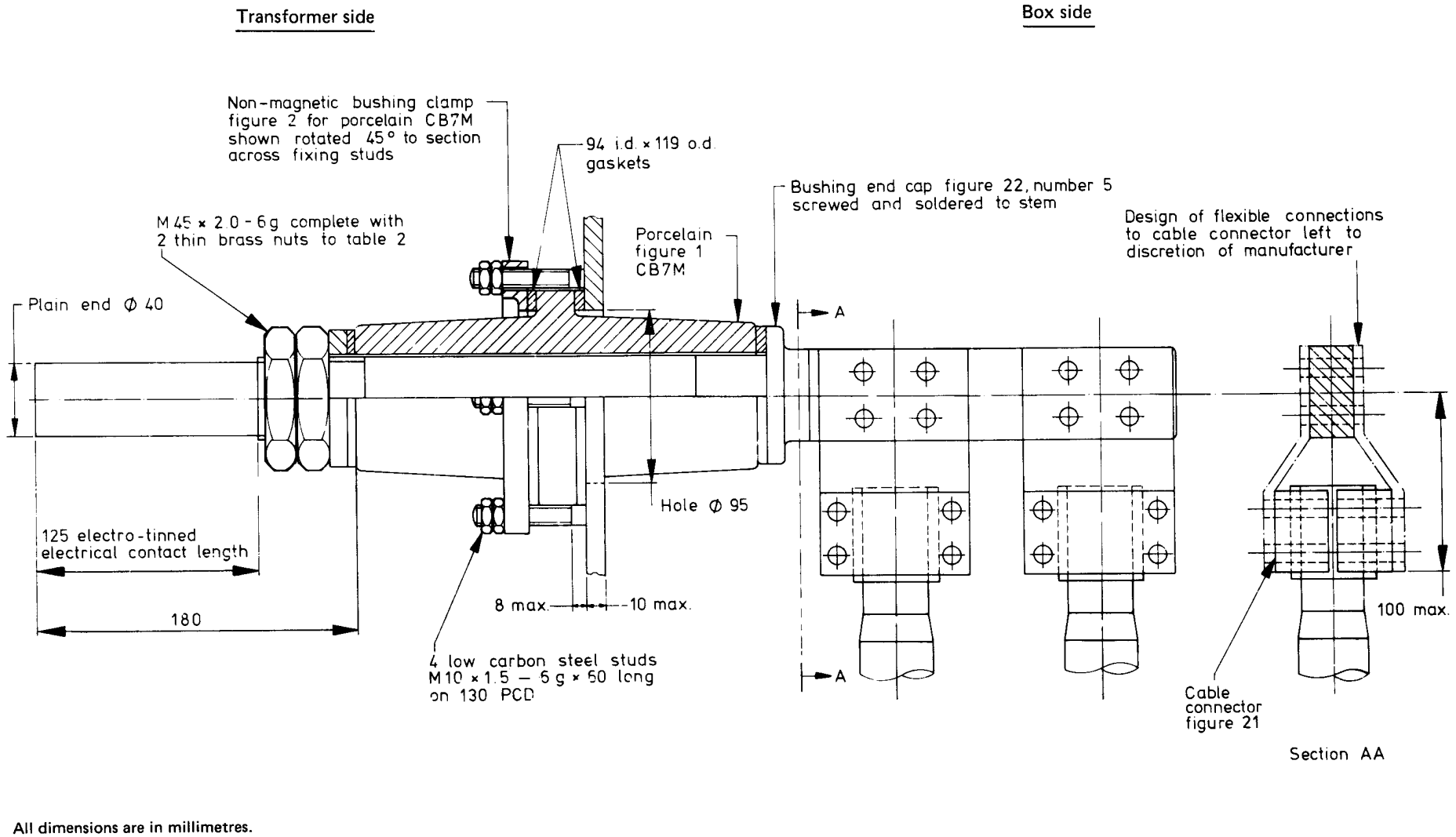
Figure 7 — Assembly of 1 600 A porcelain bushing for use up to 12 kV rated voltage (one or two cables per terminal)



End cap drilling no.	No. of cables per terminal	*A*	*D*	*E*	*L*
2	1	130	45	—	85
3	2	230	35	80	190
4	2	270	45	95	225

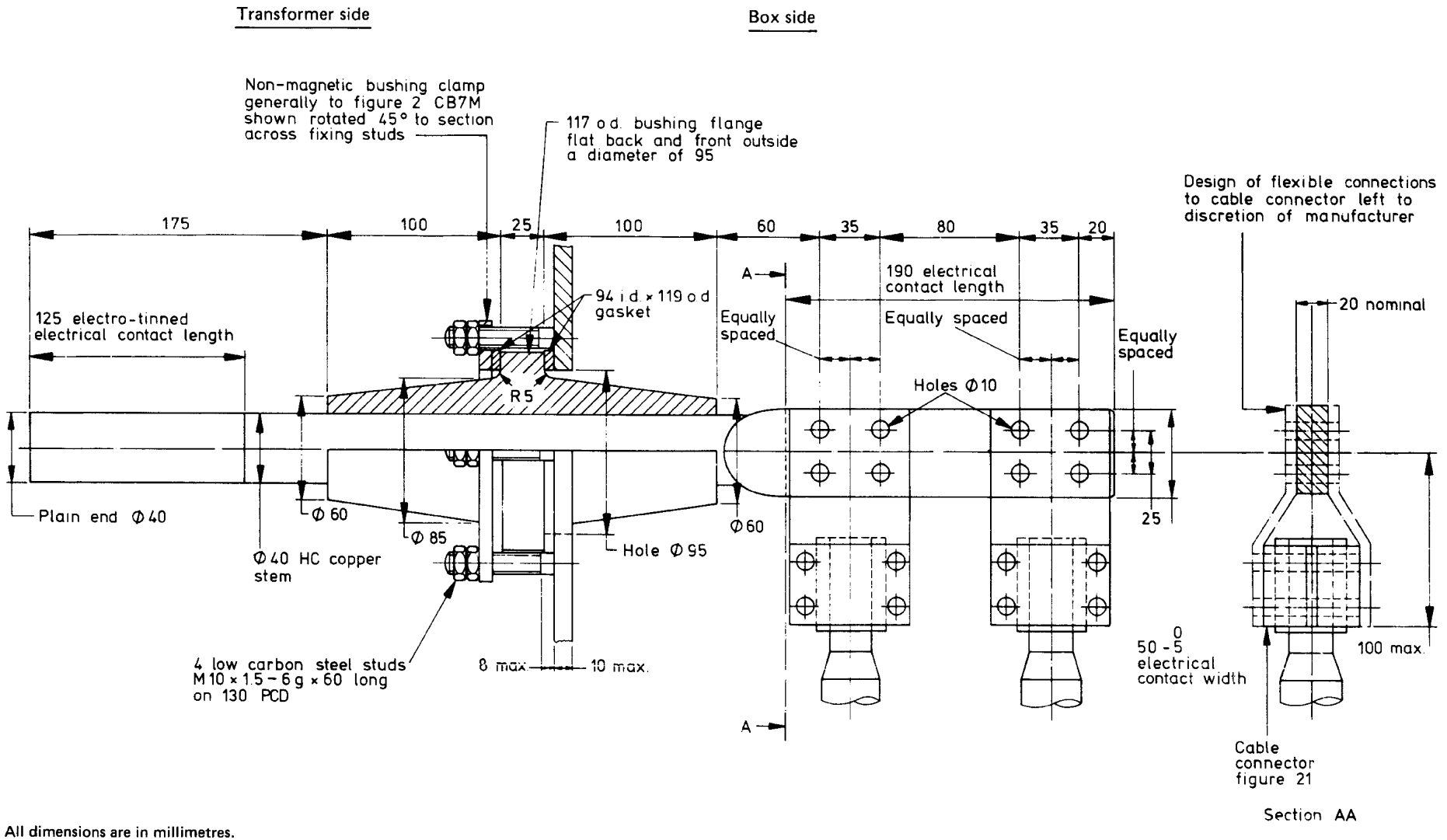
All dimensions are in millimetres.

Figure 8 — Assembly of 1 600 A epoxide resin bushing for use up to 12 kV rated voltage (one or two cables per terminal)



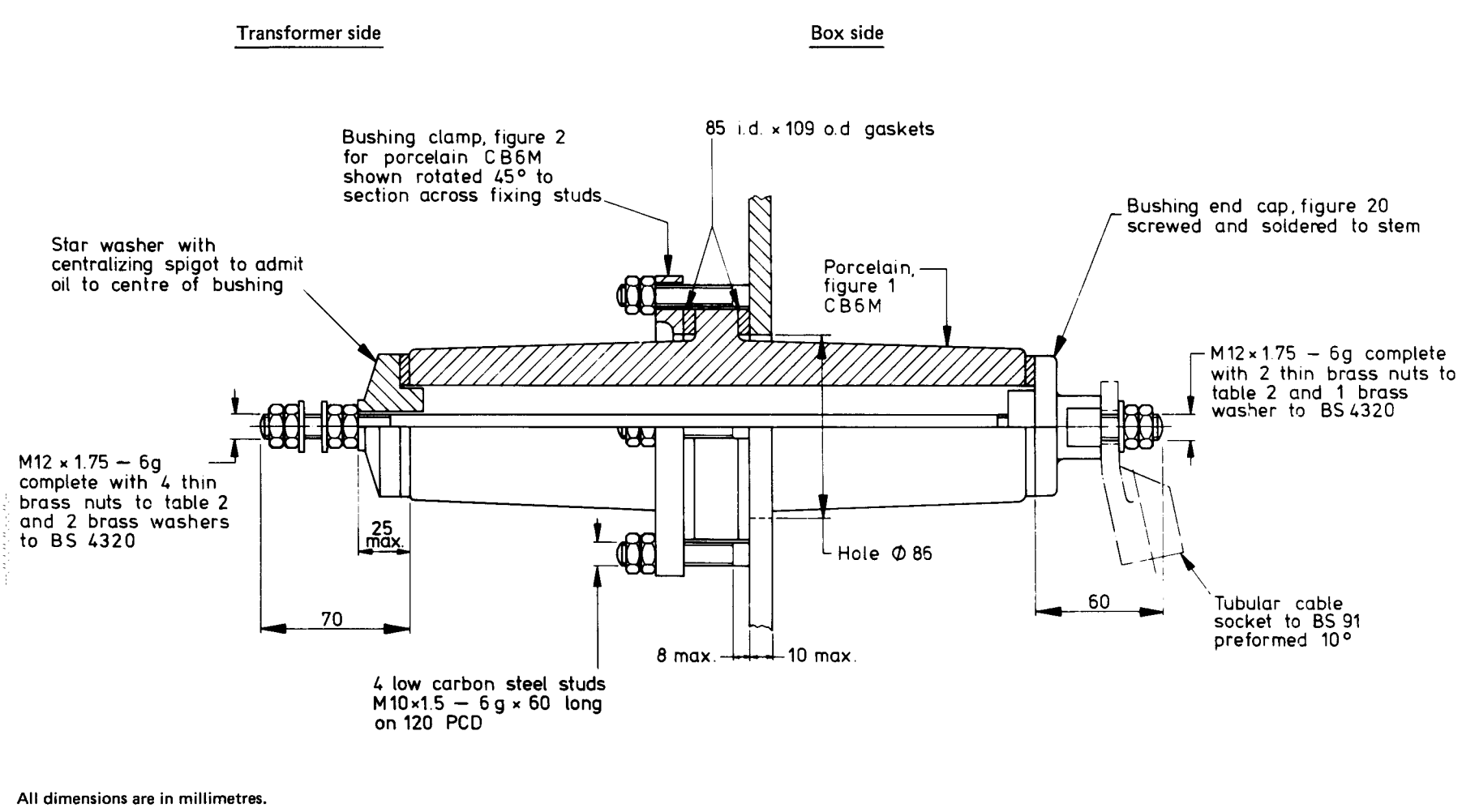
All dimensions are in millimetres.

Figure 9 — Assembly of 2 500 A porcelain bushing for use up to 12 kV rated voltage (two cables per terminal)



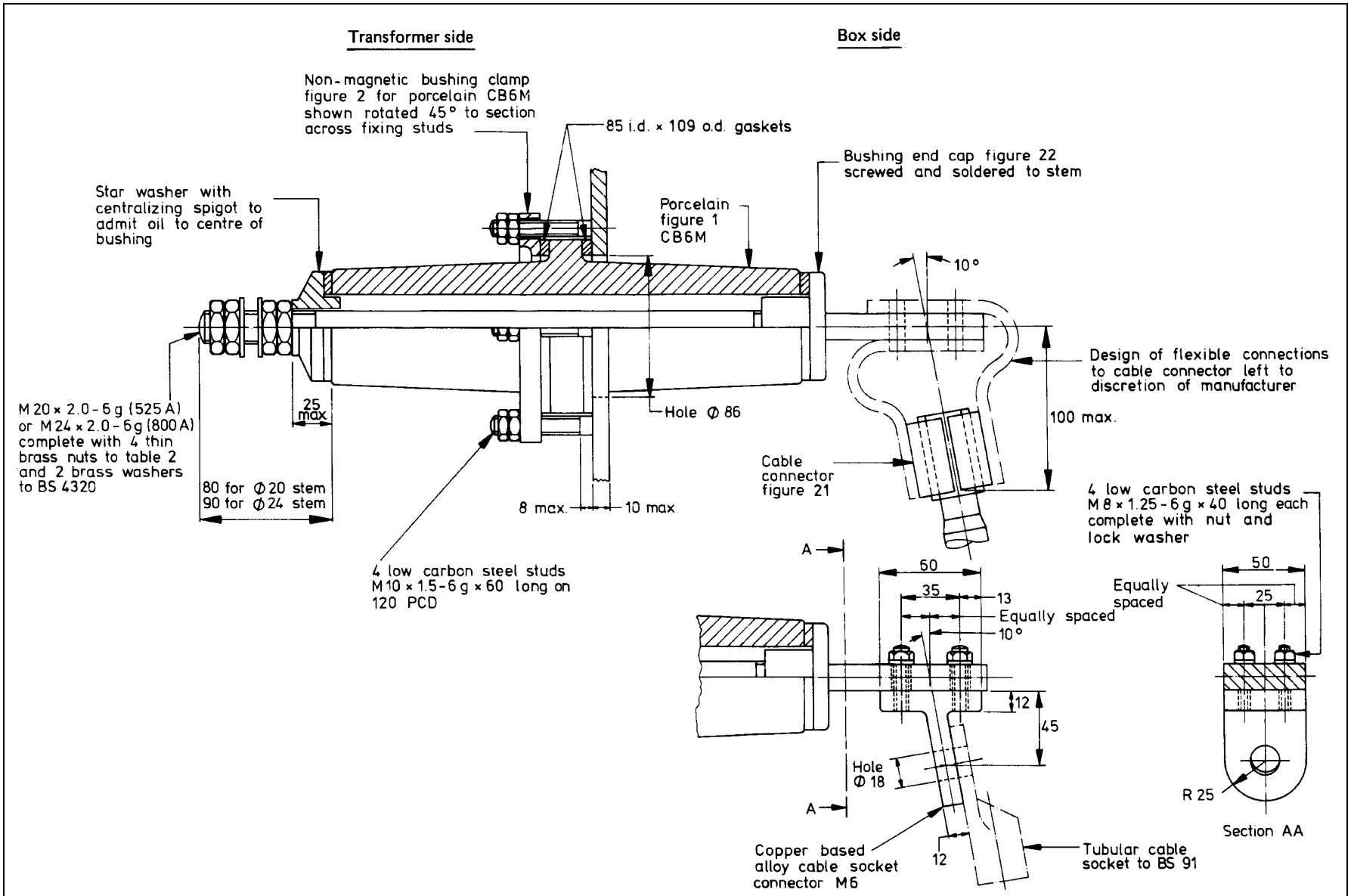
All dimensions are in millimetres.

