BRITISH STANDARD

BS 5685-3: 1986

Electricity meters —

Part 3: Specification for meters having Class 1 electro-mechanical maximum demand indicators

UDC 621.317.78 + 681.138.87

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Power Electrical Engineering Standards Committee (PEL/-) to Technical Committee PEL/14, upon which the following bodies were represented:

BEAMA Meter Association

Department of Energy (Electricity Division)

Electricity Supply Industry in England and Wales

Institution of Electrical Engineers

This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 December 1986

The following BSI references relate to the work on this standard:
Committee reference PEL/14
Draft for comment 80/28885 DC

ISBN 0 580 14997 8

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

Foreword

This Part of BS 5685 has been prepared under the direction of the Power Electrical Engineering Standards Committee. It supersedes BS 37-5, which is withdrawn.

This Part should be read in conjunction with BS 5685-1:1979[1)]. The arrangement of format and relationship of subject to clause number are the same as in Part 1.

The requirements of Part 1 in respect of watt-hour meters and Part 4 in respect of var-hour meters apply to the supporting meter as defined herein. This Part gives requirements for a maximum demand indicator and consequent variations to the meter.

This British Standard is related to IEC 211 but not equivalent in technical content.

Other Parts of BS 5685, published at the same time as this Part, are as follows:

— *Part 2: Special requirements for single phase coin-operated prepayment flat rate and two-part tariff watt-hour meters of Class 2 and fixed charge collectors of Class 2;*

— *Part 4: Specification for Class 3 var-hour meters.*

Further Parts dealing with other types of meter and meter accessories are in preparation.

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 6, 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)] BS 5685:1979 has been renumbered BS 5685-1 by amendment.

1 Scope

This Part of BS 5685 specifies the mechanical and electrical requirements and type tests for meters having maximum demand indicators of Class 1. Such indicators are intended to operate as attachments coupled mechanically to watt-hour or var-hour meters and to indicate the maximum mean value of power (active or reactive) measured during successive equal intervals of time. The supporting meter may have any specified accuracy class.

Requirements are given for the limits of the mutual effects between the indicator and the meter.

This Part of BS 5685 does not apply to meters with maximum demand indicators based on thermal effects, to those operated by impulses, to wholly electronic types or to cumulative indicators intended only for control purposes.

NOTE The titles of the publications referred to in this Part of BS 5685 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 Part of BS 5685 the definitions given in **3.1** to **3.38** of Part 1 apply together with the following.

NOTE For convenience of referencing the numbering of definitions in this clause and Part 1 is consecutive.

3.39 class index

3.39.1
accuracy class index

a number corresponding to the numerical value of the limit of percentage error of the supporting meter under the reference conditions specified in this Part of BS 5685

NOTE See clause **8**.

3.39.2
maximum demand class index

a number corresponding to the numerical value of the limit of percentage error of the indicated maximum demand at the rating, due to the indicator and independent of the classification of the supporting meter

3.40
var-hour meter (reactive volt-ampere-hour meter)

an integrating instrument which measures var-hours (reactive volt-ampere hours) or decimal multiples thereof

3.41
supporting meter

a watt-hour or var-hour meter to which the maximum demand indicator is attached and which operates the propelling device of the maximum demand indicator

3.42 maximum demand indicator

an instrument for indicating maximum demand on electric power systems in the form of an attachment to a meter which generally comprises **3.42.1** and **3.42.2**.

3.42.1
propelling device

a device which, when operated by the supporting meter, can drive the maximum demand indicating device

3.42.2
disconnecting element

an element which releases the coupling between the maximum demand indicator and the supporting meter

NOTE This term is preferred to the terms "tripping element" or "detent element" which are sometimes used.

3.42.3
restoring element

an element which restores the propelling device to its initial position without affecting the position of the maximum demand indicating device

3.42.4
timing element

an element, inside or outside the meter case, which determines the demand integration period

3.42.5 maximum demand indicating device

A device which may take the form of **3.42.5.1**, **3.42.5.2** or **3.42.5.3**.

