109-1:2019

CEB
SPECIFICATION

SINGLE PHASE & THREE PHASE STATIONARY METER TEST SYSTEM

CEB Approved Specification
27/02/19
Chairman Dist. Coordination Committee

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SPECIFICATION FOR SINGLE PHASE & THREE PHASE STATIONARY ELECTRICITY METER TEST SYSTEM (MTS)

1.0 SCOPE

This specification covers the general requirements of the design, manufacture, testing, supply, installation and commissioning of:

(a) Single Phase Stationary Electricity Meter Test System.
(b) Three Phase Stationary Electricity Meter Test System.

as indicated in the schedule of prices.

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage (U)	400 V
(b)	System highest voltage (U_m)	440 V
(c)	System frequency	50 Hz
(d)	Method of earthing	Effectively earthed
(e)	System fault level	25 kA

3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	30 °C
(b)	Maximum ambient temperature	40 °C
(c)	Maximum relative humidity	90%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(e)	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(f)	Isokeraunic (Thunder days) level	100 days

4.0 APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.

(a)	IEC 60736:1982	Testing equipment for electrical energy meters.
(b)	IEC 61010-1:2010	Safety requirements for electrical equipment for measurement control and laboratory use.
(c)	IEC 60348:1978	Safety requirements for electronic measuring apparatus.
(d)	IEC 60529:1989	Degree of protection provided by the enclosure.
(e)	IEC 62052-11:2003	Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment

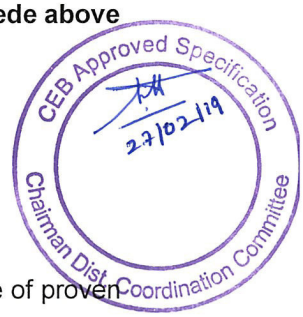
This equipment shall be able to perform tests for the meters which comply with the following standards

(a)	IEC 62053-21:2003	Electricity metering equipment (AC) - Particular requirements – Static meters for active energy (Classes 1 and 2)
(b)	IEC 62053-22:2003	Electricity metering equipment (AC) - Particular requirements – Static meters for active energy (Classes 0.2 S and 0.5 S)

(c)	IEC 62053-23:2003	Electricity metering equipment (AC) - Particular requirements – Static meters for reactive energy (Classes 2 and 3)
(d)	IEC 62053-24:2014	Electricity metering equipment (AC) - Particular requirements – Static meters for reactive energy (Classes 0.5 S, 1 S and 1)
(e)	IEC 62056-21:2002	Electricity metering - Data exchange for meter reading, tariff and load control - Part 21: Direct local data exchange
(f)	IEC 62058-11:2008	Electricity metering equipment (AC) – Acceptance inspection – General acceptance inspection methods
(g)	IEC 62058-21:2008	Electricity metering equipment (AC) – Acceptance inspection – Particular requirement for electromechanical meters for active energy (classes 0.5, 1 and 2)
(h)	IEC 62058-31:2008	Electricity metering equipment (AC) – Acceptance inspection – Particular requirement for static meters for active energy (classes 0.2S, 0.5S, 1 and 2)

Material conforming to other International Standards which are equal to or higher but not less stringent than the Standards stipulated above may be offered. When such alternative Standards are used, reference to such Standards shall be quoted and English language copies of such Standards shall be provided with the offer.

However in the event of discrepancy, details given in this CEB specification supersede above standards.



5.0 BASIC FEATURES

5.1. General Requirements

(a) The Meter Test System (MTS) shall be of Static Programmable Automatic type of proven design.

(b) MTS shall be able to connect to 400V three phase four wire TT distribution system.

(c) The MTS should be capable of continuous operation of 24 x 7 hours.

(d) The MTS shall be suitable for calibrating and testing Electromechanical (Ferraris) meters (having rotating disc) conforming to IEC 62052-11 and Static meters (having light emitting diodes (LED)) conforming to IEC 62052-11, IEC 62053-21, 22, 23, 24.

