BRITISH STANDARD

BS 5685-1: 1979

Incorporating Amendment Nos. 1 and 2

Electricity meters —

Part 1: Specification for Class 0.5, 1 and 2 single-phase and polyphase, single rate and multi-rate watt-hour meters

UDC 621.317.78:681.138.87

Cooperating organizations

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

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

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

BEAMA Meter Association
Electrical Power Engineers' Association

This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Committee, was published under the authority of the Executive Board and comes into effect on 30 March 1979

The following BSI references relate to the work on this standard:
Committee reference PEL/14
Draft for comment 77/29500 DC

ISBN 0 580 10615 2

Amendments issued since publication

Amd. No.	Date of issue	Comments
3061	August 1979	
4792	May 1985	Indicated by a sideline in the margin

Contents

Foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Committee. It closely follows IEC Publication 521 "*Class 0.5, 1 and 2 alternating-current watt-hour meters*", although it has been necessary to put in additional clauses and consequent modifications to cater for British requirements already standardized. Significant technical additions and deviations are indicated by vertical lines in the margin.

This standard is harmonized with HD 309.1 of the European Committee for Electrotechnical Standardization with regard to Class 2 meters.

BS 5685, in four Parts, will supersede all the various Parts of BS 37. BS 37-6, BS 37-8 and BS 37-10 were withdrawn in December 1983 without replacement. This Part of BS 5685 supersedes BS 37-2, BS 37-4, BS 37-7, BS 37-11 and BS 37-12, which have been withdrawn. BS 5685-2 will supersede BS 37-3; BS 5685-3 will supersede BS 37-5 and BS 5685-4 will supersede BS 37-9. On completion of the four Parts of BS 5685, BS 37-1 will be withdrawn.

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 26, an inside back cover and a back cover.

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

1 Scope and references

1.1 Scope. This standard specifies the mechanical and electrical requirements and type tests, for single-phase and polyphase, single rate and multi-rate, induction type watt-hour meters of accuracy Classes 0.5, 1 and 2, for the measurement of alternating current electrical active energy of a frequency in the range of 45 Hz to 65 Hz, and having a voltage across the connection terminals not exceeding 600 V (line-to-line for meters for polyphase systems).

The standard does not apply to measuring devices, such as those used for telemetering electrical energy, which are dealt with in other standards, nor to maximum demand indicators. The standard does not apply to meters for testing purposes, nor to special types of watt-hour meters such as excess meters (although it does apply to multi-rate meters).

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

2 Units

The units employed in this standard are in accordance with BS 5775-5.

3 Definitions

For the purposes of this British Standard the following definitions apply. For further definitions relating to measurement see BS 4727-1:Group 04.

3.1
watt-hour meter (active-energy meter)

an integrating instrument which measures active energy in watt hours or in decimal multiples thereof

3.2
induction meter

a meter in which currents in fixed coils react with the currents induced in the conducting moving element, generally a disc or discs, which causes its movement

3.3
multi-rate meter

a meter provided with a register consisting of more than one set of drums or dials, each set becoming operative at times corresponding to different tariff rates

3.4
meter rotor

the moving element of the meter upon which the magnetic fluxes of fixed windings and of braking elements act, and which operates the register

3.5
meter driving element

a working part of the meter which produces a torque by the action of its magnetic fluxes upon the currents induced in the moving element. It generally comprises electromagnets with their control devices

3.6
meter braking element

the part of the meter which produces a braking torque by the action of its magnetic flux upon the currents induced in the moving element. It comprises one or more magnets and their adjusting devices

3.7
register of a meter (counting mechanism of a meter)

the part of the meter which registers the energy, or more generally the value of the quantity measured by the meter

3.8 meter base

The back of the meter by which it is generally fixed and to which are attached the frame, the terminals or the terminal block and the cover; for a flush-mounted meter, it may include the sides of the case.

3.8.1
meter socket

an enclosure with jaws to accommodate terminals of a detachable watt-hour meter and which has connectors from the termination of the circuit conductors. It may be a single-position socket for one meter or a multiple-position socket for two or more meters

3.9
meter cover

the enclosure on the front of the meter, made either wholly of transparent material or opaque material provided with window(s) through which the movement of the rotor can be seen and the register can be read

3.10
meter case

this comprises the base and the cover

3.11
meter frame

the part to which are affixed the driving elements, the rotor bearings, the register, usually the braking element, and sometimes the adjusting devices

3.12
accessible conducting part

a conducting part which can be touched by the standard test finger[1)], when the meter is installed ready for use

3.13
protective earth terminal

the terminal connected to accessible conducting parts of a meter, for safety purposes

3.14
terminal block

a support made of insulating material on which all or some of the terminals of the meter are grouped together

3.15
terminal cover

a cover which covers the meter terminals and, generally, the ends of the external wires or cables connected to the terminals

3.16
current circuit

the winding of the driving element and the internal connections of the meter through which flows the current of the circuit to which the meter is connected

NOTE When the meter incorporates a current transformer, the current circuit also includes the transformer windings.

3.17
voltage circuit

the winding of the driving element and internal connections of the meter, supplied with the voltage of the circuit to which the meter is connected

[1)] See **6.1.1** of BS 5458:1977.

3.18
auxiliary circuit

the elements (windings, lamps, contacts, etc.) and connections of an auxiliary device within the meter case intended to be connected to an external device, i.e. clock, relay, or impulse counter

3.19
basic current[2)] (I_b)

the value of current in accordance with which the relevant performance of the meter is fixed

3.20
rated maximum current[2)] (I_{max})

the highest value of current at which the meter purports to meet the accuracy requirements of this standard

3.21
reference voltage[2)]

the value of voltage in accordance with which the relevant performance of the meter is fixed

3.22
reference frequency

the value of frequency in accordance with which the relevant performance of the meter is fixed

3.23
basic speed

the nominal speed of rotation of the rotor expressed in revolutions per minute when the meter is under reference conditions and carries basic current at unity power factor

3.24
basic torque

the nominal value of the torque on the rotor when at rest, when the meter is under reference conditions and carries basic current at unity power factor

3.25
meter constant

a constant expressing the relation between the energy registered by the meter and the corresponding number of revolutions of the rotor, either in revolutions per kilowatt hour or watt hours per revolution

3.26
reference temperature

the ambient temperature specified for reference conditions

3.27
clearance

the shortest distance measured in air between conductive parts

3.28
creepage distance

the shortest distance measured over the surface of insulation between conductive parts

3.29
type

the designation used for defining a particular design of meter, manufactured by one manufacturer, having:

a) similar metrological properties,

b) the same uniform construction of parts determining these properties,

[2)] The terms voltage and current indicate r.m.s. values unless otherwise specified.

c) the same number of ampere turns for the current winding at basic current and the same number of turns per volt for the voltage winding at reference voltage,

d) the same ratio of the maximum current to the basic current.

they may have several values of basic current and several values of reference voltage

these meters are designated by the manufacturer by one or more groups of letters or numbers, or of a combination of letters and numbers. Each type has one designation only

NOTE 1 The type is represented by the sample meter(s) intended for the type tests, and whose characteristics (basic currents and reference voltages) are chosen from the values given in the tables proposed by the manufacturer.

NOTE 2 Where the number of ampere turns would lead to a number of turns other than a whole number, the product of the number of turns of the windings and the value of the basic current may differ from that of the sample meter(s) representative of the type. It is advisable to choose the next number immediately above or below in order to have whole numbers of turns.

Only for this reason may the number of turns per volt of the voltage windings differ, but by not more than 20 %, from that of the sample meters representative of the type.

NOTE 3 The ratio of the highest to the lowest basic speed of the rotors of each of the meters of the same type should not exceed 1.5.

3.30
type test

a test carried out under prescribed conditions to verify one of the characteristics of the type of the meter

3.31
type approval procedure

the procedure according to which the series of type tests is carried out on one meter or on a small number of meters of the same type having identical characteristics, selected by the manufacturer, to verify that the respective type of meter complies with all the requirements of the standard for the relevant class of meters

3.32
qualification procedure

the procedure according to which type tests are carried out on one meter or on a small number of meters of the same type having identical characteristics, selected at random, to verify that the meter type has no serious systematic abnormalities. The precise tests and the number of meters to be tested are to be agreed between the parties

NOTE In practice, it is considered that no serious systematic abnormalities exist when two out of three meters tested comply with the relevant requirements of this standard for the test under consideration.

3.33
percentage error

the percentage error is given by the following formula:

$$\text{Percentage error} = \frac{\text{energy registered by the meter} - \text{true energy}}{\text{true energy}} \times 100$$

NOTE Since the true value cannot be determined, it is approximated by a value with a stated uncertainty that can be traced to standards agreed upon between manufacturer and user or to national standards.