3.42.5.1
maximum demand pointer

a pointer which can move against slight restraint over a fixed scale

3.42.5.2
cyclometer number drums

drums bearing numbers which can move against slight restraint adjacent to a fixed index

3.42.5.3
movable indicator

an indicator which can move against slight restraint adjacent to a fixed scale

3.42.6
maximum demand zero resetting device

a device which enables the maximum demand indicating device to be reset to the scale zero position manually or by other means

3.42.7
dial

a visible surface which carries one or more scales and numbers together with the necessary inscriptions

3.42.8
scale

the series of marks and numbers from which is obtained the value of the measured quantity

3.42.9
scale marks

marks on the dial for the purpose of dividing the scale into suitable intervals

3.42.10
scale division

the distance between two consecutive scale marks

3.42.11
scale numbering

the series of numbers forming part of the scale

3.43
indicated maximum demand

the highest mean value of power (active or reactive) indicated by the maximum demand indicator during successive equal intervals of time between one zero resetting of the maximum demand indicator and the next

3.44
mean value of power (active or reactive)

the active or reactive energy divided by the time in which this energy has been produced or absorbed

3.45
demand integration period

the nominal duration of each of the consecutive equal intervals of time (e.g. 30 min), which comprises the sum of the time that the driving element of the maximum demand indicator is coupled to the meter and the detent time

3.46
detent time

the interval of time at the end of, but within, each demand integration period during which the disconnecting element releases the coupling between the propelling device and the supporting meter, to allow the propelling device to be restored to its initial position

3.47
effective range

that part of the indication where measurements can be made with the stated accuracy

3.48
rating (in terms of the quantity measured)

the value of the upper limit of the effective range

3.49
coefficient *K* of a maximum demand indicator

the coefficient by which a reading in arbitrary divisions is to be multiplied to obtain the value of the corresponding mean value of power (active or reactive)

3.50
reading factor *C* of a maximum demand indicator

the factor by which it is necessary to multiply a reading in units of power (active or reactive), in order to obtain the value of the corresponding power expressed in the same units

NOTE This factor is principally used when the meters are associated with instrument transformers.

3.51
cumulative demand indicator

a maximum demand indicator with supplementary graduated number drum(s) for recording the total of the maximum demand indications of successive zero resetting operations

4 Classification

4.1 Supporting meter

The accuracy class of supporting meters shall be one of those specified in BS 5685-1 or BS 5685-4.

4.2 Maximum demand indicator

All indicators shall be Class 1 (i.e. maximum demand Class index 1).

5 Mechanical requirements

5.1 General

The meter shall comply with **5.1** of BS 5685-1:1979.

5.2 Case

The case shall comply with **5.2** of BS 5685-1:1979 in addition to the following.

Protection of the maximum demand indicator shall be as that of the supporting meter. Metal parts of the maximum demand indicator accessible from outside, if insulated from the meter, shall be provided with means for the effective connection of an appropriate earthing conductor.

The knob of the zero resetting device shall be made either of insulating material or metal. If the knob is made of metal, protection against electric shock shall be provided.

5.3 Windows

Windows shall comply with **5.3** of BS 5685-1:1979. In addition, the maximum demand indicating device and dial shall be visible.

5.4 Terminals, terminal block(s) and protective earth terminal

The terminals, terminal block(s) and protective earth terminal shall comply with **5.4** of BS 5685-1:1979.

5.5 Terminal cover(s)

The terminal cover(s) shall comply with **5.5** of BS 5685-1:1979.

5.6 Flammability

The terminal block, the terminal cover and the case shall comply with **5.6** of BS 5685-1:1979.

5.7 Register (counting mechanism)

The register shall comply with **5.7** of BS 5685-1:1979.

5.8 Direction of rotation and marking of the rotor

The direction of rotation and marking of the rotor shall comply with **5.8** of BS 5685-1:1979.

5.9 Maximum demand zero resetting device

This device shall be such that, in its normal position, it does not affect the maximum demand indicating device, and such that it can be sealed or locked in this position only. Resetting of the maximum demand indicating device shall be possible only after breaking the seal or with a special tool.

5.10 Scale marking

5.10.1 *Pointer-type and movable indicators*. The scale shall be marked in W, kW, MW, var, kvar, or Mvar, or in arbitrary divisions.

If it is marked in arbitrary divisions, the value of the maximum demand in appropriate units shall be derived by the use of the coefficient K which shall be marked on the dial.

If the scale is graduated and marked in units of the measured quantity, these units shall be marked on the dial.

