

**TECHNICAL SPECIFICATION OF 40 POSITION FULLY AUTOMATIC METER TESTING
BENCH WITH REFERENCE METER OF CLASS 0.01**

1. OBJECTIVE:

To provide facilities for doing routine, acceptance and certification test (error test and dial test) on 1 phase, 3 phase whole current, 3 phase CT/PT operated, RSS, ERS and Energy meters. The following types of Sub Standard Meter of Accuracy Class 0.05, 0.1, and electricity meters of class 0.2S, 0.5S, 0.5, 1.0 and 2.0 available with utility can be tested (electronic and electromechanical type).

2. SCOPE:

Supply, installation and commissioning of 40 Position fully Automatic Electronic Meter Testing Equipment with reference Meter of Accuracy Class 0.01. In addition to above, bidder shall also be required to provide:

1. Operations & Maintenance Manuals including drawings.
2. Training to purchasers employees on all aspects of operation and maintenance.
3. Continued technical support during guarantee period.
4. The Major component of test bench like Source, Reference Standard Meter should be from same make i.e. supplier's own product.

3. OPERATING CONDITIONS:

The meter test equipment shall be suitable for giving an uninterrupted service in following conditions:

- a) Ambient temperature (-) 10°C to (+) 50°C for operation and from (-) 10°C to (+) 60°C for storage.
- b) Relative humidity up to 95%.
- c) Mains voltage shall be 3x240V ± 10% for three phase supply.
- d) Frequency 50Hz ± 5 %.
- e) Cabinet for source must be dust proof.

4. APPLICABLE STANDARD:

| Purpose | Applicable |
|-------------------------|------------------------------------|
| Meter Testing | IEC 62052-11, 62053-11, 21, 22, 23 |
| Safety | IEC 61010 |
| Meter Testing Equipment | IEC 60736, IS 12346, IS15707 |

5. TEST TO BE PERFORMED:

The offered meter test system shall be capable to perform the following tests on the meters as per IEC 62052-11, 62053-11, 21, 22, 23

- a) Pre-warming
- b) Accuracy test as per IS/IEC
- c) Starting current test

- d) Creep test
- e) Dial test
- f) Influence quantity test related to accuracy test
 - Voltage, Frequency, reverse phase sequence, voltage unbalance
 - Influence of Harmonic component in voltage and current circuit, odd and sub harmonic and Voltage dip and interruption test.

In addition, the offered meter-testing system shall be capable to perform the following tests on RSS and ERSS under testing using frequency output of built in ERSS.

- g) Accuracy testing of reference standard used into test system against high precision reference standard
- h) Accuracy testing of reference standard (low accuracy) against the built in reference standard.
- i) The offered system shall be capable for testing/calibration of ABT panel mounted meters. Required cables set shall be provided with the test bench.
- j) The offered system shall be capable for testing/calibration of LTCT operated meters without using ICTs (isolation current transformers). Required cables shall be provided along with the test bench.

6. CONSTRUCTION AND COMPONENT OF SYSTEM:

The complete system shall consist of at least the following essential components, the specifications of which are defined hereinafter in this document:

A source, which shall be microprocessor-based, modular type, having in-built Voltage Amplifier and Current Amplifiers, specifications of which are given subsequently in this specification as per clause nos.7 and 8 respectively.

- a) Three Phase Reference Meter (ERSS) – clause 09
- b) Meter Mounting Rack with error display units – clause 11& 12
- c) Windows based software to operate the system - clause 16

The cabinet shall be modular type in which the source and ERSS (including all their components) shall be placed. This cabinet shall have facility for easy opening and closing as and when required, with doors system. Screwed panels which take time in opening / closing shall not be acceptable. Doors shall be lockable to allow access by authorized personnel only. A cooling fan of suitable capacity shall be provided to avoid temperature increase inside the cabinet during normal operation.

