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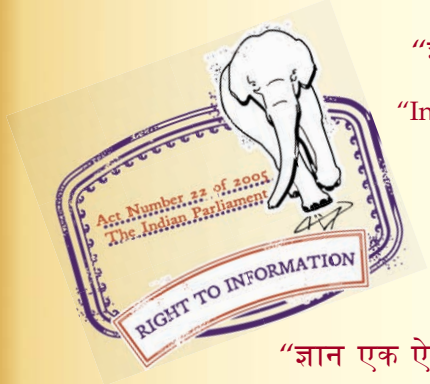
IS 2206-1 (1984): Flameproof electric lighting fittings, Part 1: Well-glass and bulkhead types [ETD 24: Illumination Engineering and Luminaries]



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Indian Standard

SPECIFICATION FOR FLAMEPROOF ELECTRIC LIGHTING FITTINGS

PART 1 WELL-GLASS AND BULKHEAD TYPES

(First Revision)

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Indian Standard

SPECIFICATION FOR FLAMEPROOF ELECTRIC LIGHTING FITTINGS

PART 1 WELL-GLASS AND BULKHEAD TYPES

(First Revision)

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Indian Standard

SPECIFICATION FOR FLAMEPROOF ELECTRIC LIGHTING FITTINGS

PART 1 WELL-GLASS AND BULKHEAD TYPES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 5 October 1984, after the draft finalized by the Illuminating Engineering and Luminaires Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The indigenous manufacture of flameproof lighting fittings for use in hazardous locations has been taken up by manufacturers in view of the rapid industrialization and extensive developments in the field of mines, petrochemicals and other similar industries in the country. Not only it is necessary to test such fittings for their flameproofness, but it is also desirable to test even imported certified flameproof lighting fittings from other countries as there are occasionally important differences in the design, tolerances, and the methods of testing being adopted in those countries. The necessity has, therefore, arisen for an Indian Standard to establish uniform procedures for manufacture and testing of such lighting fittings so as to ensure that they are capable of being used safely in locations where dangerous concentration of flammable gases may occur.

0.3 Grouping of flammable gases and vapour with corresponding maximum permissible dimensions for gaps between joint surfaces and other constructional requirements pertaining to flameproof enclosures are covered under IS : 2148-1981* and therefore, that standard is a necessary adjunct to this specification.

0.4 This standard (Part 1) is one of a series of specifications for flameproof electric lighting fittings. Other parts of this specification are as follows:

Part 2 Fittings using glass tubes;

*Specification for flameproof enclosures of electrical apparatus (*second revision*).

Part 3 Fittings using plastic tubes (Group 1 only); and

Part 4 Portable flameproof hand lamps.

0.5 This standard (Part 1) deals with fittings using well-glasses, and glasses of various designs other than glass tubes, and includes the floodlight type of fitting. The specification indicates requirements of material for the body and glass; constructional details; also dimensions and strength tests for the glass. The requirements in Part 1 also include impact tests which can be withstood by toughened glasses but not, in general, by annealed glasses.

0.5.1 The standard recognizes three types of flameproof glass for well-glasses and glasses of the bulkhead or flat type, namely Type A, Type B and Type C (acid-etched internally). Types A and C may be required by the customer to comply with all the tests included in this standard and suitable for use under conditions involving exceptional risk of mechanical damage. Type B is not required to comply with the impact tests and is therefore acceptable for less strenuous service conditions.

0.6 In the specification maximum surface temperature is based on three ranges, namely ranges *X*, *Y* and *Z*. The temperature rises associated with these ranges are related to a maximum service ambient temperature of 35°C; in conformity with international practice, however, the tests are to be made in an ambient temperature of between 20°C and 30°C. The maximum values for ranges *Y* and *Z* are specified for fittings used only in the position of axial alignment for which they are designed (*see* **16**).

For electrical apparatus which can be normally used in different positions, the temperature in each position is to be determined and the highest temperature is to be considered. When the temperature is determined in certain position only this shall be specified in the test report (*see* **17**) and the electrical apparatus shall be marked accordingly.

Fittings for range *X* are tested in the operating position producing the highest surface temperature.

0.6.1 The temperature range categories applicable to the various gases and vapours are given in Appendix A.

For applications where cellulose solutions are involved, fittings of the temperature range *Z* may be installed, subject to the terms of Note 4 to **16.1**. The portable handlamps are not suitable for such application.

0.7 All fittings are required to comply with the relevant clauses of IS : 2148-1981*.

*Specification for flameproof enclosures of electrical apparatus (*second revision*).

0.8 In preparing this standard, assistance has been derived from BS: 889-1965 'Flameproof electric lighting fittings', issued by the British Standards Institution.

0.9 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 1) covers range of non-portable lighting fittings of flameproof construction, intended for use where explosive mixtures of air and flammable gases or vapour may occur. This part deals with fittings using well-glasses or bulkhead type, of both dished and flat design and includes flood light type of fittings.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Flameproof Lighting Fitting — A flameproof lighting fitting is one that will withstand, when the fitting is properly assembled, and internal explosion of the flammable gas or vapour which may enter or which may originate inside the enclosure without suffering damage and without communicating the internal inflammation to the external flammable gas or vapour, through any joint or other opening in the fitting.

2.2 Acceptance Tests — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

2.3 Routine Tests — Tests carried out on each item to check requirements which are likely to vary during production.

2.4 Type Tests — Tests carried out to prove conformity with the specification. These are intended to prove the general qualities and design of a given type of flameproof lighting fitting.

3. GENERAL REQUIREMENTS, MATERIAL AND CONSTRUCTION

3.1 Flameproof lighting fittings shall comply with the requirements of this sqecification and the design shall be such that then all the parts have been properly assembled including the attachment of cables or conduit, the assembly shall be flameproof.

*Rules for rounding off numerical values (*revised*).

3.2 Material — The enclosure shall be of metal or any other material approved by the certifying authority, chosen for its strength; resistance to corrosion by agents, such as water, corrosive gases or vapours that may be found near its location in use; and lightness where this is possible to achieve without sacrificing strength and without giving rise to other hazards, such as incendive frictional sparking. Wherever possible, welded sheet steel construction in place of cast iron is recommended. This results in uniform nominal wall thickness, reduces weight and greater strength.

3.2.1 *Finish* — Aluminium paint on the body of the fitting is prohibited.

3.3 Flameproof Enclosures (Permissible Gaps) — All machined surfaces of joints on the enclosure shall under no circumstances be tampered with or covered with paint. Only slight greasing may be permitted. The maximum permissible dimensions for gaps between joint surfaces in relation to the grouping of flammable gases and vapours should be as specified in IS : 2148-1981*.

4. TYPES OF GLASSES

4.1 Three types of glasses are recognized as a standard, as follows:

Type A Glasses — Type A glasses for flameproof fittings shall comply in all respects with the requirements of **5** and **6** of this specification.

Type B Glasses — Type B glasses for flameproof fittings shall comply with the requirements for **5** and **6**.

Type C Glasses — Type C glasses for flameproof fittings are glasses which are etched, by the glass manufacturer, with acid on the inner surface in order to produce a silk finish, light-diffusing texture. Such glasses shall comply with the mechanical tests prescribed for Type A glasses.

NOTE 1 — Only Types A and C glasses are permitted in the temperature range *X* (*see* **16**) or for Group 1 application (*see* IS : 2148-1981*).

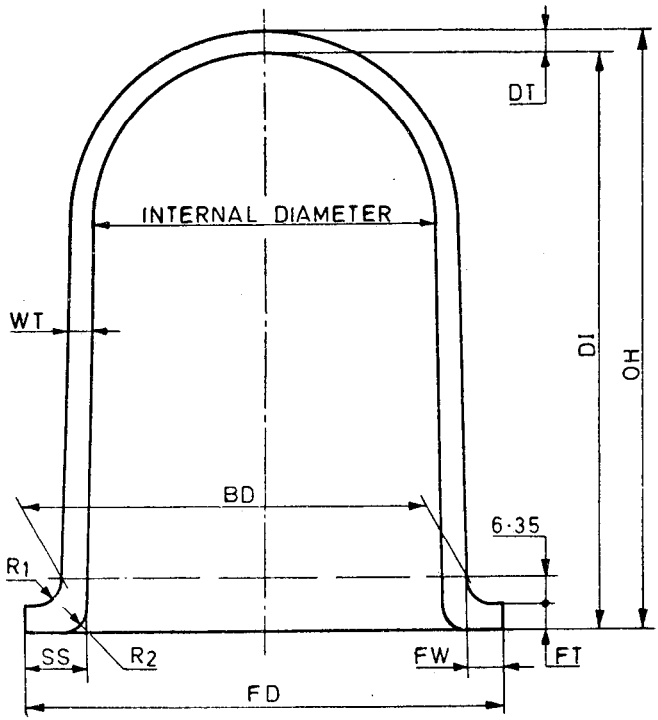
NOTE 2 — Selection of glasses for a particular fitting should be done keeping in view the permissible temperature rise, mechanical strength and potential hazard in the location where lighting fitting is to be installed.