NOTE 1 It may be necessary to multiply the reading by the factor C, having regard to transformation ratios, in order to obtain the indicated maximum demand in the same units.

For polyphase pointer-type maximum demand meters the length of the scale, as measured along the arc described by the tip of the pointer, shall be not less than 228 mm. The zero position of the pointer shall be within the bottom left hand quadrant of the scale.

NOTE 2 There are no requirements for scale length for single-phase meters.

The full scale values of the scale marking shall be as shown in Table 1.

NOTE 3 There are no requirements for scale marking full scale values for reference voltages other than those shown in Table 1.

The lower limit of the effective range shall be 20 % of the rating.

Except when a platform scale is used the tip of the pointer shall have a knife-edge and shall extend over approximately half the length of the shortest scale mark.

The scale shall be divided by minor scale marks, each of which represents a value of 1, 2 or 5 units (or decimal multiples thereof) of the measured quantity. Intermediate scale marks shall be lengthened minor scale marks, and major scale marks shall be lengthened intermediate scale marks. The relationship between minor, intermediate and major scale marks, in terms of the value of the measured quantity represented by the minor scale mark, shall be one of the following:

a) 1 major = 5 intermediate = 25 minor;

b) 1 major = 2 intermediate = 10 minor;

c) 1 major = 5 intermediate = 10 minor.

Table 1 — Scale marking full scale values

Meters for	Reference voltage	Basic current	Scale marking
		A	kW or kvar
Direct connection single-phase	240	20	28
Direct connection polyphase	415	40	75
		80	120
Connection through voltage and/or current transformer	—	1 5	Not greater than the kW or kvar equivalent of twice the basic current at unity power factor

NOTE 4 Examples of the scale markings a), b) and c) are shown in Figure 1.

All scale marks shall be of the same thickness, which for knife-edge pointers shall not differ from the thickness of the pointer and shall not in any case exceed 0.4 mm. The minor marks shall be between 1/30 and 1/20 of the length of the pointer. Intermediate marks shall be 1.3 to 1.5 times the length of the minor marks. Major marks shall be 1.7 to 2.0 times the length of the minor marks. Only the major marks shall be numbered.

Means shall be provided to prevent damage to the pointer and demand mechanism if the pointer is driven by the supporting meter beyond full scale.

5.10.2 *Cyclometer number drum type indicator*. The figure height on cyclometer number drums shall be between 4.6 mm and 8.9 mm.

NOTE The requirements to which pointer-type maximum demand indicators are subject also apply to cyclometer-type maximum demand indicators, where appropriate.

5.11 Direction of movement of pointer

The direction of movement of the pointer of a pointer-type maximum demand indicator shall be clockwise or from left to right.

The angle subtended by the scale of the maximum demand indicator shall be not less than 270°.

5.12 Stability of maximum demand indication

Except when it is being reset or being driven by the maximum demand mechanism, the maximum demand indicating device shall not move.

5.13 Detent time

The detent time shall not exceed 1 % of the demand integration period for values up to and including 20 min.

The detent time shall not exceed 15 s for demand integration periods of 30 min and 60 min. The detent time shall be included in the demand integration period.

5.14 Standard value of demand integration periods

The standard values of demand integration periods shall be 5, 10, 15, 20, 30 and 60 min.

6 Electrical requirements

6.1 Standard currents

The standard currents shall comply with Table 2 of BS 5685-1:1979.

6.2 Standard reference voltages

The standard reference voltages shall comply with Table 3 of BS 5685-1:1979.

6.3 Power losses

6.3.1 *Voltage circuits*. The loss in each voltage circuit shall comply with **6.3.1** of BS 5685-1:1979.

6.3.2 *Current circuits*. The apparent power taken by each current circuit shall comply with **6.3.2** of BS 5685-1:1979.

6.3.3 *Auxiliary circuits*. The loss on each continuously energized auxiliary voltage circuit at the marked voltage shall not exceed 6 W, 12 V·A and an additional 2 W, 3 V·A for every 100 V or part thereof above 240 V.

6.4 Heating

The meter shall comply with **6.4** of BS 5685-1:1979. In addition, the permissible limit of temperature rise for the winding of the disconnecting element, and for the timing element if internal, shall be 50 °C.

6.5 Dielectric properties

The meter shall comply with **6.5**, **6.5.1**, **6.5.2** and **6.5.3** of BS 5685-1:1979.

6.6 Disconnecting element and timing element operating voltage limits

The disconnecting element, and the timing element if internal, shall operate at 80 % of the marked voltage or at 90 % of the minimum marked voltage where the meter is marked for a range of voltages.

7 Marking of meters

7.1 Nameplates

The meter shall comply with **7.1** of BS 5685-1:1979.

7.2 Connection diagrams and terminal marking

The meter shall comply with **7.2** of BS 5685-1:1979.

7.3 Marking of maximum demand indicators

The maximum demand indicator dial shall bear the following information:

a) the constant K or reading factor C where relevant;

b) the demand integration period;

c) the reference voltage and reference frequency of auxiliary circuits if these differ from the voltage and frequency of the supporting meter;

d) the unit in which the maximum demand indicator registers (for example, kW or Mvar).

NOTE See also **5.10** and **5.11** for scale marking.

8 Accuracy

8.1 Conditions under which the tests shall be carried out

Tests shall be carried out in accordance with the conditions of **8.1** of BS 5685-1:1979 except that they shall take account of the effect of the maximum demand indicator which shall be coupled to the supporting meter but which shall not be driving its maximum demand indicating device. In these conditions, the errors shall be within the limits of **8.2** for the meter without a maximum demand indicator.

Before each test the propelling device shall be reset to the zero position and shall then be driven by the meter slightly from the zero position.

NOTE This requirement is to ensure uniformity of test conditions.

8.2 Limits of error

The meter shall comply with **8.2** of BS 5685-1:1979.

8.3 Test of meter constant

The meter shall comply with **8.3** of BS 5685-1:1979.

8.4 Interpretation of test results

The requirements of **8.4** of BS 5685-1:1979 shall apply.

8.5 Effect of influence quantities

The requirements of **8.5**, **8.5.1** and **8.5.2** of BS 5685-1:1979 shall apply.

8.6 Short-time overcurrents

The requirements of **8.6**, **8.6.1** and **8.6.2** of BS 5685-1:1979 shall apply.

8.7 Influence of self-heating

The requirements of **8.7** of BS 5685-1:1979 shall apply.

8.8 Error of the maximum demand indicator

The error of the maximum demand indicator over the effective range (which is additional to any error of the supporting meter) shall be within ± 1.0 % of the rating. Two tests shall be made, one in the region of 25 %, and one in the region of 80 % of the rating.

8.9 Variation in error due to mechanical burden of the maximum demand indicator

Under reference conditions and at unity power factor for watt-hour meters and zero power factor for vat-hour meters, the variation in error due to disconnection of the propelling device, when the indicator is coupled to the supporting meter but is not driving the maximum demand indicating device, shall not exceed the values given in Table 2.

Table 2 — Limits of variation in error due to mechanical burden

Percentage of basic current	Percentage limit of variation in error	
	Polyphase meters	Single-phase meters
5	3.5	5
20	2.5	4

9 Starting and running with no-load

9.1 Starting

When the supporting meter is coupled to the maximum demand indicator with its propelling device at 90 % of the maximum scale reading, but without the maximum demand indicating device being driven, it shall start and continue to run in accordance with the requirements for the supporting meter but with an increased tolerance of 0.5 % standard current (balanced load for polyphase meters).

With the maximum demand indicating device being driven, the starting current shall not exceed 4 % of the standard current.

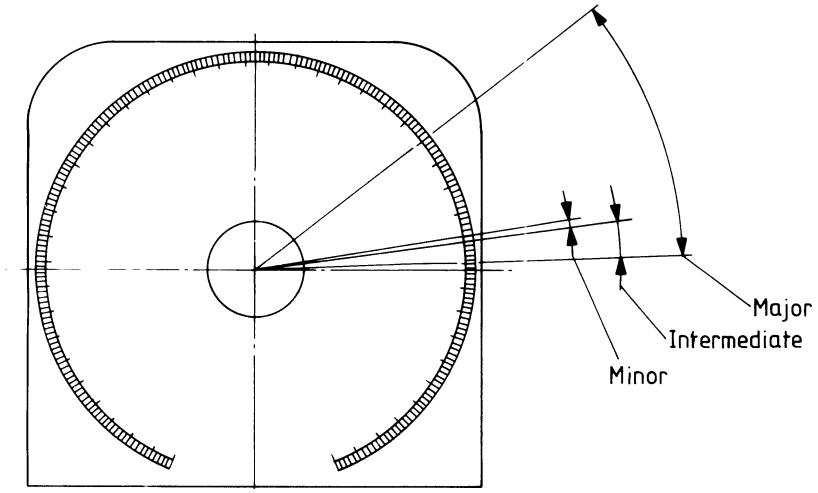
In the case of cyclometer indicating devices the test shall be made with not more than two number drums moving.

