

CONFIRMED
NOVEMBER 1979

Specification for

Boxes for the enclosure of electrical accessories

UDC 621.3-758

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British Electric Conduit Systems Manufacturers	Electrical Power Engineers Association
British Plastics Federation	Fire Offices Committee
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Electrical Association for Women	Women's Advisory Committee of BSI

This British Standard, having been approved by the Electrical Industry Standards Committee, was published under the authority of the Executive Board on 31 December 1970

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The following BSI references relate to the work on this standard:
Committee reference ELE/4/19
Draft for comment 67/20411

ISBN 580 06416 6

Amendments issued since publication

Amd. No.	Date	Comments
838	January 1972	
1081	January 1973	
5192	January 1988	
5930	May 1988	
6347	August 1991	Indicated by a sideline in the margin

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Foreword

This standard makes reference to the following British Standards:

BS 229, *Flameproof enclosure of electrical apparatus*.

BS 2817, *Types of enclosure of electrical apparatus*.

BS 4568, *Steel conduit and fittings with metric threads of ISO form for electrical installations. Part 2 — Fittings and components*.

This British Standard has been compiled to meet the request for a specification for boxes for general use in electrical installations of domestic, industrial, business, municipal, hospital and similar buildings.

At the time of publication the screw thread specified for fixing the accessories in the boxes is the 4BA thread currently in use. With the publication of Amendment No. 2 on 1 January, 1973, only M3.5 threads may be used for this purpose.

The boxes specified are intended for wiring systems and accessories in general use, installed within the service conditions specified.

The termination requirements of the various wiring systems at the boxes have not been specified but boxes of the types specified in this British Standard are available from manufacturers with suitable attachments and knockouts to provide for the varying systems in general use.

The 35 mm and 47 mm deep boxes specified in BS 1363¹⁾ have been incorporated in this British Standard, together with the 16 mm boxes specified in BS 3676²⁾.

Requirements have been specified with regard to construction and materials to be used in the manufacture of boxes, together with tests for ensuring adequate mechanical strength and durability during service conditions specified.

Section 2 of this specification relates to 16 mm deep boxes with lugs providing for angular adjustment.

Section 3 of this specification relates to boxes of greater than 16 mm internal depth with one or more adjustable lugs.

A range of architrave boxes is included.

Additional boxes primarily intended for use with steel conduit are specified in BS 4568, *Steel conduit and fittings with metric threads of ISO form for electrical installations— Part 2: Fittings and components*, which is the metric revision of part of BS 31.

This British Standard does not supersede BS 2817, *Types of enclosure of electrical apparatus*, or BS 229, *Flameproof enclosure of electrical apparatus*.

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 and ii, pages 1 to 28, an inside back cover and a back cover.

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¹⁾ BS 1363, *13 A plugs, switched and unswitched socket outlets and boxes*.

²⁾ BS 3676, *Switches for domestic and similar purposes (for fixed or portable mounting)*.

1 General requirements for boxes with fixed lugs

1.1 Scope

This British Standard specifies requirements for boxes intended to contain one or more electrical accessories and to be recessed into a wall or ceiling or similar flat surfaced structure. Some boxes may also be suitable for surface mounting (see 1.5.7).

Section 1 of the specification provides for a range of box sizes based on a defined unit of area measurement with the permissible depths of box for each of the sizes. Position and numbers of accessory fixing lugs, together with the threaded fixing holes, for mounting electrical accessories are specified. Section 2 specifies boxes with provision for lugs allowing angular adjustment of the accessory and with threaded M3.5 holes for accessory fixing. Section 3 specifies boxes with provision for one or more lugs allowing angular adjustment of the accessory in boxes of greater than 16 mm internal depth.

Interchangeability dimensions for architrave boxes, based on a different defined unit of area, are also specified.