5. WELL-GLASSES

5.1 The requirements specified under **5.2** to **5.5** are applicable to all well-glasses.

*Specification for flameproof enclosures of electrical apparatus (*second revision*).

The test specified under **20.3** shall be carried out on all well-glasses individually. The tests described under **20.4** to **20.6** shall be applied only to type samples selected at random, but all batches of well-glasses shall be capable of withstanding the tests described under this clause, except that **20.5** shall not apply to Type B glasses. All these tests specified under **20.3** to **20.6** shall be carried out on unmounted well-glasses (*see* Fig. 1).



Code of Dimensions

FD = Flange diameter	*FW* = Flange overhang width
BD = Body diameter	*SS* = Seating surface
ID = Internal diameter	*DI* = Depth (internal)
DT = Dome thickness	*OH* = Overall height
WT = Wall thickness	R_1 = Outer radius
FT = Flange thickness	R_2 = Inner radius

All dimensions in millimetres.

FIG. 1 WELL-GLASS: TERMS AND DIMENSIONAL CHARACTERISTICS (DIAGRAMMATIC ONLY)

5.2 Composition of Glass — Well-glasses may be made of glass of any composition, subject to their satisfying the requirements under **5.3** and **20.3** to **20.6**.

5.3 Light Transmission — Well-glasses shall be made of glass having a light absorption not greater than 6 percent per cm of thickness.

NOTE — This clause is not intended to apply to opal or coloured glasses.

5.4 Finish of Surface (Types A and B) — These glasses (*see* **4**) shall not be subjected to any process such as grinding, etching or any method of roughening which may impair or destroy the fire-finish acquired during blowing or moulding, with the exception that the marking required by **19** shall be produced, by an appropriate method, in such a position that it will be visible after assembly in the fitting.

Type C — These glasses (*see* **4**) are etched with acid on the inner surface to produce a silk finish, light-diffusing texture.

5.5 Dimensions — Recommended dimensions for well-glasses are given in Appendix B.

5.5.1 *Thickness of Wall (WT)** — The ratio of the thickest to the thinnest part of the wall of any well-glass shall not exceed 4 to 3. Where a prismatic pattern is carried, the measurement of thickness shall be taken at the root of the prism.

5.5.2 *Diameter of the Body (BD)* — The nominal outside diameter of the body of a well-glass, measured 6·35 mm away from the flange, shall be as specified by the maker of the fitting and be within the tolerances stated in Table 1.

TABLE 1 TOLERANCES ON DIAMETER OF WELL-GLASS BODIES

OUTSIDE DIAMETER OF BODY		TOLERANCE
Over	Up to and Including	
(1)	(2)	(3)
mm	mm	mm
—	127	± 2·4
127	254	± 3·2
254	305	± 4·0
305	381	± 4·8

*See the Code of dimensions given in Fig. 1 for interpretation of letter reference.

5.5.3 *Thickness of Domed End (DT)* — The thickness of the domed end (*DT*) shall be not less than the minimum wall thickness. The thickest part of the dome shall not exceed the average wall thickness by more than the relevant amount given in Table 2.

TABLE 2 PERMISSIBLE INCREASE IN THICKNESS OF DOME OF WELL-GLASSES

Outside Diameter of Body		Permissible Increase From Average Wall Thickness (Percent)
Over	Up to and Including	
(1)	(2)	(3)
mm	mm	
—	127	80
127	254	100
245	—	125

Note — Where a prismatic pattern is carried, the measurement of thickness shall be taken at the root of the prism.

5.5.4 *Diameter of Flange (FD)* — The nominal outside diameter of the flange shall be as required by the maker of the fitting and be within the same tolerance as per specified in **5.5.2** for diameter of body. These tolerances are to cover all permissible variations of diameter, including ellipticity or ovality.

5.5.5 *Flange Overhang Width (FW)* — The flange overhang width (that is, the distance to which the flange extends outwards, from the outside of the cylindrical portion of the body, at a point 6·35 mm from the flange) shall be within the limits shown in Table 3.

TABLE 3 FLANGE OVERHANG WIDTH OF WELL-GLASSES

Outside Diameter of Body		Flange Overhang Width (FW)			
		Types A and C		Type B	
Over	Up to and Including	*Min*	*Max*	*Min*	*Max*
(1)	(2)	(3)	(4)	(5)	(6)
mm	mm	mm	mm	mm	mm
—	101·6	7·94	9·52	6·35	9·52
101·6	127	9·52	12·7	6·35	11·1
127	178	11·1	14·3	7·94	12·7
178	254	12·7	15·87	9·52	14·3
254	305	15·87	19·05	11·1	17 46
305	381	19·05	22·2	12·7	20·64

5.5.6 *Thickness of Flange (FT)* — The thickness of the flange, measured parallel to the axis of the well-glass, shall comply with the dimensions given in Table 4.

TABLE 4 FLANGE THICKNESS OF WELL-GLASSES

Outside Diameter of Body		Thickness of Flange	
Over	Up to and Including	Types A and C (Nominal)*	Type B (Minimum)
(1)	(2)	(3)	(4)
mm	mm	mm	mm
—	101·6	7·94	7·94
101·6	127	9·52	9·52
127	178	11·1	11·1
178	254	12·7	12·7
254	305	14·29	14·29
305	381	15·87	15·87

*Tolerance ± 0·8 mm on the nominal dimension adopted by the manufacturer.

5.5.7 *Flatness of ' Seating ' Surface of Flange* — The ' Seating ' surface (SS) of the flange shall be at right angles to the cylindrical axis of the well-glass, within 3 degrees, and shall be so nearly flat that when the well-glass is stood with its flange on a plane surface, it shall not be possible to insert between the plane surface and the flange a feeler gauge of the following appropriate thickness:

$$\text{For sizes up to 177·8 mm diameter} = \frac{7 \times \text{nominal dia of body}}{1\,000}$$

$$\text{For sizes above 177·8 mm diameter} = \frac{\text{nominal diameter of body}}{100}$$

5.5.8 *Parallelism of Flange Surfaces* — The opposite parallel surfaces of the flange shall be parallel to within ± 1·6 mm.

The outer corner (R_1) of the flange shall be rounded to 1·6 mm radius. The inner corner (R_2) between the flange and outer surface of the wall shall be rounded to between 3·17 mm and in 1·6 mm radius.

Note — If imported glassware is used, it may comply with the national specification of the country of supply as far as width and thickness of flange are concerned.

6. GLASSES OF THE BULKHEAD TYPE, INCLUDING DISHED AND FLAT DESIGNS

6.1 The requirements specified under **6.2** to **6.5** are applicable to all glasses; the test specified under **20.3** shall be carried out on all glasses

individually. The tests described under **20.4** to **20.6** shall be applied only to type samples selected at random, but all batches of glasses shall be capable of withstanding the tests described under this clause, except that **20.4** shall not apply to Type B glasses. All the tests specified under **20.3** to **20.6** shall be carried out on unmounted glasses.

6.2 Composition of Glass — Glasses may be made of any composition, subject to their satisfying the requirements specified under **6.3** and **20.1.1.**

6.3 Light Transmission — Glasses shall be made of glass having a light absorption not greater than 6 percent per cm of thickness.

NOTE — This clause is not intended to apply to opal or coloured glasses.

6.4 Finish of Surface (Types A and B) — These glasses (*see* **4**), except toughened flat glasses, shall not be subjected to any process such as grinding, etching or any method of roughening, which may impair or destroy the fire-finish acquired during blowing or moulding, with the exception that the marking required by **19** shall be produced, by an appropriate method, in such a position that it will be visible after a assembly in the fitting.

The edges of toughened flat glasses may be ground prior to the toughening process.

Type C — These glasses (*see* **4**) are etched with acid on one side only (the inner surface when fitted) to produce a silk finish, light-diffusing texture.

6.5 Dimensions

6.5.1 *Variation in Thickness* — The variation permissible in thickness shall be −0, + 33·33 percent of the thickness required by the maker of the fitting. Where the glass is of a prismatic type, the measurement of thickness shall be taken at the root of the prism.