Figure 10 — Assembly of 2 500 A epoxide resin bushing for use up to 12 kV rated voltage (two cables per terminal)



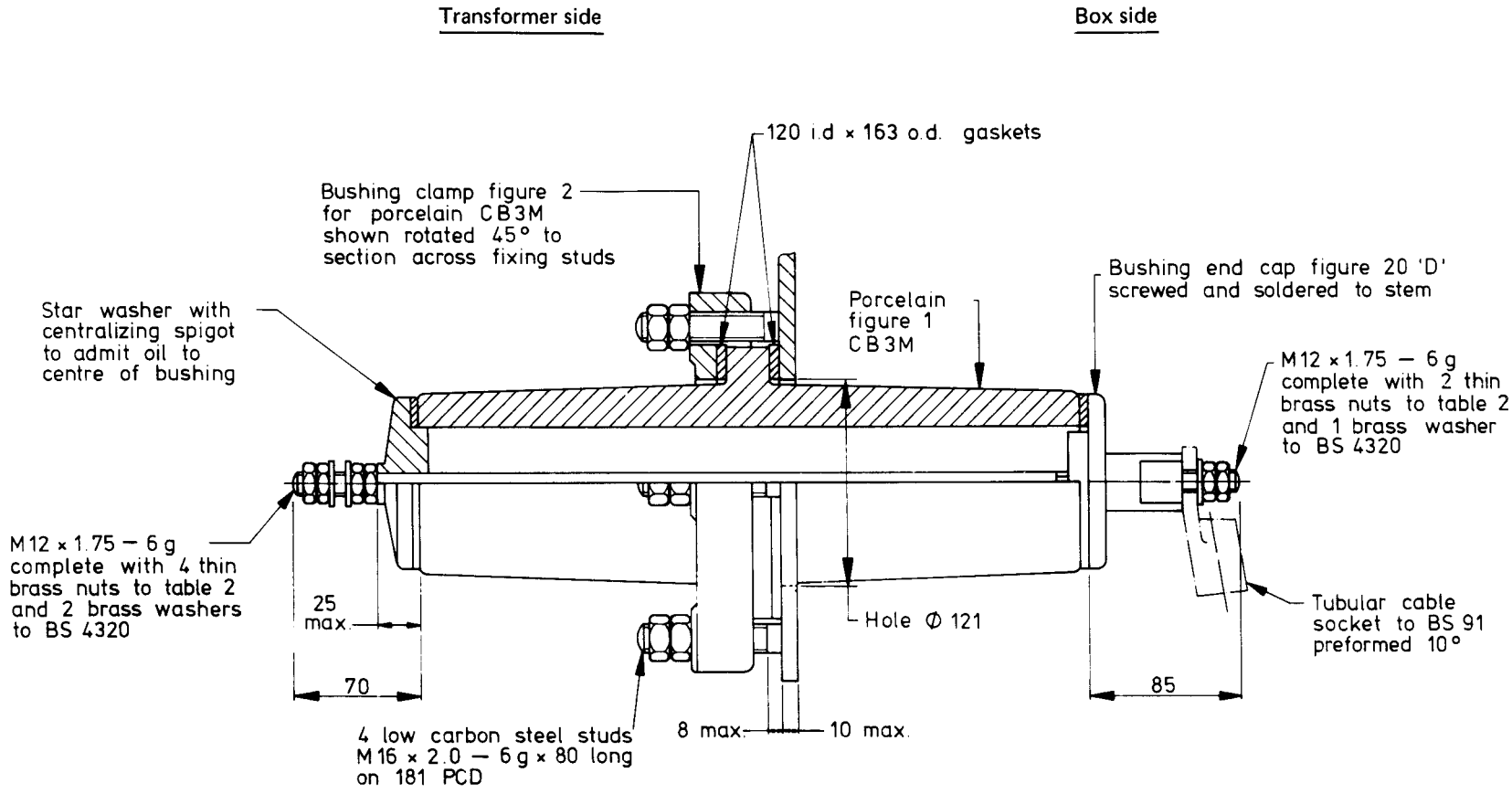
All dimensions are in millimetres.

Figure 11 — Assembly of 250 A porcelain bushing for use up to 24 kV rated voltage



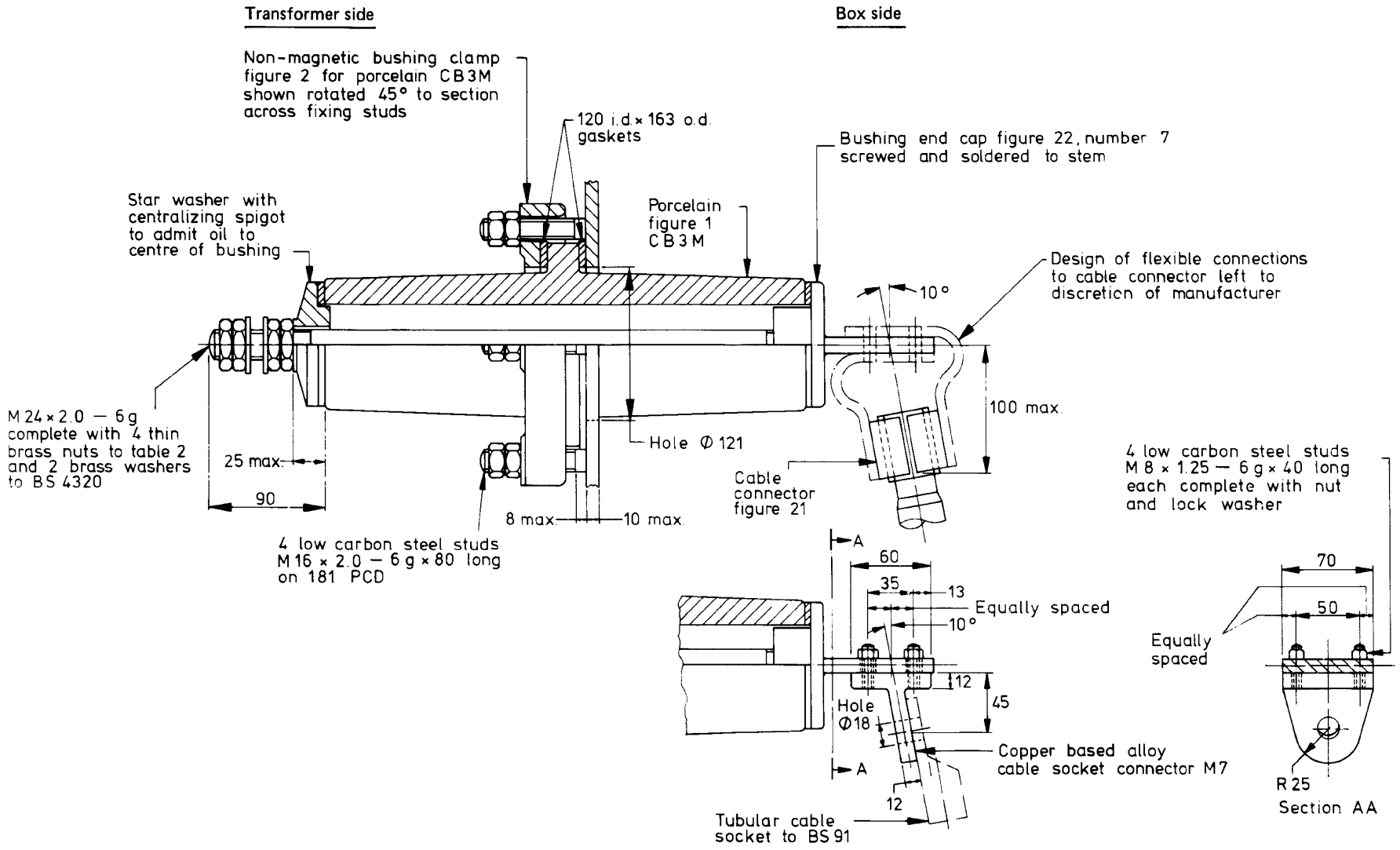
All dimensions are in millimetres.

Figure 12 — Assembly of 525 A and 800 A porcelain bushings for use up to 24 kV rated voltage



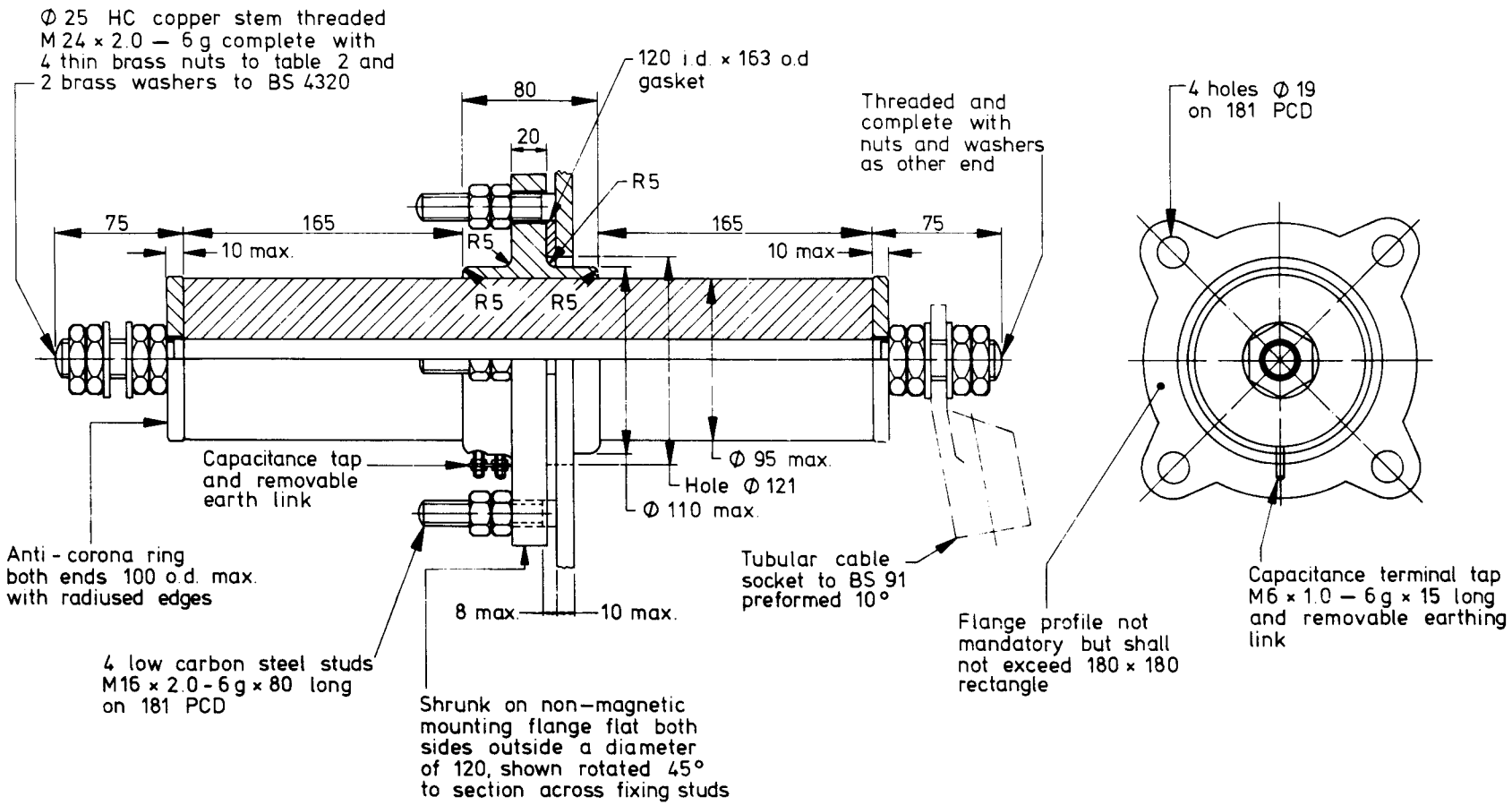
All dimensions are in millimetres.

Figure 13 — Assembly of 250 A porcelain bushing for use up to 36 kV rated voltage



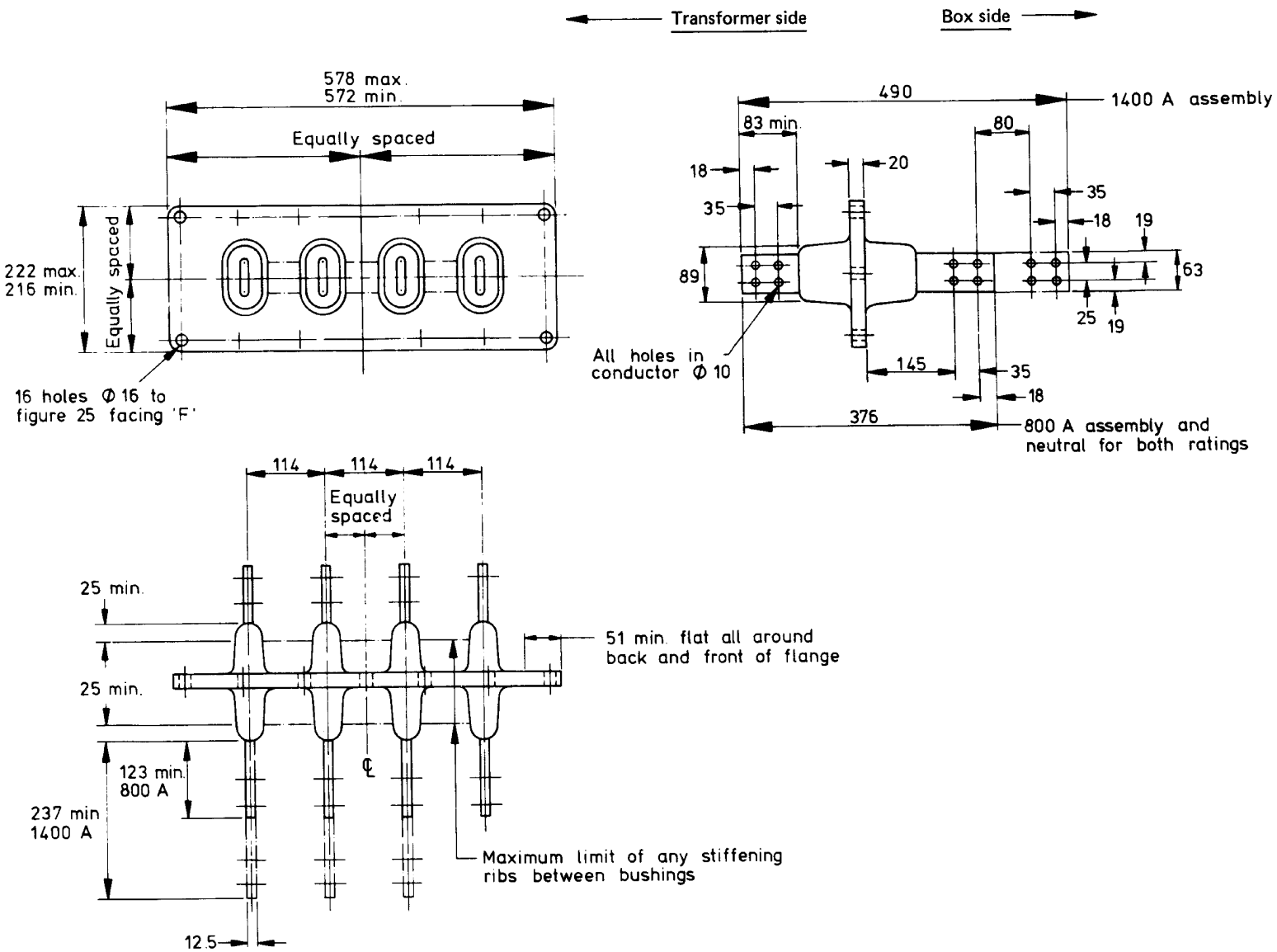
All dimensions are in millimetres.