1.2 Definitions

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

1.2.1

electrical accessory

any device, other than a lighting fitting, associated with the wiring and current-using appliances of an installation; for example, a switch, a fuse, a socket-outlet or switched socket-outlet, a lampholder or a ceiling rose³⁾

1.2.2

electrical accessory box

a box without cover or lid suitable for containing one or more electrical accessories and for recessing into or mounting on a wall or ceiling or similar flat surfaced structure

1.2.3

electrical accessory enclosure

an electrical accessory box complete with a protective cover or lid. The protective cover may be part of the electrical accessory

1.2.4

unit area

a unit of area in the form of a module having sides of length equal to 60.3 mm. Box sizes are expressed as multiples of this module, e.g. UA1

NOTE This definition does not apply in the case of architrave boxes.

1.2.5

electrical accessory fixing lug and screw thread

the provision made within the box for mounting or suspending the electrical accessory clear of the base of the box, it is threaded M3.5 and it may extend to the base of the box

1.2.6

knockouts

the portion of the side or base of a box which can readily be removed when required

1.2.7

adjustable lug

an accessory fixing lug with provision for movement for the purpose of aligning the accessory

1.2.8

architrave box

an electrical accessory box intended for the installation of a special range of electrical accessories where the space available is insufficient for a standard accessory

1.3 Service conditions

The boxes shall be suitable for use in an atmosphere not subject to excessive pollution by smoke, chemical fumes, salt-laden spray, etc.

In addition boxes of insulating material shall be suitable for use in an ambient temperature having a peak value not exceeding 40 °C with an average value not exceeding 35 °C over 24 h periods.

NOTE 1 Under normal conditions of service the available cooling air is subjected to natural atmospheric variations of temperature and hence the peak temperature occurs only occasionally during the hot season, and on those days when it does occur it does not persist for long periods. Meteorological records indicate that a temperature of at least 10 Centigrade degrees below the peak temperature will occur within the 24 h period, and that the average temperature over any 24 h period that includes the peak temperature will be at least 5 Centigrade degrees below the peak value.

NOTE 2 Boxes which comply with this specification may be unsuitable for exposure to conditions of extreme pollution without further protection. Where service conditions differ appreciably from those specified above, the manufacturer should be consulted in selecting boxes of appropriate material and finish. Guidance regarding the finish of ferrous boxes, together with corresponding tests, is given in 1.10. The purchaser should indicate the required degree of protection.

1.4 Marking

1.4.1 Every box shall be indelibly marked with the following particulars:

- 1) the number of this British Standard, i.e. BS 4662,
- 2) identifying name and/or trade mark.

³⁾ This definition generally conforms with that in the Regulations for Electrical Equipment of Buildings published by the IEE.

1.4.2 Additional information regarding the type may be included, expressed as a number of unit areas, number of lugs and depth, e.g. 1/2/16.

1.5 Construction and materials

1.5.1 The design dimensions and construction of the box shall comply with any type shown in Figure 1a to Figure 7.

1.5.2 Boxes of metal or insulating material shall be sufficiently strong to resist mechanical damage and the service conditions specified. Boxes shall be so constructed that they cannot readily be deformed, that they cannot be brought into contact with any live parts and that they do not allow access to any live parts when the installation has been completed by the fixing in position of the accessories.

The material used shall not support combustion.

NOTE A test for resistance to combustion is under consideration.

Boxes shall also be tested in accordance with 1.7 to 1.10.

1.5.3 The thickness of the walls and base of all types of boxes, excluding provision for conduit or cable entries and local reductions above the fixing lugs, shall be not less than that specified in Table 1.

1.5.4 Steel boxes of folded construction in material of less than 1.5 mm thickness and above 16 mm internal depth, shall have the sides tied at the corners or joined together to ensure adequate strength and rigidity. Maximum external dimensions exclude any corner ties or attachments which may be necessary for the construction of the box.

Table 1 — Minimum wall thickness of boxes

Material	16 mm internal depth mm	Above 16 mm internal depth mm
Steel	0.9 (1.0) nominal	1.1 (1.25) nominal
Cast iron	2.0	2.3
Insulating material	1.5	2.0

1.5.5 All sheet metal threaded to receive a screw shall have sufficient thickness to allow not less than two full threads⁴⁾.