(e) Test sequences used in MTS shall be able to pre-define according to the IEC 62052-11, 62053-21, 22, 23, 24 and IEC 62058. MTS shall also be capable of testing meters under harmonic conditions in both voltage and current.

(f) There shall be facilities to test the Apparent Maximum Demand (kVA) recorded in the meters and should be able to carry out the register test.

(g) The MTS shall be suitable for testing of meters with closed voltage & current link.

(h) The MTS shall be able to generate non-sinusoidal waveforms (superposition of harmonics in the fundamental) and apply to meter under test.

5.2. Requirements for Three Phase MTS

(a) The MTS shall be suitable for testing direct connected three phase four wire and Current Transformer (CT) operated three phase four wire and CT/VT operated three phase three wire meters (both static and electro mechanical).

(b) MTS shall be capable of testing active power class 0.2S and reactive power class 0.5S meters and meters of lower accuracies according to IEC 62053-21, 22, 23, 24.

(c) The Meter Test System shall have the facility of batch testing and should be able to test and calibrate 20 meters simultaneously.

(d) The test bench shall have Isolated Current Transformers (ICT) electronically compensated that can be either connected or disconnected through the software. The accuracy of the whole test bench including wiring, contacts with terminals, contactors, error calculators, acquisition system and the reference standard meter shall not deviate from 1.5 x reference standard meter accuracy.

(e) Typical accuracy of reference standard meter shall be equal or better than 0.02% for active, reactive and apparent power and energy for entire measurement ranges.

5.3. Requirements for Single Phase MTS

(a) The MTS shall be suitable for testing 240V single phase two wire electro mechanical meters of accuracy class 2 and electronic meters of accuracy class 1 & 0.5.

(b) The MTS shall have the facility of batch testing and should be able to test and calibrate 40 meters simultaneously.

(c) The test bench shall have MSVT that can be either connected or disconnected through the software. The accuracy of the whole test bench including wiring, contacts with terminals, contactors, error calculators, acquisition system and the reference standard meter shall not deviate from 1.5 x reference standard meter accuracy.

(d) Typical accuracy of reference standard meter shall be 0.05% for active, reactive and apparent power and energy for entire measurement ranges.

5.4. MTS Components

The MTS shall comprise the following components.

(a) Power source
(b) Reference Standard Meter
(c) Meter Suspension Rack and Connections
(d) Scanning Heads
(e) Error Indication System
(f) Software, PC, Monitor & Printer

5.4.1. Power Source

The power source for the meter test system shall be an automatic computer controlled unit of adequate capacity or any other arrangement suitable for direct connection to the purchaser's mains as stipulated in Clause 2.0 (System Parameters).

The output power of the power source shall be suitable for direct connection to the meters without removing the detachable link in the voltage coil circuit of the meters. The accuracy of the system should remain unaffected even when the power source is directly connected to unregulated mains.

	Parameter	Three Phase MTS	Single Phase MTS
General features	Test frequency range	40 to 65 Hz in the step of 0.01 Hz	
	Phase angle setting	Current & voltage outputs can be software adjusted for phase angle 0 to 359.9 with a resolution of 0.1	
	Control	There shall be provision to ON/OFF voltage and current circuits.	
	Design Features	All components like voltage, current source and reference standard	

		meter shall be rack mounted in closed cabinet. Ventilation and cooling fan shall be provided for heat dissipation. Front and back side doors shall have locks to protect. Front end door shall have glass window to see the display of reference standard meter and other indications of the source.	
Voltage	Output range	Software programmable from 0V to 300V(Phase to Neutral) with a resolution of 0.1V	
	Stability	50 ppm per hour	
	Power rating	Not less than 3 x 1000 VA, but designed power rating should be sufficient for the full operation	Not less than 1000VA, but designed power rating should be sufficient for the full operation
	Setting accuracy of amplitude	Better than 0.05%	
	Setting accuracy of phase angle	Better than 0.05°	
	Distortion factor	<0.5%	
	Protection	Voltage circuit shall be protected against short circuit and over load	
	Display & Diagnosis	Shall have display to indicate the operating range. Shall have diagnosis feature to indicate the fault in case of abnormality	
Current	Output range	Software programmable from 1mA to 120A with a resolution of 0.001A	
	Stability	50 ppm per hour	
	Power rating	Not less than 3 x 2000 VA, but designed power rating should be sufficient for the full operation	Not less than 1500VA but designed power rating should be sufficient for the full operation
	Setting accuracy of amplitude	Better than 0.05%	
	Setting accuracy of phase angle	Better than 0.05°	
	Distortion factor	<0.5%	
	Protection	Current circuit shall be protected against open circuit and over load.	
	Display & Diagnosis	Shall have display to indicate the operating range. Shall have diagnosis feature to indicate the fault in case of abnormality.	