The cabinet shall have protective earth terminals which shall be earthed during installation at site. The cabinet shall have one mains-switch to switch-off the incoming power supply. The cabinet shall also be protected against overload, under voltage and over voltage through suitable protection devices. With its doors closed, the cabinet housing the source and ERSS shall provide degree of protection equal to or better than IP-30.

The source shall be easily programmable so as to give:

- a) Reference output frequency independent of mains, with quartz controlled operation range from 45 Hz. to 65 Hz. in steps of 0.01 Hz. with high efficiency, power-factor compensation according to IEC 60555.
- b) Stability at inductive, capacitive and non-linear loads for the power factor.
- c) Protection against overload and short circuit and provision for superimposition of harmonics in the range of 2nd to 21st harmonics.
- d) Star system (phase angle 120°)
- e) Any asymmetrical system.
- f) Computer controlled adjustment of star system (120°) or asymmetrical system in steps of 0.01°.
- g) Any non-balanced system

Power Factor compensation shall be provided as per IEC 60555 so that the meter-testing system shall draw purely sinusoidal current from the mains A.C. supply without polluting it.

7. SPECIFICATION OF VOLTAGE AMPLIFIER:

The voltage amplifier used in the Source shall be a digital resonant switch mode voltage amplifier. It should have closed control conception of the frequency generator for high stability and high precision of test voltage. It should have output VA burden rating not less than 1600 VA per phase. The voltage amplifier should have following capabilities and features:

- a) Electronic protection against Overload and Short Circuit
- b) LED indication for faults such as overload, short-circuit, power-supply failure
- c) Efficiency better than 85%.
- d) Stability 100 ppm / h with integration time of 60 seconds
- e) Distortion factor 0.5 %
- f) Maximum possible DC content < 0.05 %
- g) Provision for super- imposition of harmonics in the range of 2nd to 21st harmonics
- h) Test voltage range: 10 -300 V (Phase-Neutral) and 17... 520 V.(Phase to Phase).
- i) Accuracy of the test setting amplitude in closed loop with reference meter: 0.05 %
- j) Accuracy of the test setting phase adjustment 0.01 °

8. SPECIFICATION OF CURRENT AMPLIFIERS:

The current amplifiers used in the Source shall be digital resonant switch mode type amplifiers. It should be closed control conception of the frequency generator for high stability and high precision of test current. It should have output VA burden rating not less than 4600VA per phase. The current amplifiers should have following capabilities and features:

- a) Electronic protection against Overload and Open Circuit& short circuit.

- b) Provision for separate ON/OFF control for voltage and current.
- c) LED indications for different faults such as overload, open-circuit, and failure of power supply.
- d) Efficiency better than 85%.
- e) Stability 100 ppm / h with integration time of 60 seconds
- f) Accuracy of the test setting amplitude in close loop with reference meter: 0.05 %
- g) Accuracy of the test setting phase adjustment : 0.01 °
- h) Distortion factor : 0.5 %
- i) Maximum possible DC content : < 0.05 %
- j) Provision for super- imposition of harmonics in the range of 2nd to 21st harmonics
- k) Test Current range 10 mA to 120 Amps. and facility to generate starting current in the range of 1 mA to 10 mA.

Note:- Here defined VA rating of current amplifier are just indicative, however manufacturer/supplier has to ensure that meter test bench is capable to run fully at maximum 120A current for 2hrs without any damaging and degradation of any performance of it.

9. SPECIFICATION OF ELECTRONIC REFERENCE STANDARD:

The class of accuracy of reference standard shall be 0.01% or better for active and reactive ranges, over the entire measurement load range & independent of the measuring mode. Current range of reference standard shall be 1 mA ... 120 A direct connected and voltage range from 10-300 V (phase - neutral), selectable through PC.

Reference standard shall have auto-range selection facility and facility of dial test (power dosing) and RS 232/ RS 485 serial communication port for communicating with PC. It must frequency output proportional to the power to calibrate against better standard.

Technical Data of Reference Standard Meter

a) Measuring modes

- 2 wire active
- 3 wire active / reactive mode
- 3 wire apparent
- 4 wire active / reactive mode
- 4 wire apparent

b) Frequency Range

Basic frequency 45 ... 65 Hz and total detectable frequency range 0...3500 Hz

c) Voltage Range

10-300V for Phase to Neutral & 17 to 520V for Phase to Phase.

d) Current Ranges

- 1 mA to 120 Amps.

e) Accuracy

- Voltage : 0.003 % for the range of 10 V to 300 V (P-N)
- Current : 0.005 % (50 mA to 120 A)
: 0.025 % (1 mA to 50 mA)
- Power / Energy (For active and reactive)
: 0.008 % at $\cos \phi = 1$ or $\sin \phi = 1$ (50mA to 120A)
: 0.01 % at $\cos \phi = 1$ or $\sin \phi = 1$ (10 mA to 50 mA)
: 0.018 % at $\cos \phi = 1$ or $\sin \phi = 1$ (1 mA to 10 mA)
The Accuracy shall be same for Active and reactive measurement
- Phase Angle Accuracy < 0.005°

A common modular cabinet with door on front and rear shall be used for housing source and reference standard.

f) Measurement Drift :

| | | |
|----------------|---|-------------|
| Voltage | : | 15 PPM/Year |
| Current | : | 25 PPM/Year |
| Power / Energy | : | 30 PPM/Year |

g) Temperature Drift :

| | | |
|-------------------|---|-----------|
| Voltage & Current | : | 0.5 PPM/K |
| Power / Energy | : | 1 PPM/K |

Temperature drift for DC reference input shall be 1 PPM / K.

h) Display :

The RSM shall have following display parameters.

- True RMS value of each voltage & current input and their DC component.
- Phase angle between voltage / current and defined reference.
- Power factor of each phase
- Active, reactive & apparent power of each phase
- Total active, reactive & apparent power
- Wave form of voltage & current and wave form and vector diagram display
- Phase Sequence
- Frequency
- Integration time

The selection facility shall be provided to select any parameters. The RSM shall have facility to maintain last setting when it is switched off.

i) Integration time

Facility to select integration time between 1 to 99 second shall be provided in the RSM. Integration time should be configurable from front panel button as well as through PC.

j) Operation

Membrane key board with membranes **push button / touch screen** to operate the RSM shall be provided in the front of the RSM

k) Reference Channel

The RSM shall have facility to select reference for phase angle measurement. Selection of reference shall be provided automatically. RSM shall also have facility to check quartz time base. The RSM shall have facility to measure DC reference voltage with an accuracy of 0.002 %. This facility will be used to verify the accuracy of RSM for intermediate check.

l) Frequency output :

This shall provide frequency output proportional to power to calibrate the reference standard against high precision reference standard. This output shall be in commonly used BNC type socket.

m) Frequency Input for calibration of substandard meters :

The frequency input connections shall be provided with BNC socket to receive electrical pulses from substandard meters. It shall be possible to calibrate/ test **ten** substandard meter.

n) Calibration:

The reference meter shall be provided along with calibration certificate from national/international accredited laboratory. The bidder shall also arrange periodical calibration (once in a year) of reference standard meter from national/internationally accredited laboratory for the tenure of 5 years from the date of **satisfactory commissioning.**

10. SPECIFICATION OF HARMONIC INJECTION UNIT:

Over the range 2nd to the 21st harmonics to the test voltage and test current, the magnitude of each harmonic shall be adjustable from 0-40% of the fundamental wave, and the maximum peak value of the wave form shall be 130% of the magnitude of the fundamental wave. Facility of controlling the phase angle of harmonics shall also be

provided. The super-imposition of harmonics shall be possible to carry out all the tests prescribed at Clause 5 (f).

11. SPECIFICATION OF METER MOUNTING RACK:

- a) Four Nos. Separate Single Sided Meter Mounting Racks shall consist of a lightweight aluminum frame for mounting of sensor heads, display devices and meters-under-test. Both the racks shall be independently and should have possibility to keep in right angle.
- b) Meters-under-test shall get connected to the voltage and current circuits by means of connecting leads.
- c) Design of the frames should be such that 40 Nos. energy meters of any type, single or three phase, 3 wire or 4 wire, whole-current or CT-VT operated can be safely and easily accommodated on it. Each rack shall have capacity to mount 10 Nos. of meters at front side, shall be supplied along with test bench. Meter mounting arrangement on rear side of rack/frame won't be acceptable.
- d) Necessary BNC type socket to test the ERSS against a precision standard of higher accuracy shall be provided on Meter Mounting Rack. BNC socket or any suitable socket shall be provided for testing ERSS of other make.
- e) Necessary BNC type socket or any other suitable arrangement shall be provided on the Meter Mounting Rack to test the inbuilt ERSS against a precision standard of higher accuracy without removing the inbuilt ERSS from the source cabinet.
- f) The Meter Mounting Racks shall be provided with 40 number of BNC type sockets for the testing of ERSS of lower accuracy. The offered software shall have facility to test these ERSS in automatic mode by using these BNC type sockets.
- g) Necessary cables shall be provided along with equipment to test ERSS having frequency output on BNC type socket.
- h) There should be a warning lamp and two emergency push-buttons fitted on the each Meter Mounting Rack.
- i) Each meter test position should have communication facility to communicate with meter under test using DLMS communication.

12. SPECIFICATION OF SCANNING HEADS AND ERROR INDICATION UNITS:

- a) 1 photoelectric scanning head for each position suitable for reading the LED & LCD pulse output of the meters-under-test shall be provided.
- b) Scanning head shall have mechanical type fixing arrangement so that scanning head can be fixed easily in a position which would facilitate accurate and proper testing of the meter-under-test.
- c) The scanning head should be insensitive to ambient light. It should give optical indication of pulses by LED.
- d) The scanning head must be able to measure LED pulse output (as per IEC 62052-11, clause 5.11) of frequency up to 1 kHz.

An Error Indication Device shall be mounted on each test position. The resolution of error indication shall be 4½ digits with decimal point configurable by software. There shall be provision on the error indication unit to reset the error or to repeat it if something is wrong. The same should have Acknowledgement function while doing testing of starting current and creep tests manually.

13. SPECIFICATION OF DIGITAL PROCESS UNIT:

For the simultaneous error measurement of 40 meters under test, the basic unit shall be equipped with:

- a) 40 inputs for scanning head pulses.
- b) 1 input for reference output
- c) 1 interface for connection with PC.
- d) Controlled output for Dosage Operation (Dial Test).

14. ISOLATING CURRENT TRANSFORMER (ICT)& MULTI-SECONDARY VOLTAGE TRANSFORMER(MSVT):

The meter test system shall have isolating current transformer (ICT) to test three phase as well as single phase closed link whole current meters.

Technical details of ICTs are.

| | |
|---------------------------|--|
| Nominal Primary current | 100A |
| Maximum Primary current | 120A |
| Nominal Secondary current | 100A |
| Maximum Secondary current | 120A |
| VA rating | 60VA @ Nominal current (100 Amp)with single turn in operation |
| Accuracy ratio error | ± 0.01% (1 A to 120 A) ± 0.03% (0.15 A to <1 A) ± 0.15% (0.02 A to <0.15 A) ± 0.3% (0.01 A to <0.02 A) |
| Phase angle error | ± 1 minutes (1 A to 120 A) ± 3 minutes (0.15 A to <1 A) ± 10 minutes (0.02 A to <0.15 A) ± 20 minutes (0.01 A to <0.02 A) |
| Operating burden | 3 mΩ |
| Max. Burden | 5 mΩ |

- There shall be provision to bypass the individual ICT automatically when secondary of ICT is kept open. Sufficient protection shall be provided to protect the ICT in case if secondary of ICT remain open while full load is running in primary.

- Secondary of ICT shall be designed in such a way that its secondary leads can be connected directly to Meter under Test. Ring type of design, which needed in operation to put multiple turns for actual connection to reach desired VA rating with loose primary/secondary type of connection won't be acceptable
- Primary connection of ICT should be fixed type and all primary connection on each ICT terminal shall be connected permanently. Primary & Secondary leads of ICT should be designed in such a way that it can carry its maximum Current i.e. 120A for 2 hours continuously without any malfunction in ICT.
- LED indication shall be provided on ICT to indicate healthiness of ICT.
- Associate Software shall have facility to indicate fault in ICT like open circuit and over load on PC. It should have facility to display message on computer screen about any fault in ICT during testing of meters.

If MSVT is required for isolation in voltage circuit for testing single phase whole current meter dual channel with IP link short. The following provision will be required:-

2 Nos. MSVT shall provide isolation in voltage circuit for testing of single phase meters with IP link short. The each MSVT shall have single Primary and 22 nos. of secondary. Individual MSVT for each location will not be acceptable.

Each MSVT shall have accuracy as below:

| Parameter | Value |
|--|---|
| No. of windings | 22 |
| Primary Voltage | 165V...300V, 45...65 Hz |
| Secondary Voltage | 165V...300V |
| Range of secondary burden | 4...15 VA |
| Error between primary and secondary | $\leq \pm 0.1\%$, $\leq \pm 2$ minutes |
| Error between the secondary windings, concerning the above mentioned range of secondary burden | $\leq \pm 0.05\%$, $\leq \pm 1$ minutes |

One sample certificate of ICT and MSVT shall be submitted along with offer.

Detailed catalogue of offered ICT & MSVT and its working principle of these both parts i.e. MSVT and ICT's shall be submitted along with offer (own make).

15. CONNECTION CABLES:

Apart from connection cable required to install and commission the meter test system itself, supplier shall provide the following set of connection cable for meter under test

| Requirement / Meter Type | Qty. (minimum) |
|---|---|
| Voltage connection cables for phase (one side with omega pin and other side with 4 mm safety plug) | 120 nos. + 10% extra for spare. |
| Voltage connection cables for neutral (one side with straight pin and other side with 4 mm safety plug) | 40 nos. |
| Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) both side pin type lug to test without ICT | 108 nos. + 10% extra for spare. |
| Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) one side pin type lug and other side connection to test bench to test without ICT | 24nos. |
| Current connection cables for testing of 1 phase 2 wire Energy meter (for 40 Nos. meter) both side pin type lug and one side along with voltage cable to test with MSVT | 36 Nos. |
| Current connection cables for testing of 1 phase 2 wire Energy meter (for 40 Nos. meter) one side pin type lug and other side connection to test bench to test with MSVT | 8 Nos. |
| Looping colored current cables (for R, Y & B phase) of 2.5 sq. mm dia. with spade type lugs for testing of 40 nos. of ABT rack mounted type meters. | 1 set |
| Voltage and Current Connection cables for testing ten no. ERSS at one time. | 40 nos. for voltage and 60 nos. for current |

Note: Closed link Direct Connected meters shall be directly connected to the secondary connection of ICTs.

16. SPECIFICATION OF COMPUTER SYSTEM (DESKTOP PC, PRINTER, MONITOR, SOFTWARES & ACCESSORIES THEREOF):

The operating of the test equipment, the display of the actual values, the processing and display of the test results and the print out of the test results, reports etc. should be effected by the associated Desktop PC (Personal Computer) system complete with licensed Windows based operating system, licensed proprietary software of the meter-testing equipment and a LaserJet printer having minimum specifications as given below to be supplied along with the meter testing system by the successful bidder.

The Desktop PC (PC) shall be connected to the measuring device and power source and necessary leads and cables for making these connections shall be provided by the vendor at his cost.

The licensed proprietary software of the meter-testing equipment shall be supplied installed on the PC. This software should be Windows based, user friendly and menu driven, operated with the help of a mouse and keyboard in manual or automatic mode.

The manual mode of operation of the licensed proprietary software of the meter-testing equipment shall allow, at least, performance of the following tasks:

- Controlling of the source
- displaying of test parameters (actual values) on PC screen
- displaying the wave form of output voltage and current and harmonics analysis
- Performance of the accuracy tests

The automatic mode of operation licensed proprietary software of the meter testing equipment should have different modules to prepare meter test sequence so as to carry out the testing in fully automatic mode. These modules shall be designed in such a way that user can prepare the test sequence very easily.

The licensed proprietary software of the meter-testing equipment shall allow, at least, performance of the following tasks:

- User interface to operate the system
- Easy to prepare test-tables by using “ drag & drop “ concept
- Supervision and control of the test procedure
- Supervision and display of the test current and voltage
- Indication of the errors of the meters- under- test
- Evaluation of the test results and generation of test-reports
- Manual testing and automatic testing facility
- Facility to define test parameters in terms of percentage and absolute terms
- Facility to define error limit in two levels
- Facility to protect the system from over voltage in manual mode and automatic mode
- Facility to check meters for short circuit and open circuit conditions prior to starting of the testing in fully automatic mode for each sequence
- Facility to interrupt the testing and restart it again
- Password facility for administrator and operator with different levels
- Print out facility of test-reports with desired header
- Facility to take back-up of data
- Absolute measurement with higher precision / more accurate standard in fully automatic mode using BNC type socket provided on Meter Mounting Rack
- Testing facility of at-least 40 different meters with 40 different constants
- Software shall have facility for display of different output voltages and currents
- Facility to display the curve of test voltage and current in presence of harmonics

- Protection of meters- under- test from high voltage and current
- Software shall have facility to indicate fault in ICT's like open circuit and over load on PC for easy identification to operator.

The licensed proprietary software of the meter-testing equipment shall have facility to display following parameters:

- Individual phase voltage
- Individual phase current
- Phase angle and power factor of symmetrical or asymmetrical star system
- Total Power Factor
- Individual phase power (Active , Reactive and Apparent)
- Total Power (Active , Reactive and Apparent)
- Frequency
- Phase Sequence
- Measurement mode
- Vectorial display
- Firm should have to arrange upgradation in software at least once in a year upto five years from date of satisfactory successful installation of testing bench failing which firms PBG may be invoked.

TECHNICAL DATA FOR PC:

| | | |
|-------------------------|---|---|
| Processor | : | Pentium i7 or equivalent / better |
| RAM | : | minimum 8 GB DDR |
| HDD | : | 1TB minimum |
| Optical Drive | : | 48X / 32X DVD / CD RW Combo Drive or better |
| Keyboard & Mouse | : | PS2/USB Multimedia / 107 keys Keyboard or better. |
| I/O ports | : | Minimum 4 high-speed USB 2.0 (2 front), Mic-In, Headphone-Out, Line- In, 2 serial, One RJ-45 minimum or better. |
| Networking | : | Onboard 10/100/1000 Mbps / Gigabit LAN |
| Modem & Communications: | : | Broadband ready. |
| Operation System | : | PC shall be supplied with licensed operating system installed windows 10 or better. |
| Monitor | : | Minimum 17 inches flat screen, CRT / TFT / LCD color monitor, |
| Printer | : | B/W LaserJet, suitable for paper size up to A4. |

17. CALIBRATION AND TESTING

The equipment shall be supplied along with the manufacturer's test certificate/s of the individual components of the meter-testing system (excluding the PC system) such as Source, Voltage and Current Amplifiers, ERSS, Harmonics Injection Unit, Meter-

Mounting Rack, Scanning-heads, Digital Process Unit, ICT or the complete meter-testing system (excluding the PC system), as well as a calibration certificate of the ERSS, valid for at least 12 months from the date of calibration. The calibration certificate of the ERSS shall be issued by any nationally or internationally recognized / accredited laboratory as per clause No. 9 n of technical specifications .

18. DOCUMENTATION

One set of following documents shall be supplied along with each test system.

- Operating manual of each components of test equipment like reference standard, amplifier, etc.
- Wiring diagram
- Calibration certificate of reference standard
- Test certificate of complete test system

19. INSTALLATION AND COMMISSIONING

The supplier shall be responsible to install & commission the meter test equipment at the purchaser location. The supplier shall submit the layout plan, installation proposal and electric supply requirements within 4 weeks after receiving the purchase order. The Purchaser shall arrange the appropriate room, location, electric supply etc. as defined in IEC 62052-11 before the supply of the system so as to permit the smooth and proper installation of the system immediately upon its delivery to the designated location/s.

20. WARRANTY

The bidder shall provide warranty for **60 months** from the date of satisfactory commissioning in the designated Meter lab of Jaipur Discom.

Firm will have to attend the test bench within three days from the date of intimation by the concerned Meter Lab. in charge otherwise it will be treated as breach of contract and action will be taken as per provisions of contract.

21. TRAINING

The supplier shall provide training on operation and maintenance of the meter test equipment **to 2 Nos. engineers and 6 Nos. technical staff of Nigam** for three days during installation and commissioning of the test bench.

A refresher course shall also be arranged by the supplier during the warranty period periodically twice in a year at respective lab.

22. Delivery schedule:-

Supply shall be commenced within two months from the date of receipt of purchase order and completion @ 8 Nos. in first quarter and balance 7 Nos. in next quarter

where after. In case ordered quantity is different then quoted quantity then delivery shall be adjusted proportionately.

23. PAYMENT:-

70% of the payment shall be released after receipt of test bench at designated meter lab and Balance 30% of payment shall be released on production of satisfactory installation and commissioning report of the concern SE(M&P).

24. WORK COMPLETION SCHEDULE:-

The installation and commissioning of fully automatic test bench shall be completed within 45 days from the date of receipt of meter test bench along with intimation of location of place i.e. designated meter lab where test bench is to be installed. The concern AEn meter lab shall give intimation to the firm only after transporting the test bench to meter lab.

25. DELAY IN WORK COMPLETION:-

In case of delay in installation and commissioning of test bench beyond 45 days from the date of intimation to the supplier about the designated meter lab (the date of receipt of letter about intimation of lab), penalty @ 0.5% of the cost of bench per week maximum upto 5% shall be livable, further to this action as deemed appropriate shall also be initiated against the firm which includes invocation of bank guarantee etc.

Guaranteed Technical Specification of 40 Position fully Automatic Electronic Meter Testing Equipment with reference Meter of Accuracy Class 0.01

| Sr. No. | Particulars | Offered |
|---------|---|---------|
| 1. | Name & address of Bidder with contact no. | |
| 2. | Name and Address of the Manufacturer | |
| 3. | Model | |
| 4. | Country of origin | |
| 5. | The Major component of test bench like Source, Reference Standard Meter should be from same make i.e. supplier's own product. | |
| 6. | FREQUENCY GENERATOR: a) Facilities shall be should be available for programming reference output frequency. b) The operating range shall be 45 Hz to 65 Hz in steps of 0.01 Hz. c) PF compensation should conform to IEC 555. | |
| 7. | VOLTAGE AMPLIFIER: a) VA rating not less than 1600 VA per phase b) Electronic protection against O/L and Short Circuit. LED indication for fault shall be provided on amplifier. c) Efficiency better than 85%. d) Stability 100 ppm / h integration time 60 sec e) Distortion factor 0.5 % f) Maximum possible DC content < 0.05 % g) Provision for super position of harmonics in the range of 2nd to 21st harmonic. h) Test voltage range 10 -300 V (Phase-Neutral) and 17... 520V (Phase to Phase) . i) Accuracy of the test setting amplitude in closed loop with reference meter: 0.05 % j) Provision for super position of harmonics in the range of 2nd to 21st harmonic. k) Accuracy of the test setting phase adjustment 0.01 ° | |
| 8. | CURRENT AMPLIFIER: a) VA rating not less than 4600VA per phase b) Electronic protection against Overload and Open Circuit LED indications for different faults such as overload, open-circuit , failure of power supply c) Efficiency better than 85%. d) Stability 100 ppm / h with integration time of 60 seconds e) Accuracy of the test setting amplitude in closed loop with reference meter:: 0.05 % f) Accuracy of the test setting phase adjustment : 0.01° | |