Figure 14 — Assembly of 800 A porcelain bushing for use up to 36 kV rated voltage



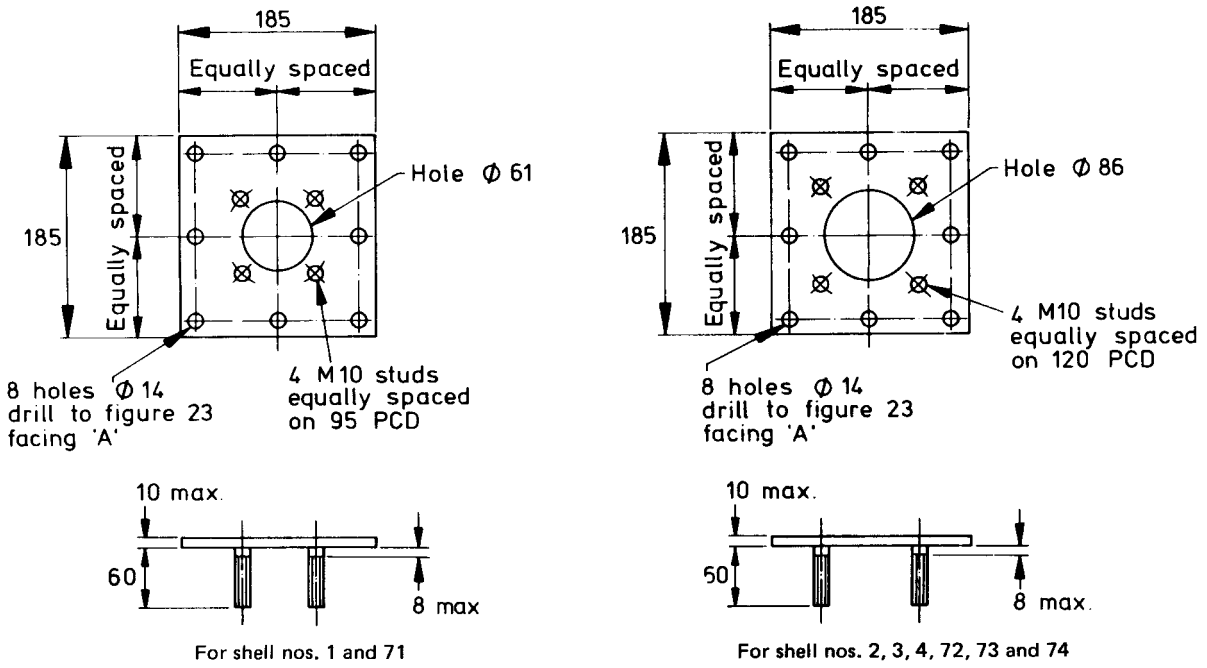
All dimensions are in millimetres.

Figure 15 — Assembly of 800 A condenser bushing for use up to 36 kV rated voltage



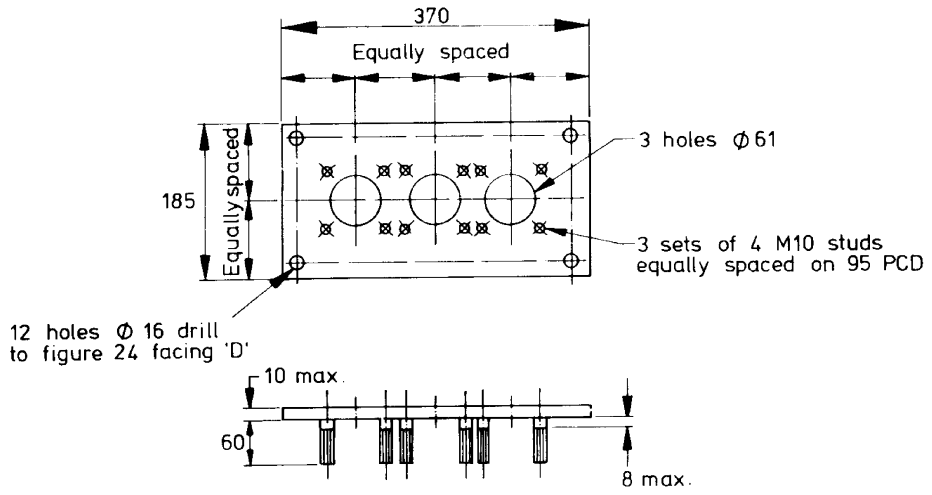
All dimensions are in millimetres.

Figure 16 — 800 A and 1 400 A cast resin bushing assemblies for use up to 1.1 kV rated voltage

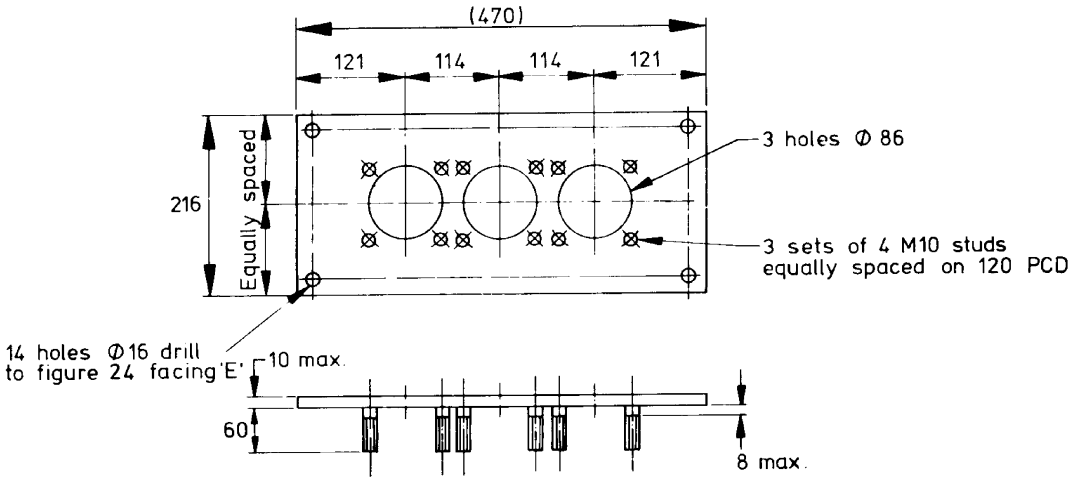


All dimensions are in millimetres.

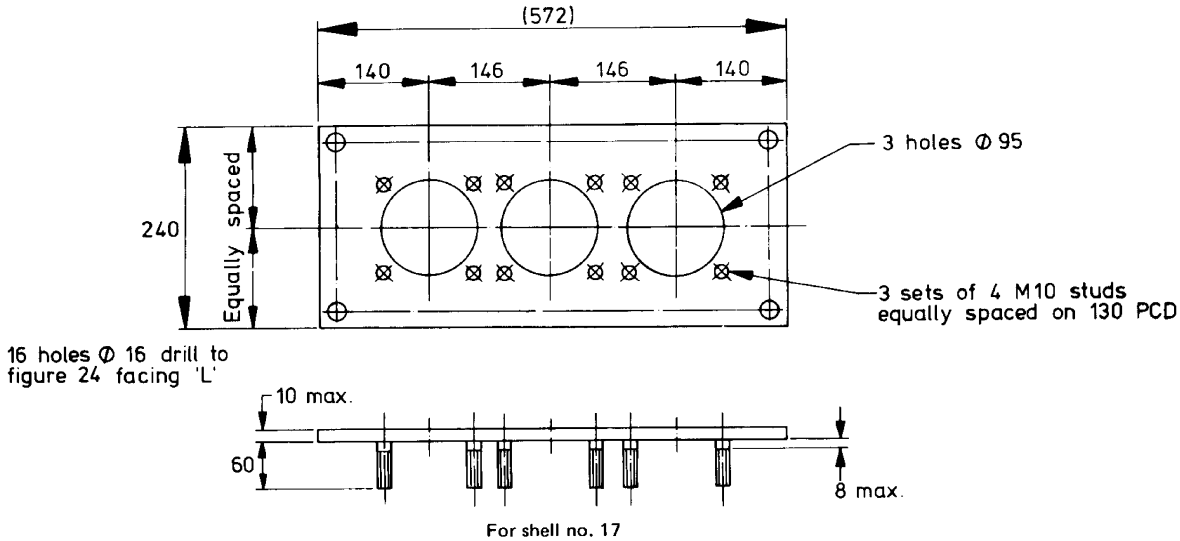
Figure 17 — Bushing mounting plates for single-pole boxes (for use up to 3.6 kV rated voltage)



For shell nos. 11, 14, 81 and 84



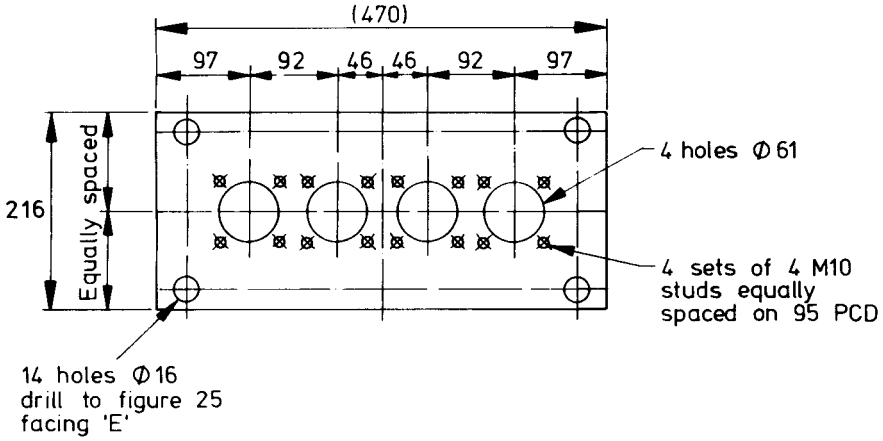
For shell nos. 12, 13, 15, 16, 82, 83, 85 and 86

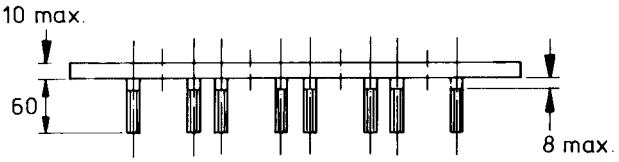


For shell no. 17

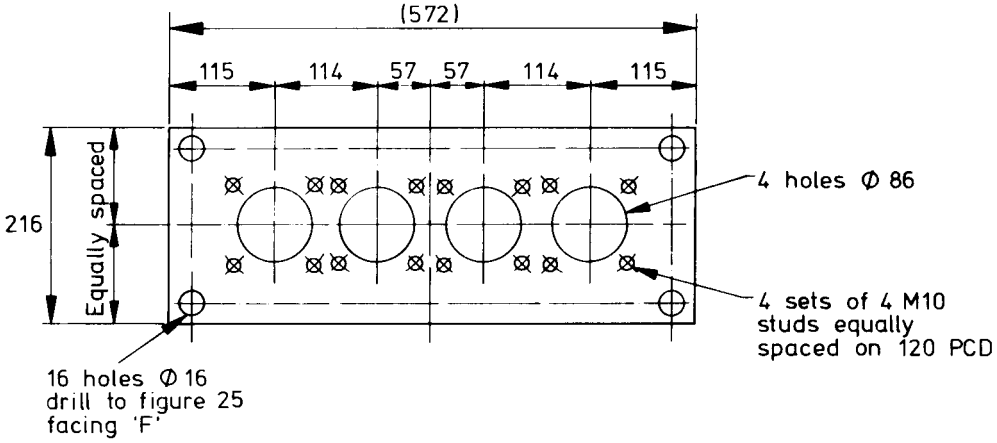
All dimensions are in millimetres.

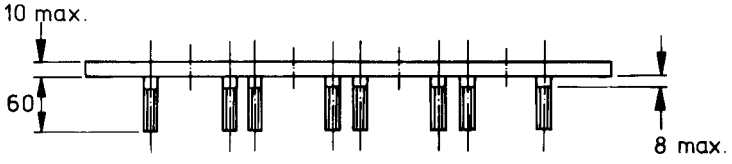
Figure 18 — Bushing mounting plates for three-pole boxes (for use up to 3.6 kV rated voltage)





For shell nos. 31, 32, 35, 101 and 104

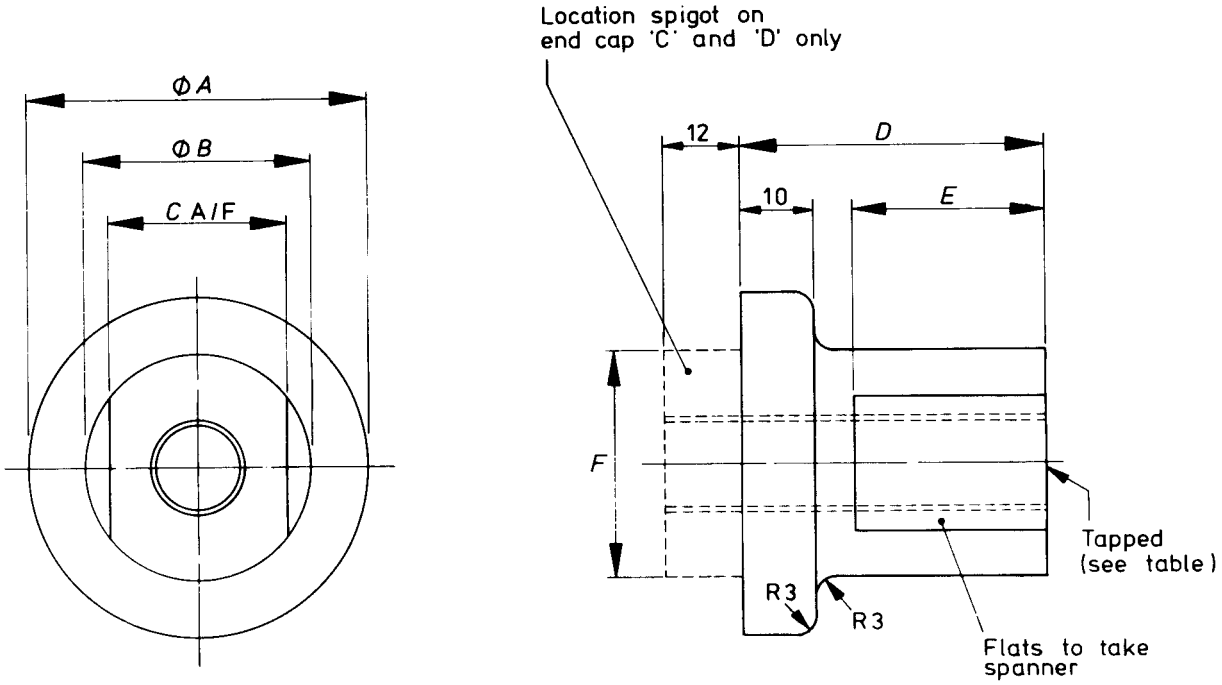




For shell nos. 33, 36, 37, 38, 102, 103, 105 and 106

All dimensions are in millimetres.