6.5.2 *Tolerance on Other Dimensions* — Dimensions measured between any chosen points on the 'seating' flange, or edge of a glass, shall conform to the dimensions required by the maker of the fitting, within + 1 percent and − 2 percent of the maximum dimensions of the glass.

6.5.3 *Width of Flange or Seating*

6.5.3.1 *Bulkhead type glasses* — In glasses where a plane flange is provided for the purpose of fixing the glass into the fitting, the flange width (that is, the distance to which the flange extends outwards from the outer surface of the curved or domed portion) shall be as given in Table 5.

6.5.3.2 *Flat or dished glasses* — The width of the seating, or bearing surface, shall be not less than the values given in Table 5.

TABLE 5 FLANGE WIDTH OF BULKHEAD TYPE GLASSES

(*Clauses* 6.5.3.1 and 6.5.3.2)

Maximum Dimension		Width of Flange			
		Types A and C		Type B	
Over	Up to and Including	*Min*	*Max*	*Min*	*Max*
(1)	(2)	(3)	(4)	(5)	(6)
mm	mm	mm	mm	mm	mm
—	101·6	7·94	11·1	6·35	11·1
101·6	127	7·94	12·7	6·35	11·1
127	178	9·52	14·3	6·35	12·7
178	254	11·1	17·46	7·94	14·3
254	381	14·3	20·64	9·52	17·46
381	601	17·46	25·4	14·3	22·2

6.5.4 *Thickness of Flange*

6.5.4.1 *Bulkhead type glasses* — The thickness of the flange, measured perpendicular to the plane surface of the flange, shall be not less than that given in Table 6.

6.5.4.2 *Flat glasses* — The thickness of the glass, measured at the edge, shall be not less than the minimum values given in Table 6 (*see also* Appendix C).

TABLE 6 FLANGE THICKNESS OF BULKHEAD TYPE GLASSES

(*Clauses* 6.5.4.1 and 6.5.4.2)

Maximum Dimension		Minimum Thickness of Flange
Over	Up to and Including	Types A, B and C
(1)	(2)	(3)
mm	mm	mm
—	101·6	7·15
101·6	127	7·15
127	178	8·74
178	254	10·32
254	381	13·5
381	601	16·67

6.5.5 *Flatness of 'Seating' Surface of Flange* — The 'seating' surface of the flange shall be at right angles to the axis of symmetry (where such exists) of the glass, to within 3 degrees, and shall be so nearly flat that

when the glass is laid with its flange on a plane surface, it shall not be possible to insert between the plane surface and the flange a feeler gauge of the following appropriate thickness for:

$$\text{Sizes up to 177·8 mm maximum dimension} = \frac{7 \times \text{maximum dimension}}{1\,000}$$

$$\text{Sizes above 177·8 mm maximum dimension} = \frac{\text{maximum dimension}}{100}$$

6.5.6 *Parallelism of Surfaces of Flange* — The opposite parallel surfaces of the flange shall be parallel to within ± 10 percent of the flange thickness for thicknesses greater than 15·87 mm, or 1·6 mm for flanges of thickness less than 15·87 mm.

The glass shall be so moulded or blown that the rim or flange shall merge into the front of the glass in a curve having a radius of not less than 1·6 mm.

7. METHOD OF SECURING GLASS TO RETAINING RING

7.1 The flange or edge of the glass shall be embedded in cement approved by the Testing Authority, and shall be contained between two metal surfaces.

In selecting a suitable cement, care shall be taken to ensure that it is satisfactory for the temperature range concerned, particularly in the case of range *X* fittings.

The length of the cemented path, with reference to Fig. 2 and 3, shall in each case be not less than 22·2 mm between the points *A* and *D*. The lengths of paths AB and CD shall in each case be not less than 7·94 mm. A typical method of weatherproofing using spigot type joint is illustrated in Fig. 4.

7.2 A recess in the metal retaining-ring may form one of these surfaces.

The opposed surface shall be provided by means of a substantial metal backing-ring.

7.3 The backing-ring shall be attached to the retaining-ring by screws, or dowels, or other equally effective means.

7.4 The backing-ring may be applied so as to intervene between the retaining-ring and the opposed surface on the body of the fitting, or it may be applied to the external surface of the retaining-ring, or in any other equally effective manner.

7.5 If they are of ferrous metal liable to rust, the surfaces in contact with the cement shall be treated to resist corrosion.

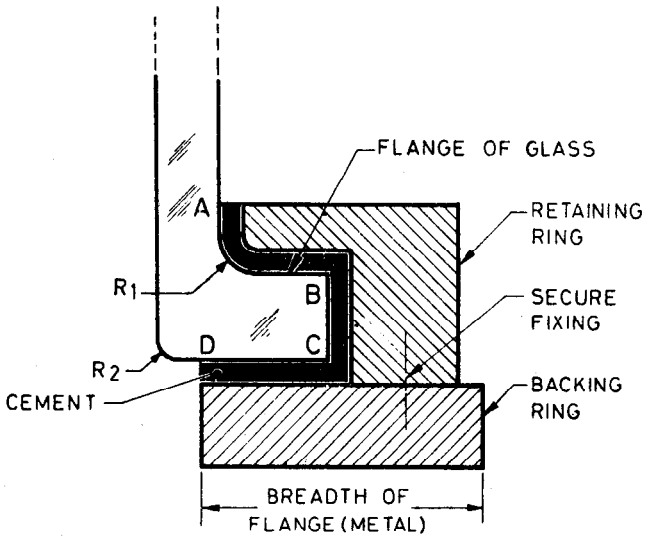


FIG. 2 TYPICAL METHOD* OF MOUNTING WELL-GLASSES

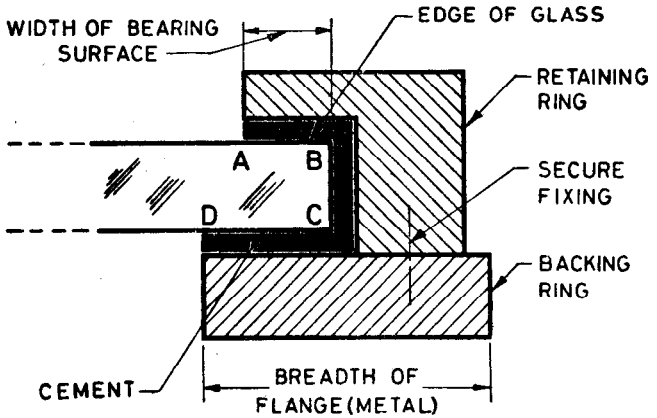


FIG. 3 TYPICAL METHOD* OF MOUNTING BULKHEAD OR FLAT GLASSES

*This sketch is intended to illustrate basic principles only and does not purport to show actual constructional detail.

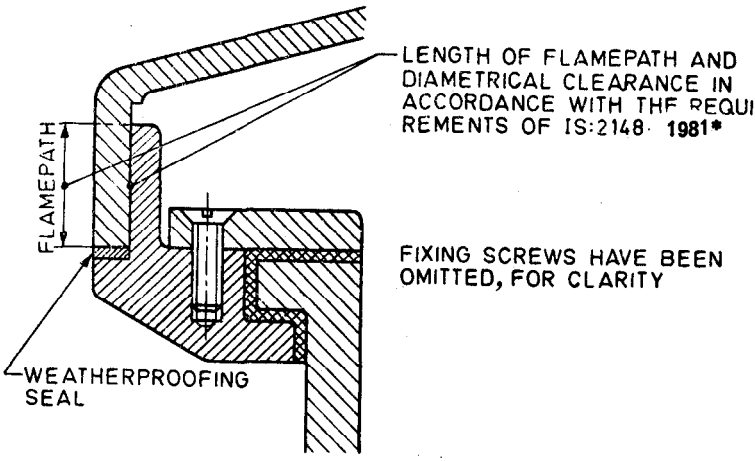


FIG. 4 TYPICAL METHOD OF WEATHERPROOFING, USING SPIGOT TYPE JOINT

This sketch is intended to illustrate basic principles only and does not purport to show actual constructional detail.

8. FITTINGS FOR USE WITH CABLE

8.1 Provision for the attachment of cable shall be made in accordance with IS : 2148-1981* and where necessary, IS : 4821-1968†, or other relevant Indian Standards.

9. LAMPS

9.1 Fittings made to this specification shall accommodate tungsten filament lamps of the appropriate wattage complying with IS : 418-1978‡ and mercury vapour discharge lamps in accordance with IS : 9900-1981§. Sodium vapour lamps and fluorescent lamps shall not be used in fittings to which this specification (Part 1) applies.