The power source shall have adequate capacity to test the stipulated numbers of meters.

5.4.2. Reference Standard Meter

The reference standard meter shall be static and reputed make and shall operate within its accuracy limit for a period of 3 years without recalibration under normal operation. Reference Standard Meter should be directly connected to the primary test circuit to ensure that the measuring accuracy of the complete system corresponds to the built in reference standard meter.

The reference Standard Meter shall have a digital display and the adjustment and control should be through user friendly software.

Parameter	Requirements
Accuracy of power and energy measurement	0.02% or better for three phase MTS 0.05% or better for single phase MTS
Display parameters	It shall have a display to indicate the following parameter ➢ rms voltage ➢ rms Current ➢ Active and reactive power

	➢ Power factor and phase angle ➢ Frequency

5.4.3. Meter Suspension Rack

The meter mounting rack shall be compact robust construction and totally corrosion free, suitable for mounting up to specified number of meters at a time, with the minimum of following features;

- Same rack should be capable of testing of both electro-mechanical and electronic meters.
- In order to reduce the length of the rack of three phase MTS, either double row or single row double sided rack shall be provided. In case of single phase MTS, double row and double sided rack shall be provided.
- Facility to perform warm-up of Meter under Test before the testing shall also be provided.
- The internal wiring (current, voltage, etc,) are fully accessible by removal of covers. Current terminals provided on rack shall be so arranged to test any No. of meters within above specified limits.
- Optical meter reading probes for each meter position shall provide for reading the meters using standard meter communication protocols such as DLMS, IEC 62056-21 etc. and should be able to carry out the register test.
- Scanning head at each meter test position with mounting arrangement.
- BNC input to get pulse outputs from meters or portable meter testing equipment which are under test at each test position with mounting arrangement shall be provided with three phase MTS. In the case of single phase MTS there shall be at least one such BNC input.
- All necessary accessories such as connecting cables, connectors, sockets etc shall be provided.
- Error indication at each test position.
- Meter mounting frame with quick connectors for current and voltage shall be available in the rack for both single phase and three phase MTS.
- In case of three phase MTS there shall be facility to mount direct connected, CT operated and CT/VT operated meters using quick connectors.
- Two Emergency switches at each side of the meter suspension rack to switch off the complete supply.
- Warning lamp to indicate the test is in progress.
- Mounting rack shall have provision to test the reference standard meter against a high precision reference standard meter.

5.4.4. Scanning Heads

The scanning head provided for each meter position in the test rack shall be insensitive to ambient light. It shall have facility to adjust sensitivity from the scanning heads at each meter mount.

The scanning head shall be suitable for fine adjustment in both- vertical and horizontal axis. It shall be suitable to scan the rotor mark of the disc and LED blinking of electronic meters and transmit data to the computer to analyze the meter under test with the standard meter.

5.4.5. Error Indication

Each meter test position shall have dedicated error indication unit.

Resolution of error indication shall be 4 ½ digit or higher.

Error indication unit shall indicate the percentage error along with plus or minus sign (+ / -)

during accuracy test and also indicate the number of edge or pulse during the starting and creep test.

5.4.6. Test Software, Computer & Printer

5.4.6.1. Test software

The associated software of the MTS shall be graphical user friendly in English Language with drop down menus and helps. It shall offer sequential testing, recording, statistical analysis and printing of Test Results in user defined formats.