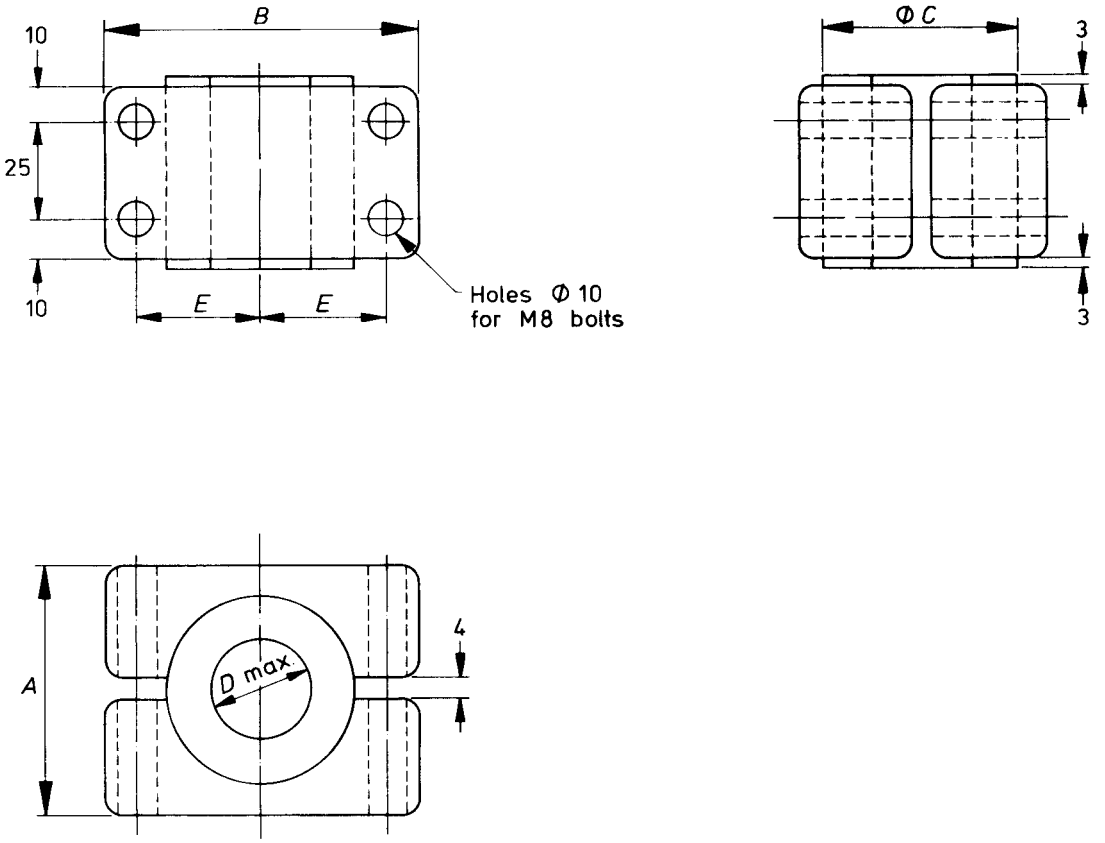
Figure 19 — Bushing mounting plates for four-pole boxes (for use up to 3.6 kV rated voltage)



Bushing end cap designation	*A*	*B*	*C*	*D*	*E*	*F*	Tapping for stems
A	43	30	24	40	25	—	M12 × 1.75 – 6H
B	43	35	30	40	25	—	M16 × 2.0 – 6H
C	66	30	24	32	18	35	M12 × 1.75 – 6H
D	98	30	24	55	25	60	M12 × 1.75 – 6H

All dimensions are in millimetres.

Figure 20 — Copper based alloy bushing end caps, designations A, B, C and D

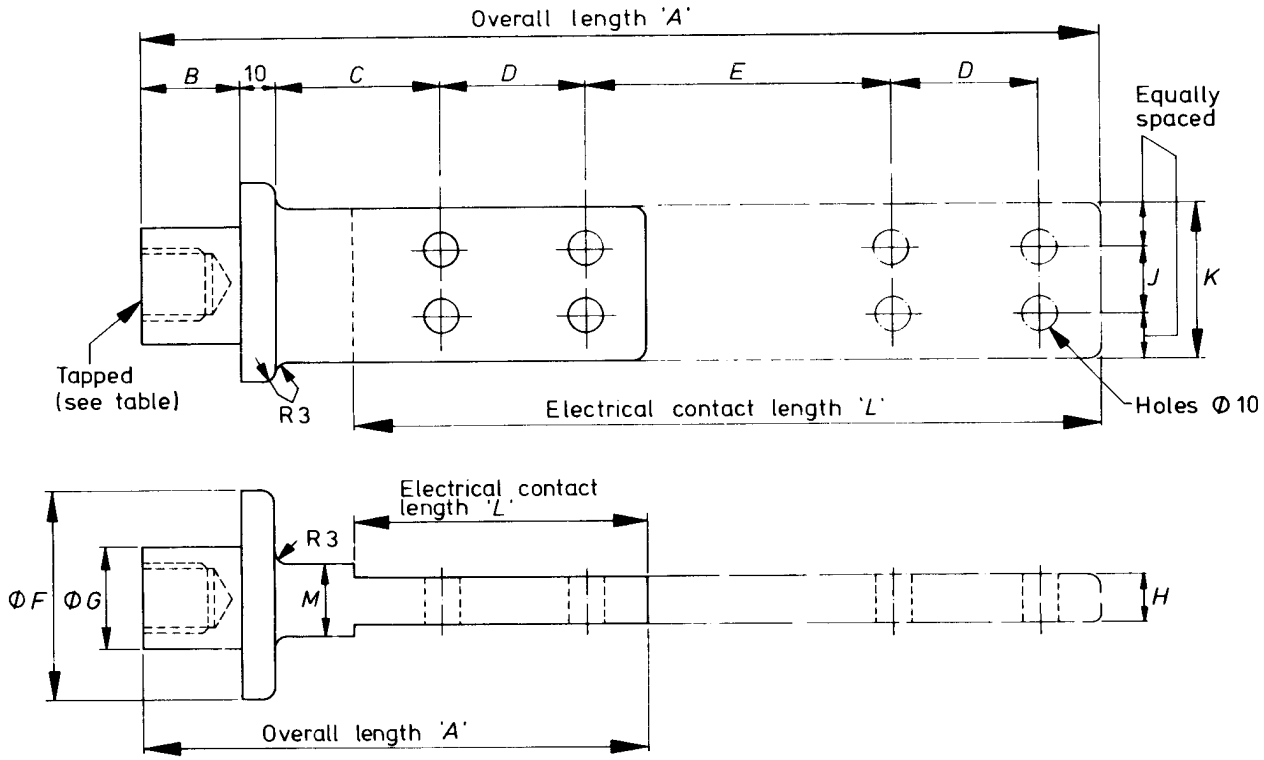


Cable connector no.	*A*	*B*	*C*	*D* max.	*E*	Max. conductor	
						Stranded	Solid circular or solid sectoral
						mm^2	mm^2
M3	45	60	30	27	22	400	740
M4	54	70	40	34	26	630	1 200
M5	65	84	48	44	32	1 000	1 600

NOTE 1 Cable ferrule to be bored with diameter 10 pilot hole or to suit purchaser's requirements up to diameter *D* max.
NOTE 2 Ferrule to be omitted when using solid circular or solid sectoral conductors. Connectors, spaced 4 apart to be bored to suit purchaser's requirements up to diameter *C* max.

All dimensions are in millimetres.

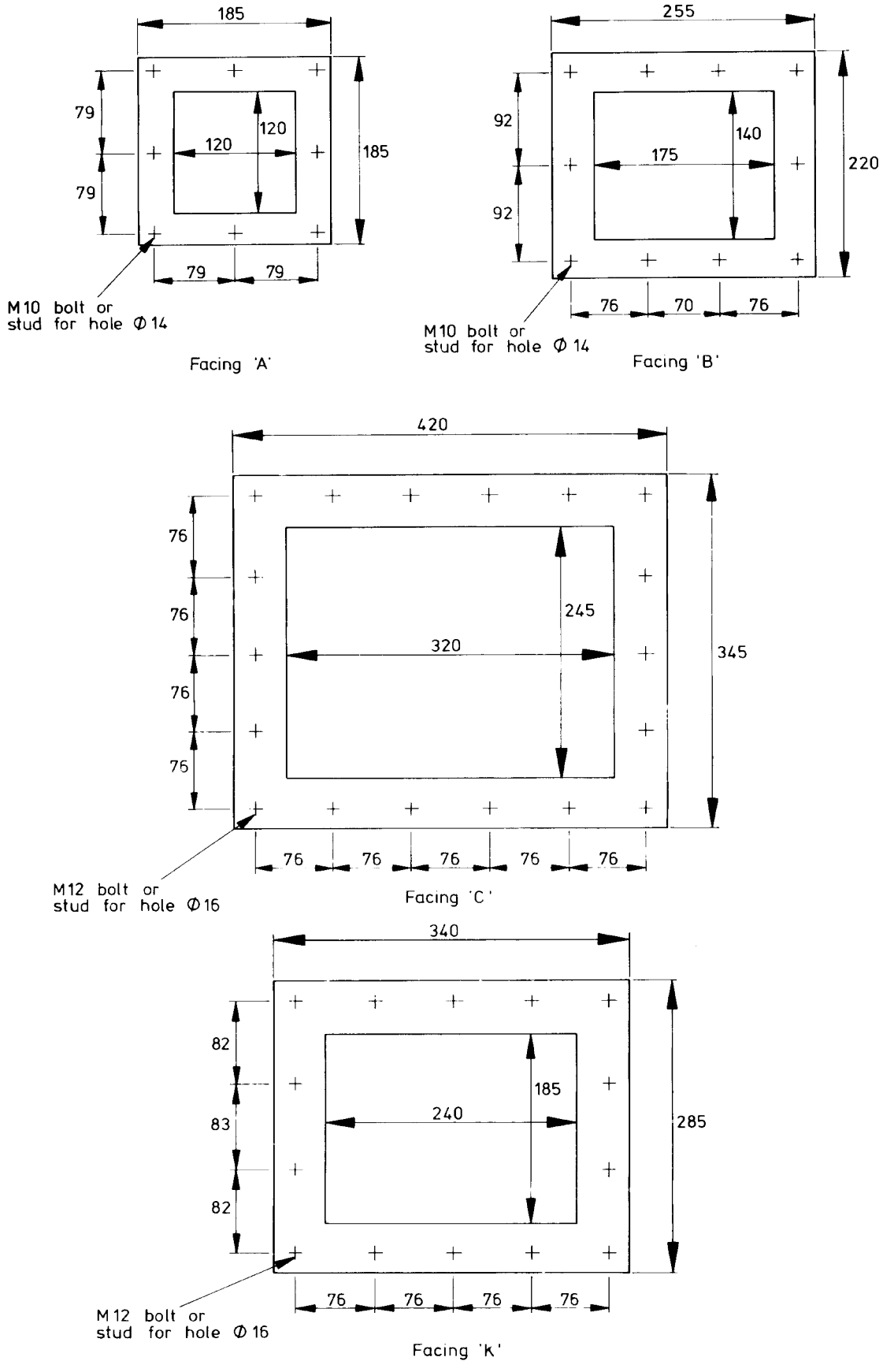
Figure 21 — Copper based alloy cable connectors and ferrules



Bushing end cap designation	No. of cables per phase	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*	*L*	*M*	Tapping for stem
1	1	136	30	44	35	—	66	35	16	25	50	75	16	M24 × 2.0 – 6H × 26 deep
2	1	155	30	50	45	—	66	35	16	25	50	90	16	M24 × 2.0 – 6H × 26 deep
3	2	250	30	44	35	80	66	35	16	25	50	190	22	M24 × 2.0 – 6H × 26 deep
4	2	295	30	50	45	95	66	35	16	25	50	230	22	M24 × 2.0 – 6H × 26 deep
5	2	268	40	44	35	80	76	45	25	25	50	195	31	M36 × 2.0 – 6H × 38 deep
6	1	136	30	44	35	—	66	35	16	25	50	75	16	M20 × 2.0 – 6H × 22 deep
7	1	125	30	35	35	—	98	60	12	50	70	75	12	M24 × 2.0 – 6H × 26 deep

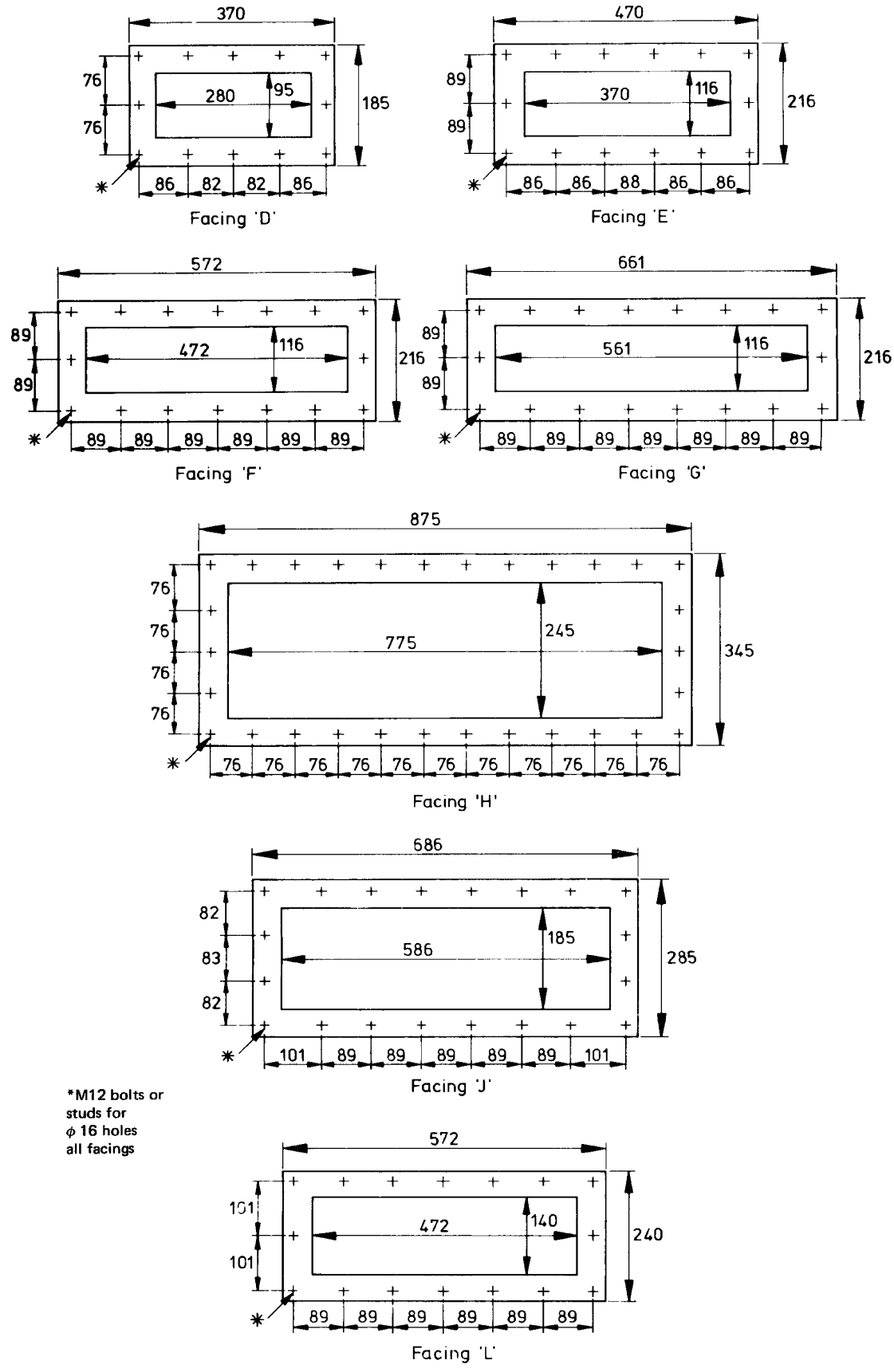
All dimensions are in millimetres.

Figure 22 — Copper based alloy bushing end caps, designations 1 to 7



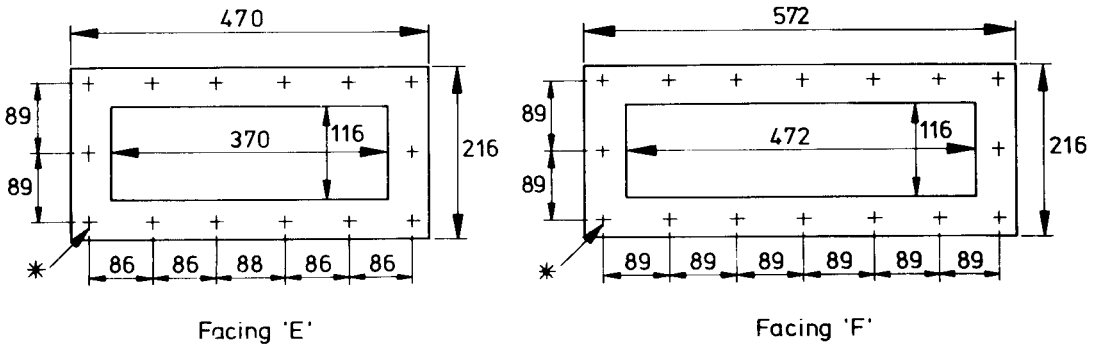
All dimensions are in millimetres.