10. LAMPHOLDERS

10.1 The bayonet lampholders shall be of metal or porcelain and shall comply with IS : 1258-1979‖.

*Specification for flameproof enclosures of electrical apparatus (*second revision*).
†Specification for cable glands and cable sealing boxes for use in mines.
‡Specification for tungsten filament general service electric lamps (*third revision*).
§Specification for high pressure mercury vapour lamps.
‖Specification for bayonet lampholders (*second revision*).

10.2 Edison screw lampholders shall be of metal or porcelain and shall comply with IS : 10276-1982*.

NOTE — The exact position of the lampholder in the fitting shall be indicated in respect of each type of lamp.

11. ATTACHMENT OF PARTS

11.1 Removable screws or studs, that is those not permanently attached to the lighting fittings, which are used for attaching covers or component parts of the enclosure shall not pass through the wall of the enclosure. A thickness of metal of not less than 3 mm or one-third of the diameter of the hole, whichever is greater, shall be left at the bottom of and around all such holes, or the hole may be blinded by the insertion of a screwed plug of length not less than 6 mm or the diameter of the hole, whichever is greater.

11.2 Screws or studs which are intended to be permanently attached to the lighting fitting, shall be securely welded or securely riveted or attached in any other equally effective manner.

11.3 All screws, nuts, washers and studs used for attaching parts of the enclosures shall comply with relevant Indian Standard.

11.4 The opening of the enclosure shall be possible only with special spanners and tools provided for the purpose.

12. CONDUIT ENTRY

12.1 Screwed Conduit — Provision for the attachment of conduit, where required, shall be made in accordance with the requirements of IS : 2148-1981†.

12.2 Conduit Stopper Boxes — Conduit stopper boxes shall be so designed that they are connected with the terminal box by means of either flanged joint, spigoted joint, screwed joint or suitable combination of such joints, without the intervention of any loose or perishable packing. They shall include barriers to retain molten insulating compound and adequate provision shall be made for filling them during installation.

13. TERMINAL BLOCKS

13.1 The terminals to which the supply cables are attached whether they form an addition to, or are separate from the lampholder, shall be substantial and shall be either (a) of the stud type of not less than M5 (*see* appropriate parts of IS : 4218‡) provided with two suitable clamping washers; or (b) of the pinching type. Screws for the pinch screw terminals shall be such as not to be readily damaged during tightening operations,

*Specification for Edison screw lamp holders.
†Specification for flameproof enclosures of electrical apparatus (*second revision*).
‡ISO metric screw threads.

and shall be of diameter not less than 80 percent of the wiring hole diameter. The size of the hole shall be not less than 3 mm in diameter. Where a screw type lampholder is used, the centre contact shall be connected to a terminal which shall be clearly identified for connection to the live conductor.

14. SECURING SCREWS OR HINGE BOLTS

14.1 Any external screws, hinges or bolts securing the various components of the fittings shall be of corrosion resistance metal or be suitably treated to resist corrosion.

Bolts, set screws, studs and nuts used to ensure the flameproofness of the enclosure shall comply with the requirements of IS : 2148-1981*.

14.2 Earthing — Earthing terminals shall be provided in every fitting at a convenient position in the body of the fittings.

15. PROVISION FOR REFLECTORS AND GUARDS

15.1 Reflectors — Where required, provision shall be made on fittings for the attachment of reflectors. The reflectors shall comply with relevant Indian Standards.

15.2 Guards — Flameproof lighting fittings with Type B glasses shall be provided with guard. In the case of fittings with Types A and C glasses, provision of guard shall be made where desired.

15.2.1 Bars in such guards shall be of metal and, when in round section, shall have the following minimum dimensions:

Diameter of Basket		*Diameter of Bar*
Above	Up to and Including	
mm	mm	mm
—	75	3
75	100	4
100	—	5

In the case of bars other than round section, they shall have a minimum cross-sectional area of 20 mm^2. At points where bars cross, they shall be firmly fixed, for example, by welding.

*Specification for flameproof enclosures of electrical apparatus (*second revision*).

15.2.2 The dimensions of openings in such guards shall be as follows:

Up to 60 W	40 mm × 50 mm, *Max*
Above 60 W and up to 200 W	50 mm × 70 mm, *Max*
Above 200 W	60 mm × 100 mm, *Max*

15.2.3 The minimum distance of the protective bars from the glass shall be:

Up to 100 mm external diameter of the body in the case of well-glasses and maximum dimension in case of bulkhead glasses		7 mm
Above 100 mm	do	10 mm

NOTE — In lighting fittings with glass window, it shall be not less than 5 mm.

15.2.4 The wire guards shall be so fixed to the main part of the lighting fitting that the use of special tools shall be essential to remove them.

16. TEMPERATURE RISE

16.1 Three ranges of temperature rise, related to the gases and vapours detailed in Appendix A are given in Table 7.

TABLE 7 TEMPERATURE RISE

RANGE	SURFACE TEMPERATURE RISE °C, *Max*
X	125
Y	75
Z	50

NOTE — Appendix A gives the permitted temperature ranges of fittings for use in the respective gases and vapours listed in IS : 2148-1981*.

The temperature rise at any part of the external surface of the fittings shall not exceed the appropriate figure given in the above table, when tested in an ambient temperature of between 20°C and 30°C.

The measurement of temperature and criterion of acceptance shall be in accordance with Appendix D.

Fittings in the ranges *Y* and *Z* shall be tested in the declared operating position (*see* **17**). Fittings in the range *X* shall be tested in the operating position which gives the highest obtainable surface temperature at the hottest point. If the fitting is designed to include an external reflector, the temperature rise shall comply with this requirement both with and without the reflector.

*Specification for flameproof enclosures of electrical apparatus (*second revision*).

The test shall be carried out with a lamp, of the type and rating which gives the greatest rise in temperature, as declared by the manufacturer.

Compliance with the requirements of this clause shall be determined by the criteria given in Appendix D.

This requirement is regarded as a type test, to be applied to a complete fitting of normal design and construction, either by the manufacturer or by an independent authority on his behalf.

The measurement of temperature shall be made in accordance with the technique described in Appendix D.

NOTE 1 — *Ambient Temperature* — While a maximum ambient service temperature of 35°C is envisaged, a reduced temperature is preferable for test purpose. In order to ensure an acceptable level of accuracy in the measurement of temperature rise, the tests may be carried out only when the ambient air temperature in the test enclosure is within the limited range of 20°C to 30°C. At the higher temperatures involved in measurements, particularly on range *X* and *Y* fittings, a significant variation can occur in the temperature rise when measured at different ambient air temperatures. The value measure for the temperature rise decreases with an increase in ambient temperature. It is to restrict, within an acceptable range, such possible variation in results that the limit on ambient air temperature permitted during measurements has been introduced.

NOTE 2 — *Methane (firedamp)* — The limit of 50°C specified as the maximum permissible temperature rise for flameproof fittings certified for Group I conditions arises from considerations which are distinct from those related to the ignition hazard.

NOTE 3 — *Ethyl Nitrite* — As the surface maximum temperature rise of range *Z* permits a greater surface temperature, in the highest ambient range, than the 72°C maximum associated with ethyl nitrite (*see* Appendix A) fittings for certification under Group II should in this case be restricted to a maximum safe surface temperature of 72°C.

NOTE 4 — *Flammable Substances* — The normal operating temperature of the lighting fitting may cause the enclosure surface to exceed the safe temperature for certain flammable substances. For instance, in the case of cellulose solutions the danger point for the solid residue is at 82°C. It is usual for range *Z* fittings to be installed where such flammable substances are present, and it is emphasized that special care is needed to ensure that the maximum ambient temperature in which the fitting is used does not exceed 30°C or, by agreement between the manufacturer and the user, that lamp wattage is reduced to avoid actual surface temperatures above the maximum safe figure. In cases of doubt, expert advice should be sought.

17. OPERATING POSITION

17.1 The manufacturer shall declare to the Testing Authority the normal operating position of the fitting.

The operating position shall be used for the purpose of testing fittings in the ranges Y and Z quoted in **16**.

NOTE — If a fitting designed for ranges Y or Z is to be installed in a significantly different operating position, the user should consult the statutory authority responsible for the safety, to ensure that the maximum surface temperature does not exceed the following limits, in the conditions of highest ambient temperature likely to be met in service (namely, 35°C).

Range Z – 85°C

Range Y – 110°C

These figures are equal to the maximum permitted temperature rise of the range, plus 35°C. (For range X, the comparable value is 160°C.)

18. FLAMEPROOF TEST

18.1 All fittings shall be of a type that has been certified as flameproof by the recognized Testing Authority (*see* IS : 2148-1981*) and shall comply in all respect with the terms of certification.

19. MARKING

19.1 Each fitting shall be permanently marked, either by raised lettering cast integrally with, or by a plate attached to the body of the fitting, in a manner which will not impair the flameproof enclosure, to indicate the following particulars:

a) Name of the manufacturer, or his agent;

b) Name (or name and number) by which the type is identified on the certificate;

c) Maximum wattage of the lamp permitted for use in the fitting;

d) A reproduction of the registered flameproof mark, if the manufacturer holds a licence to apply this mark;

e) Number of the flameproof certificate given by the statutory authority, the group number or numbers indicating the group of gases and vapours covered by the certificate, and the temperature range letter (or alternately in °C appropriate to the maximum permissible surface temperature assigned to the range, that is, 85°C, 110°C, 160°C); and

f) Normal operating position of the fittings.

19.2 Each glass shall be marked indelibly, and in a prominent position with:

a) a reproduction of the registered flameproof mark, such a mark is evidence that the glass complied with the requirements of the specification and that the manufacturer holds a licence to apply the mark; and

b) Letters *A*, *B* or *C* indicating the type of glass.

*Specification for flameproof enclosures of electrical apparatus (*second revision*).

19.3 The voltage range and frequency appropriate to the discharge-lamp auxiliary gear shall be marked in a prominent position, either inside or outside, in the vicinity of the terminal compartment.

19.4 Marking of Earth Connection — The earthing terminal shall be identified by the symbol ⏚ marked in a legible and indelible manner on or adjacent to the terminal.

19.5 The fittings may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defind system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

20. TESTS

20.1 Classification of Tests

20.1.1 *Type Tests* — The following shall constitute the type tests:

a) Dimensional check-up (*see* **20.2**);
b) Static hydraulic test (*see* **20.3**);
c) Impact test (*see* **20.4**);
d) Thermal shock test (*see* **20.5**);
e) Durability test (*see* **20.6**);
f) Test for temperature-rise (*see* **20.7**); and
g) Test for flameproofness (*see* **20.8**).

20.1.2 *Acceptance Tests* — The following shall constitute the acceptance tests:

a) Dimensional check-up (*see* **20.2**);
b) Static hydraulic test (*see* **20.3**);
c) Impact test (*see* **20.4**);
d) Thermal shock test (*see* **20.5**); and
e) Durability test (*see* **20.6**).

20.1.2.1 The number of samples for acceptance tests and the criterion of approval shall be as given in Appendix E.

The glass (well-defined or bulkhead) shall not be used for more than one test.

No glass (well-glass or bulkhead) which has been used for any of these tests shall be put into service, but shall be destroyed after the tests have been completed.

20.1.3 *Routine Tests* — The following shall constitute the routine tests:

a) Dimensional check-up (*see* **20.2**); and

b) Static hydraulic test (*see* **20.3**).

20.2 Dimensional Check-up — The lighting fittings shall be examined for the various dimensions and shall comply with the requirements of this specification.

20.3 Static Hydraulic Test — Each glass, held at its flange or seating surface only, shall be tested to a static hydraulic pressure as specified below, applied internally for not less than 15 seconds or more than 20 seconds. The pressure should be brought up gradually to the prescribed value, the time taken being not more than one minute:

Outside Diameter of Body	*Internal Pressure*
mm	kg/cm^2
Up to 125	7·0
Above 125 and up to 175	8·5
Above 175	10·5

NOTE — In the case of a bulkhead glass, the external diameter refers to the maximum dimension of the aperture of the fitting, measured in a straight line across the widest part of the opening in the metal retaining-ring to which the glass is cemented.

20.4 Impact Tests

20.4.1 This is applicable only to Type A and Type C glasses.

20.4.2 A ballistic pendulum apparatus as described in Appendix F is required by means of which the specimens can be given impact of predetermined magnitudes with a 1·8 kg hammer faced at end with a hardened steel hemisphere of 25 mm diameter. Other forms of apparatus may be used, provided that they enable tests to be carried out similar in all respects to the tests described.

20.4.3 *Procedure* — The specimen to be tested shall be supported appropriately by hard woodblocks so that, when the hammer is at rest in its equilibrium position, the end of the hammer just touches the point on the specimen at which blow is to be struck. The hammer shall be pulled aside through measured distances when the test specimen has been fixed

in position and allowed to swing freely back to strike the test specimen. The magnitudes of the impacts given shall be expressed in terms of the vertical height of all equivalent to the distance through which the hammer was displaced from its position of equilibrium before being released.

20.4.4 *Requirements* — The glass shall be capable of withstanding, at any point on the cylindrical portion in the case of well-glasses or at any point not less than 25 mm from the seating surface in the case of bulkhead glasses, an impact, normal to the surface of the glass, given by the spherical end of the 1·8 kg hammer at the end of a swing equivalent to the vertical height of fall specified as follows:

Diameter (Well-Glass) or Maximun Dimension	*Effective Height of Fall* (1·8 kg Hammer)
mm	mm
Up to 100	160
Above 100 and up to 125	240
,, 125 ,, ,, ,, 175	400
,, 175	640

20.5 Thermal Shock Test

20.5.1 The glasses shall be capable of withstanding the thermal shock given by heating them for 15 minutes in an air oven, then plunging them into water at a temperature between 15°C and 30°C the difference between oven and water temperature being not less than 125°C in the case of type A and Type C glasses and 75°C in the case of Type B glass.

20.5.2 In the case of well-glasses, they shall be plunged with domed end first and in the case of bulkhead glasses, the exterior surface in service shall be plunged downwards. In the case of flat glasses, they shall be horizontal at the moment of immersion.

20.6 Durability Test

20.6.1 To test the durability of a glass, it shall be subjected to a series of temperature cycles in a humid atmosphere, the temperature being caused to vary from room temperature to 60°C during each cycle. The attacked surfaces shall subsequently be examined visually.

20.6.2 *Preparation of the Specimen* — For the above test, the specimen may be of any convenient size, not generally exceeding 75 mm square. It is important that the surfaces should be free from grease. The surface of the specimen shall be fine finished. It may be cleaned by washing with soap and rinsing thoroughly with distilled water (when the specimen is clean it should be possible to cover the surface uniformly with film of water and

for the film to drain off the surface without leaving drops adhering locally).

20.6.3 *Apparatus* — It consists of a covered tank, with the bottom completely covered with water, so constructed that the specimen can be supported 50 mm above water level, either lying flat or standing on edge. Provision is made for heating the water and maintaining a temperature of 60°C ± 2°C in the space above the water. This temperature can be registered by a thermometer suspended from the cover. It is convenient to have the cover of the tank made in a curved or sloping form to prevent dripping of condensed water over test specimens.

20.6.4 *Procedure* — The specimen shall be placed in a tank 50 mm above the water level and the temperature shall be maintained at 60°C ± 2°C for a period of 10 hours (preferably during the day time) during each cycle. The whole chamber is allowed to cool down to room temperature after 10 hours at 60°C the heating recommended on the following day, the entire cycle occupying 24 hours. This procedure shall be repeated six times consecutively.

20.6.5 *Interpretation of Results* — On removal from the tank, the specimen shall be examined by reflected light and shall not show more than a faint tarnish with local spotting. Examination of the upper surface is facilitated if the under surface is laid on a piece of black velvet or is blackened with Indian ink.

20.7 Test for Temperature-Rise

20.7.1 The test shall be carried out with a lamp of the description and rating declared by the manufacturer to give the greatest rise in temperature. The lamp shall comply with the relevant Indian Standard and shall be opereted at the nominal wattage.

20.7.2 This requirement is regarded as a type test, to be applied to a complete fitting of normal design and constructions either by the manufacture or by an independent authority on his behalf. The measurement of temperature shall be made in accordance with **D-1.**

20.7.3 Compliance with the requirements of this clause shall be determined by the criteria given in **D-2.**

20.8 Test for Flameproofness — All fittings purporting to comply with this specification shall be of a type that has been certified as flameproof by the recognized testing authority (*see* IS : 2148-1981*).

*Specification for flameproof enclosures of electrical apparatus (*second revision*).

APPENDIX A

(*Clause* 0.6.1 *and* 16.1)

TEMPERATURE RANGES FOR GASES AND VAPOURS

Gas or Vapour	*Permitted Temperature Ranges*
Methane (Firedamp)	*Z*
Ammonia Methane (industrial) Blast furnace gases Carbon monoxide Propane Butane Pentane Hexane Heptane Iso-octane Decane Benzene Xylene Cyclohexane Acetone Ethylmethylletone Methyl acetate Ethyl acetate *n*-Propyl acetate *n*-Butyl acetate Amyl acetate Chloroethylene Methanol (Methyl alcohol) Ethanol (Ethyl alcohol) Iso-butyl alcohol *n*-Butanol Amyl alcohol Buta-1 : 3-diene	*X*, *Y* and *Z*
Ethyl nitrite	Special (*see* Note 3 to **16.1**)
Diethyl ether	*Y* and *Z*
Ethylene Ethylene oxide Coal gas (Town gas) Coke-oven gas	*X*, *Y* and *Z*

NOTE — It is not permitted to use flameproof lighting fittings in the presence of certain gases, such as:

Acetylene	Carbon disulphide	Ethyl nitrate
Hydrogen	Water gas	

Summary— Range *Z* All except ethyl nitrite.

Range *Y* All except ethyl nitrite and methane (firedamp).

Range *X* All except ethyl nitrite methane (firedamp), and diethyl ether.

APPENDIX B

(*Clause* 5.5)

STANDARD DIMENSIONS OF TYPES A AND C WELL-GLASSES

B-1. In order to facilitate the manufacture and supply of toughened well-glasses, the dimensions of a limited number of sizes of such glasses have been agreed by representatives of the interested glass manufacturers and flameproof fittings manufacturers. The details are set out in Table 8.

It is not intended that glasses of other dimensions should be excluded from the specification and application may be made for flameproof certificates in respect of fittings with such glasses.

TABLE 8 STANDARD DIMENSIONS OF WELL-GLASSES

DIMENSION	SIZE				
	mm	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)
Nominal diameter	88·9	139·7	177·8	235	298·5
Flange diameter* (*FD*)	88·9 ± 2·4	139·7 ± 2·4	179·4 ± 3·18	236·54 ± 3·18	300·04 ± 3·97
Outside diameter of body (*BD*) (6·4 mm) away from flange	70·64 ± 2·4	116·68 ± 2·4	153·19 ± 3·18	207·17 ± 3·18	264·32 ± 3·97
Flange thickness (*FT*)	7·94 ± 0·8	9·53 ± 0·8	11·1 ± 0·8	12·7 ± 0·8	14·3 ± 0·8
Minimum internal diameter at bottom of well (*ID*)	50·8	92·08	127	177·8	228·6

(*Continued*)

TABLE 8 STANDARD DIMENSIONS OF WELL-GLASSES — *Contd*

DIMENSION	SIZE				
	mm	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)
Minimum internal depth (*DI*)	66·68	111·13	146·84	200·82	257·18
Overall height (*OH*)	73·58 ± 3·18	125·41 ± 3·18	161·13 ± 3·18	217·49 ± 3·18	276·23 ± 3·18
Flange width (*FW*)	8·73 ± 0·8	11·1 ± 1·59	12·7 ± 1·59	14·3 ± 1·59	17·46 ± 1·59
Wall thickness (*WT*)	7·14 ± 0·8	7·94 ± 1·59	7·94 ± 1·59	8·73 ± 1·59	9·53 ± 2·4
Maximum dome thickness (*DT*)	11·9	14·3	15·88	16·67	19·05

*Designations in Fig. 1.

NOTE 1 — The limits to the dimensions of the flange diameter are to cover all variations of diameter, whatever the cause.

NOTE 2 — The limits to the flange thickness do not include any departure of the seating from a flat surface, or any lack of parallelism of the top and bottom surfaces of the flange; for this, **5.5.6** and **5.5.7** apply.

NOTE 3 — The limits of the wall thickness include all permissible variations of thickness, including eccentricity and non-axiality of the inner surface relative to the outer surface.

The variations in the thickness of any one glass should be not greater than that set out in **5.5.1** that is 33⅓ percent of the thinnest part of the cylindrical portion of the body, except in so far as variations in thickness over the dome end are permitted up to the various limits given in Table 2.

APPENDIX C

(*Clause* 6.5.4.2)

GUIDE TO THE THICKNESS OF FLAT GLASSES

C-1. The figures in the following table are a guide to the maximum clear diameter of glasses, for a range of thicknesses, mounted in the manner described in **7** and intended to withstand the appropriate hydraulic test pressures specified in **6**.

TABLE 9 THICKNESS OF FLAT GLASSES

(*Clause* C-1)

Nominal Glass Thickness	Maximum Clear Diameter	
	Type A	Type B
mm	mm	mm
7·14	108	50·8
9·53	133·4	69·85
12·7	177·8	95·25
19·05	238·13	127
25·4	314·33	171·45
31·75	393·7	190·5
38·1	473·1	228·6

NOTE — For square glasses, the diagonal should not generally exceed the diameter stated for circular glasses of the same thickness.

APPENDIX D

(*Clauses* 16.1, 20.7.2 *and* 20.7.3)

METHOD OF MEASUREMENT OF TEMPERATURE-RISE AND CRITERIA OF ACCEPTANCE OF A FLAMEPROOF LIGHTING FITTING

D-1. METHOD OF MEASUREMENT

D-1.1 The test is made in a rectangular traught-proof enclosure, the top and at least three sides of which are double walled, the base being solid. The double walls which are spaced 15 cm apart are made of perforated metal, the maximum diameter of the holes being 2 cm and the area of the apertures being approximately 40 percent of the total area. The enclosure is of such size that there is a clearance of not less than 20 cm between any part of the fitting and the internal walls of the enclosure. The internal size of the enclosure is, however, not to be less than 90 cm cube. The walls are painted to provide consistent testing conditions as between one enclosure and another. At the temperatures involved, the colour of the paint is of little significance, and a medium grey is often used.

D-1.2 Fittings are so positioned that the light source is near to centre of the enclosure. Suspended and free standing fittings are supported in the normal manner. Ceiling and wall mounting fittings are fixed to a black painted wooden board to simulate the supporting surface. This board should be not

less than 15 mm thick and of sufficient size of extend not less than 10 cm outside the projection on it of the fitting, and to leave a gap of not less than 10 cm between it and the inside wall of the enclosure. The board is separately supported in the appropriate position in the enclosure.

D-1.3 Temperature measurements are made by means of thermocouples (*see* IS : 2053-1974*).

D-1.4 Thermocouples for measuring the surface temperature of a fitting are attached to the surface in such a way that good thermal contact is obtained with the minimum of disturbance of the thermal conditions.

Adequate thermal contact can be obtained by the following methods whichever is appropriate to the particular surface.

a) By mechanical clamping under existing screw.

b) By soldering using the smallest possible amount of solder.

NOTE — Methods (a) and (b) are normally used on metal parts only.

c) By suitable adhesive using only the minimum quantity needed to fix the thermocouple and taking care that the junction is not separated by the adhesive from the surface to be measured, or lagged by an excess of adhesive covering it. Applying the adhesive to the sides of the wires is a suitable technique. For transparent materials, a colourless cement is used to avoid absorbing radiation. With thermoplastic materials, the cement is preferably one based on the material itself. When measuring the surface temperature of material, of low thermal conductivity, a length of about 2 cm of the thermocouple wires leading to the junction is also cemented to the surface to minimize conduction losses.

d) By means of a thermocouple in a holder, such as those shown in Fig. 5 and 6, a little oil or grease being applied to the surface where the junction touches to ensure good thermal contact. A holder suitable for convex surfaces is shown in Fig. 5 in which the thermocouple is held under tension in a spring holder and pressed against the surface. A holder suitable for flat surfaces which when resting on the surface allows a bowed strip thermocouple to lie flat on the surface is shown in Fig. 6.

The hottest point on the fitting is found by preliminary exploration using a thermocouple in a holder, such as those shown in Fig. 5 and 6 and a thermocouple fixed to this point. With material of low thermal conductivity, such as glass or plastics, it is important that the point of maximum temperature may vary widely from one position to another.

*Specification for thermocouple pyrometers (*first revision*).