In insulating materials, there shall be not less than four full threads.

Except in the case of architrave boxes, provision shall be made to allow screws to be inserted for a minimum distance of 15 mm from the front face of the box.

1.5.6 Boxes shall be provided with fixing lugs in opposite sides of the box and their numbers and position shall be as specified in Figure 1a to Figure 7.

All fixing lugs shall be threaded M3.5 and their shape and method of forming shall be to the manufacturer's preference providing that they accept the appropriate contour gauge shown in Figure 8. In boxes 16 mm deep where lugs of insulating material are used, the lugs shall extend to the bottom of the box and shall shield the screw against inadvertent contact with cables.

Threaded holes in lugs shall comply with the test described in 1.8.

1.5.7 Provision shall be made for a hole or holes in the base of the box for securing it to a mounting surface. The hole(s) shall be not less than 4.8 mm diameter. The fixing hole(s) in boxes made of insulating material shall be situated in adequately strengthened sections of the moulding.

A box which is also suitable for surface mounting shall not have holes or gaps in its sides other than those expressly provided for cable entry.

1.5.8 Provision shall be made, unless otherwise specified by the purchaser, for at least one cable entry in all types of boxes.

1.5.9 In boxes UA 1/2/16 one cable entry shall be at right angles to the centre line through the fixing holes for the accessory.

NOTE Additional cable entries may be provided to the manufacturer's preference.

1.5.10 The dimensions of knockouts in boxes for the reception of conduit shall be the nominal conduit size +0.25 mm with a tolerance of -0.0 +0.50 mm.

NOTE This does not exclude the provision of entries of forms other than circular.

A knockout in a metal box shall sustain a gradually applied load equivalent to a weight of 4.5 kg, applied at right angles to any point upon its surface by a mandrel with a 6 mm diameter flat end.

Knockouts in boxes shall be so located that lock-nuts or bushes when clamped in position will seat satisfactorily against the walls of the box.

1.6 Earthing

Provision shall be made for the addition of means for the effective earthing of all metal boxes.

In boxes of insulating material provision shall be made for fixing a terminal for the earth continuity conductor(s). The means provided shall be rigidly fixed to the box.

⁴⁾ Special attention is drawn to this requirement for boxes where the wall thickness is less than 1.25 mm nominal.

Any terminal or similar device for earthing, fixed in the box of 16 mm depth shall be entirely outside a circle of 36.25 mm radius, struck from the centre of any unit area of the box, and preferably in a corner of the box. Any arrangements provided for the optional fitting of such a terminal or similar device, shall be such that the appropriate terminal or device when fitted in the intended manner, shall be entirely outside the prescribed circle.

Earthing terminals within architrave boxes shall be positioned so as not to encroach on the minimum free space requirement of the box. Compliance shall be checked by the use of the appropriate gauge shown in Figure 11. The appropriate gauge shall insert fully into the appropriate box without undue force.

1.7 Type tests

1.7.1 All tests described in this specification shall be type tests.

1.7.2 The manufacturer shall provide a certificate at the purchaser's request as evidence that the box complies with all the relevant requirements of this standard.

1.7.3 Certificates of the type tests, with certified detailed drawings of the type of box, shall be held available by the manufacturer, together with a record of any alterations, whether essential or not, which have been made to the box since the tests were carried out.

1.7.4 Type tests may be made by the manufacturer or he may arrange for a recognized authority to make any type test on his behalf.

1.7.5 The tests described in 1.8, 1.9 and 1.10 shall be carried out on separate sets of boxes of three samples each.

1.7.6 Boxes shall be deemed not to comply with this specification if there are more failures than one sample in any one of the tests. If one sample fails in a test that test shall be repeated on a second set of three boxes all of which shall then comply with the repeated tests. If any box fails in the retest then all the boxes are deemed to have failed to comply with this specification.