Figure 23 — Facings for single-pole boxes



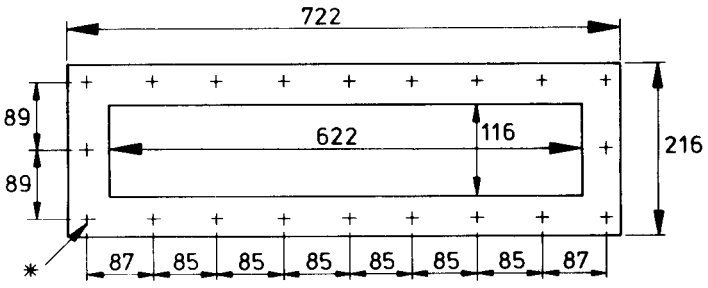
All dimensions are in millimetres.

Figure 24 — Facings for three-pole boxes



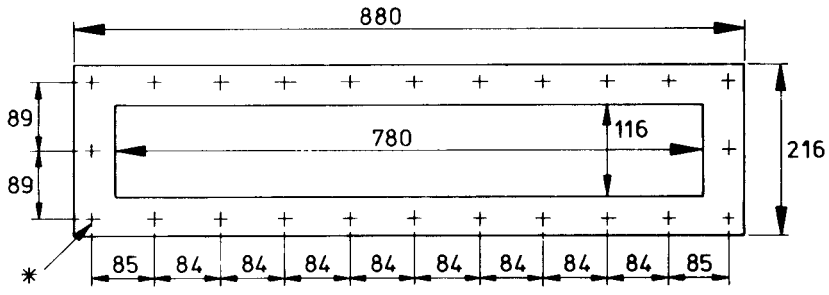
Facing 'E'

Facing 'F'



Facing 'M'

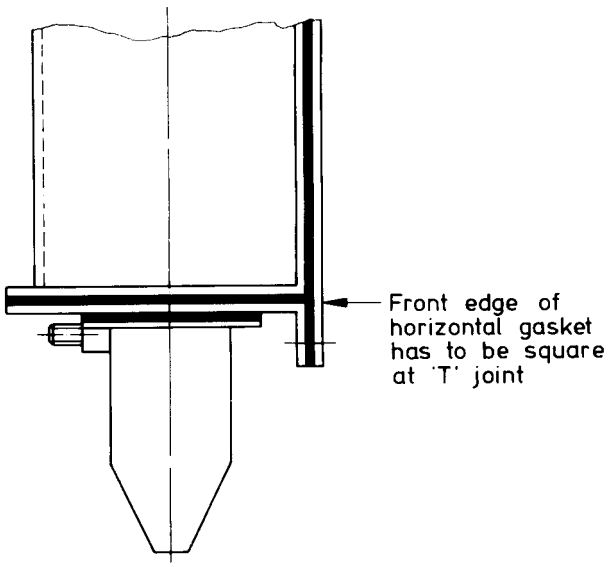
*M12 bolts or studs for ϕ 16 holes all facings



Facing 'N'

All dimensions are in millimetres.

Figure 25 — Facings for four-pole boxes



All dimensions are in millimetres.

Figure 26 — Typical arrangement of gland plate mounting for compound filled boxes

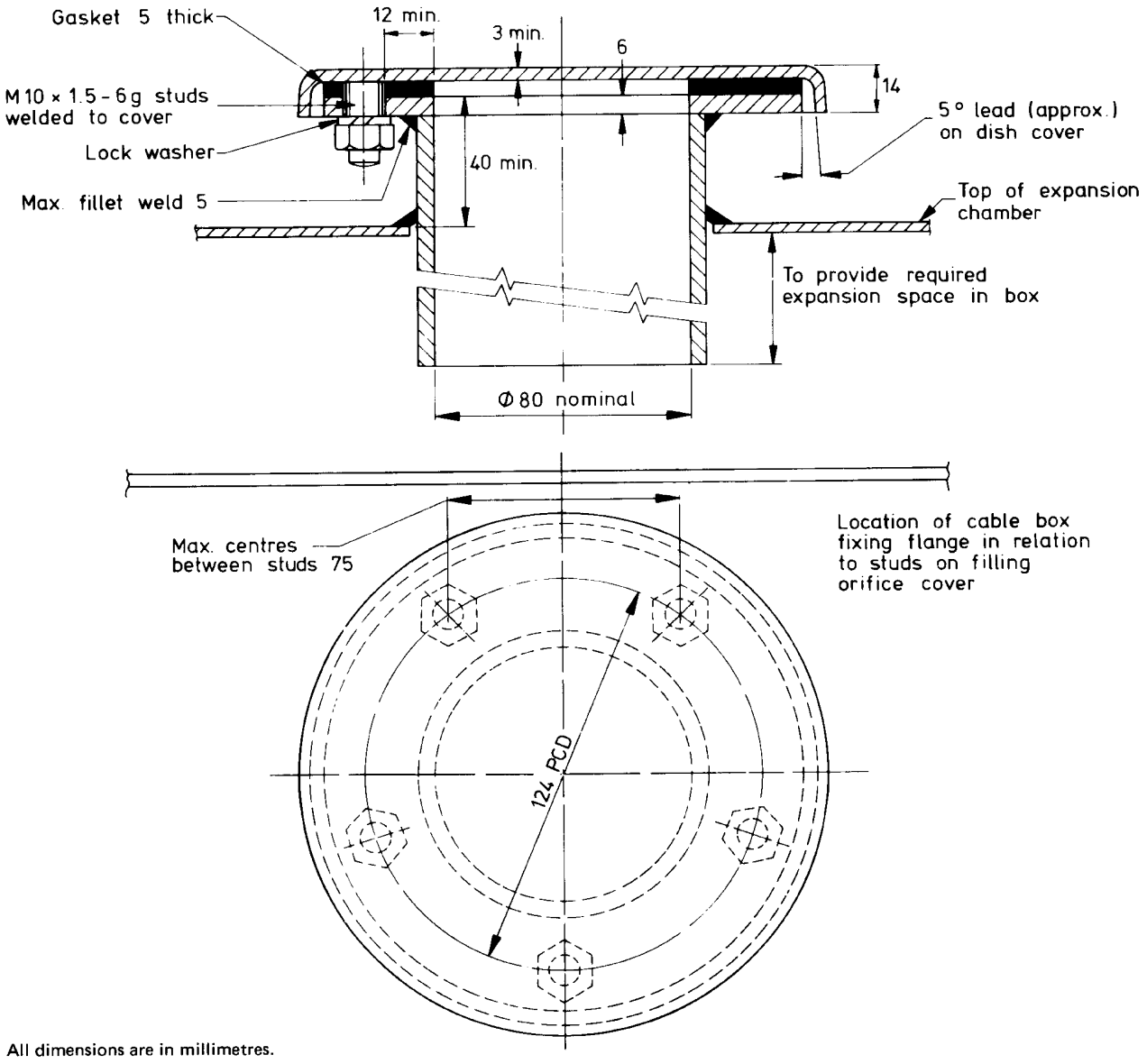
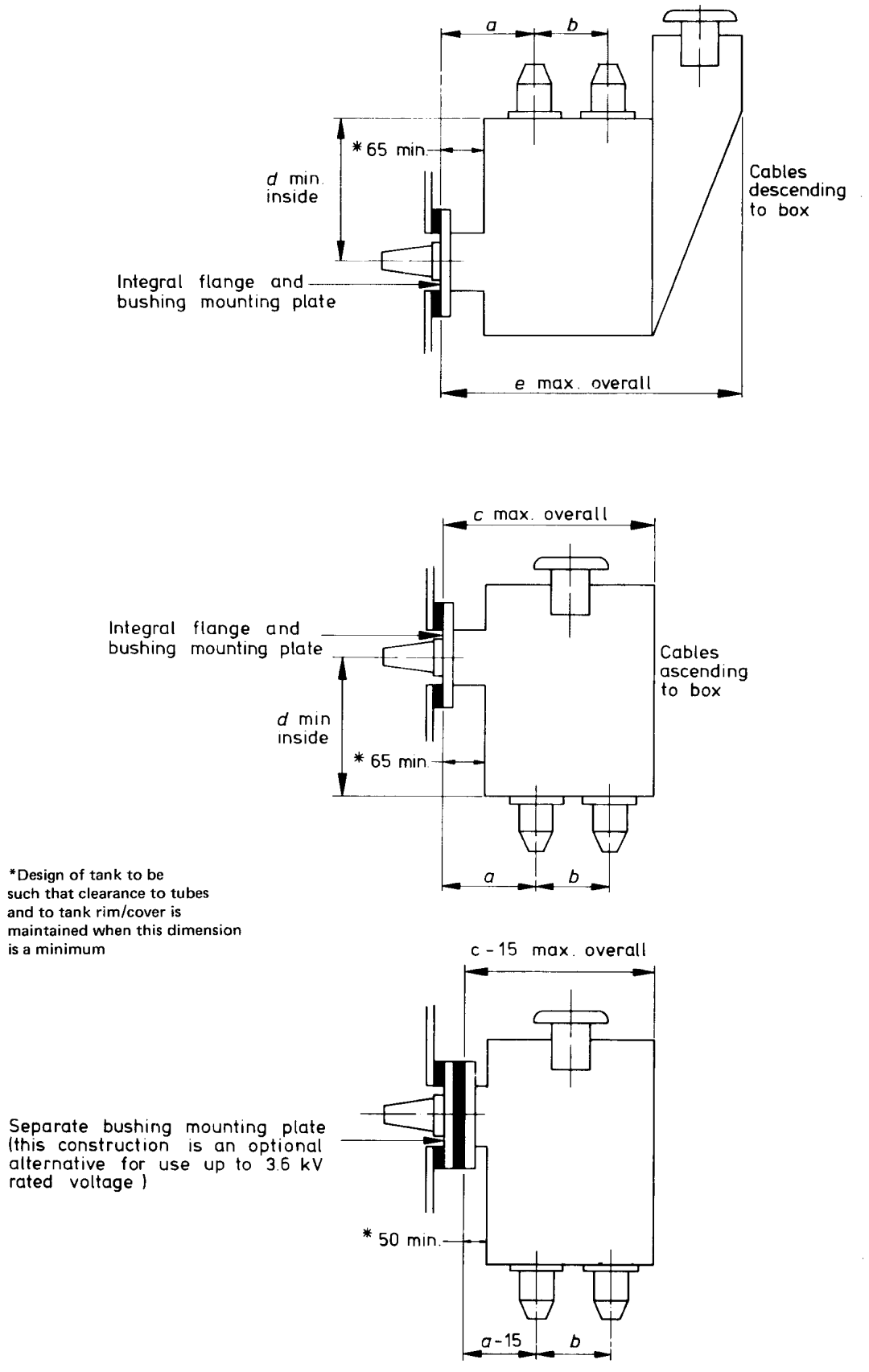
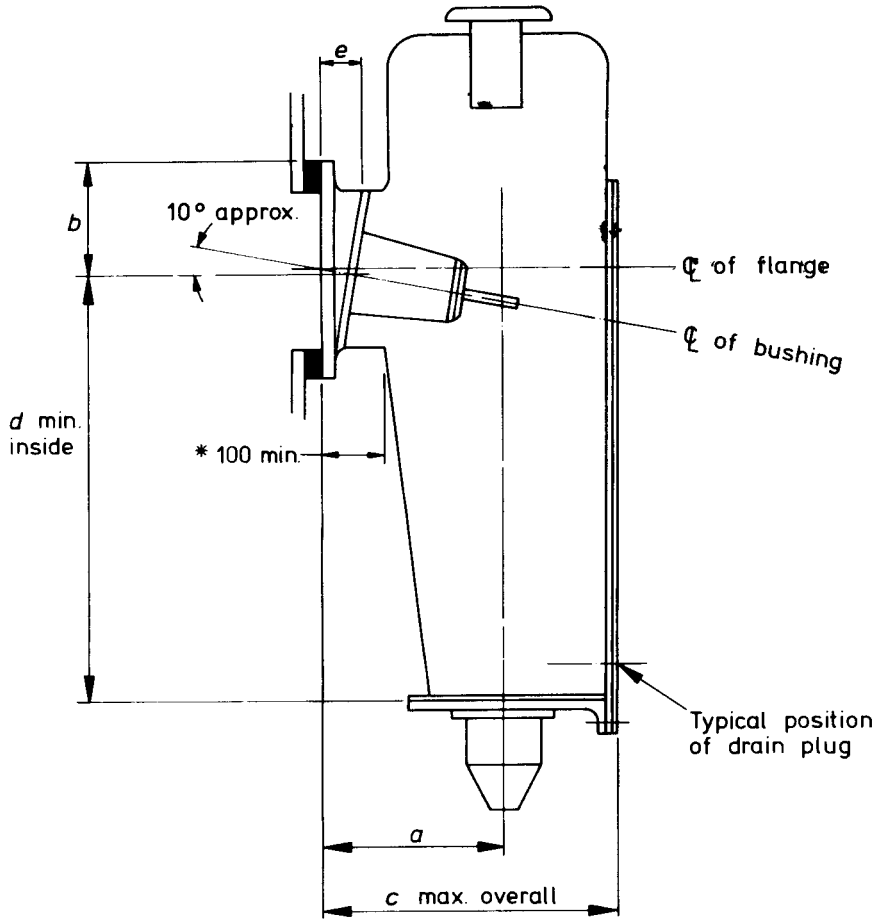


Figure 27 — Assembly of filling orifice



All dimensions are in millimetres.

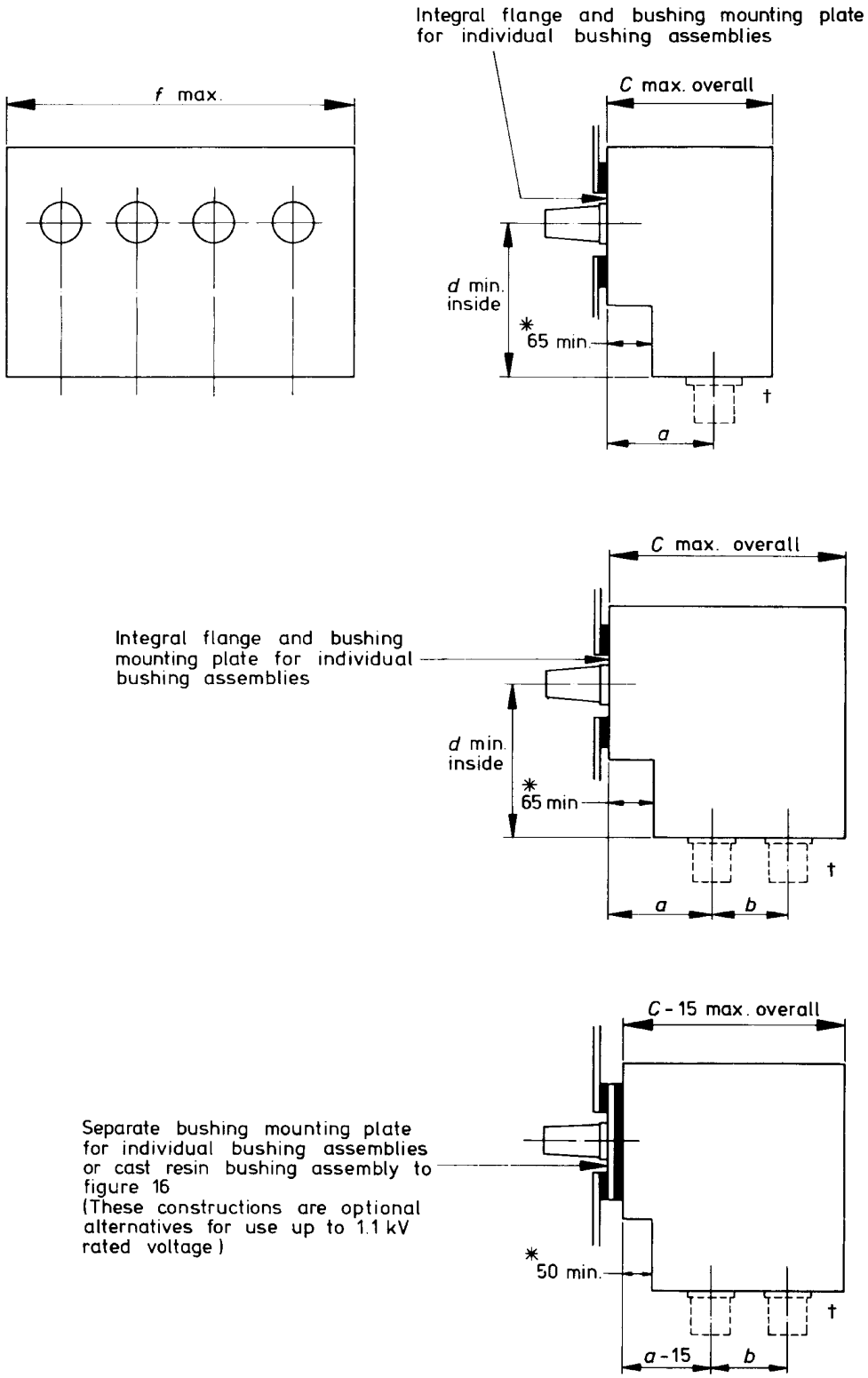
Figure 28 — Shell dimensions for filled boxes (for use up to 12 kV rated voltage, see Table 3, Table 4, Table 5 and Table 7)



*Design of tank to be such that clearance to tubes and to tank rim/cover is maintained when this dimension is a minimum.