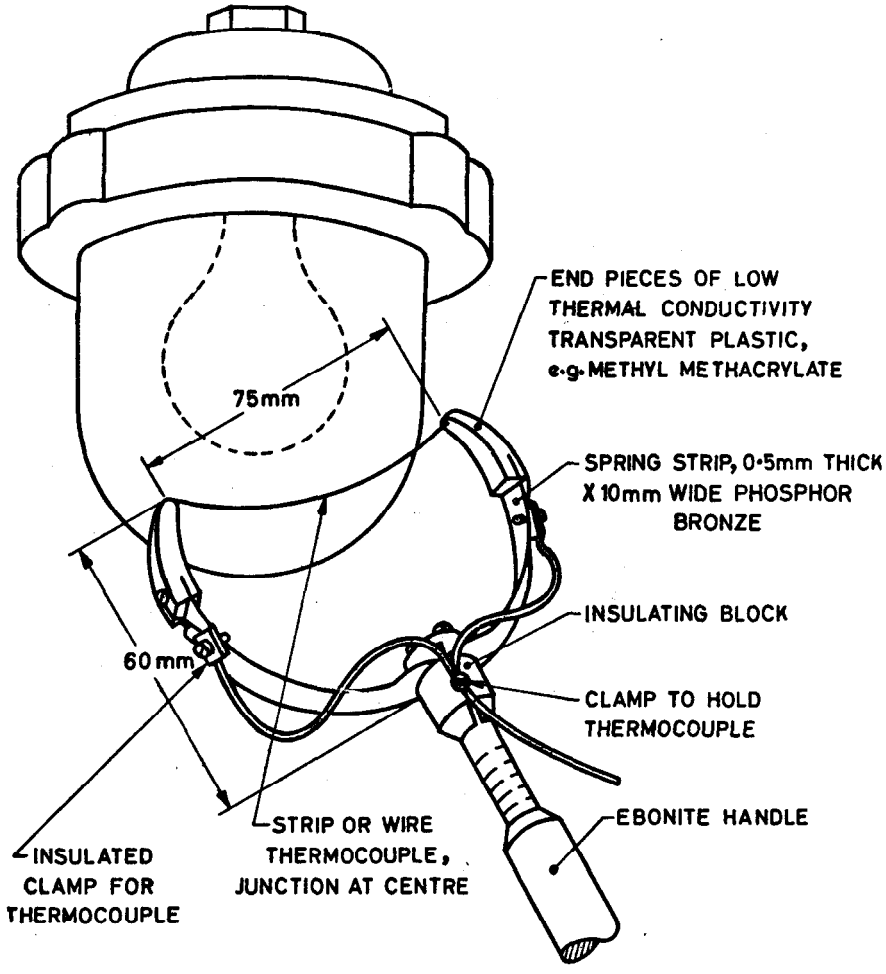


FIG. 5 THERMOCOUPLE HOLDER SUITABLE FOR CONVEX SURFACES

D-1.5 The emf developed by the thermocouple is preferably measured by a potentiometer circuit. The cold junction is kept in a small deep dewar vessel containing a suitable liquid, for example, to prevent rapid changes in temperature. Its temperature is measured by an accurate mercury-in-glass thermometer.

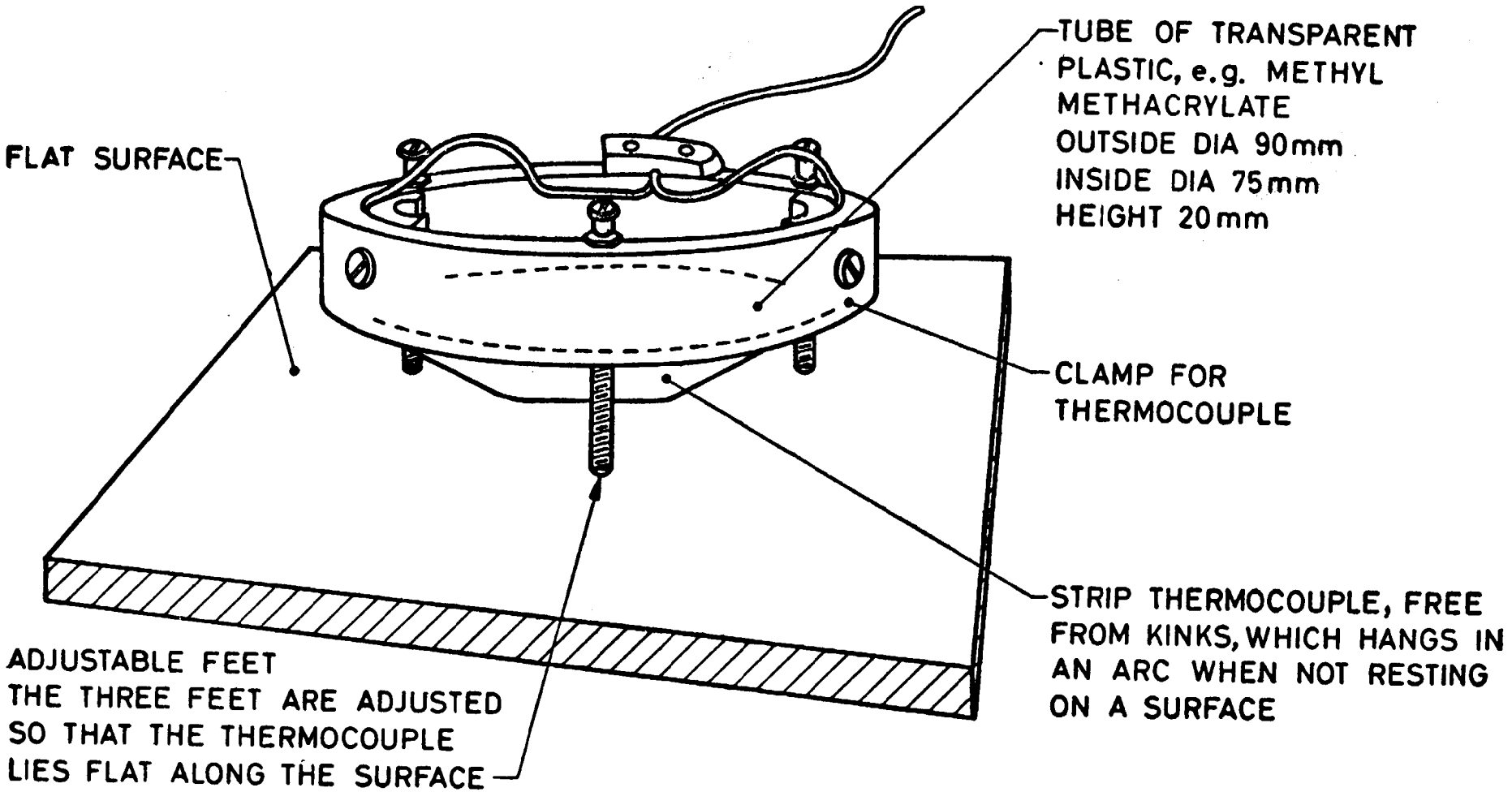


FIG. 6 THERMOCOUPLE HOLDER SUITABLE FOR FLAT SURFACE

D-1.6 The ambient temperature is measured within the test enclosure by an accurate mercury-in-glass thermometer placed near to one of the side walls at the same height as the fitting. The bulb of the thermometer is shielded against radiation by a double walled cylinder of polished metal. A suitable size is about 10 cm long, the inner and outer cylinders having diameters of about 6 cm and 8 cm respectively. The temperature-rise is to be determined by subtracting this ambient temperature from the temperature of the point measured on the fitting.

The ambient temperature within the enclosure during the test is within the range 20 to 30°C.

D-1.7 The test is continued until steady temperatures are attained, the operating conditions for the fitting as defined under **16** being maintained constant.

D-2. CRITERIA OF ACCEPTANCE

D-2.1 Compliance with the requirements of **16** is determined by the following criteria:

a) If the measured value of the maximum surface temperature-rise at the hottest spot on a fitting does not exceed the limit for the appropriate range given above, the fitting shall be deemed acceptable.

b) If the measured value exceeds the limit by 5°C or more, the fitting shall be deemed unacceptable.

c) If the measured value is between the limit and 5°C above it, a second test shall be made. (This test may either be made on a second fitting or on the first fitting after complete dismantling and re-assembly.)

d) If the second measured value does not exceed the limit plus 2·5°C, the fitting shall be deemed acceptable.

e) If the second measurement exceeds the limit by more than 2·5°C, the fitting shall be deemed unacceptable.

APPENDIX E

(*Clause* 20.1.2.1)

SAMPLING PLAN FOR ACCEPTANCE TEST

E-1. LOT

E-1.1 In any consignment, all the glasses of the same type and size manufactured under similar conditions of production shall be grouped together to constitute a lot.

