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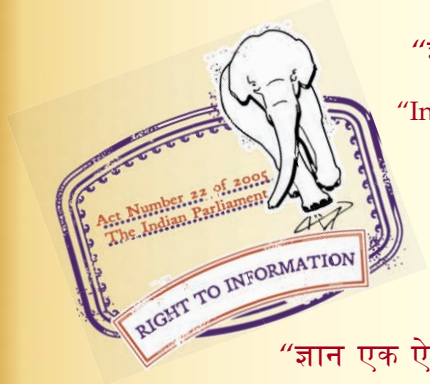

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"Knowledge is such a treasure which cannot be stolen"

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IS : 3553 - 1966

Indian Standard

(Reaffirmed 2005)

SPECIFICATION FOR WATERTIGHT ELECTRIC LIGHTING FITTINGS

Fourth Reprint JANUARY 1990
(Incorporating Amendment No. 1)

UDC 628·94 : 621·32 - 213·32

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4

August 1966

Indian Standard

SPECIFICATION FOR WATERTIGHT ELECTRIC LIGHTING FITTINGS

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SPECIFICATION FOR WATERTIGHT ELECTRIC LIGHTING FITTINGS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 April 1966, after the draft finalized by the Illuminating Engineering and Lifts Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard has been prepared to cover certain special types of fittings which are designed such that entry of water is not possible under specified conditions. This specification includes watertight and submersible lighting fittings of all types and takes into account the various types of electric lamps now available. Drip-proof, rain-proof and jet-proof lighting fittings are covered by IS : 3528-1966*.

0.3 Though this standard covers submersible lighting fittings, the test for protection against entry of water has not been specified and it shall be matter of agreement between the purchaser and supplier; suitable testing procedure is being evolved and it is hoped that a satisfactory testing procedure will be added at a later date.

0.4 This standard shall be read in conjunction with IS : 1913-1961†.

0.5 This standard is one of a series of Indian Standards on electric lighting fittings. Other standards in this series are:

IS : 1777-1961 Specification for industrial lighting fittings with metal reflectors

IS : 1913-1961 General and safety requirements for electric lighting fittings

IS : 1947-1961 Specification for flood lights

IS : 2149-1962 Specification for luminaires for streetlighting (Since revised).

IS : 2206 (Part I)-1962 Specification for flameproof electric lighting fittings : Part I Well-glass and bulkhead types

*Specification for waterproof electric lighting fittings.
†General and safety requirements for electric lighting fittings. (Since revised).

IS : 2493-1963 Specification for well-glass lightings fitting for use underground in mines (Non-flameproof type)

IS : 3528-1966 Specification for waterproof electric lighting fittings

0.6 In preparing this standard assistance has been derived from the following publications:

IEC Publication 16 Lighting fittings for tubular fluorescent lamps. International Electrotechnical Commission.

B.S. 3820 : 1965 Specification for electric lighting fittings. British Standards Institution.

0.7 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 specification covers electric lighting fittings which prevent entry of water and are designed for use at supply voltage not exceeding 250 volts and for the enclosure of tungsten filament or electric discharge lamps.

1.2 The fittings covered by this standard are classified according to the type of construction and method of test specified as:

a) watertight lighting fittings, and

b) submersible lighting fittings.

1.3 This standard does not cover luminaires for street lighting (*see* IS : 2149-1962†) drip-proof, rain-proof and jet-proof electric lighting fittings (*see* IS : 3528-1966‡).

2. TERMINOLOGY

2.0 For the purpose of this standard the definitions given in IS : 1913-1961§ and the following shall apply.

2.1 Watertight Fittings — Fittings which shall withstand submersion to a depth of 5 cm at its highest point without water entering, but not intended to be used permanently submerged in water.

*Rules for rounding off numerical values (*revised*).
†Specification for luminaires for streetlighting.
‡Specification for waterproof electric lighting fittings.
§General and safety requirements for electric lighting fittings. (Since revised).

2.2 Submersible Fittings — Watertight fittings so constructed that they would be capable of satisfactory operation when submerged under a specified head of water for an indefinite period.

2.3 Tight (used as a suffix) — Applies to a fitting such as watertight, dust-tight, etc, which is so constructed that it will exclude the specific material under conditions which may be specified.

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

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

3. MATERIAL, DESIGN, CONSTRUCTION AND WORKMANSHIP

3.0 General — The fittings shall comply with the general and safety requirements of IS : 1913-1961*.

3.1 The fittings shall be so constructed that they shall withstand mechanical stresses to which they may be subjected during normal use and maintenance.

3.2 Protection Against Condensation — Fittings intended for use in situations where condensation may occur shall be adequately insulated or shall be so enclosed that normal insulation is sufficiently protected.

3.3 Protection Against Ageing and Corrosion — Fittings shall be so constructed from materials and have such finishes that no undue deterioration occurs in the safety, performance or appearance during normal life when operating in the conditions for which they are intended.

3.3.1 A general guidance in respect of ageing and corrosion for the design of lighting fittings is given in Appendix A.

3.4 Photometric Data — The photometric data to be provided by the manufacturer of the lighting fittings is given in Appendix B.

4. MARKING

4.1 The following information shall be indelibly marked on each lighting fitting in a place readily visible during maintenance:

a) Manufacturer's name, or trade-mark or both,

b) Model or type designation,

c) Voltage, type and wattage of the lamp to be used, and

d) Country of manufacture.

*General and safety requirements for electric lighting fittings. (Since revised).

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

4.3 The lighting 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-defined 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.

5. TESTS

5.1 Classification of Tests

5.1.1 *Type Tests* — The following shall constitute type tests:

a) Insulation resistance (dry) test (*see* **5.2**);
b) High voltage test (*see* **5.3**);
c) Test for temperature-rise (*see* **5.4**);
d) Test for thermal shock proofness for cover glass (*see* **5.5**); and
e) Test for protection against entry of water (*see* **5.6**):
   1) Test for watertight fittings,
   2) Test for submersible fittings, depending on the classification.

5.1.2 *Routine Tests* — The insulation resistance (dry) test (*see* **5.2**) and high voltage test (*see* **5.3**) shall be carried out as routine tests.

5.2 Insulation Resistance (Dry) Test

5.2.0 This test may be carried out at the prevailing atmospheric temperature and humidity.

5.2.1 The insulation resistance shall be measured between:

a) live parts of different polarity inside the fitting, and
b) live parts and external metal parts of the fitting by the application of a dc voltage of 500 V for one minute.

5.2.2 The insulation resistance values thus measured shall not be less than 5 megohms.

NOTE — The insulation resistance test between live parts of different polarity is not applicable to discharge lamp fittings containing transformers or power-factor correction capacitors.

5.3 High Voltage Test

5.3.1 The fittings shall satisfactorily withstand the application of 1 000 V rms between the parts specified in 5.2.1.

5.3.1.1 The test voltage shall be approximately of sine-wave from having any convenient frequency between 40 to 60 cycles per second.

5.3.1.2 The full test voltage shall be applied gradually. The initial voltage shall not exceed 30 percent of the full test voltage and shall be increased uniformly to the full voltage within 30 seconds. The full test voltage shall be maintained for one minute after which the test voltage shall be diminished rapidly to 30 percent of its full value before switching it off.

5.3.1.3 There shall be no puncture or arcing during the high voltage test.

5.3.2 For routine test, the high voltage test may be carried out in the form of a flash test by the application of 1 500 V rms for a duration of approximately 5 seconds between the parts specified in 5.2.1.

NOTE — The high voltage test between live parts of different polarity is not applicable to discharge lamp fittings containing transformers or power-factor correction capacitors.

5.4 Test for Temperature-Rise

5.4.1 The test shall be carried out with a lamp of 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 operated at nominal voltage.

5.4.2 The measurement of temperature shall be made in accordance with Appendix C.

5.4.3 In normal operation any surface which is likely to be touched more than momentarily in ordinary service, shall not attain a temperature greater than 55°C if made of metal, or 65°C if made of other materials.

NOTE — The temperature-rises given above are with reference to an ambient temperature of 40°C.

5.5 Test for Thermal Shock proofness for Cover Glass

5.5.1 The thermal shock-proofness of the cover glass shall be tested by operating the lighting fittings in still air until the glass has attained a steady temperature and then pouring cold water at 10 to 12°C on the glass while the lamp is still burning.

5.5.2 This test shall be repeated four times and shall not cause any damage to the glass.

5.6 Test for Protection Against Entry of Water

5.6.1 The following test shall be carried out depending on the classification of the lighting fittings. Immediately afterwards the insulation resistance of the fittings shall be measured in accordance with **5.2.1** and the measured value shall not be less than 2 megohms.

5.6.2 *Test for Watertight Fittings* — The fitting shall be immersed for 24 hours in water at a temperature of 27 $\pm$5°C, the highest point of the lighting fitting being about 5 cm below the surface of the water. Before immersion, the lighting fitting is heated (by switching on the lamp) so that the temperature of the lighting fitting exceeds the temperature of the water by 5 to 10°C. At the end of the 24-hour submersion period there shall be no visible evidence of water having entered the fitting.

NOTE — This test is not adequate for testing lighting fittings designed for submerged operation.

5.6.3 *Test for Submersible Fittings* — under consideration.

6. CRITERION OF APPROVAL

6.1 Samples to be mutually agreed upon by the purchaser and the manufacturer, shall be submitted for testing together with relevant data. The testing authority shall issue a type approval certificate if the lighting fittings are found to comply with the requirements of tests given in **5**.

6.2 In the case of failure in any one type test, the testing authority may, at its discretion, call for fresh samples not exceeding twice the number of original samples and subject them to tests in which failure occurred. If in repeat tests, no failure occurs, the tests may be considered to have been satisfied.

APPENDIX A

(*Clause* 3.3.1)

PROTECTION AGAINST AGEING AND CORROSION

A-0. GENERAL

A-0.1 The following general guidance on good practice for protection against ageing and corrosion is to be regarded as being typical and not exhaustive. Although the types of atmosphere in which lighting fittings

operate are numerous, they are divided into two main groups for the purpose of this specification:

a) For use outdoors and in conditions of high humidity, and

b) For use in chemically corrosive atmospheres.

A-1. LIGHTING FITTINGS FOR USE OUTDOORS AND IN CONDITIONS OF HIGH HUMIDITY

A-1.1 Although it is assumed that these lighting fittings will not be required to operate in conditions where chemical vapours are present, it should be remembered that all atmospheres contain a small proportion of corrosive gases, such as sulphur dioxide, and that in the presence of moisture these may cause severe corrosion over a long period of time.

A-1.2 Where condensation takes place regularly, electroplated steel components should not be used. Although some electroplated finishes have very good resistance to corrosion attack, if the plated coating is damaged during the erection or maintenance, attack on the base metal will be rapid. It is, therefore, advisable for protection to choose suitable corrosion resistance metals (such as the stainless steel and silicon aluminium alloys) for the base rather than to rely wholly on protective finishes.

A-1.3 Dipped metal finishes are not covered by **A-1.1** and **A-1.2**; however, a heavy hot-dipped galvanized finish may be satisfactory.

A-1.4 Metal components that are in contact should be made from metals which lie close to each other in the potential series to avoid electrochemical corrosion. For example, brass or other copper alloys should not be used in contact with aluminium or aluminium alloys; stainless steel is much more satisfactory.

A-1.5 Where plastics are used, materials shall be chosen which do not suffer significant change in dimensions caused by absorption of water. Cellulosic materials are in general unsuitable for conditions of high humidity. Where the construction with plastic includes cemented joints, the cement used shall be able to withstand continuous exposure to moisture for long periods without deterioration.

A-1.6 The effects of corrosion can be reduced by attention to details of design. As far as possible, hinges should be shrouded, fixing studs should be under rather than on upper surfaces, and lips should be incorporated in the design to shed water away from joints.

A-2. LIGHTING FITTINGS FOR USE IN CHEMICALLY CORROSIVE ATMOSPHERES

A-2.1 Where lighting fittings are to be used in chemically corrosive atmospheres, all the precautions given above for lighting fittings designed for

outdoor use and in humid atmospheres should be observed as condensation of corrosives is usually possible, and the following additional measures should be taken.

A-2.2 In general, lighting fittings whose bodies are made by casting a corrosion resistance metal will give better service than sheet metal ones.

A-2.3 The base metal and the paint or other protective system should be chosen to combat the particular corrosives present, as most materials are subject to attack by some corrosive. For example, paints which are highly acid resistance may not be able to withstand attack by some alkalis.

A-2.4 While most plastics offer good resistance to attack by many organic acids and alkalis, they are liable to attack by a number of organic chemicals. The effect depends on the type of plastic and on the particular chemicals present, and materials shall be chosen to suit the conditions.

A-2.5 Although vitreous enamel finishes are very resistant to many chemicals, it is essential for good service that the enamel coating should be free from any broken areas or cracks otherwise attack on the base metal will be rapid.

A-2.6 Where the corrosive conditions are very bad, it is advisable to paint the whole installation after assembly with a bitumastic anticorrosive paint.

APPENDIX B

(Clause 3.4)

PHOTOMETRIC DATA

B-1. Light distribution data is required for the purpose of:

a) assessing the photometric performance of the lighting equipment, and

b) designing lighting installations on a factual basis.

B-2. Some or all of the following items of information shall be provided by the manufacturer of the fitting:

a) Light distribution curve(s) in one or more vertical planes,

b) Total light output ratio,

c) Upward light output ratio, and

d) Downward light output ratio.

The above data shall be stated for the condition when a clean fitting is equipped with a lamp(s) each with its light centre in the correct normal position and each having a luminous output equal to the average luminous output throughout the life of such lamps, this reference value of the lamp output being recorded on each separate set of data or chart together with the technical description of the lamps used. When the lamp used for the test is covered by the relevant Indian Standards, the appropriate reference value for luminous output will be taken therefrom or a correction factor provided for adjusting the data accordingly if it has been prepared for a lamp output other than that specified.

APPENDIX C

(*Clause* 5.4.2)

METHOD OF MEASUREMENT OF TEMPERATURE-RISE OF A LIGHTING FITTING

C-1. METHOD OF MEASUREMENT

C-1.1 The test is made in a rectangular draught-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 mm 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.

C-1.2 Fittings are so positioned that the light source is near the 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 to 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.

C-1.3 Temperature measurements are made by means of thermocouples (*see* IS : 2053-1962 Specification for thermocouple pyrometers)*.

C-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 may 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 materials 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. 1 and 2, 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. 1 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. 2. The hottest point on the fitting is found by preliminary exploration using a thermocouple in a holder, such as those shown in Fig. 1 and 2 and a thermocouple fixed to this point. With materials of low thermal conductivity, such as glass or plastics, it is important to remember that the point of maximum temperature may vary widely from one position to another.

*The use of other devices for surface temperature measurement is being kept under review. Some instruments are available which use a thermistor mounted in a probe and are convenient for exploring over a surface to find the hottest point. In the present stage of development, not all probes are suitable for accurate surface temperature measurement on materials of low thermal conductivity because they extract too much heat at the point of contact. Careful selection of instrument is necessary if reliable absolute measurements are to be obtained on such surfaces.