All dimensions are in millimetres.

Figure 29 — Shell dimensions for filled boxes (for use at 24 kV and 36 kV rated voltage, see Table 6)



*Design of tank to be such that clearance to tubes and to tank rim/cover is maintained when this dimension is a minimum.

†Mechanical (compression) cable gland or box base cleat as required.

All dimensions are in millimetres.

Figure 30 — Shell dimensions for unfilled boxes with cast resin bushing assemblies in accordance with Figure 16 for use up to 1.1 kV rated voltage and individual bushing assemblies for use up to 3.6 kV rated voltage (see Table 8, Table 9, Table 10 and Table 11)

Appendix A Information to be given with enquiry and order

To enable the manufacturer to provide the correct standard box in accordance with this standard, the following particulars have to be given when enquiring for or ordering cable boxes or equipment fitted with cable boxes:

a) rated voltage;

b) rated current;

c) number of poles;

d) number of cables per phase;

e) type of cable and sectional area and material of conductor;

f) diameter over metal sheathing;

g) diameter over armouring;

h) whether open backed or closed backed construction is required (see **3.2** and Figure 28 and Figure 30);

i) gland details (wiping, mechanical [compression], insulated or uninsulated, with or without island layer);

j) whether cables enter from below or from above;

k) type of box (filled or unfilled) and filling medium;

l) flange facing letter;

m) shell number.

Appendix B Wiping glands for metallic sheathed cables

B.1 General

B.1.1 *Recognized types of gland assembly.* The following types of gland assembly are recognized.

Type A — For unarmoured cables with metallic sheaths where the gland body is not insulated from the equipment casing (see Figure 29).

Type B — For armoured cables with metallic sheaths where the gland body is not insulated from the equipment casing (see Figure 29).

Types C1 and C2 — For unarmoured cables with metallic sheaths but provided with insulation between the equipment casing and the gland body (see Figure 33 and Figure 31, respectively).

Types D1 and D2 — For armoured cables with metallic sheaths but provided with insulation between the equipment casing and the gland body (see Figure 33 and Figure 31, respectively).

Type E1 — For unarmoured cables as type C1 but provided with an island layer (see Figure 34) between the equipment and the gland body. (See Figure 35 for gland type E1.)

Type F1 — For armoured cables as type D1 but provided with an island layer (see Figure 34) between the equipment casing and the gland body. (See Figure 35 for gland type F1.)

The numeral 1 in types C, D, E and F refers to gland insulation of the plate and bush type shown in Figure 37.

The numeral 2 in types C and D refers to gland insulation of moulded body type shown in Figure 35.

B.1.2 *Use of glands with armoured cables.* Gland assemblies B, D1, D2 and F1 with the appropriate armour clamp are suitable for single wire armoured, double wire armoured or tape armoured cables; Figure 41 shows the required range of armour clamps.

B.1.3 *Sizes of glands.* Three gland sizes are recognized; two glands have 4-bolt fixing and are designated X and Y, one gland has 6-bolt fixing and is designated Z. They are illustrated in Figure 31 to Figure 33 and the range of cable sheath diameters appropriate to each gland is given in Table 12.

Table 12 — Gland sizes

Gland sizes	Range of cable sheath diameters	
	Types A and B (uninsulated glands)	Types C, D, E, F (insulated glands)
	mm	mm
X	12 to 51	12 to 46
Y	25 to 78	25 to 72
Z	25 to 94	25 to 87

B.1.4 *Marking.* The glands shall be legibly and permanently marked with the size of the gland (see **B.1.3**).

B.2 Materials and construction

B.2.1 *Glands*

B.2.1.1 *Materials.* The glands are designed for making a plumbed joint to the metallic (normally lead or aluminium) sheath of a cable and shall be made of brass complying with the requirements of BS 1400, reference DCB1 or PCB1.

B.2.1.2 *Construction.* Figure 31 to Figure 33 show the dimensions of the glands. Because of their use with oil or oil-based compound filled cable boxes, all glands shall be of a construction to avoid porosity, e.g. die formed.

Glands shall have all edges and corners rounded and be supplied untinned.

The face of the earth boss shall be flat to facilitate good contact between the gland and the earth bond.

B.2.2 ***Armour clamps***

B.2.2.1 *Materials.* The armour clamps shall be made of steel and after manufacture a metallic anti-corrosion finish shall be applied.

B.2.2.2 *Construction.* Figure 41 shows the dimensions of the required range of armour clamps.

B.2.3 ***Island layers***

B.2.3.1 *Materials.* The island layer shall be made of non-ferrous metal and, due to its possible use with oil or oil-based compound, shall be of a construction to avoid porosity (e.g. die formed) and have all edges and corners rounded.

B.2.3.2 *Construction.* The faces of the earth bosses shall be flat to facilitate good electrical contact with the earth bond or short-circuiting strap.

NOTE It is not necessary to use island layers to check insulation when a moulded insulator as shown in Figure 35 is used.

B.2.4 *Insulation.* The moulded insulator shown in Figure 35 shall be made of a suitable epoxy resin or a material having equivalent properties.

The plates shown in Figure 37 shall be made of black cotton-filled phenolic moulding resin complying with the requirements of type MS of BS 771 or a material having equivalent properties.

The bushes shown in Figure 37 shall be made of a suitable black polyamide nylon or a material having equivalent properties.

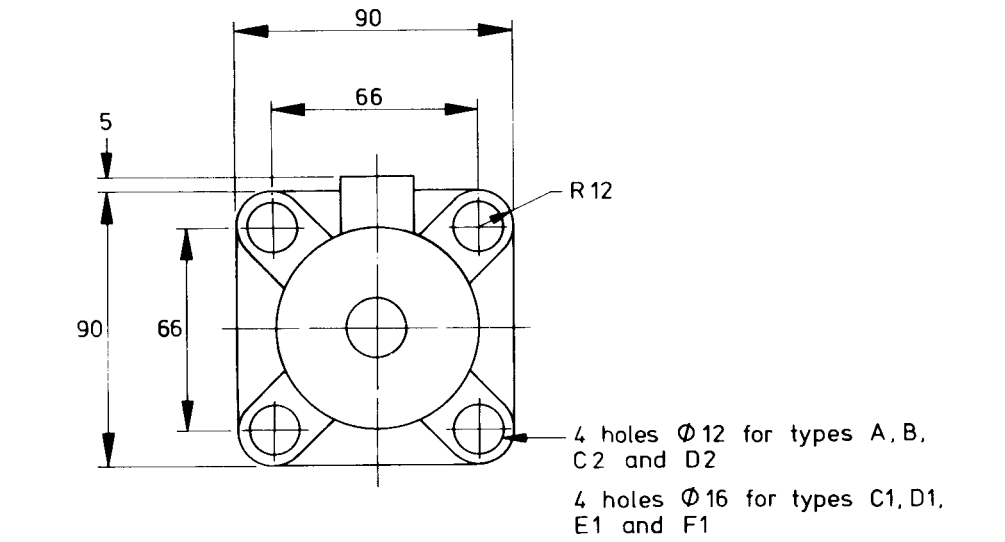
Insulation assemblies shall not be adversely affected by compounds having a pouring temperature not exceeding 160 °C.

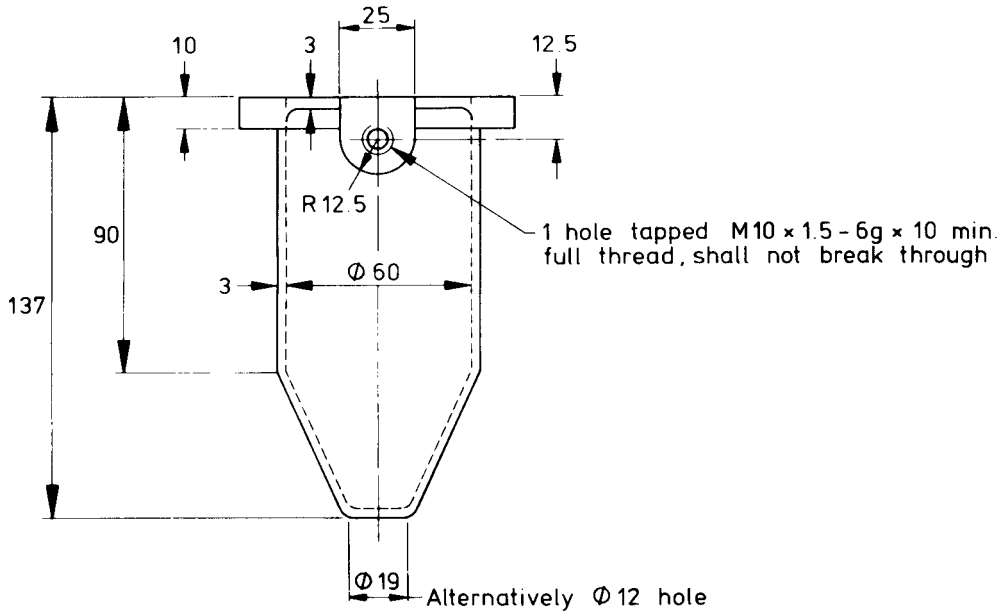
B.3 Oil tightness performance. Glands shall be capable of withstanding a pressure of 0.7 bar gauge for 12 h, during which time no leakage shall occur.

NOTE Generally, a routine oil tightness test is made on cable box gland combinations for filling with oil or oil-based compound, assembled as in service as far as practicable.

B.4 Gland insulation performance. The glands, when assembled with the largest applicable diameter cable, shall be capable of withstanding for 1 min without breakdown a voltage of 2 kV a.c. or 5 kV d.c. between the gland and the body of the box or between the gland and the island layer, and between the island layer and the box when fitted with plate and bush type insulation (see Figure 37, Figure 38 and Figure 40).

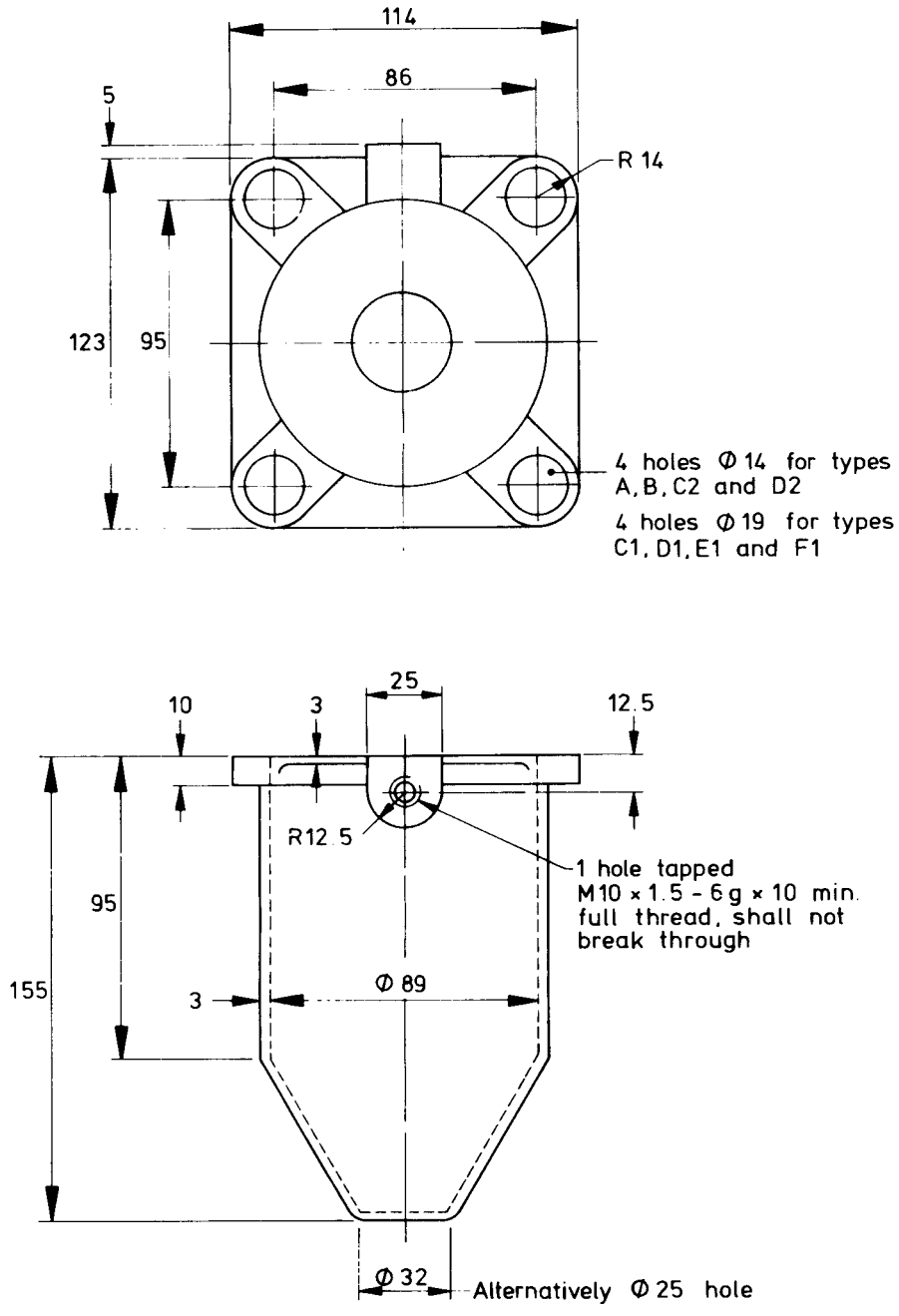
Where moulded insulators as detailed in Figure 35 are used, each insulator, when assembled as in service, shall be capable of withstanding a d.c. voltage test of 10 kV applied for 1 min. The moulded insulator shall be capable of withstanding a cantilever loading of not less than 500 Nm for 1 min without any evidence of failure or incipient failure.