9.2 Running with no-load

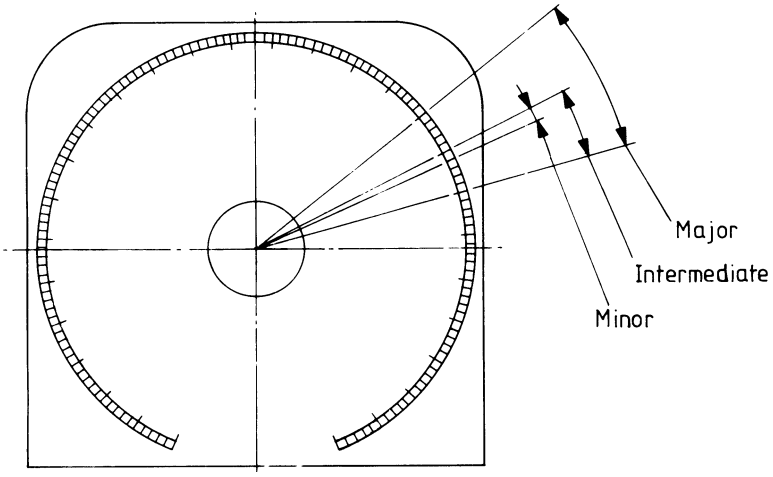
The meter shall comply with **9.2** of BS 5685-1:1979.

10 Adjustment

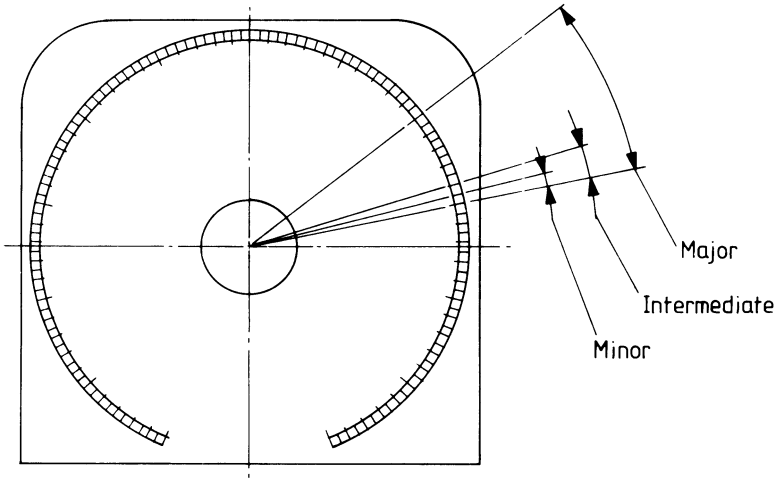
The requirements of clause **10** of BS 5685-1:1985 shall apply.



(a) 1 major = 5 intermediate = 25 minor



(b) 1 major =.2 intermediate = 10 minor



(c) 1 major = 5 intermediate = 10 minor

Figure 1 — Examples of scale marking

Publications referred to

BS 5685, *Electricity meters.*

BS 5685-1, *Specification for Class 0.5, 1 and 2 single-phase and polyphase, single rate and multi-rate watt-hour meters.*

BS 5685-2, *Special requirements for single phase coin-operated prepayment flat rate and two-part tariff watt-hour meters of Class 2 and fixed charge collectors of Class 2*[2)].

BS 5685-4, *Specification for Class 3 var-hour meters.*

BS 5775, *Specification for quantities, units and symbols.*

BS 5775-5, *Electricity and magnetism.*

IEC 211, *Maximum demand indicators, Class 1.0*[2)].

[2)] Referred to in the foreword only.

BSI — British Standards Institution

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

Revisions

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

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

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

Buying standards

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

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

Information on standards

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

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

Copyright

BSI
389 Chiswick High Road
London
W4 4AL