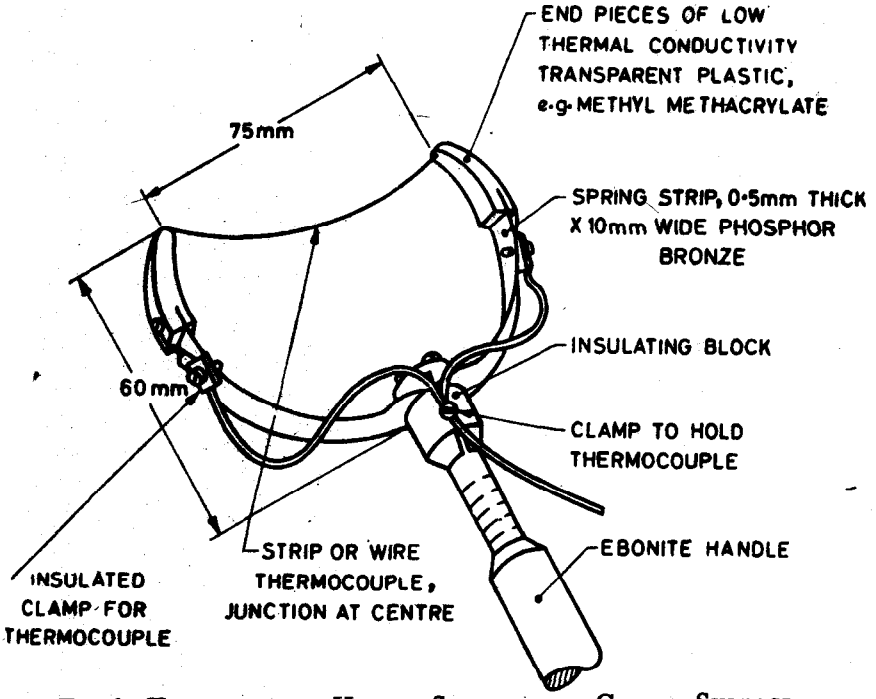

FIG 1 THERMOCOUPLE HOLDER SUITABLE FOR CONVEX SURFACES

C-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, glycerine, to prevent rapid changes in temperature. Its temperature is measured by an accurate mercury-in-glass thermometer.

C-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 should be within the range of 15 to 50°C.

C-1.7 The test is continued until steady temperatures are attained, the operating conditions for the fitting as defined under **5.4** being maintained constant.

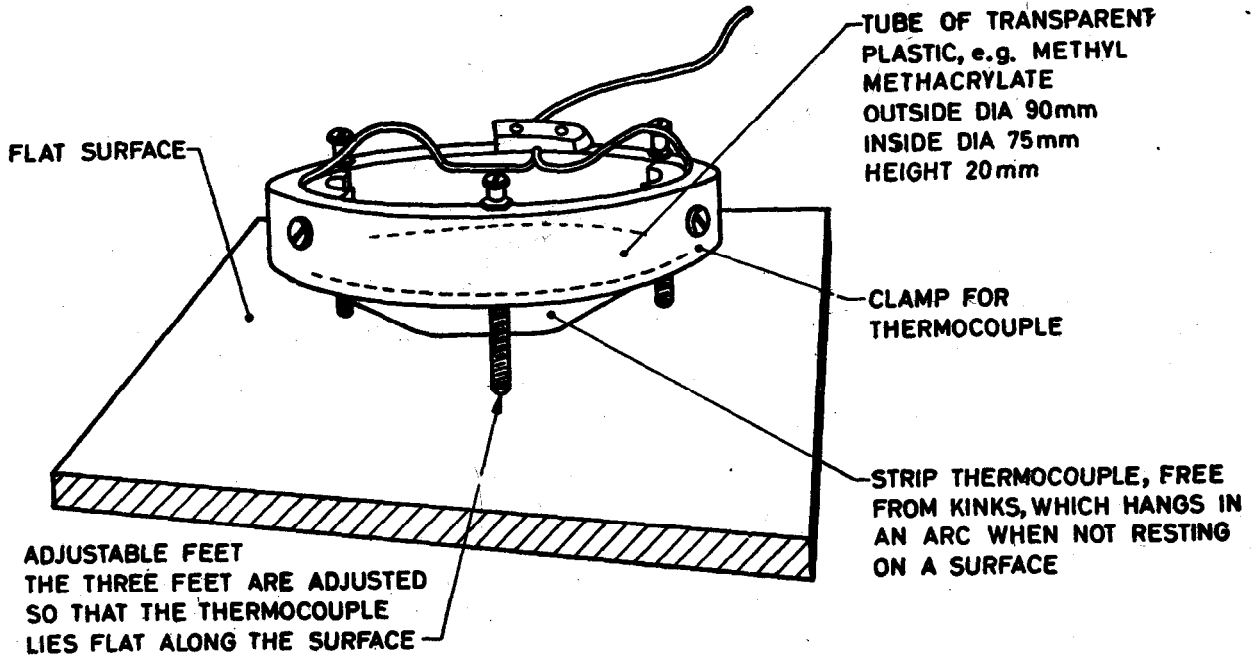

FIG. 2 THERMOCOUPLE HOLDER SUITABLE FOR FLAT SURFACES

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Printed at Simco Printing Press, Delhi, India