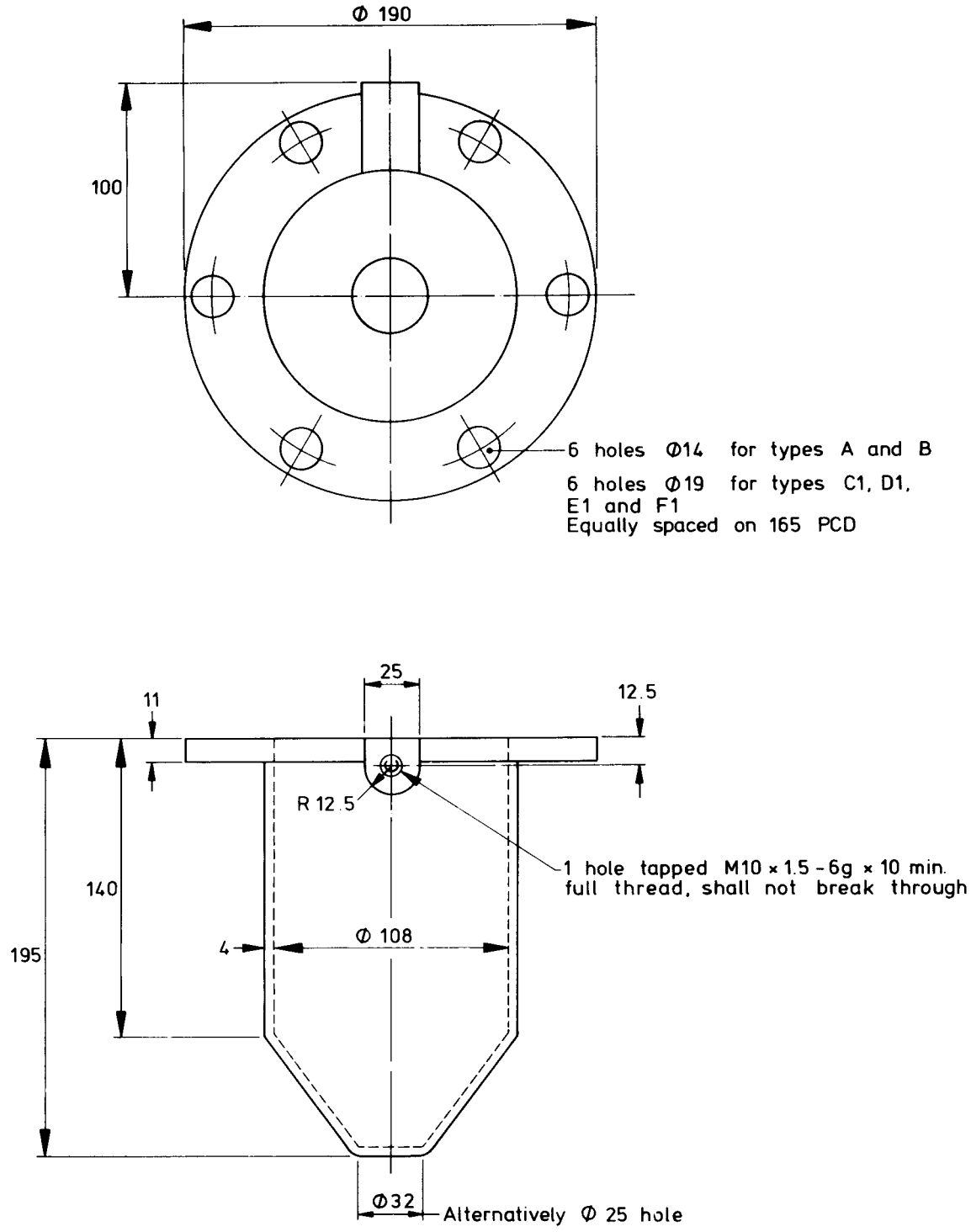
All dimensions are in millimetres.

Figure 31 — Gland size X



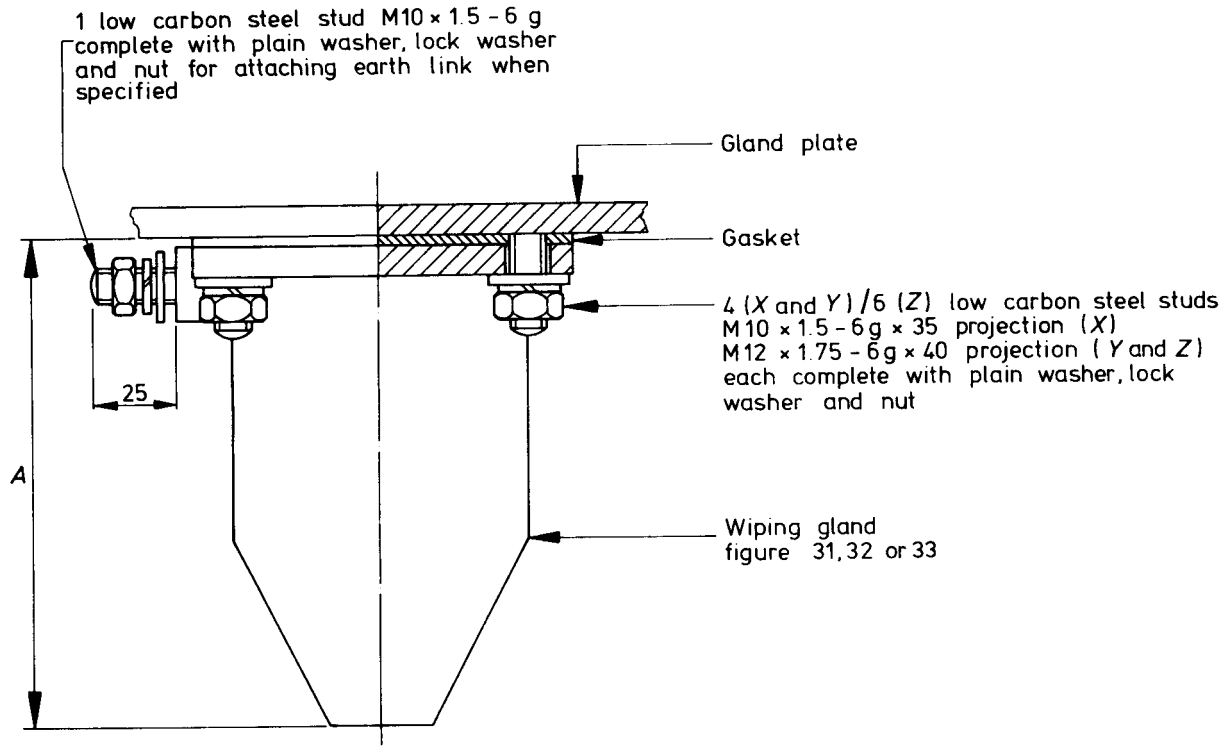
All dimensions are in millimetres.

Figure 32 — Gland size Y



All dimensions are in millimetres.

Figure 33 — Gland size Z

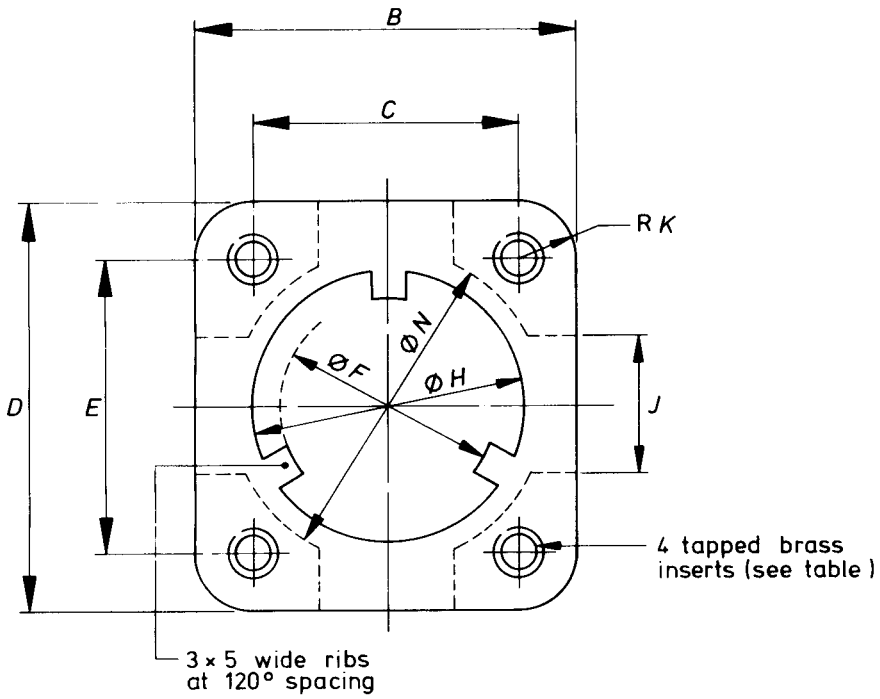


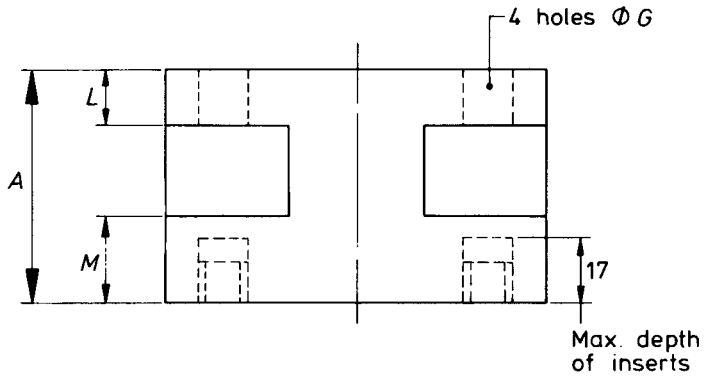
Gland size	*A*
X	140
Y	158
Z	198

NOTE The dimension *"A"* allows 3 mm for thickness of compressed gasket.

All dimensions are in millimetres.

Figure 34 — Typical arrangement of uninsulated gland assembly types A and B (sectioned to show gland fixings)

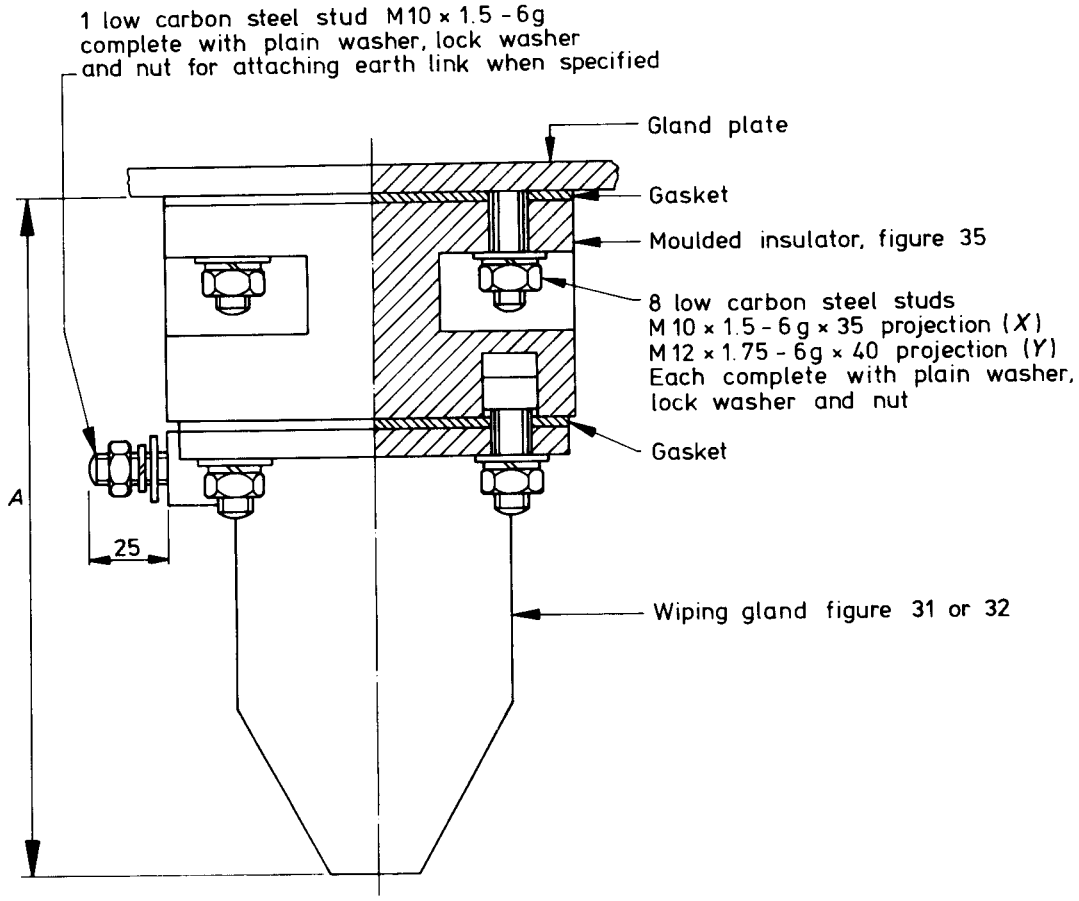




Gland size	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*	*L*	*M*	*N*	Tapping for inserts
X	63	95	66	95	66	50	12	60	32	14.5	16	22	73	M10 × 1.5 – 6g × 12 deep
Y	76	124	86	133	95	78	14	88	44	19	19	29	102	M12 × 1.75 – 6g × 12 deep

All dimensions are in millimetres.

Figure 35 — Moulded insulator for gland assembly types C2 and D2

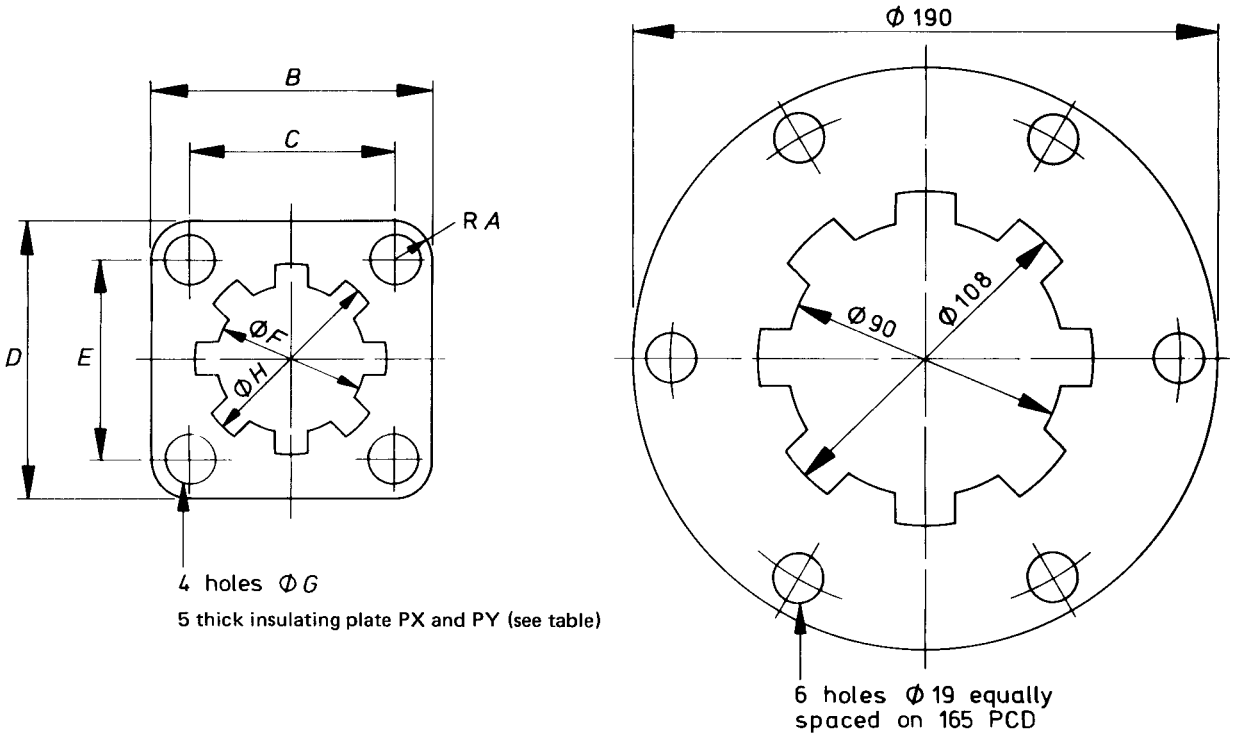


Gland size	*A*
X	206
Y	237

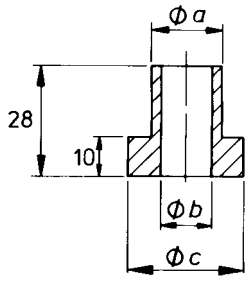
NOTE The dimension *"A"* allows 6 mm total for thickness of compressed gaskets.