3.34
variation of error due to an influence quantity

the difference between the percentage errors of the meter when only one influence quantity assumes successively two specified values

3.35
influence quantity or factor

any quantity or any factor other than the measured quantity whose effects may modify the measured results

3.36
distortion factor

the ratio of the r.m.s. value of the harmonic content (obtained by subtracting from a non-sinusoidal alternating quantity its fundamental term) to the r.m.s. value of the non-sinusoidal quantity.
The distortion factor is usually expressed as a percentage

3.37
mean temperature coefficient

the ratio of the variation of the percentage error to the change of temperature which produces this variation

3.38
vertical working position

the position of the meter in which the shaft of the rotor is vertical

3.39
class index

a number which gives the limits of the permissible percentage error, for all values of current between 0.1 I_b and $I_{max,}$ for unity power factor (and, in the case of polyphase meters, with balanced loads) when the meter is tested under reference conditions (including permitted tolerances on the reference values) as defined in this standard

4 Classification

In this standard, meters are classified according to their respective class indices, i.e. 0.5, 1 and 2.

5 Mechanical requirements

5.1 General. Meters shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:

a) personal safety against electric shock;

b) personal safety against effects of excessive temperature;

c) safety against spread of fire.

All parts which are subject to corrosion under normal working conditions shall be effectively protected. Any protective coating shall not be liable to damage by ordinary handling nor injuriously affected by exposure to air, under normal working conditions.

The meter shall have adequate mechanical strength and shall withstand the elevated temperature which is likely to occur in normal working conditions.

The components shall be reliably fastened and secured against loosening.

The electrical connections shall be such as to prevent any opening of the circuit, including any overload conditions specified in this standard.

The construction of the meter shall be such as to minimize the risks of short-circuiting of the insulation between live parts and accessible conducting parts due to accidental loosening or unscrewing of the winding, screws, etc.

5.2 Case. The meter shall have a reasonably dustproof case which can be sealed in such a way that the internal parts of the meter are accessible only after breaking the seals.

The cover shall not be removable without the use of a tool, coin or any similar device.

The case shall be so constructed and arranged that any non-permanent deformation cannot prevent the satisfactory operation of the meter.

The case of a Class 0.5 meter shall be constructed so that, if mounted according to the manufacturer's instructions, the meter shall not deviate by more than 0.5° in all directions from its vertical position (see footnote b to Table 10).

For single-phase, two wire meters, the overall dimensions of the meter and the spacing of fixing holes shall be in accordance with the relevant values given in Table 20.

Unless otherwise specified, meters intended to be connected to a supply mains where the voltage under normal conditions exceeds 250 V to earth, and whose case is wholly or partially made of metal, shall be provided with a protective earth terminal.

5.3 Windows. If the meter cover is not transparent, one or more windows shall be provided for reading the register and observation of the rotor. These windows shall be covered by plates of transparent material which cannot be removed without breaking the seals.

5.4 Terminals, terminal block(s) and protective earth terminal. Terminals may be grouped in a terminal block(s) having adequate insulating properties and mechanical strength. In order to satisfy such requirements, when choosing insulating materials for the terminal block(s), adequate testing of materials should be taken into account.

The material of which the terminal block is made shall be capable of passing the tests specified in BS 2782-1:Method 121A for a temperature of 135 °C.

The holes in the insulating material, which form a prolongation of the terminal holes, shall be of sufficient size to accommodate the insulated conductors.

Unless otherwise specified by the user, it shall be possible to disconnect easily the relevant voltage terminal(s) from the input current terminal(s).

The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating.

All direct connected meters for rated maximum currents up to and including 160 A, and all meters operated from external current transformers, shall have two screws in each current terminal for effectively clamping the external conductors or thimbles.

Screw connections transmitting contact force and screw fixings which may be loosened and tightened several times during the life of the meter, shall screw into a metal nut.

Electrical connections shall be so designed that contact pressure is not transmitted through insulating material.

The clearances and creepage distances of the terminal block and those between the terminals and the surrounding parts of the metal enclosure shall be not less than the values specified in Table 1 for voltages existing when operating under reference conditions.

Table 1 — Clearances and creepage distances

Voltage	Clearance	Creepage distance
V	mm	mm
Up to 25	1	1
From 26 to 60	2	2
From 61 to 250	3	3
From 251 to 450	3	4
From 451 to 600	4	6

For current circuits, the voltage is considered to be the same as for the related voltage circuit.

Terminals with different potentials which are grouped close together shall be protected against accidental short-circuiting. Protection may be obtained by insulating barriers. Terminals of one current circuit are considered to be at the same potential.

The terminals, the conductor fixing screws, or the external or internal conductors shall not be liable to come into contact with metal terminal covers.

The clearance between the terminal cover, if made of metal, and the upper surface of the screws, when screwed down to the maximum applicable conductor which can be fitted, shall be not less than the relevant values indicated in Table 1.

For single-phase, two wire meters, the dimensions and spacing of the terminals shall be in accordance with the relevant values given in Table 20. (See Figure 1.)

For polyphase meters, the current terminals of direct connected meters having rated maximum currents up to and including 100 A shall be in accordance with the values *K*, *L* and *P* given in Table 20.

For direct connected polyphase meters having a rated maximum current above 100 A and up to and including 160 A, the diameter of the terminal bore shall be 12.7 + 0.5, – 0 mm.

The protective earth terminal, if any, shall:

a) be electrically bonded to the accessible metal parts,

b) if possible, form part of the meter base;

c) preferably be located adjacent to its terminal block;

d) accommodate a conductor having a cross section at least equivalent to the main current conductors but with a lower limit of 6 mm^2 and an upper limit of 16 mm^2 (these dimensions apply only when copper conductors are used);

e) be clearly identified by the earthing symbol[3)].

All parts of every terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.

After installation, it shall not be possible to loosen the protective earth terminal without the use of a tool, coin or any similar device.

NOTE The extent to which this clause applies to switchboard pattern meters should be agreed between the parties concerned.

5.5 Terminal cover(s). The terminals of a meter, if grouped in a terminal block, shall have a separate cover which can be sealed independently of the meter cover. The terminal cover shall enclose the actual terminals, the conductor fixing screws and, unless otherwise specified, a suitable length of the external conductors and their insulation.

When the meter is panel-mounted, no access to the terminals shall be possible without breaking the seal(s) of the terminal cover(s).

5.6 Flammability. The terminal block, the terminal cover and the case shall ensure reasonable safety against fire. If not of metal the terminal cover and case shall be of a material which complies with the requirements of the flammability test given in Appendix B and illustrated in Figure 7.

NOTE The results of this test relate only to the specific end use situation and should not be used for any general assessment of the potential fire hazard of materials.

If the materials of the terminal block, the terminal cover and the case meet this requirement, the finished articles need not be tested.

5.7 Register (counting mechanism). The register may be of the drum or of the pointer type.

The principal unit in which the register records shall be the kilowatt hour (kW h) or the megawatt hour (MW h).

In drum-type registers, the principal unit in which the register records shall be marked adjacent to the set of drums. In this type of register, only the last drum, i.e. the drum on the extreme right, may be movable continuously.

In drum-type registers, the figure height shall lie between 4.6 mm and 8.9 mm, except for those which indicate decimal fractions of the unit.

In pointer-type registers, the unit in which the register records shall be marked adjacent to the units dial in the form: 1 kW h/div, or 1 MW h/div, and adjacent to the other dials shall be marked the decimal multiples. For example, in a meter registering in terms of kilowatt hours, the units dial shall be marked: 1 kW h/div and the other dials to the left of the units dial shall be marked: 10 – 100 – 1 000, etc.

The radius of the circles, except those which indicate decimal fractions of the unit, shall be not less than 7.0 mm and the radial length of the pointers shall be less than the radius of the circles but by not more than 0.5 mm. The height of the figures around the circles shall be not less than 2.3 mm and not more than 2.8 mm.

Drums, when continuously rotating, or dials indicating the lowest values shall be graduated and numbered in ten divisions, each division being subdivided into ten parts or any other arrangement ensuring the same reading accuracy.

3) See BS 5458.

Drums of drum-type registers or dials of pointer-type registers which indicate a decimal fraction of the unit shall, when they are visible, be encircled in colour or be coloured.

The register shall be able to record, starting from zero, for a minimum of 1 500 h, the energy corresponding to rated maximum current at reference voltage and unity power factor. Any higher values can be agreed upon between the parties concerned.

For multi-rate registers, the registers shall be marked with a designation of the respective rates. For two-rate meters, the designation shall be "NORMAL" and LOW" and for three-rate meters, the designation shall be "HIGH", "NORMAL" and "LOW". For two-rate meters the register marked "LOW" shall be the upper register, the register marked "NORMAL" shall be the lower register. For three-rate meters, the register marked "LOW" shall be at the top and the register marked "HIGH" shall be at the bottom. A visible means shall be provided to indicate which register is in operation.