1.8 Mechanical strength

1.8.1 Strength of lugs

A rigid metal plate shall be placed across the front of the box with a clearance of 2.5 mm minimum, between the top face of the lug and the rear face of the plate. A M3.5 screw through the plate shall be inserted for the specified minimum engagement and shall be tightened, once only, with a minimum torque of 0.4 Nm.

The lug shall remain in serviceable condition.

1.8.2 Safety on impact

1.8.2.1 For the purposes of the mechanical strength test, the apparatus and methods described in 1.8.2.2 to 1.8.2.7 shall apply to boxes of insulating material.

1.8.2.2 Boxes are tested with the impact test apparatus shown in Figure 12. The pendulum consists of a steel tube suspended in such a way that it swings only in a vertical plane. A hammer of mass 0.15 kg is rigidly fixed to the lower end with its axis 1 m from the axis of suspension. The striking element is a hemispherical face made of hard wood (hornbeam or European ash) and having a radius of 10 mm. The design of the apparatus is such that a force between 1.9 N and 2.0 N has to be applied to the face of the hammer to maintain the pendulum in a horizontal position.

1.8.2.3 The support for the sample is a sheet of plywood 8 mm thick and 250 mm square without any metallic backplate. The apparatus is fixed to a solid wall of brick, stone, concrete or the like.

1.8.2.4 The support of the sample is such that the sample can be so placed that the point of impact lies in the vertical plane containing the suspension axis of the pendulum. The sample can be turned about an axis perpendicular to the support, the sample can be turned about a vertical axis and the sample can be moved horizontally and vertically.

1.8.2.5 Boxes are mounted on the support which is described in 1.8.2.3.

1.8.2.6 The sample is so placed that the point of impact lies in the vertical plane containing the suspension axis of the pendulum. For all tests the hammer falls from a height of 150 mm measured vertically between the point of impact on the sample and the face of the hammer at the point of release. Ten blows are applied to points evenly distributed over the sample. None of the blows shall be applied within 5 mm of any knockout.

1.8.2.7 A sample shall be deemed to comply with the requirements of this test even though, during the test, cracks may appear and small pieces may become detached, provided that the detachment of such pieces does not permit any access to the interior of the box when it is covered with a flat plate placed across the front of the box.

1.9 Stability at elevated temperatures

This test shall apply to boxes of insulating material. The box shall be mounted in an oven by means of fixing screw(s) passing through the normal fixing hole(s) in the base of the box.

A rigid metal plate shall be placed across the front of the box with a clearance of 2.5 mm minimum, between the top face of the lug and the rear face of the plate. The plate shall be attached by means of two M3.5 screws inserted in opposite lugs for a minimum engagement of 4 threads and each shall be tightened, once only with a minimum torque of 0.4 Nm and a load shall be centrally suspended from the plate so that the total mass of the plate and the load is 2.3 kg.

The box shall be maintained at a temperature of 45 ± 5 °C for a period of 48 h.

At the end of the period there shall be no appreciable distortion of the box, and the box shall accept the appropriate gauge shown in Figure 6.

1.10 Resistance to corrosion of steel and cast iron boxes

1.10.1 General requirements

All boxes shall be appropriately protected against rust and corrosion, such protection being applied to both inside and outside of boxes.

(Plain sleeve entries for unscrewed tubing, screwed threads and machined surfaces are excluded from this requirement.)

1.10.2 Test for boxes with ordinary protection

Remove all grease from the parts to be tested by immersion in trichloroethylene for 10 min. Then immerse the parts for 10 min in a 10 % solution of ammonium chloride in water at a temperature of 20 ± 5 °C.

Without drying, but after shaking off any drops, place the parts for 10 min in a box containing air saturated with moisture at a temperature of 20 ± 5 °C.

After the parts have been dried for 10 min in a heating cabinet at a temperature of 100 ± 5 °C, their surface shall show no signs of rust. Traces of rust on sharp edges and any yellowish film removable by rubbing shall be ignored.

1.10.3 Test for boxes with heavy protection

The box to be tested is degreased by immersion in carbon tetrachloride for 10 min and wiped dry with a piece of soft cloth. It is then immersed in a 2 % solution of sulphuric acid in water for 15 s, thoroughly cleaned in running water and again wiped dry with a piece of clean soft cloth.

The sample is then immersed in a solution of copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) in distilled water, having a specific gravity of 1.186 at 20 °C.

Boxes with heavy protection are degreased as described above and then totally immersed in the solution. The solution and the samples are maintained at a temperature of 20 ± 1 °C, without stirring.

NOTE The solution is made by dissolving 360 grammes of crystalline copper sulphate in 1 litre of distilled water, and neutralizing with copper carbonate or copper hydroxide (about 1 g/l). The specific gravity is then checked and adjusted as necessary.

The container shall be such that it will not react with the solution and shall be of such a size as to provide clearance of at least 25 mm between the walls thereof and the sample.

Each sample is immersed 4 times in succession in the same solution, each time for one minute. A fresh solution is used for each sample. After each immersion, the sample is immediately cleaned in running water with a brush to remove any black deposit. The sample is then wiped dry with a piece of clean soft cloth and, except after the fourth immersion, returned to the solution. Care should be taken to clean out all holes and pockets.

After the test, the sample shall show no precipitation of copper which cannot be scrubbed off in running water, if necessary after immersion in a 10 % solution of hydrochloric acid in water for 15 s. Traces of copper precipitation on screw threads, sharp edges and machined surfaces are ignored.

2 Additional requirements for flush switch boxes of 16 mm internal depth fitted with lugs providing for angular adjustment

2.1 Construction

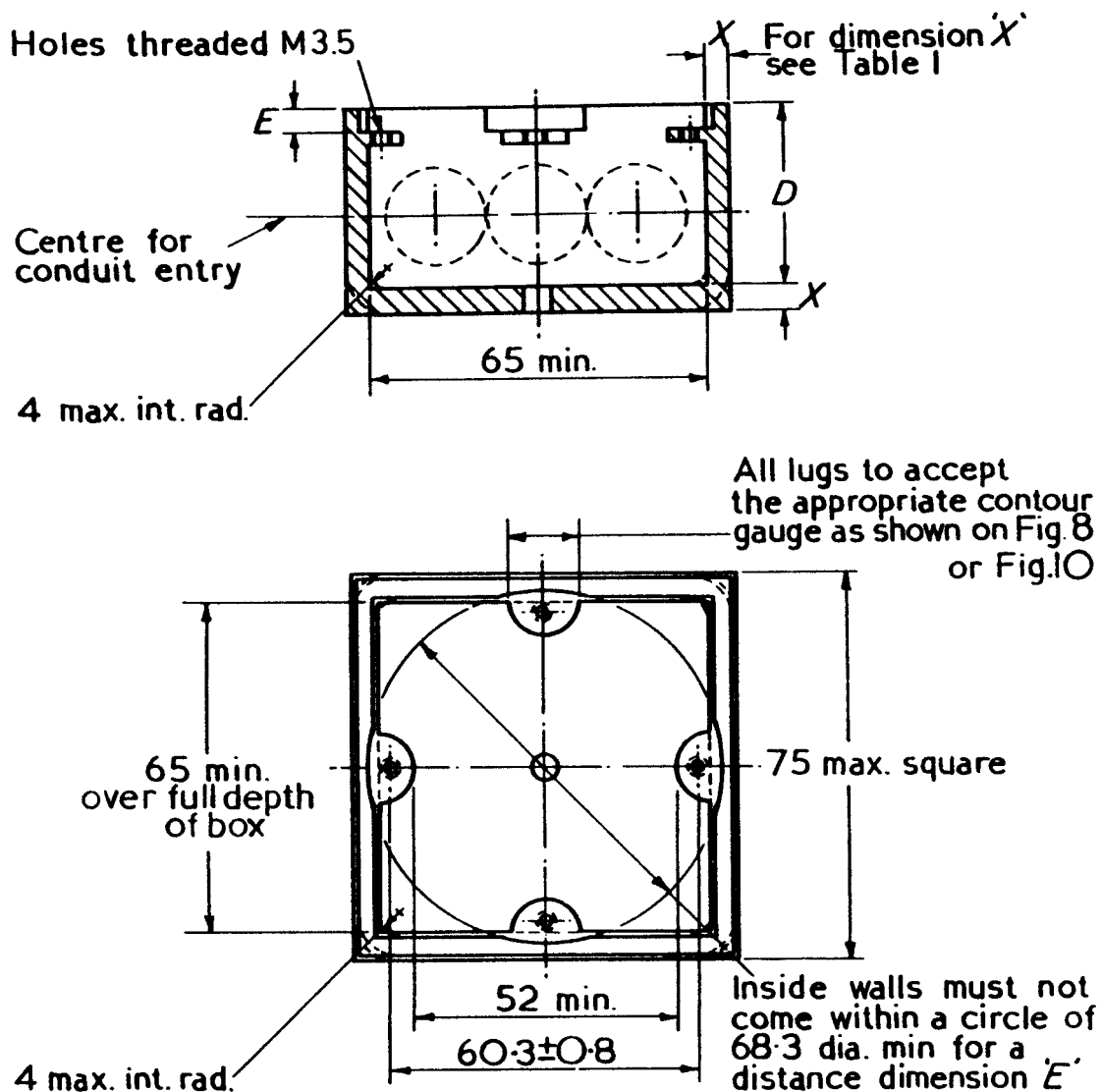
The shape and method of movement of the lugs which contain the M3.5 threaded holes, or the movement of the threaded holes themselves, shall be to the manufacturer's preference, provided the box accepts the appropriate contour gauge shown in Figure 9 and complies with the requirements of the test described in 1.8.1.

3 Additional requirements for flush boxes of greater than 16 mm internal depth fitted with one or more lugs providing for angular adjustment

3.1 Construction

The shape and method of movement of the adjustable lug or lugs which contain the M3.5 threaded hole, or the movement of the threaded hole itself, shall be such that the movement of the threaded hole does not exceed 2 mm either side of the nominal fixing centre line at right angles to it, and such that the adjustable lug and means of support can be accommodated within the gauge shown in Figure 10 at the full extent of the threaded hole movement.

Compliance shall be checked by measurement and by use of the gauge shown in Figure 10.



For 16 mm deep boxes when dimension $E=0$ mm the 68.3 dimension may be 65 min.

This drawing is not intended to govern design except as regards dimensions shown

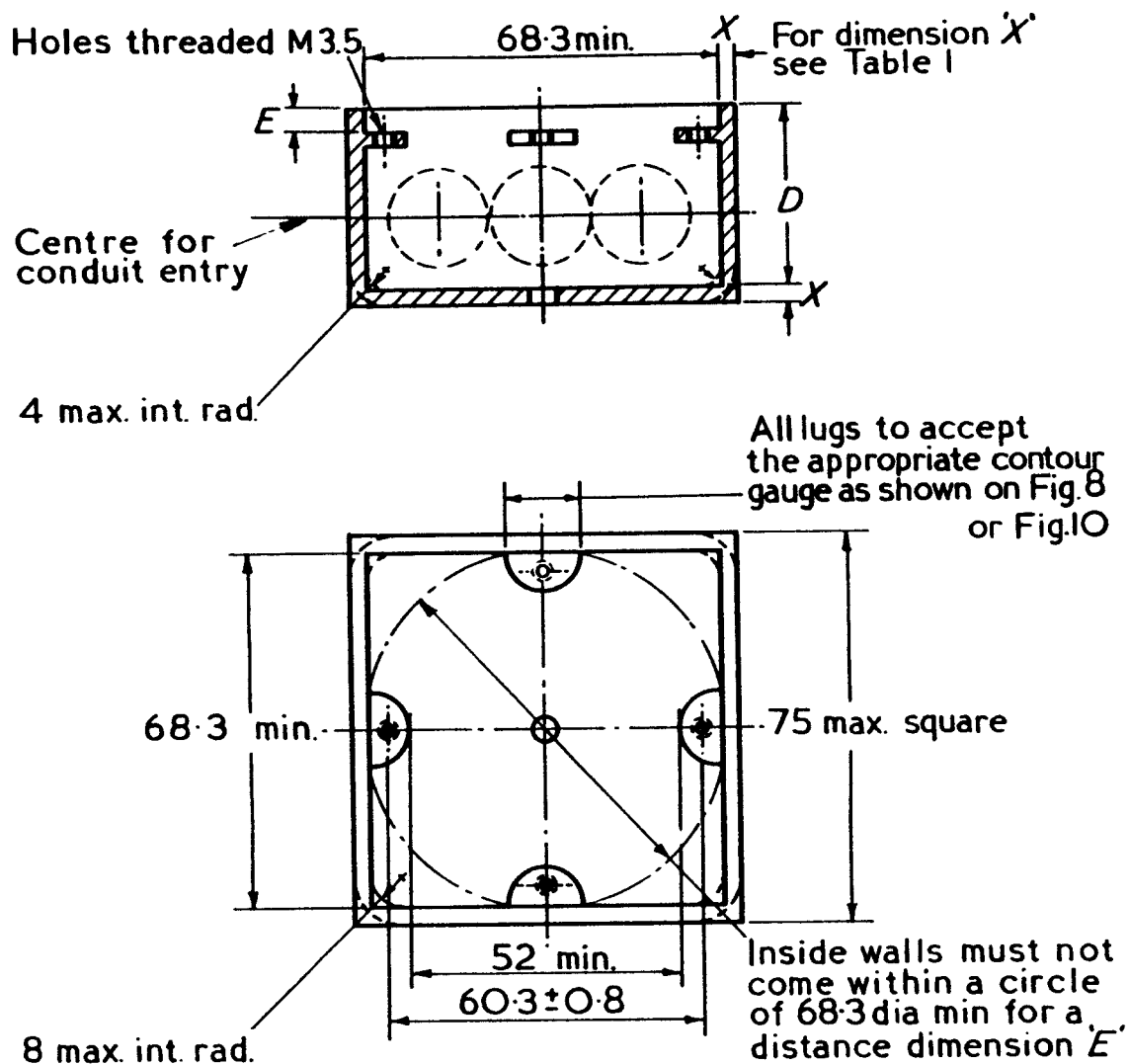
First angle projection

Dimensions are in millimetres

Figure 1a — Electrical accessory box: size UA1
(Cast metal or insulating material)

Dimensions relating to Figure 1a

Size	No. of lugs	D	E
UA1	2	$16 \begin{smallmatrix} +1.0 \\ -0.8 \end{smallmatrix}$	$0 \begin{smallmatrix} +4 \\ -0 \end{smallmatrix}$
UA1	2	$25 \begin{smallmatrix} +1.5 \\ -0.8 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$
UA1	4	$25 \begin{smallmatrix} +1.5 \\ -0.8 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$
UA1	2	$35 \begin{smallmatrix} +1.5 \\ -1.0 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$
UA1	4	$35 \begin{smallmatrix} +1.5 \\ -1.0 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$
UA1	2	$41 \begin{smallmatrix} +2 \\ -2 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$
UA1	4	$41 \begin{smallmatrix} +2 \\ -2 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$
UA1	2	$47 \begin{smallmatrix} +2 \\ -2 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$
UA1	4	$47 \begin{smallmatrix} +2 \\ -2 \end{smallmatrix}$	$5 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix}$



For 16 mm deep boxes with dimension $E=0$ mm the 68.3 dimension may be 65 min.

This drawing is not intended to govern design except as regards dimensions shown

First angle projection

Dimensions are in millimetres

Figure 1b — Electrical accessory box: size UA1

(Steel)