All dimensions are in millimetres.

Figure 36 — Typical arrangement of insulated gland assembly (utilizing moulded insulator) types C2 and D2 (sectioned to show gland and insulator fixings)



Insulating plate	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
PX	12	90	66	90	66	48	16	60
PY	14	114	86	123	95	75	19	90



Insulating bush
Type A (M10 fastener)
Type B (M12 fastener)

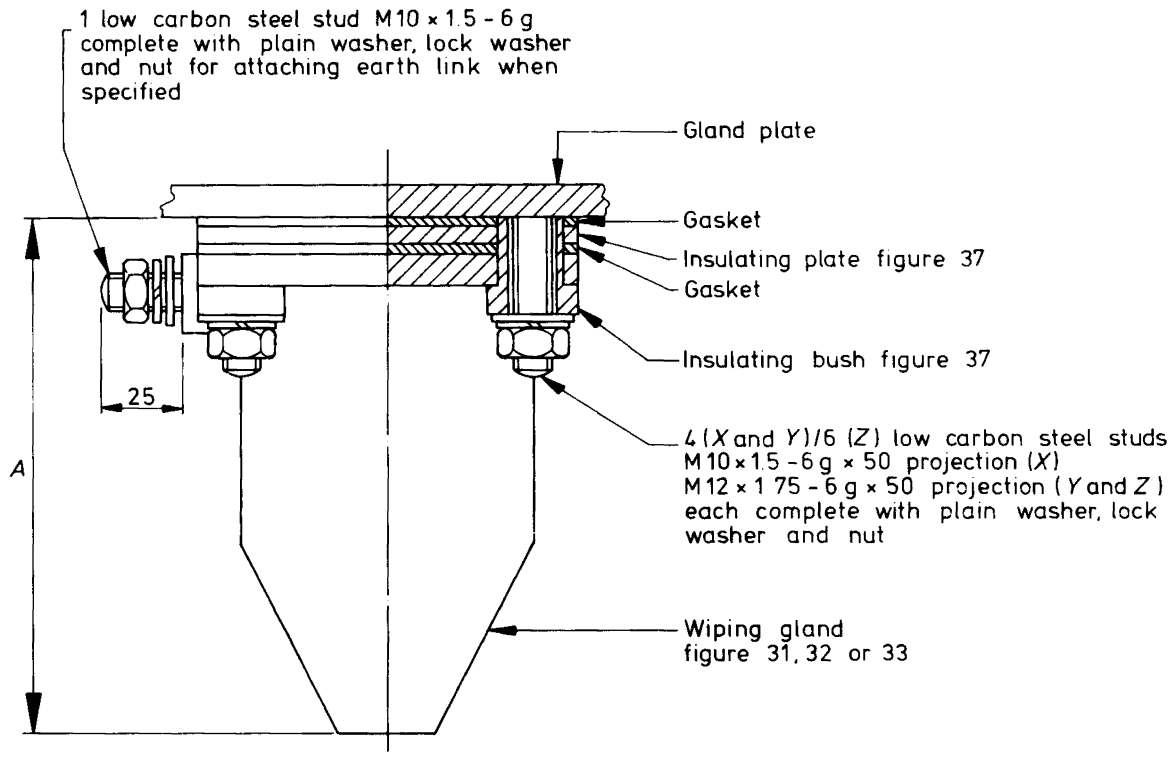
Insulating bush	*a*	*b*	*c*
A	15	11.2	22
B	18	14	28

Gland size	Insulating plate	Insulating bush
X	PX	A
Y	PY	B
Z	PZ	B

NOTE So that the filling medium can run freely into the gland no more than half the minimum area of the annulus between the bore of the gland and the maximum cable sheath diameter is to be taken up by the insulating plate.

All dimensions are in millimetres.

Figure 37 — Insulation for gland assembly types C1, D1, E1 and F1

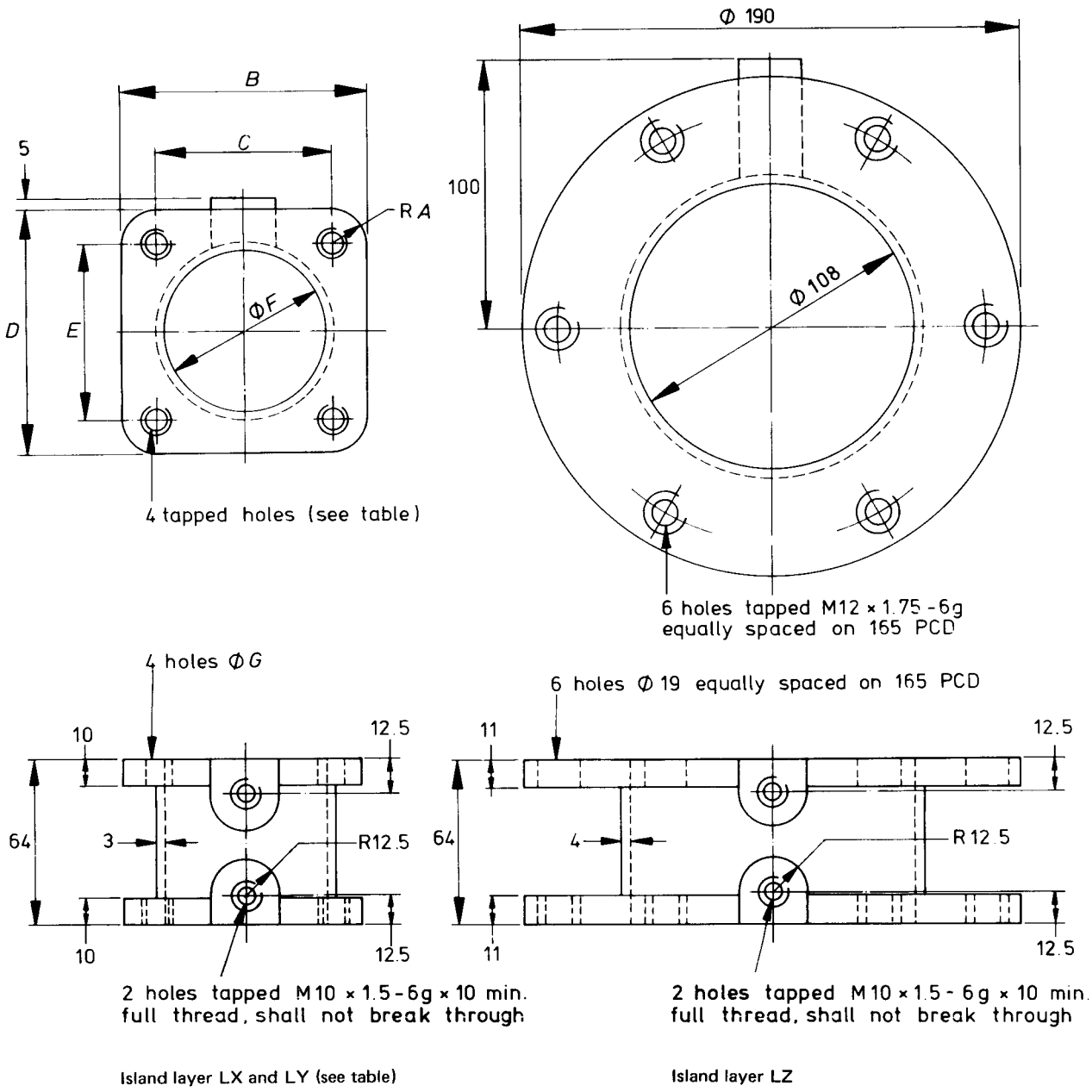


Gland size	*A*
X	148
Y	166
Z	206

NOTE The dimension *"A"* allows 6 mm total for thickness of compressed gaskets.

All dimensions are in millimetres.

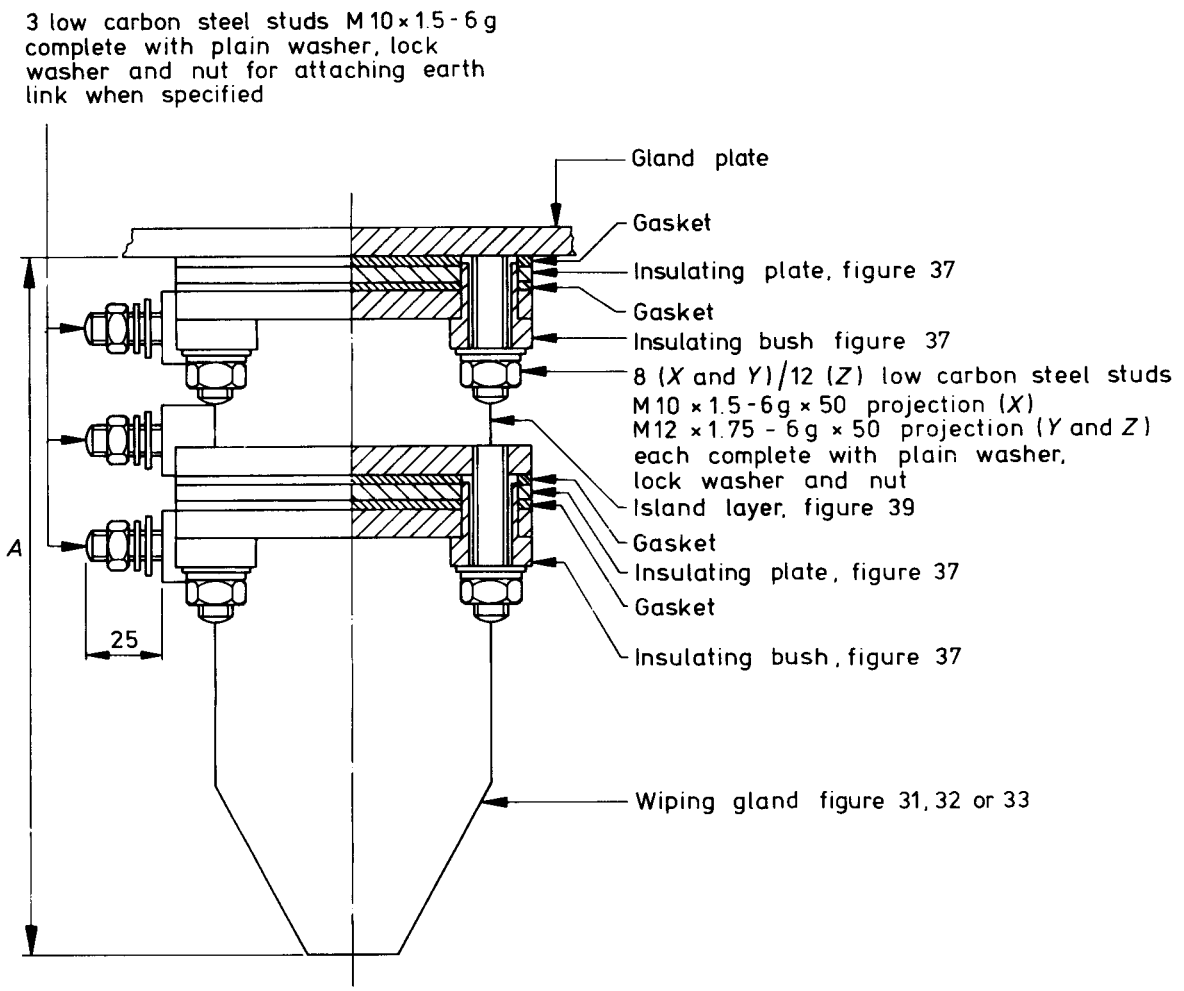
Figure 38 — Typical arrangement of insulated gland assembly (utilizing insulating plate and bushes) types C1 and D1 (sectioned to show gland fixings)



Island layer size	*A*	*B*	*C*	*D*	*E*	*F*	*G*	Tapped holes
LX	12	90	66	90	66	60	16	M10 × 1.5 – 6g
LY	14	114	86	123	95	90	19	M12 × 1.75 – 6g

All dimensions are in millimetres.

Figure 39 — Island layers for gland assembly types E1 and F1

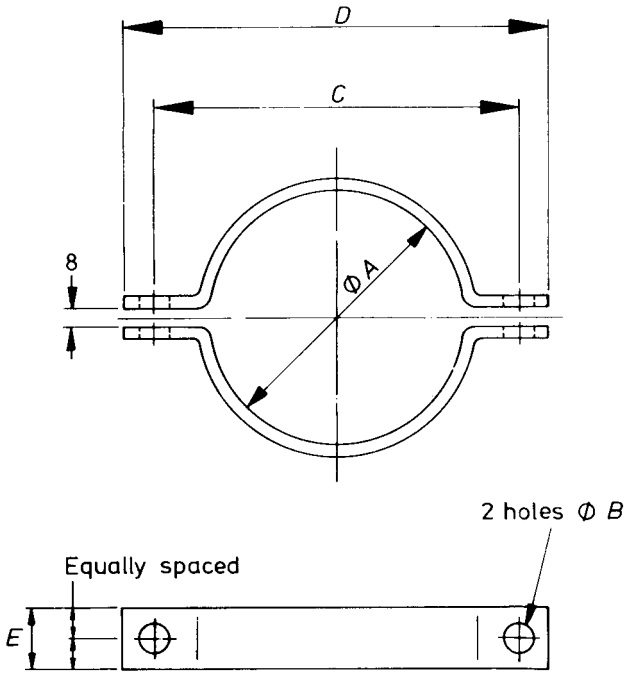


Gland size	*A*
X	223
Y	241
Z	281

NOTE The dimension *"A"* allows 12 mm total for thickness of compressed gaskets.

All dimensions are in millimetres.

Figure 40 — Typical arrangement of insulated gland assembly with island layer (utilizing insulating plates and bushes) types E1 and F1 (sectioned to show gland and island layer fixings)



Armour clamp size	*A*	*B*	*C*	*D*	*E*
CX	73	12	117	142	25
CY	103	12	146	171	25
CZ	123	14	172	202	30

All dimensions are in millimetres.

Figure 41 — Armour clamps

Publications referred to

BS 91, *Electric cable soldering sockets.*
BS 148, *Insulating oil for transformers and switchgear.*
BS 171, *Power transformers.*
BS 223, *High-voltage bushings.*
BS 381C, *Colours for specific purposes.*
BS 771, *Phenolic moulding materials.*
BS 923, *Guide on high-voltage testing techniques.*
BS 1400, *Copper alloy ingots and copper alloy castings.*
BS 1858, *Bitumen-based filling compounds for electrical purposes.*
BS 1872, *Electroplated coatings of tin.*
BS 3643, *ISO metric screw threads.*
BS 3692, *ISO metric precision hexagon bolts, screws and nuts.*
BS 3816, *Cast epoxide resin insulating material for electrical applications at power frequencies.*
BS 4320, *Metal washers for general engineering purposes.*
BS 4963, *Tests on hollow insulators for use in high voltage electrical equipment.*
BS 5622, *(IEC 71-1) Guide for insulation co-ordination.*
BS 5622-1, *Terms, definitions, principles and rules.*
BS 6121, *Mechanical cable glands for elastomer and plastics insulated cables.*
BS 6346, *PVC-insulated cables for electricity supply.*
BS 6480, *Impregnated paper-insulated cables for electricity supply.*

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL