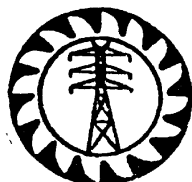


004: 2000

CEB
STANDARD

**THREE PHASE THREE WIRE UNBALANCED LOAD
TWO RATES METERS**



CEYLON ELECTRICITY BOARD
SRI LANKA

Specification

for

**THREE PHASE THREE WIRE UNBALANCED
LOAD TWO RATE METERS**

**CEB Standard 004 : 2000, Specification for Three Phase Three Wire
Unbalanced Load Two Rate Meters**

CEB Standard 004 : 2000

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SPECIFICATION FOR THREE PHASE THREE WIRE UNBALANCED LOAD TWO RATE METERS FOR USE IN 11 KV AND 33 KV SYSTEMS

1.0 SCOPE

This specification covers the design, manufacture and testing of the following metering equipment for use in 11 kV and 33 kV system of the CEB which are to be used in conjunction with the metering transformers conforming to CEB Standard 006.

- (a) 3 Phase 3 wire, unbalanced load, two rate kWh meters.
- (b) 3 Phase 3 wire, unbalanced load KVA maximum demand meters.
- (c) Time switches.
- (d) Voltage selector relays.
- (e) Summation current transformers.

2.0 SYSTEM PARAMETERS

		11 kV -----	33 KV -----
(a) Nominal Voltage	:	11 kV	33 kV
(b) System Highest Voltage	:	12 kV	36 kV
(c) System frequency	:	50 Hz.	50 Hz.
(d) Number of phases	:	03	03
(e) Method of earthing	:	Effectively earthed	Non effective earthing
(f) System fault level	:	250 MVA	750 MVA

3.0 SERVICE CONDITIONS

- (a) Annual average ambient temperature : 30 deg. C.
- (b) Maximum ambient temperature : 50 deg. C.
- (c) Maximum relative humidity : 90 %
- (d) Environmental conditions : Humid tropical climate with polluted atmosphere.
- (e) Operational altitude : From MSL to 1900M above MSL.

4.0 APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the standards specified below or later editions and/or amendments thereof.

Any deviation from the following standards shall be stated clearly.

- | | | |
|---------------------------|---|---|
| (a) BS 5685-1979 (1986) | : | Electricity Meters |
| Part 1 (1986) | : | kWh Meters |
| Part 3 (1986) | : | Maximum Demand Indicators |
| Part 4 (1986) | : | Var-hour Meters |
| Part 5 (1987) | : | Time Switch |
| (b) IEC 521 - 1988 | : | Alternating current
Watt-hour Meters |
| (c) IEC 211 - 1966 | : | Maximum Demand Indicators |
| (d) BS 3938 - 1973 (1982) | : | Current Transformers
(Summation) |
| (e) IEC 185 - 1987 | : | Current Transformers |
| (f) IEC 145 - 1963 | : | Var-hour Meters |

The equipment and components conforming to any other international standards which are equal to or higher but not less rigid than the standards and specification stipulated could be offered.

When such alternative Standards are used reference to such standards shall be quoted and English Language copies of such standards shall be furnished with the offer.

The rating of the equipment may differ from the standard ratings given in BSS/IEC in order to accommodate the requirements of the CEB.

5.0 BASIC FEATURES

5.1 General requirements for

- (a) kWh Meter
- (b) kVAh Meter with Maximum Demand Indicator (MDI)
- (c) kVArh Meter (Applicable for Electronic Type MDI only)
- (d) Voltage Selector Relay

The equipment shall be dust proof and suitable for use under tropical conditions (Clause 3.0). They are to be used in heavily polluted atmosphere.

- 5.1.1** The equipment shall have a separate cover for the terminal block in addition to the main equipment cover. Provision shall be made to the user to seal the equipment cover and the terminal cover separately.

If the cover is of non-transparent material a window of glass or suitable transparent material shall be provided to facilitate reading of the meter. The window shall be securely bonded to prevent the dislocation by use of force from out-side.

If the equipment cover is of transparent material, no separate window for reading is required.

5.1.2 The equipment shall have bottom terminals. The terminal cover shall be of insulating material and shall be of the extended type. The terminal covers shall be provided with easily breakable knockouts for the entry of service wires. The equipment shall have provision for panel mounting.

5.1.3 The design and manufacture of the equipment shall be such that the equipment operates within stipulated error limit for the respective class of the equipment for a period of at least 15 years without requiring re-calibration or overhauling.

5.2 Design requirements for

- a) kWh Meter**
- b) kVAh Meter with MDI**
- c) kVArh Meter (Applicable for Electronic Type MDI only)**

5.2.1 The Meters shall be rated at 110V, 5A, 50 Hz and the voltage coils shall be able to withstand a maximum working voltage of 125V.

5.2.2 The Meters shall indicate directly the kWh / kVA of the primary circuit without the use of any multiplying factors when used in association with Current Transformers whose ratios are indicated in the Schedule of Prices, and 11kV/110V and 33kV/110V Voltage Transformers. The relevant CT and VT ratios shall be marked on the name plate of the Meter.

5.2.3 Easy access to the full load, element balance, inductive load and low load adjustments shall be available. It shall be possible to operate these adjustments easily without the use of any special tools.

5.2.4 The Meters shall have reverse running stops to prevent the meter disc from running in the reverse direction.

5.2.5 In conforming to the relevant standards (in Clause 4.0), with no current in the current circuits, the rotor of the Meter shall not make a complete revolution at any voltage between 80% and 110% of the reference voltage.

5.2.6 The rotor bearings shall be of the magnetic suspension (bottom) type.

5.2.7 The upper surface of the rotor disc shall have black coloured markings dividing the circumference preferably into 200 divisions. The marking at each 1/100 th of the circumference shall be longer than those between. Marking at each 1/10 th of the circumference shall be still longer and shall be numbered from 0 to 9. The edge of the rotor disc shall carry an easily visible black coloured mark with a width between 1/20 and 1/30 the circumference of the disc to facilitate testing. This mark shall either start from the marking for number 0 or end at the marking on number 0 stated above.

5.3 Special design requirements for kWh Meters

- 5.3.1 The meter shall be of accuracy Class 2 as per IEC 521 (1988)/BS 5685 : Part 1 : 1979 (1985).
- 5.3.2 The kWh Meters shall be of two rate type. The two registers shall be independent from each other and be marked "Normal" and "High". The register marked "Normal" shall be registering normally and it should be possible to stop this and to activate the register marked "High" with an external voltage signal of 110V from the time switch. The activating coil shall be capable of continuous operation.
- 5.3.3 The register shall have at least six digits. If it is a mechanical register it shall be of drum type with medium jumping figures. If it is an electronic register it shall be of Liquid Crystal Display (LCD) or other type suitable for use under tropical conditions stated in Clause 2.0 above. The LCD shall have the minimum life span of 15 years stipulated for Meters.
- 5.3.4 The Meter Constant shall be embossed on the body of the register to facilitate identification when carrying out repairs.
- 5.3.5 If a pulse emitting device is not incorporated in the Meter, the Meter shall have provision for the incorporation of a pulse emitting device.

5.4 Special Design Requirements for kVAh meters with kVA maximum demand indication. (MDI)

- 5.4.1 The maximum demand indicating Meter may be of either electro-mechanical type or electronic type. If the MDI is of electro-mechanical type then it shall be of Merz type.
- 5.4.2 If the MDI is of electronic type and requires signals from a kWh meter and a kVAh Meter, the offer shall include the complete set of those meters and pulse emitters.
- 5.4.3 The Meter shall be capable of indicating the maximum of average kVA demand over a demand integration period of fifteen (15) minutes. MDI shall be of accuracy Class 2.
- 5.4.4 The equipment shall operate within the stipulated error limits for accuracy Class 2 within the power factor range of 0.33 lagging to Unity and 0.66 leading on unbalanced loads.
- 5.4.5 If the indicator is of electro-mechanical type full range of the dial shall be used to indicate the rated kVA plus the permitted over load.
- 5.4.6 The Meter shall be incorporated with an internal timing element to reset the demand integration period at the end of each 15 minute interval. If the meter is of electro mechanical type then this shall be operated by a synchronous motor. In this case the synchronous motor and the solenoid coil shall be of continuous rating at 110V, 50 Hz and be able to withstand a maximum working voltage of 125V. The time lapsed in the integrating period shall be indicated.

- 5.4.7 An external manual device shall be provided for resetting the maximum demand indicator. This shall be a press button or such similar simple method having facilities for sealing separately.

5.5 Design requirements for Time Switch

- 5.5.1 The Time Switch is to be used in association with the two rate meter sets to give the external signal to activate the "High" register.
- 5.5.2 Time switches shall be rated at 110V, 50 Hz. and be capable of withstanding a maximum working voltage of 125V.
- 5.5.3 The Time Switch shall be operated by either a Synchronous or a Quartz Oscillator Drive rated at 110V, 50 Hz. If it is operated by a synchronous drive it shall have a spring reserve to ensure operation of the time switch for at least 48 hours continuously during a supply failure. This spring shall be automatically recharged when supply (110 V, 50 Hz.) is restored.
- 5.5.4 If it is operated by a Quartz Oscillator Drive there shall be a battery back-up to ensure operation of the time switch for at least 48 hours continuously during a supply failure. This battery shall be recharged through a built in charger when the supply of 110V, 50 Hz is restored. The life time of this rechargeable battery shall be at least 10 years.
- 5.5.5 The make (On) and break (Off) times of the switch shall be independently adjustable. The time of day and the switching time settings of the switch shall be clearly marked and visible for purposes of resetting and checking. The dial of the device shall be for 24 hours. The minimum setting period possible between operations shall not be more than one hour.
- 5.5.6 If facilities are provided to test the operation of the contacts they shall have proper sealing facilities to avoid malpractice.
- 5.5.7 A set of auxiliary contacts of not less than 1A rating at 110V shall be available for connection to a visual indication of the operation of the higher tariff.

5.6 Design Requirements for Voltage Selector Relay

- 5.6.1 The Voltage Selector Relay is to be used at summation metering installations to select voltage supply to meter from any one of the feeders that is energized, so that an uninterrupted voltage supply to the meter is ensured.
- 5.6.2 The relay shall be rated at 110V, 50 Hz. and be capable of withstanding a maximum working voltage of 125V. If at any time the selected supply voltage falls below a predetermined value of 80%, which shall preferably be adjustable, the selector relay shall immediately select a voltage supply from one of the other circuit which has the voltage above the predetermined value. The operation shall be automatic and the searching of the selector relay for the desired voltage shall be in a given order of the inputs.
- 5.6.3 Indication of the input from which the output is fed shall be available on the front panel. Facilities shall be available externally to test the operation of the relay.

5.7 Design Requirements for Summation Current Transformer

- 5.7.1 The Summation Current Transformer is to be used when only one meter set is used to meter energy supply from two or more feeders.
- 5.7.2 The Primary and the Secondary of the Summation Current Transformer shall be rated at 5A, 50 Hz, which shall have Multi Primaries two or more as per Schedule of Prices) and each of the primaries shall match the corresponding feeder current transformers, the rating of which shall be supplied separately (see Schedule of Prices).
- 5.7.3 It shall be of Class 1 accuracy and rated for 15VA burden. All terminals shall be clearly marked and be provided with requirements of bolts, nuts, washers etc. for wiring. It shall have provision for panel mounting.

6.0 QUALITY ASSURANCE

Manufacturer shall process ISO 9001 Quality Assurance for the manufacture of Three Phase Three Wire Unbalanced Load Two Rates Meters for the plant where the manufacture of Three Phase Three Wire Unbalanced Load Two Rates Meters is done. The Bidder shall furnish a copy of the ISO Certificate certified as true copy of the original by the manufacturer, along with the offer.

7.0 ADDITIONAL REQUIREMENTS

The equipment shall be reliable, of rugged construction and of a proven design.

7.1 Rating Plate Markings

- 7.1.1 The words "Property of the Ceylon Electricity Board" shall be engraved on the name plate.
- 7.1.2 A serial number (which will be indicated at the time of placing an order) shall also be engraved on the name plate.
- 7.1.3 The standard information stipulated in the standard specified shall be indicated on the name plate.

7.2 Service and Tools

- 7.2.1 A list of spare parts and tools if supplied with the equipment shall be furnished with the offer.
- 7.2.2 In addition, the prices of a recommended set of spares and special tools necessary for 10 years of operation shall be quoted separately (item wise)

7.3 Packing

All items shall be packed in a manner to prevent damage due to rough handling and each packing shall indicate the Type, Rating and Serial No. of the item.

8.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

The following shall be furnished with the offer.

- (a) Catalogues describing the equipment and indicating in the model number.
- (b) Literature describing the operational feature of the equipment.
- (c) Constructional features, materials used for components and relevant technical literature.
- (d) Complete dimensional drawings.
- (e) Bidders shall furnish a minimum of three (3) Performance Certificates obtained from Electricity Supply Authorities outside the country of the Manufacturer to whom the Bidders have supplied Meters of similar type in the past five years.

The certificate shall indicate the type (model) of the Meter, Year of Supply, Quantity Supplied, Percentage of Defective Meters and the Performance of the Meters based on field experience or field studies.

The purchaser reserves the right to communicate with such Electricity Supply Authorities with regard to the performance of the Meters and the authenticity of the Performance Certificates issued by them.

- (f) The details of the information that will be indicated on the Name Plate of the equipment.
- (g) Completed Schedule of Particulars.
- (h) Type Test Certificates

The Test Certificates, Performance Curve, Tables etc. of the Type Test performed conforming to the standard specified. The Type Test shall be performed at a reference voltage of 110 V at a reference frequency of 50 Hz. and at a reference temperature. The test certificates shall clearly identify the equipment concerned, showing the manufacturer's identity, ref. no. and basic parameters, and shall be from a **recognised independent testing authority acceptable to the Purchaser.**

Failure to furnish these particulars and the samples as per Clause 9.0 will result in the offer being rejected.

9.0 SAMPLE STUDY

One sample of each item with manufacturers seals shall be handed over to the Purchaser or before the date of closing of tender. They will be returned to the unsuccessful tenderer after decision is made on the offer. The samples furnished by the successful tenderer will be retained and set off against the quantities to be supplied under the main award.

10.0 INSPECTION AND TESTING

10.1 Inspection

The selected Bidder shall make necessary arrangements for inspection by a representative of the Purchaser and to carry out in his presence necessary routine tests of the equipment offered.

10.2 Sample/Acceptance Test

The following test as per relevant IEC shall be witnessed by the representative of the Purchaser. Extra copies of these Test Certificates shall also be supplied with the equipment.

- (a) Clearance and creepage distances
- (b) Power loss
- (c) Apparent power loss
- (d) Heating
- (e) AC voltage test
- (f) Flammability test
- (g) Variation due to self-heating
- (h) Percentage error limits

Each consignment of equipment shall accompany one set of test results recorded in tabular form to conform to the above. If the test results are recorded in separate sheets all such sheets pertaining to each consignment shall be bound together as one volume.

11.0 TECHNICAL LITERATURE AND DRAWINGS

Technical Literature in English language on the installation, operation and maintenance shall be supplied with each set of equipment and they shall be descriptive and self explanatory, complete with necessary diagrams and drawings.

12.0 ANNEXURE

Schedule of Particulars

ANNEXURE**SCHEDULE OF PARTICULARS
(To be filled by the Bidder)**

- | | | |
|-----|---|---|
| 1. | Class of Meter | : |
| 2. | Type No. | : |
| 3. | Basic Current (I_b) | : |
| 4. | Rated Voltage | : |
| 5. | Frequency | : |
| 6. | Power loss | : |
| 7. | Apparent Power Loss | : |
| 8. | Temperature Rise | : |
| | (a) Windings | : |
| | (b) External surfaces of the case | : |
| 9. | Material of Cover, Base
and the Terminal Block | : |
| 10. | Maximum Withstand Temperature of | : |
| | (a) Terminal block | : |
| | (b) Terminal cover and meter case | : |
| 11. | Type of Register | : |
| 12. | Impulse Withstand Voltage | : |
| 13. | AC Withstand Voltage | : |
| 14. | Percentage error limits with | : |
| | (a) Balance loads | : |
| | (i) at $0.05 I_b$ and unity p.f. | : |
| | from $0.1 I_b$ to I_{max} unity p.f. | : |
| | (iii) at $0.1 I_{max}$ | : |
| | a) 0.5 lagging | : |
| | b) 0.8 leading | : |

- (iv) From $0.2 I_b$ to I_{max}
 - a) 0.5 lagging :
 - b) 0.8 leading :
- (i) from $0.2 I_b$ to I_b at unity p.f. :
- (ii) at $0.5 I_b$ and 0.5 lagging :
- (iii) at I_b and 0.5 lagging :
- (iv) from I_b to I_{max} and unity p.f. :
- 15. Limits of Variations (in % of error)
due to short-time over Currents at Basic
Current and Unity p.f. :
- 16. Limits of Variations (in % of error)
due to Self-heating at I_{max} .
 - (i) at unity p.f. :
 - (ii) at 0.5 lagging :
- 17. Starting Current (% of basic current)
at Unity p.f. :
- 18. Minimum Range of Adjustment
(of rotation speed of the rotor in %)
 - (i) Breaking Element ($0.5 I_{max}$)
and unity p.f. :
 - (ii) Low load ($0.5 I_b$)
and unity p.f. :
 - (iii) Inductive load :
 - (a) ($0.5 I_b$) 0.5 lagging :
 - (b) ($0.5 I_{max}$) 0.5 lagging :
- 19. Any deviation from this Specification
(indicate the relevant Clause Nos.) :