E-1.2 The number of glasses to be selected from the lot shall depend upon the size of the lot and shall be in accordance with Table 10.

TABLE 10 SAMPLE AND ACCEPTANCE NUMBER

(*Clauses* E-1.2, E-2.1 *and* E-2.2)

LOT SIZE	SAMPLE SIZE	ACCEPTANCE NUMBER
(1)	(2)	(3)
Up to 100	12	1
101 to 150	15	1
151 ,, 300	18	1
301 ,, 500	21	1
501 ,, 1 000	24	1
1 001 and above	30	2

E-1.2.1 These glasses shall be selected from the lot at random. For this purpose, a reference may be made to IS : 4905-1968*; or otherwise all the glasses in the lot may be arranged in a serial order and starting from any random glass, every rth glass may be selected, r being the integral part of N/n, where N is the lot size and n is the sample size.

E-2. CRITERIA FOR CONFORMITY

E-2.1 The glasses selected in accordance with col 1 and 2 of Table 10 shall be subjected to dimensional check up and static hydraulic test. A glass failing to satisfy either of the requirements shall be termed as 'defective'. The lot shall be considered as conforming to these requirements if the number of defectives found in the sample is less than or equal to acceptance number given in col 3 of Table 10; otherwise the lot shall be rejected without further testing.

E-2.2 The lot which has been found as conforming to the above requirements shall then be subjected to impact test, thermal shock test and durability test. For this purpose, glasses selected in **E-2.1** shall be divided into three equal groups and each group shall be subjected to impact test, thermal shock test and durability test respectively. The lot shall be considered as conforming to these requirements if no defective is found and shall be rejected if two or more defectives are found.

If only one sample fails, another sample of the same size shall be taken from the lot at random and tested for that particular requirement in which it has failed. The lot shall be considered as conforming to the requirements if no defective is found in the second sample otherwise the lot shall be rejected

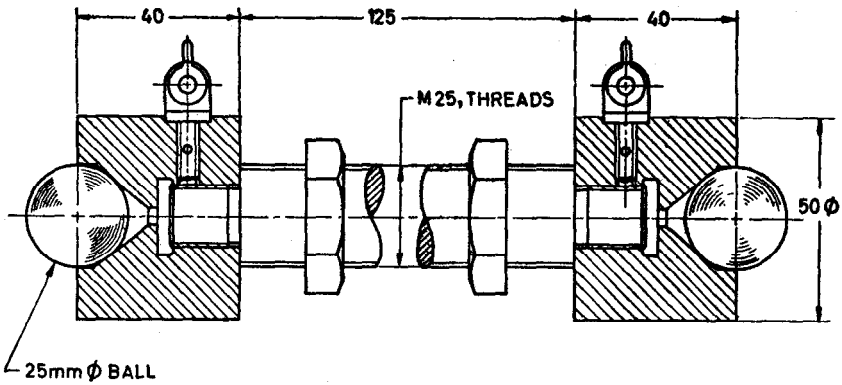
*Methods for random sampling.

APPENDIX F
(*Clause* 20.4.2)

IMPACT TESTING APPARATUS

F-1. DESCRIPTION

F-1.0 A suitable apparatus for carrying out the impact tests (*see* **20.4.2** is indicated diagrammatically in Fig. 7 and 8.



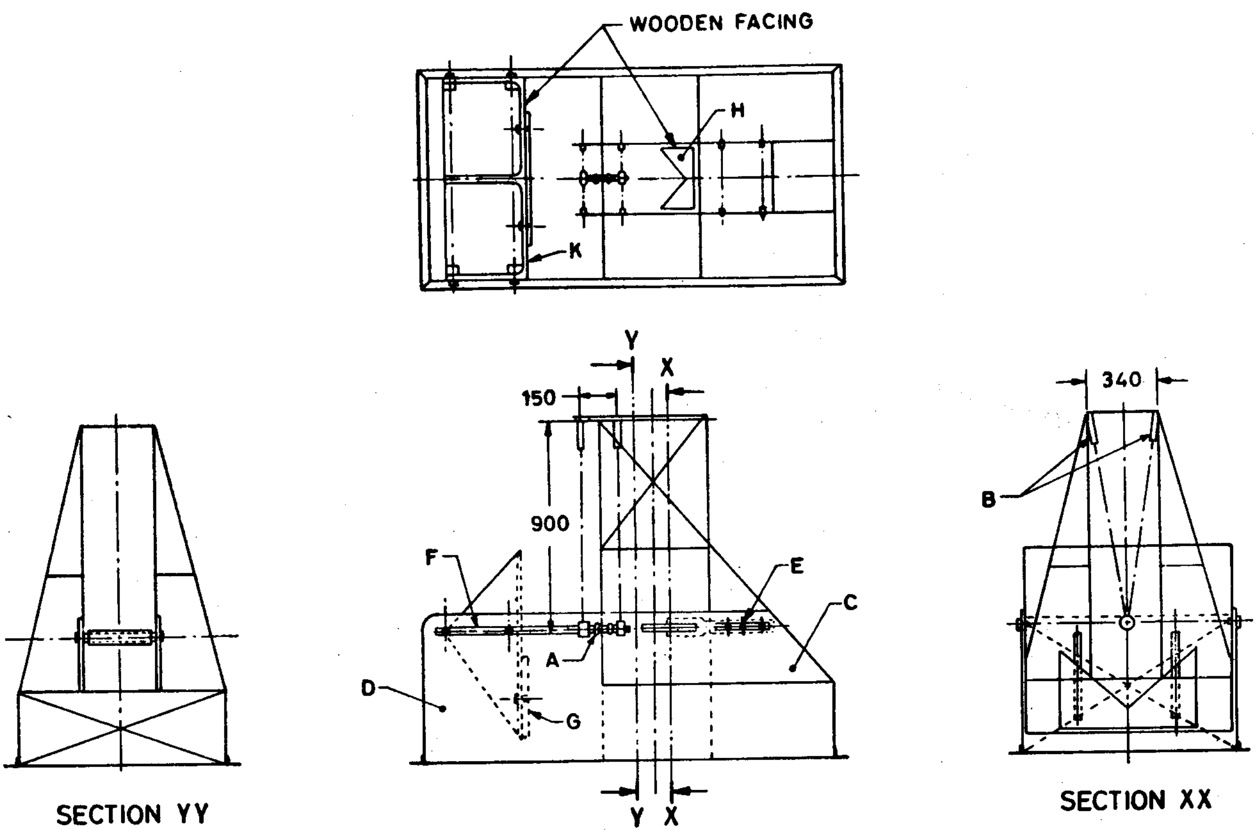
Hammer weight 1·8 kg, additional weight can be added.
All dimensions in millimetres.

FIG. 7 HAMMER FOR IMPACT TESTING APPARATUS

F-1.1 It consists of a steel framework with a hammer *A* suspended from a beam in such a way that the hammer swings parallel to itself when pulled out to its equilibrium position and released. On each end of the hammer is a hemisphere of 12·5 mm radius made of hardened steel.

F-1.2 The hammer is suspended as shown by four steel cables, the lengths of which can be adjusted by means of the turn buckles *B* so as to make the hammer hang symmetrically in the centre of the main frame.

F-1.3 The steel plates *C* and *D* have slots *E* and *F* on level with the equilibrium position of the hammer, and specimen supports *H* and *K* are supported by, and can be clamped in position by studs passing through these slots. Support *H* is a wooden-faced *V* block to support a well-glass mounted with its axis vertical so that it can be struck on the cylindrical wall. Support *K* is a wooden-faced flat plate to support a bulkhead front with its plane vertical; for flat bulkhead glasses the wooden facing of support *K* shall have a central hole of a shape such that the face of the glass is supported only around its perimeter where a seating shall be



All dimensions in millimetres.

FIG. 8 IMPACT TESTING APPARATUS

afforded of width equal to the maximum flange width specified in Fig. A. *V* carriage *G*, movable in vertical slot in *K*, permits variation of the position of the bulkhead front vertically; vertical position of a well-glass can be varied by packing under it. The slots *E* or *F* allow the specimen to be moved horizontally until it is just in contact with the ball of the hammer when in its position of equilibrium; and by removing the studs in the slot *E* or *F* either support can be removed completely to allow the hammer a clear blow at the other.

A tray to receive the broken pieces of a specimen can readily be inserted under either support.

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	st

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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PART 1 WELL-GLASS AND BULKHEAD TYPES

(First Revision)

(*Page* 26, *Appendix* A, *Note*) — Delete the word 'Hydrogen' from the list of gases.

(ETDC 45)

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