Basic Features of software

The MTS software system shall provide automatic testing of Ferraris and static meters against reference standard meter and enables computer controlled error testing of three phase meters/single phase meters.

Software shall allow testing all meters under test having different meter constant but same voltage and current ratings.

The MTS software shall be menu driven and includes clearly understood screen windows referring to the test sequence and selection. This shall allow the user to efficiently use the capabilities and reduces data entry from the keyboard. The operation of the software shall be simple and on-line help shall be provided at screen windows. The modular software shall facilitate the testing procedures by guiding the user to set the test bench system according to test points control of testing sequence and the testing parameters evaluation and display of meter error and their status provide recording of testing results.

The software shall allow operator to

- Create type tables (data of meter type) and individual meter specific details
- Input the test sequence (as per IEC standard)
- Conduct automatic testing with control, monitor the test parameter and test sequence, conduct the testing
- Conduct the influence quantity testing as per IEC standard
- Visualize the maximum voltage and current applied in the selected test sequence as a safety precaution
- Run a scanning head adjustment test
- Read the meters using standard meter communication protocols such as DLMS, IEC 62056-21

The MTS software shall also allow operator to enter the details (rated voltage, basic current, maximum current, meter constant and the accuracy Class) of meter under test. Based on these data it shall carry out the testing operations on the meters under test on the test bench as per IEC specified above.

The various test points for these tests shall be kept as database tables either based on standards or user specific. The user defines the test plan and the testing is then sequentially performed on the selected test points according to the plan.

The software should

- Generate, indicate the result on PC monitor, archive the result and print test results in a user pre-formatted non editable report.
- In addition separate report generation in editable file formats such as excel, csv files for analysis.

Installation software with the user License and customer support shall be provided, including software upgrades, free of cost throughout the life time.

5.4.6.2. Computer, Monitor and Printer

The MTS computer and the printer which has the local customer support, shall have following or better features.

- Intel core i7 2.5GHz Processor, 4GB RAM, Hard Disk system of minimum effective capacity of 1 TB with minimum RAID level 1, 18.5" Widescreen (WXGA) LED Monitor, 2 of 3.0 USB and 2 of 2.0 USB Ports, serial & parallel ports as per the test bench design requirement, 1G Ethernet interface, multifunction keyboard. Language of all software and operating system shall be in English.

- A dedicated laser color printer shall be provided for printing of test reports in A4 size with 20 ppm minimum printing speed. All wearable parts including printer cartridges should be available in the local market.

5.5. Surge Protection System for MTS

Equipment shall be protected irrespective of the building protection system as per BS EN/IEC 62305 by a suitable surge protective device which shall be supplied with the system.

6.0 REQUIREMENTS FOR SELECTION

6.1. Quality Assurance

The manufacturer shall possess ISO 9001:2015 or latest Quality Assurance Certification valid throughout the delivery period of this bid, for the manufacture of MTS for the plant where manufacturing is being 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.

6.2. Manufacturing Experience

The manufacturer shall have minimum of fifteen (15) years experience in manufacturing MTSs. Out of this period offered MTS should have been supplied successfully outside the country of the manufacturer for minimum of ten (10) years for usage in utilities/accredited laboratories. Those supplied product has to be similar to offered item and shall have been used in service utilities/accredited laboratories over past five (5) years. Performance certificates issued from such previously supplied utilities/accredited laboratories shall be furnished with the offer.

If the manufacturer has supplied similar items to CEB with proven sales records; without any adverse performance records, such manufacturers will be exempted from above requirements.

6.3. Test Certificates

Test and Calibration certificates together with reports for the offered system or a similar system and calibration certificates of equipment used to calibrate the meter Testing Benches being manufactured, conforming to the above referred standards or any other international standard which is not less stringent, issued by:

Either

(a) an accredited independent testing laboratory acceptable to the CEB or

(b) an accredited or independent testing laboratory acceptable to the CEB where the tests have been witnessed by CEB or a reputed independent body acceptable to CEB

shall be furnished with the offer.

In case if the submitted tests are according to any other international standard which is not less stringent than the specified, then the copy of the used standard in English shall be submitted with offer.

Proof of accreditation and accredited scope by a national/ international authority shall be forwarded with the offer. Test certificates shall be complete including all the pages as issued by the testing authority. Test certificates/reports shall be in English language. Parts of test certificates/reports shall not be acceptable.

7.0 INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

(a) Following technical details in English clearly identifying the offered items, but not limited to:

(i) Comprehensive catalogues,
(ii) Dimensional drawings,
(iii) Schematic diagrams,
(iv) Calculations, graphs and tables
(v) Operational literature,
(vi) Name plate drawing to scale, incorporating the particulars called for
(vii) Constructional & mounting details with electrical clearances
(viii) A copy of the manual of the software.
(ix) Materials used for components & relevant literature and electrical properties and mechanical properties

(b) ISO 9001:2015 or latest Quality Assurance Certificate in accordance with clause 6.1.

(c) Manufacturer shall furnish a list of supplies with supplied item, purchaser (specifying address contact persons and contact details, country), year & quantity to prove his manufacturing experience and outside the country sales in accordance with Clause 6.2.

(d) Test Certificates in accordance with the clause 6.3.

(e) Duly filled and signed 'Annex – A: Schedule of Technical Requirements and Guaranteed Technical Particulars'.

(f) Duly filled and signed 'Annex – B : Non – Compliance schedule

(g) Details of Surge Protection System

(h) A set of spare parts manual and technical details of the equipment and components shall be supplied with the equipment. These documents constitute a part from the equipment supplied and shall be listed with the equipment supplied to make sure that the documents are shipped along with the equipment.

Not furnishing above documents and details may result in offer being rejected.

8.0 PERFORMANCE GUARANTEES AND WARRANTY

Manufacturer shall provide 5 years warranty to CEB for the items and accessories from the date of delivery to CEB stores. Manufacturer should forward the duly signed Warranty Certificate together

with the letter of acceptance of the award.

Manufacturer should provide CEB a performance guarantee with the letter of acceptance of the award ensuring service levels and technical performance given in his offer are met and maintained during the first year after the delivery to CEB stores.

9.0 SAMPLES

Not applicable.

10.0 SPARES

The manufacturer shall provide atleast following essential spares with the delivery without extra cost.

Item	Single phase MTS	Three phase MTS
Scanning head complete with cable	3 Nos	3 Nos
Quick connectors including all current leads and voltage leads	Connectors for 5 positions	Connectors for 5 positions
Meter holding mechanism	2 Nos	2 Nos

In addition, after sale services to ensure trouble free operation of the MTS for a minimum period of 10 years should be guaranteed.

11.0 PACKING AND LABELING/MARKING

11.1. Packing

The Automatic kWh Meter Test System shall be suitably packed to prevent damage during transport and handling.

11.2. Identification and Labeling/Marking

The MTS shall carry a Rating plate indicating the following information marked indelibly, legibly and in a weatherproof and abrasion proof manner:

(a) the word "CEB"
(b) Ratings: voltage U_0/U (U_m)/ current
(c) Standard/s adopted
(d) Product type, Model No
(e) year of manufacture, manufacturer's name or trade mark, warranty period
(f) Other markings stipulated in the standards

12.0 INSPECTION AND TESTING

12.1. Inspection and Training

The Successful bidder shall make necessary arrangements for inspection by an Engineer appointed by the CEB and also to carry out in his presence necessary Acceptance tests on procured item and material without any additional cost. Acceptance test reports shall be a part of

the shipping document. CEB may waive off the inspection either with the condition of witnessing the acceptance tests by an independent body acceptable to CEB or completely. In such a situation a notice of waive off will be issued in advance to the supplier.

Training on installation, commissioning, operation and troubleshooting shall also be provided at the manufacturer's plant for two engineers of CEB free of additional cost. Further after the delivery and commissioning CEB local staff shall be given a training on installation, operation and troubleshooting onsite.

12.2. Acceptance Tests

Visual inspection and dimensional checks in addition to the following test reports shall form the acceptance test report.

(a) AC. Voltage Test
(b) Accuracy Test (percentage error limits)
(c) Functional test

12.3. Delivery, Installation and Commissioning

Supplier shall ensure the equipment is delivered to the CEB site without any damage and impacts. MTS with all necessary devices shall be installed in the CEB premises to the working order. CEB is liable to provide the Distribution panels at the proximity of 10m. All other wiring, lifting and placing the equipment, foundation frames and access will be the liability of supplier.

12.4. Document to be supplied along with MTS

Following technical details in English Language shall be supplied.

(a) Technical details of each component such as reference standard, amplifier, scanning head etc.
(b) Wiring diagram
(c) Operating Manual / Instructions
(d) Manual of software in hard and soft formats for all above
(e) Calibration certificate (traceable to international laboratory)

13.0 ANNEXES

Annex – A : Schedule of Technical Requirements and Guaranteed Technical Particulars
Annex – B : Non-Compliance Schedule

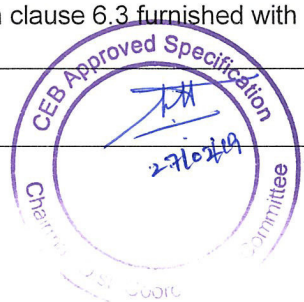
ANNEX A

SCHEDULE OF TECHNICAL REQUIREMENTS AND GURANTEED TECHNICAL PARTICULARS

(Information of the offer shall be filled by the manufacturer for each type of MTS in separate pages)

		Offered
1.	Type of MTS (single/three phase) offered?	
2.	Name of the Manufacturer	
3.	Country of Origin	
4.	Model Number	
5.	Applicable Standards	
	Components of the Meter Test System	
6.	Power Source	
	A) General Features	
	(a) Test frequency range	
	(b) Phase angle setting	
	(c) Control	
	(d) Design Features	
	B) Voltage	
	(a) Output range	
	(b) Stability	
	(c) Control	
	(d) Power rating	
	(e) Setting accuracy of amplitude	
	(f) Setting accuracy of angle	
	(g) Distortion factor	
	(h) Superposition of harmonics	
	(i) Protection	
	(j) Display & Diagnosis	
	C) Current	
	(a) Output range	
	(b) Stability	
	(c) Control	
	(d) Power rating	

	(e) Setting accuracy of amplitude	
	(f) Setting accuracy of angle	
	(g) Distortion factor	
	(h) Superposition of harmonics	
	(i) Protection	
	(j) Display & Diagnosis	
7.	Reference Standard Meter	
	(a) Make & Type of Meter	
	(b) Display Type	
	(c) Voltage range & Accuracy	
	(d) Current range & Accuracy	
	(e) Accuracy of power and energy measurement	
	(f) Display of parameters	
8.	Meter Suspension Rack	
	(a) No of meters that can be mounted at a time	
	(b) No. of scanning heads	
	(c) Availability of Error Indication Unit	
	(d) Resolution of indication unit	
	(e) Emergency switches	
	(f) Warning Lamp	
9.	Test Software, Computer & Printer	
	(a) Type of Software	
	(b) Type of Computer • Memory Capacity- RAM -Hard Disk • Serial & Parallel ports • Keyboard Type	
	(c) Monitor – Type & Size	
	(d) RAID level provided?	
	(e) Printer – Type & Make	
11.	Whether a certified copy of ISO 9001:2015 or latest furnished with the offer?	
12.	Whether the entire Test Certificates in accordance with clause 6.3 furnished with the offer?	
13.	Whether all information provided as per clause 7.0?	



14	Whether necessary spares and after sale services provided as per the clause 10.0?	

.....
Signature of the Manufacturer and seal

.....
Date

I/We certify that the above data are true and correct

.....
Signature of the Bidder and seal

.....
Date

Annex – B

Non-Compliance Schedule

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

.....
Signature of the Manufacturer

.....
Date

I/We certify that the above data are true and correct

.....
Signature of the Bidder and seal

.....
Date

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