The register change-over device shall operate at 80 % of the marked voltage when the meter is marked with a single voltage or at 90 % of the minimum marked voltage when the meter is marked for a range of voltages. The register change-over device shall not remain operative at or below 10 % of a single marked voltage or at or below 10 % of the mean of a range of voltages.

In a two-rate meter, the register which is in operation when the coil is energized shall be that marked "LOW".

With the meter voltage circuit energized and with no current in the meter current circuit, the registration on any register shall not exceed a half revolution of the pointer or number drum of the lowest denomination for 100 operations of the change-over device(s).

The circular scales or number drums shall be as detailed in Table 21.

Register markings shall be indelible and easily readable.

5.8 Direction of rotation and marking of the rotor. The edge of the rotor nearest an observer viewing a meter from the front shall move from left to right for positive registration. The direction of rotation shall be marked by a clearly visible arrow.

The edge and/or upper surface of the disc shall carry an easily visible mark with a width of between 1/20th and 1/30th of the circumference of the disc to facilitate revolution counting. Other marks may be added for stroboscopic or other tests, but such marks shall be so placed as not to interfere with the use of the main visible mark for photoelectric revolution counting.

6 Electrical requirements

6.1 Standard currents. The standard currents are as given in Table 2.

Table 2 — Standard basic currents

Meters for	Basic current	Maximum rated current
	A	A
Direct connection, single-phase	20	80
Direct connection, polyphase	40 80	100 160
Connection through current transformer	1 5	1.2 6
NOTE When the meter is operated from a current transformer(s), attention is drawn to the need for matching the current range of the meter in relation to that of the secondary of the current transformer(s).		

6.2 Standard reference voltages. The standard reference voltages are as given in Table 3.

Table 3 — Standard reference voltages

Meters for	Standard reference voltages	Exceptional values
	V	V
Direct connection	127, 220, 240, 380, 415, 480	100, 120, 200, 277, 500, 600
Connection through voltage transformer	57.7, 63.5, 100, 110, 115, 120, 173, 190, 200	

6.3 Power losses

6.3.1 *Voltage circuits*. The loss in each voltage circuit of a meter at reference voltage, reference temperature and reference frequency shall not exceed the values shown in Table 4.

Table 4 — Power loss

Meters	Class of meter	
	0.5 and 1	2
Single-phase	3 W and 12 V A	2 W and 8 V A
Polyphase	3 W and 12 V A	2 W and 10 V A

6.3.2 *Current circuits*. The apparent power taken by each current circuit of a meter at basic current, reference frequency and reference temperature shall not exceed the values shown in Table 5.

Table 5 — Apparent power loss

Single-phase and polyphase meters	Class of meter		
	0.5	1	2
Basic current 40 A and below	6.0 V A	4.0 V A	2.5 V A
Currents exceeding 40 A and not exceeding 80 A	—	—	5.0 V A
NOTE When the meter is operated from current transformer(s), attention is drawn to the need for considering the power losses in relation to the rated output of the current transformer(s) and the impedance of the connecting leads.			

6.3.3 *Auxiliary circuits*. The loss in each auxiliary voltage circuit at the reference voltage shall not exceed 4 W, 8 V A and an additional 2 W, 3 V A every 100 V or part thereof above 240 V.

6.4 Heating. Under normal conditions of use, windings and insulation shall not reach a temperature which might adversely affect the operation of the meter.

With each current circuit of the meter carrying rated maximum current and with each voltage circuit (and with those auxiliary voltage circuits which are energized for periods of longer duration than their thermal time constants) carrying 1.2 times the reference voltage, the temperature rise of the respective parts shall not exceed the values given in Table 6 with an ambient temperature not exceeding 40 °C.

During the test, the duration of which shall be 2 h, the meter shall not be exposed to draught or direct solar radiation.

Table 6 — Heating

Part of meter	Temperature rise
	K
Windings	60
External surfaces of the case	25

After the test, the meter shall show no damage and shall comply with the requirements of the dielectric tests of **6.5.2** and **6.5.3**.

Except for the requirements relating to the temperature rise of the windings given in Table 6, the insulation materials shall comply with the appropriate requirements of BS 2757.

The temperature rise of the windings shall be determined by the variation of resistance method[4)]. The measurement shall be carried out at the point of connection between the current winding and the respective terminal.

For the measurement of circuit resistance, the cable to be used for energizing the meter shall have a length of about 1 m and a cross section such that the current density is less than 4 A/mm^2.

[4)] The International Standard of resistance for copper is IEC Publication 28.

6.5 Dielectric properties. The meter and its incorporated auxiliary devices, if any, shall be such that they retain adequate dielectric qualities under normal conditions of use, taking account of the atmospheric influences and different voltages to which they are subjected under normal conditions of use.

Consequently, the meter shall withstand the dielectric proving tests specified in **6.5.2** and **6.5.3**.

The tests shall be carried out only on a complete meter, with its cover (except when indicated hereafter) and terminal cover, the screws being screwed down to the maximum applicable conductor fitted in the terminals.

These tests shall be carried out once only on a meter, in accordance with the appropriate procedure given in BS 923.

During type tests, the dielectric property tests are considered to be valid only for the terminal arrangement of the meter which has undergone the tests. When the terminal arrangements differ, all the dielectric property tests shall be carried out anew.

For the purpose of these tests, the term "earth" has the following meaning:

a) when the meter case is made of metal, the earth is the case itself placed on a flat conducting surface;

b) when the meter case or only a part of it is made of insulating material, the earth is a conductive foil wrapped around the meter and connected to the flat conducting surface on which the meter base is placed. Where the terminal cover makes it possible, the conductive foil shall approach the terminals and the holes for the conductors within a distance of approximately 20 mm.

During the impulse and the a.c. voltage tests, the circuits which are not under test are connected either to the frame or to the earth as indicated hereafter.

The impulse voltage tests are carried out first and the a.c. voltage tests afterwards.

During these tests, no flashover, disruptive discharge or puncture shall occur.

After these tests, there shall be no change in the percentage error of the meter greater than the uncertainty of the measurement.

In this subclause, the expression "all the terminals" means the whole set of the terminals of the current circuits, voltage circuits and auxiliary circuits (if any) having a reference voltage over 40 V.

6.5.1 *General conditions for dielectric properties tests*. These tests shall be made in normal conditions of use. During the test, the quality of the insulation shall not be impaired by dust or abnormal humidity.

Unless otherwise specified, the normal conditions for insulation tests are:

ambient temperature	15 °C to 25 °C
relative humidity	45 % to 75 %
atmospheric pressure	86 kPa to 106 kPa (860 mbar to 1 060 mbar)

6.5.2 *Impulse voltage test*. The impulse voltage tests are intended to determine the capability of the meter to withstand without damage short-time overvoltages of high values.

NOTE The aim of the tests in **6.5.2.1** is essentially to ensure, on the one hand, the quality of the insulation of the voltage windings between turns or between layers and, on the other hand, the insulation between different circuits of the meter which in normal service are connected to conductors of different phases of the network and between which overvoltage may occur.
The test in **6.5.2.2** is intended to provide overall verification of the behaviour of the insulation of all the electrical circuits in the meter relative to earth. This insulation represents an essential safety factor for personnel in the event of overvoltage on the network.

The energy of the generator used for the test shall be in accordance with the relevant requirements of BS 923. The waveform of the impulse is the standard 1.2/50 μs lightning impulse according to BS 923 and its peak value is 6 kV. For each test, the impulse voltage is applied ten times with the same polarity.

6.5.2.1 *Tests of insulation for circuits and of insulation between the circuits*. The test shall be made independently on each circuit (or assembly of circuits) which are insulated from the other circuits of the meter in normal use. The terminals of the circuits which are not subjected to impulse voltage shall be connected to earth.

Thus, when in normal use the voltage and the current circuits of a driving element are connected together, the test shall be made on the whole. The other end of the voltage circuit shall be connected to earth and the impulse voltage shall be applied between the terminal of the current circuit and earth. When several voltage circuits of a meter have a common point, this point shall be connected to earth and the impulse voltage successively applied between each of the free ends of the connections (or the current circuit connected to it) and earth.

When in normal use, the voltage and the current circuits of the same driving element are separated and appropriately insulated (e.g. each circuit connected to measuring transformer) the test shall be made separately on each circuit.

During the test of a current circuit, the terminals of the other circuits shall be connected to earth and the impulse voltage shall be applied between one of the terminals of the current circuit and earth. During the test of a voltage circuit, the terminals of the other circuits and one of the terminals of the voltage circuit under test shall be connected to earth and the impulse voltage shall be applied between the other terminal of the voltage circuit and earth.

The auxiliary circuits intended to be connected either directly to the mains or to the same voltage transformers as the meter circuits and with a reference voltage over 40 V shall be subjected to the impulse voltage test in the same conditions as those already given for voltage circuits. The other auxiliary circuits shall not be tested.

6.5.2.2 *Test of insulation of electric circuits relative to earth*. All the terminals of the electric circuits of the meter, including those of the auxiliary circuits with a reference voltage over 40 V, shall be connected together.

The auxiliary circuits with a reference voltage below or equal to 40 V shall be connected to earth.

The impulse voltage shall be applied between all the electric circuits and earth.

6.5.3 A.C. voltage test. The a.c. voltage tests shall be carried out in accordance with Table 7.

The test voltage shall be substantially sinusoidal, having a frequency between 45 Hz and 65 Hz, and applied for 1 min. The power source shall be capable of supplying at least 500 VA.

During the tests relative to the frame [a) in Table 7], the circuits which are not under test shall be connected to the frame.

During the tests relative to earth [c) in Table 7], the auxiliary circuits with reference voltages equal to or below 40 V shall be connected to earth.

7 Marking of meters

7.1 Nameplates. Every meter shall bear the following information.

a) The manufacturer's name or trade mark and, if required, the place of manufacture.

b) The designation of type (see **3.29**) and, if required, space for approval mark.

c) The number of phases and the number of wires for which the meter is suitable (e.g. single-phase, two wire; three-phase, three wire; three-phase, four wire); these markings may be replaced by the graphical symbols shown in Appendix A.

d) The serial number and year of manufacture. If the serial number is marked on a plate fixed to the cover, the number is to be marked also on the meter base or frame.

e) The reference voltage in one of the following forms:

1) the number of elements if more than one, and the voltage at the meter terminals of the voltage circuit(s);

2) the nominal voltage of the system or the secondary voltage of the instrument transformer to which the meter is intended to be connected.

Examples of markings are shown in Table 8.

f) The basic current and the rated maximum current expressed, for example, thus: 20 – 80 A for a meter having a basic current of 20 A and a rated maximum current of 80 A[5)].

[5)] When the meter is connected to a current transformer, the rated maximum current may be limited by the overload capacity of the transformer.

Table 7 — A.C. voltage tests

Test voltage r.m.s.	Points of application of the test voltage
	a) *Tests which may be carried out with the cover and terminal cover removed* Between the frame and:
2 kV [for tests 1), 2), 3) and 4)]	1) each current circuit which, in normal service, is separated and suitably insulated from the other circuits[a],
	2) each voltage circuit, or set of voltage circuits having a common point which, in normal service, is separated and suitably insulated from the other circuits[a],
	3) each auxiliary circuit or set of auxiliary circuits having a common point, and whose reference voltage is over 40 V,
and	4) each assembly of current-voltage windings of one and the same driving element which, in normal service, are connected together but separated and suitably insulated from the other circuits[b],
500 V, [for test 5)]	5) each auxiliary circuit whose reference voltage is equal to or below 40 V.
600 V or twice the voltage applied to the voltage windings under reference conditions, when this voltage is greater than 300 V (the higher value)	b) *Tests which may be carried out with the terminal cover removed, but with the cover in place when it is made of metal* Between the current circuit and the voltage circuit of each driving element, normally connected together, this connection being temporarily broken for the purpose of the test[c].
2 kV	c) *Test to be carried out with the case closed, the cover and terminal cover in place* Between, on the one hand, all the current and voltage circuits as well as the auxiliary circuits whose reference voltage is over 40 V, connected together, and, on the other hand, earth.

[a] The simple breaking of the connection which is normally included between current and voltage windings, is not generally sufficient to ensure suitable insulation which can withstand a test voltage of 2 kV.
Tests 1) and 2) generally apply to meters operated from instrument transformers and also to certain special meters having separate current and voltage windings.
[b] Circuits which have been subjected to tests 1) and 2) are not subjected to test 4). When the voltage circuits of a polyphase meter have a common point in normal service, this common point shall be maintained for the test and, in this case, all the circuits of the driving elements are subjected to a single test.
[c] It is not, strictly speaking, a dielectric strength test, but a means of verifying that the insulation distances are sufficient when the connecting device is open.

g) The reference frequency in hertz.

h) The constant of the meter in the form: x W h/rev or x rev/kW h.

NOTE The symbol "rev" for revolutions (instead of the more correct "r") is specified here in accordance with IEC Publication 521, which reflects usage in industry worldwide.

i) The class index of the meter indicated either by the number 0.5 placed in a circle, or by the Figure 1 placed in a circle according to the class of the meter, or by: "Cl. 0.5", "Cl. 1", "Cl. 2". In the absence of marking, the meter shall be regarded as a Class 2 meter.

j) The reference temperature if different from 23 °C.

k) The number of this British Standard, i.e. BS 5685.

Information under a), b) and c) may be marked on an external plate permanently attached to the meter cover.

Information under d) to k) shall be marked on a nameplate preferably placed within the meter and which may, for example, be attached to the meter register. The information may be marked on the meter dial.

The marking shall be indelible, distinct and readable from outside the meter.

If the meter is of a special type (e.g. provided with a reversal-preventing device or, in the case of a multi-rate meter, if the voltage of the change-over magnet differs from the reference voltage), this shall be specified on the nameplate or on a separate plate.

If the meter registers energy through instrument transformers of which account is taken in the meter constant, the transformation ratio(s) shall be marked.

It is also permitted to use standard symbols[6)].

7.2 Connection diagrams and terminal marking. Every meter shall be indelibly marked with a diagram of connections. For polyphase meters, this diagram shall also show the phase sequence for which the meter is intended.

If the meter terminals are marked, this marking shall appear on the diagram.

The standard connections of the respective direct connected meters covered by this standard are shown in Figure 2 to Figure 6.

8 Accuracy

8.1 Conditions under which the tests shall be carried out

a) The meter cover shall be in position.

b) For drum-type registers, only the most rapidly moving drum shall be turning.

c) Before any tests are made, the voltage circuits shall have been energized for at least

4 h for Class 0.5 meters

2 h for Class 1 meters

1 h for Class 2 meters

and the measuring currents shall be set progressively to increasing or decreasing values and the current circuits shall be energized at each value for a sufficient time to obtain thermal stability with corresponding constant speed of rotation.

d) In addition, for polyphase meters, the phase sequence shall be as marked on the diagram of connections and the voltages and currents shall be substantially balanced (see Table 9).

e) Reference test conditions shall be as shown in Table 10.

Table 8 — Voltage marking

Meters	Voltage at the terminals of the voltage circuit(s)	Nominal system voltage
Single-phase 2 wire 240 V	240 V	240 V
Single-phase 3 wire 2 element 240 V (240 V to the mid-wire)	240 V	480 V
Three-phase 4 wire 2 element (415 V between phases)	2 × 415 V	3 × 415 V
Three-phase 4 wire 3 element (240 V phase to neutral)	3 × 240(415) V	3 × 240/415 V

Table 9 — Voltage and current balance

Polyphase meters	Class of meter		
	0.5	1	2
Each of the voltages between line and neutral or between any two lines shall not differ from the average corresponding voltage by more than	± 0.5 %	± 1 %	± 1 %
Each of the currents in the conductors shall not differ from the average current by more than	± 1 %	± 2 %	± 2 %
The phase displacements of each of these currents from the corresponding line-to-neutral voltage, irrespective of the power factor, shall not differ from each other by more than	2°	2°	2°

6) IEC Publication 387 gives symbols for alternating current electricity meters.

Table 10 — Reference conditions

Influence quantity	Reference value	Permissible tolerances for meters of Class		
		0.5	1	2
Ambient temperature	Reference temperature or, in its absence, 23 °C[a]	± 1 °C	± 2 °C	± 2 °C
Working position	Vertical working position[b]	± 0.5°	± 0.5°	± 0.5°
Voltage	Reference voltage	± 0.5 %	± 1.0 %	± 1.0 %
Frequency	Reference frequency	± 0.2 %	± 0.3 %	± 0.5 %
Waveform	Sinusoidal voltage and current	Distortion factor less than:		
		2 %	2 %	3 %
Magnetic induction of external origin at the reference frequency	Magnetic induction equal to zero	Induction value which causes a variation of error not greater than[c]:		
		0.1 %	0.2 %	0.3 %

[a] If the tests are made at a temperature other than the reference temperature, including permissible tolerances, the results shall be corrected by applying the appropriate temperature coefficient of the meter.

[b] *Determination of the vertical working position* (see **5.2**). The construction and assembly of the meter should be such that the correct vertical position is ensured (in both the front-to-back and left-to-right vertical planes) when:

a) the base of the meter is supported against a vertical wall, and

b) a reference edge (such as the lower edge of the terminal block) or a reference line marked on the meter case is horizontal.

[c] The test consists of:

a) for a *single-phase* meter, determining the errors at first with the meter normally connected to the mains and then after inverting the connections to the current circuits as well as to the voltage circuits. Half of the difference between the two errors is the value of the variation of error. Because of the unknown phase of the external field, the test has to be made at 0.1 I_b at unity power-factor and 0.2 I_b at 0.5 power factor.

b) for a *three-phase* meter, making three measurements at 0.1 I_b at unity power-factor after each of which the connections to the current circuits and to the voltage circuits are changed over 120°, while the phase sequence is not altered. The greatest difference between each of the errors so determined and their average value is the value of the variation of error.

8.2 Limits of errors. When the meter is under the reference conditions given in **8.1**, the percentage errors shall not exceed the limits for the relevant accuracy class given in Table 11 and Table 12.

Table 11 — Percentage error limits

(Single-phase meters and polyphase meters with balanced loads)

Value of current	Power factor	Percentage error limits for meters of Class		
		0.5	1	2
0.05 I_b	1	± 0.1	± 1.5	± 2.5
From 0.1 I_b to I_{max}	1	± 0.5	± 1.0	± 2.0
0.1 I_b	0.5 lagging 0.8 leading	± 1.3 ± 1.3	± 1.5 ± 1.5	± 2.5 —
From 0.2 I_b to I_{max}	0.5 lagging 0.8 leading	± 0.8 ± 0.8	± 1.0 ± 1.0	± 2.0 —
When specially requested by the user: from 0.2 I_b to I_b	0.25 lagging 0.5 leading	± 2.5 ± 1.5	± 3.5 ± 2.5	— —

Table 12 — Percentage error limits

(Polyphase meters carrying a single-phase load, but with balanced polyphase voltages applied to voltage circuits)

Value of current	Power factor of the relevant element	Percentage error limits for meters of Class		
		0.5	1	2
From 0.2 I_b to I_b	1	± 1.5	± 2.0	± 3.0
0.5 I_b	0.5 lagging	± 1.5	± 2.0	—
I_b	0.5 lagging	± 1.5	± 2.0	± 3.0
From I_b to I_{max} (I_b excluded)	1	—	—	± 4.0
NOTE When testing for compliance with Table 12, the test current shall be applied to each element in sequence.				

The difference between the percentage error when the meter is carrying a single-phase load at basic current and unity power factor and the percentage error when the meter is carrying a balanced polyphase load at basic current and unity power factor, shall not exceed 1 %, 1.5 % and 2.5 % for meters of Classes 0.5, 1 and 2 respectively.

8.3 Test of meter constant. It shall be verified that the ratio between the number of revolutions of the meter rotor and the indication of the register is correct.

8.4 Interpretation of test results. Certain test results may fall outside the limits indicated in Table 11 and Table 12 owing to uncertainties of measurements and other parameters capable of influencing the measurements. However, if by one displacement of the zero line parallel to itself by no more than the limits indicated in Table 13 all the test results are brought within the limits indicated in Table 11 and Table 12, the meter type shall be considered acceptable.

Table 13 — Interpretation of test results

	Class of meter		
	0.5	1	2
Permissible displacement of the zero line, %	0.3	0.5	1.0

8.5 Effect of influence quantities. When determining the effect of an individual influence quantity, the conditions and the values of all other influence quantities shall be as stated in **8.1**.

The influence quantities taken into consideration for fixing the above reference conditions and evaluating their effects on the results of various tests are as follows:

ambient temperature

working position

voltage

frequency

waveform

magnetic induction of external origin.

8.5.1 *Influence of ambient temperature*. The determination of the mean temperature coefficient for a given temperature shall be made over a temperature range of 20 K, 10 K above and 10 K below that temperature, but in no case shall the temperature be lower than 0 °C nor higher than 40 °C.

The mean temperature coefficient shall in all cases be determined at least for the reference temperature and shall not exceed the limits given in Table 14.

Table 14 — Temperature coefficient

Value of current	Power factor	Mean temperature coefficient %/K for meters of class		
		0.5	1	2
From 0.1 I_b to I_{max}	1	0.03	0.05	0.10
From 0.2 I_b to I_{max}	0.5 lagging	0.05	0.07	0.15

8.5.2 *Other influence quantities*. Other influence quantities are as given in Table 15.

8.6 Short-time overcurrents. The test circuits shall be practically non-inductive.

After the application of the short-time overcurrent with the voltage maintained at the terminals, the meter shall be allowed to return to the initial temperature with the voltage circuit(s) energized (about 1 h).

8.6.1 *Meter for direct connection*. The meter shall be able to carry an impulse current[7)] whose peak value equals 50 times rated maximum current (or 7 000 A, whichever is less), and which remains over 25 times rated maximum current (or 3 500 A, whichever is less) during 1 ms.

After this test, the variation of the error shall not exceed the value shown in Table 16.

8.6.2 *Meter for connection through current transformer*. The meter shall be able to carry for 0.5 s a current equal to 10 times rated maximum current.

After this test, the variation of the error shall not exceed the value shown in Table 16.

Table 15 — Influence quantities

Change in the value of the influence quantities with respect to reference conditions	Value of current (balanced load unless otherwise stated)	Power factor	Limits of variation in percentage error for meters of Class		
			0.5	1	2
Oblique suspension 3°	0.05 I_b	1	1.5	2.0	3.0
	I_b and I_{max}	1	0.3	0.4	0.5
Voltage ± 10 %	0.1 I_b	1	0.8	1.0	1.5
	0.5 I_{max}	1	0.5	0.7	1.0
	0.5 I_{max}	0.5 lagging	0.7	1.0	1.5
Frequency ± 5 %	0.1 I_b	1	0.7	1.0	1.5
	0.5 I_{max}	1	0.6	0.8	1.3
	0.5 I_{max}	0.5 lagging	0.8	1.0	1.5
Magnetic induction of external origin 0.5 mT[a]	I_b	1	1.5	2.0	3.0
Waveform: 10 % of third harmonic in the current[b]	I_b	1	0.5	0.6	0.8
Reversed phase sequence	From 0.5 I_b to I_{max}	1	1.5	1.5	1.5
	0.5 I_b (single phase load)	1	2.0	2.0	2.0
Magnetic field of an accessory[c]	0.05 I_b	1	0.3	0.5	1.0
Mechanical load of either single or multi-rate register[d]	0.05 I_b	1	0.8	1.5	2.0

[a] A magnetic induction of external origin of 0.5 mT produced by a current of the same frequency as that of the voltage applied to the meter and under the most unfavourable conditions of phase and direction shall not cause a variation in the percentage error of the meter exceeding the values shown in the table.
This magnetic induction may be obtained by placing the meter in the centre of a circular coil, 1 m in mean diameter, of square section and of small radial thickness relative to the diameter, and having 400 ampere-turns.
[b] The distortion factor of the voltage shall be less than 1 %.
The variation in percentage error shall be measured under the most unfavourable phase displacement of the third harmonic in the current compared with the fundamental current.
[c] Such an accessory, enclosed in the meter case, is energized intermittently, e.g. the electromagnet of a multi-rate register.
It is preferable that the connection to the auxiliary device(s) is marked to indicate the correct method of connection. When these connections are made by means of plugs and sockets, these connections should be irreversible.
However, the variations of errors shall not exceed those indicated in the table when the meter is tested with the connections giving the most unfavourable condition.
[d] The effect is compensated when calibrating the meter.

[7)] This impulse current can be obtained, for example, by a capacitor discharge or thyristor control of the mains supply.

Table 16 — Variations due to short-time overcurrents

Meters for	Value of current	Power factor	Limits of variation in percentage error for meters of Class		
			0.5	1	2
Direct connection	I_b	1	—	1.5	1.5
Connection through current transformers	I_b	1	0.3	0.5	1.0

8.7 Influence of self-heating. After the voltage circuits have been energized at reference voltage for at least 4 h, 2 h and 1 h for Classes 0.5, 1 and 2, respectively, without any current in the current circuits, the rated maximum current shall be applied to the current circuits. The meter error shall be measured at unity power factor immediately after the current is applied and then at intervals short enough to allow a correct drawing to be made of the curve of error variation as a function of time. The test shall be carried out for at least 1 h, and in any event until the variation of error during 20 min does not exceed 0.2 %.

The same test shall then be carried out at 0.5 (lagging) power factor.

The variation of error, measured as specified, shall not exceed the values given in Table 17.

9 Starting and running with no-load

For these tests, the conditions and the values of the influence quantities shall be as stated in **8.1** except for any changes specified below.

9.1 Starting. The rotor of the meter shall start and continue to run at the current shown in Table 18.

It shall be verified that the rotor completes at least one revolution.

For meters with drum-type registers, the test shall be made with not more than two drums moving.

9.2 Running with no-load. With no current in the current circuit(s), the rotor of the meter shall not make a complete revolution at any voltage between 80 % and 110 % of the reference voltage.

For drum-type registers, these conditions shall apply with only one drum moving.

10 Adjustment

Generally, suitable means of adjustment are provided. By agreement between user and manufacturer, it is permitted for the latter to produce meters without means of further adjustment.

A meter provided with means of adjustment and which has been adjusted satisfactorily according to this standard shall be capable of being further adjusted at least to the extent shown in Table 19.

Tests shall be made under the conditions stated in **8.1**.

Table 17 — Variations due to self-heating

Value of current	Power factor	Limits of variation in percentage error for meters Class		
		0.5	1	2
I_{max}	1	0.5	0.7	1.0
	0.5 lagging	0.7	1.0	1.5

Table 18 — Starting currents

	Percentage of basic current for meters of Class			Power factor
	0.5	1	2	
Single-rate meters without reversal-preventing device	0.3	0.4	0.5	1
All other meters	0.4	0.4	0.5	1

Table 19 — Minimum range of adjustment

Adjustment	Value of current	Power factor	Minimum range of adjustment of rotation speed of the rotor in percentage for meters of Class		
			0.5	1	2
Braking element	0.5 I_{max}	1	± 2	± 2	± 4
Low load	0.05 I_b	1	± 2	± 2	± 4
Inductive load	0.5 I_b 0.5 I_{max}	0.5 lagging 0.5 lagging	± 1 —	± 1 —	— ± 1

NOTE For polyphase meters, the verification of the range of adjustment for inductive load should be made on each driving element and should be determined when the current circuit of each element is carrying basic current lagging 60° behind the voltage at the terminals of that element, all the voltage circuits of all driving elements carrying balanced polyphase voltage, whose r.m.s. value is equal to the reference voltage in the phase sequence as indicated on the connection diagram.

Table 20 — Dimensions and spacing of fixing holes and terminals

Letter designation	Dimension	
		mm
A[a]	Maximum overall height (measured from lower face of terminal block)	209.6
B[a]	Maximum overall width	158.8
C[a]	Maximum overall projection (measured from front of meter board)	146.1
D[b]	Vertical distance between centre of top fixing hole and centreline of bottom fixing holes	138.1 to 141.3
E[b]	Vertical distance from centreline of bottom fixing holes to lower face of terminal block	23.8 to 27.0
F[b]	Distance between centres of bottom fixing holes and centreline of meter	51.6 to 53.2
G[b]	From centrelines of main terminal holes 2 and 3 to centreline of meter	10.3 to 11.9
J[b]	From centrelines of main terminal holes 1 and 4 to centreline of meter	34.1 to 35.7
K	Diameter of bore in terminal	8.0 to 8.2
L	Length of parallel portion of bore in terminal plus depth of any lead-in from lower face of terminal block	28.5 (min.)
M	From front of meter board to centreline of main terminal holes	17.4 to 20.7
N	Diameter of fixing holes	5.1 to 5.6
P[a]	Terminal clamping screw flat-ended slightly chamfered, M6[c]	—
Q[a]	Length of standard pin to enter the terminal hole	27.0 (max.)
R	Diameter of bore in auxiliary terminal	3.0 (min.)
S	Length of parallel portion of bore in auxiliary terminal for two-rate meters plus depth of any lead-in from lower face of block	13.0 (min.)
T	From centreline of meter to centreline of auxiliary terminal of a two-rate meter	22.2 to 23.8
W	From centreline of bottom fixing holes to centreline of lower pinch screws	12.5 to 15.0
Y	From centreline of lower pinch screws to centreline of upper pinch screws	7.5 to 10.5

NOTE The items applicable to single-phase, two wire meters are shown in Figure 1.

[a] This dimension is not shown in Figure 1.

[b] For the purpose of estimating the tolerances the datum line for the dimensions *D*, *E*, *F*, *G*, *J* shall be:
vertical datum: centreline of meter.
horizontal datum: centreline of bottom fixing holes.

[c] This screw shall give a suitable grip on any wire from 1 mm^2 to 35 mm^2.

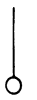
Table 21 — Graduation of circular scales or number drums

Category	kW rating (based on I_{max})	kW h for one division of the circular scales or number drums
1	up to 2.5	1 000, 100, 10, 1, 1/10, 1/100
2	above 2.5 up to 25	10 000, 1 000, 100, 10, 1, 1/10
3	above 25 up to 250	100 000, 10 000, 1 000, 100, 10, 1
4	above 250 up to 2 500	1 000 000, 100 000, 10 000, 1 000, 100, 10
5	above 2 500 up to 25 000	10 000 000, 1 000 000, 100 000, 10 000, 1 000, 100
or alternatively		**MW h for one division of the circular scales or number drums**
4	above 250 up to 2 500	1 000, 100, 10, 1, 1/10, 1/100
5	above 2 500 up to 25 000	10 000, 1 000, 100, 10, 1, 1/10
6	above 25 000 up to 250 000	100 000, 10 000, 1 000, 100, 10, 1

Appendix A Graphical symbols for watt-hour meters

A.1 The symbols shown below by way of example are derived by representing each voltage winding by a line and each current winding by a black or white dot (small circle). The dot representing the current winding of a meter element is placed at one or other end of the line representing the voltage winding of the same meter element when the two windings have a common point. If two or three voltage windings have a common end, this is represented by lines meeting at a point, the angles between two of the lines indicate (with the appropriate sign convention) the phase difference between the voltages. If this angle is 180°, the common point is marked by a small line [see symbol c)]. The number of lines also indicates the number of meter elements.

A.2 Examples

a) 

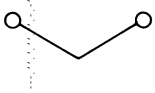
Symbol a) indicates a meter with one element, having one current winding and one voltage winding (for single-phase, two wire circuits).

b) 

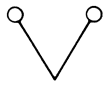
Symbol b) indicates a meter with one element, having one voltage winding and two current windings (for single-phase, two wire circuits).

c) 

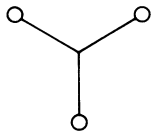
Symbol c) indicates a meter having two elements, each having a voltage winding and a current winding, which latter are connected in the outers of a single-phase, three wire circuit, the corresponding voltage windings being connected between the outers and the mid-wire.

d) 

Symbol d) indicates a meter having two elements, each having a voltage winding and a current winding, each of which latter is inserted in a phase conductor of a three-phase circuit, the voltage winding of each element being connected between the neutral and the phase conductor in which its current winding is inserted.

e) 

Symbol e) indicates a meter having two elements, each having a voltage winding and a current winding, and connected for the 2-wattmeter method (for three-phase, three wire circuits).

f) 

Symbol f) indicates a meter having three elements, each having a voltage winding and a current winding, and connected for the 3-wattmeter method (for three-phase, four wire circuits).

g) 

Symbol g) indicates a meter having two elements, each having a voltage winding and a current winding, which latter are connected in the two-phase conductors of a two-phase, three wire circuit.

Appendix B Flammability test (see **5.6**)

B.1 A specimen of the material used for non-metallic cases of meters shall be tested in accordance with the following conditions.

B.2 Form of test specimen

The specimen shall be formed in a moulding tool and shall be 127 ± 1.0 mm long, 25 ± 0.5 mm wide and 3 ± 0.3 mm thick. A line shall be drawn across the specimen 38 + 1.0, – 0 mm from one end.

B.3 Procedure

The specimen shall be tested in a draughtfree atmosphere. It shall be clamped in a rigid support at one end so that its longitudinal axis is horizontal and its transverse axis is 45° to the horizontal and so that the marked line on the specimen is clearly visible. The mark shall be 38 + 1.0, – 0 mm from the free end.

A piece of clean wire gauze (aperture 850 µm, mesh number 18[8]) 100 ± 5 mm square shall be clamped in a horizontal position 6 ± 1.0 mm below the specimen with 6 ± 1.0 mm of the unsupported end of the specimen projecting beyond the edge of the gauze as shown in Figure 7. A Bunsen burner of nominal 10 mm diameter bore with a non-luminous flame 12 mm to 19 mm in height shall be placed under the centre of the free end of the specimen so that the top of the flame just touches it.

The flame shall be removed after 10 ± 0.5 s and the specimen shall not burn back or scorch more than 38 mm, that is, not beyond the line marked on the sample.

The test shall be repeated on two further samples, in which conformity with the same requirements shall be established.

If compliance with the requirements, as laid down above, is obtained on all three samples, the material shall be deemed to be satisfactory.

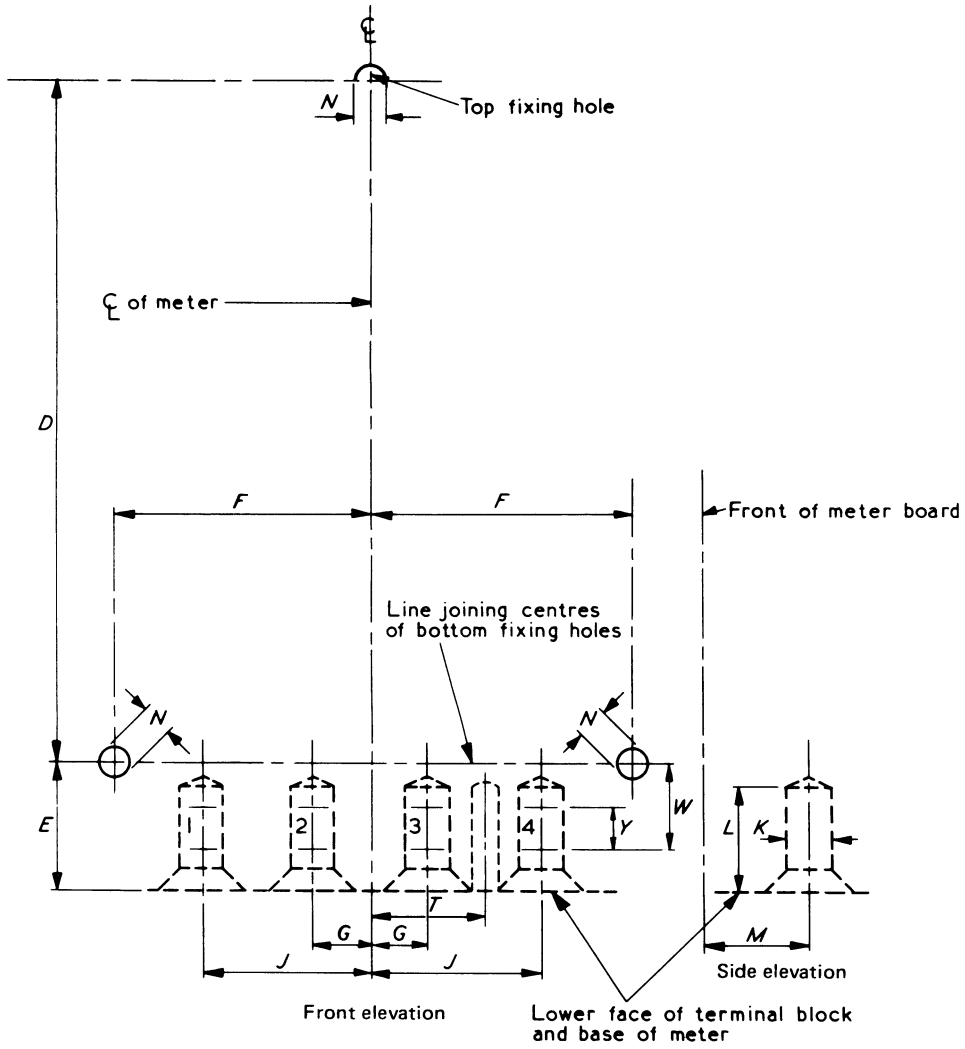


Figure 1 — Spacing of fixing holes and terminals for single-phase, two wire meters

[8] See BS 410.

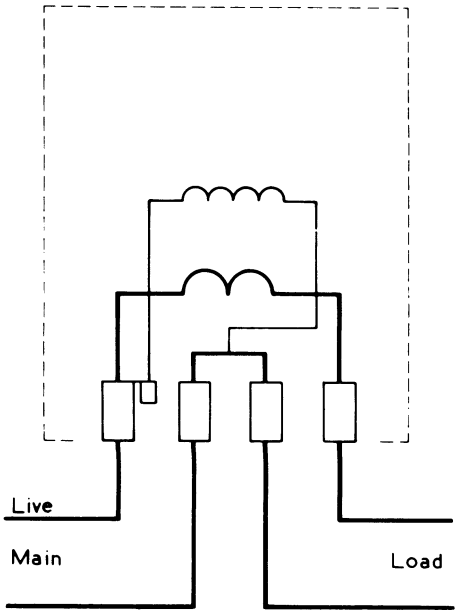


Figure 2 — Diagram of connections for a single-phase, two wire, single rate meter

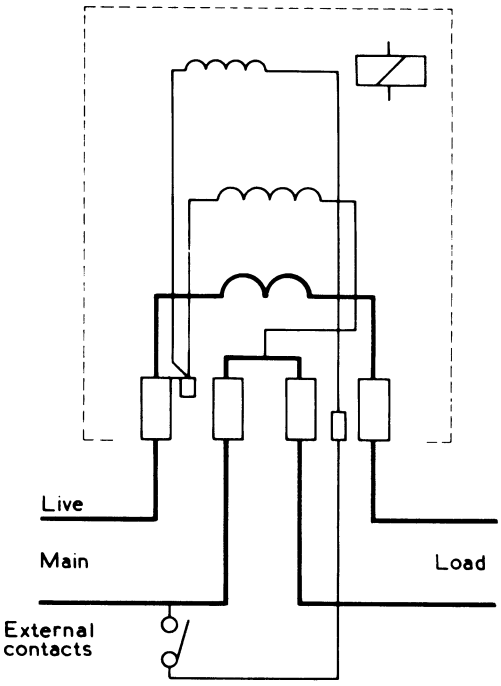


Figure 3 — Diagram of connections for a single-phase, two wire, two-rate meter

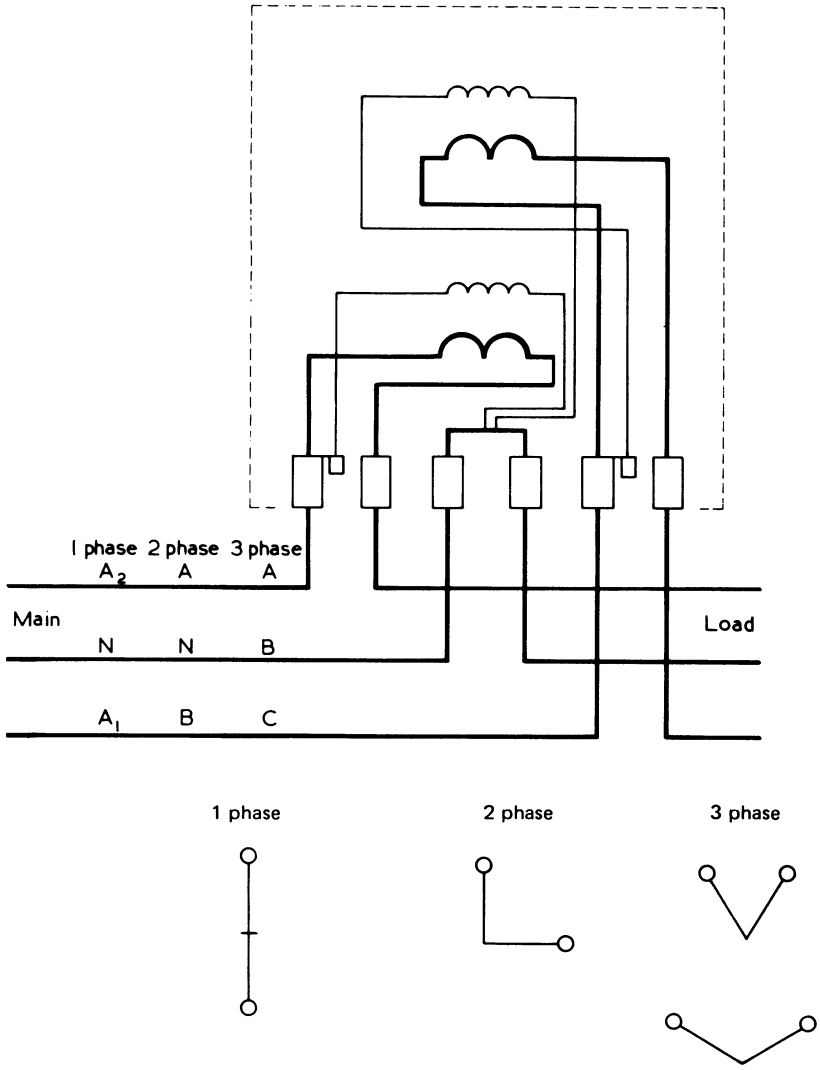


Figure 4 — Connections for a two element meter used on three wire systems

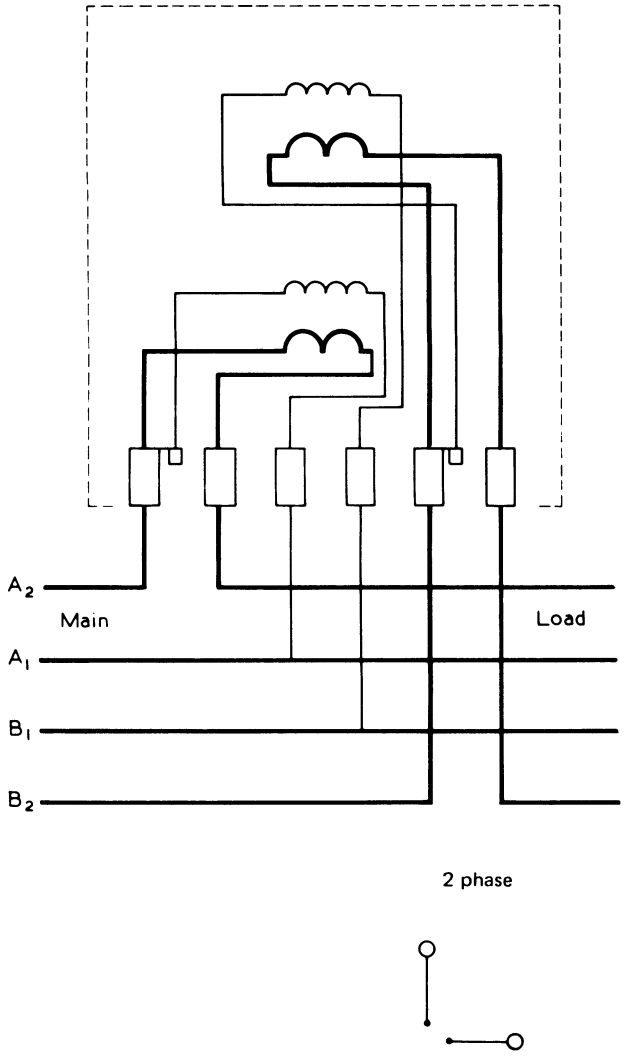


Figure 5 — Connections for a two element meter used on a two-phase, four wire system

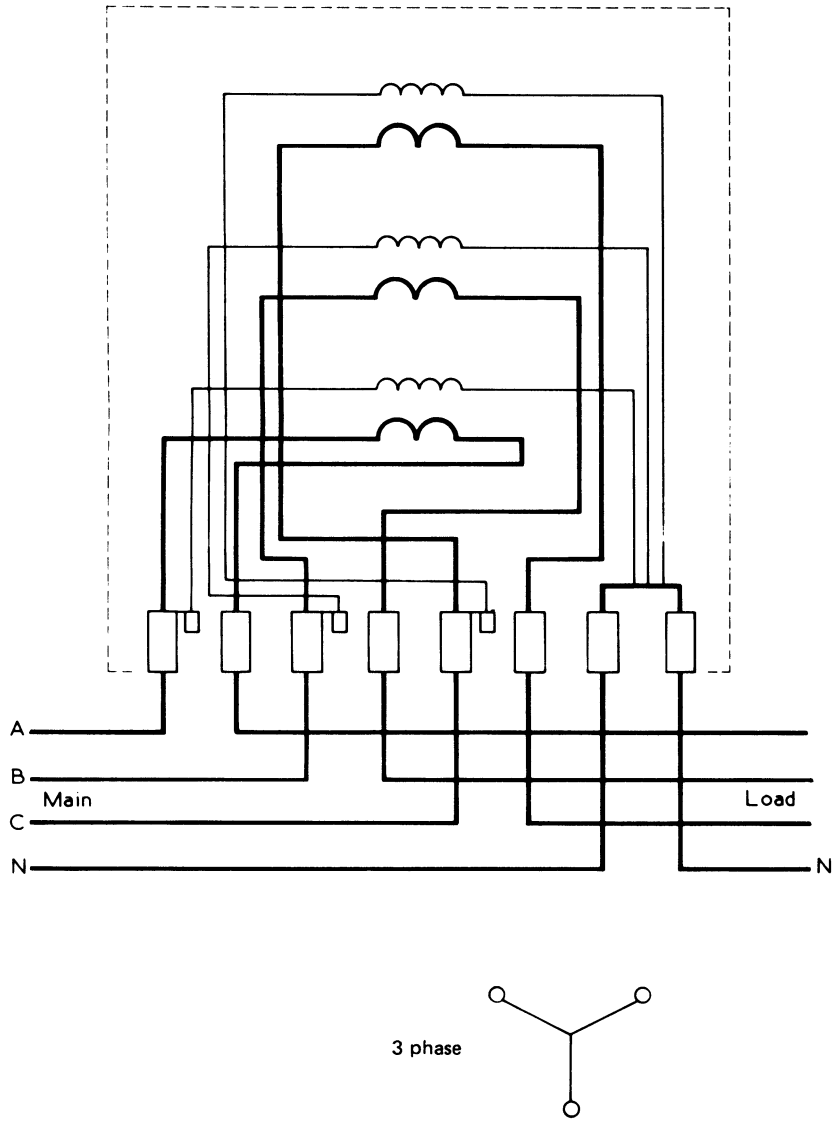
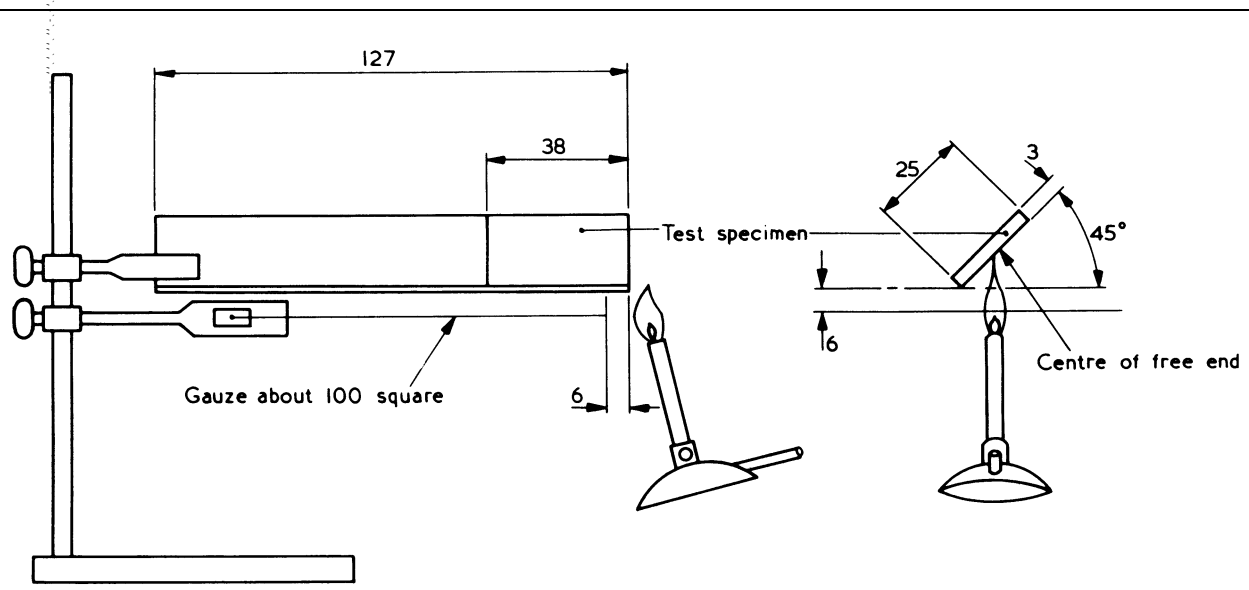


Figure 6 — Connections for a three element meter used on a three-phase, four wire system



All dimensions shown are in millimetres unless otherwise stated.
Tolerances on dimensions ± 1.0 % unless otherwise indicated in Appendix B.

Figure 7 — Arrangement for flammability test

Publications referred to

BS 410, *Specification for test sieves*.

BS 923, *Guide on high-voltage testing techniques*.

BS 1991, *Letter symbols, signs and abbreviations*.

BS 1991-6, *Electrical science and engineering*.

BS 2757, *Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service*.

BS 2782, *Methods of testing plastics*.

BS 2782-1, *Thermal properties*.

BS 4727, *Glossary of electrotechnical, power, telecommunications, electronics, lighting and colour terms*.

BS 4727-1, *Terms common to power, telecommunications and electronics*.

BS 4727:Group 04, *Measurement terminology*.

BS 5458, *Specification for safety requirements for indicating and recording electrical measuring instruments and their accessories*.

IEC 28, *International Standard of resistance for copper*.

IEC 387, *Symbols for alternating-current electricity meters*.

IEC 521, *Class 0.5, 1 and 2 alternating-current watthour meters*.

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