| | | |
|----|---|--|
| | <p>g) Distortion factor : 0.5 %</p> <p>h) Maximum possible DC content : < 0.05 %</p> <p>i) Provision for super- imposition of harmonics in the range of 2nd to 21st harmonics</p> <p>j) Test Current range 10 mA to 120 Amps. and facility to generate starting current in the range of 1 mA to 10 mA.</p> <p>Note:- Here defined VA rating of current amplifier are just indicative, however manufacturer/supplier has to ensure that meter test bench is capable to run fully at maximum 120A current for 2hrs without any damaging and degradation of any performance of it.</p> | |
| 9. | <p>PHASE POSITION ADJUSTER:</p> <p>Test voltage & current system can be freely selectable for symmetrical / non symmetrical and balance / unbalance load system</p> | |
| 10 | <p>CONSTRUCTION FEATURES:</p> <p>a) Source and Reference Standard Must be housed in one cabinet</p> <p>b) Cabinet must have door in front and rear to provide accessibility and for ease in maintenance.</p> <p>c) Meter Mounting Racks shall be constructed by Aluminum section</p> | |
| 11 | <p>HARMONIC INJECTION UNIT:</p> <p>a) Facility of controlling the phase angle of harmonics shall be provided.</p> <p>b) The superimposition of harmonics shall be only possible in manual / automatic operation.</p> <p>c) Over the range 2nd to the 21st harmonics to the test voltage and test current, the magnitude of each harmonic shall be adjustable from 0-40% of the fundamental wave, and the maximum peak value of the wave form shall be 130% of the magnitude of the fundamental wave.</p> | |
| 12 | <p>REFERENCE STANDARD METER:</p> <p>The class of accuracy of reference standard shall be 0.01% or better for active and reactive ranges, over the entire measurement load range & independent of the measuring mode. Current range of reference standard shall be 1 mA ... 120 A direct connected and voltage range from 10-300 V (phase - neutral), selectable through PC.</p> <p>Reference standard shall have auto-range selection facility and facility of dial test (power dosing) and RS 232/RS 485 serial communication port for communicating with PC. It</p> | |

must frequency output proportional to the power to calibrate against better standard.

Technical Data of Reference Standard Meter

a) Measuring modes

- 2 wire active
- 3 wire active / reactive mode
- 3 wire apparent
- 4 wire active / reactive mode
- 4 wire apparent

b) Frequency Range

Basic frequency 45-65 Hz and total detectable frequency range 0...3500 Hz

c) Voltage Range

10 ...300 V Phase to Neutral & 17 -520V Phase to phase

d) Current Ranges

- 1 mA to 120 Amps.

e) Accuracy

- Voltage : 0.003 % for the range of 10 V to 300 V (P-N)
- Current : 0.005 % (50 mA to 120 A)
: 0.025 % (1 mA to 50 mA)
- Power / Energy (For active and reactive)
: 0.008 % at $\cos \phi =1$ or $\sin \phi =1$ (50mA to 120A)
: 0.01 % at $\cos \phi =1$ or $\sin \phi =1$ (10 mA to 50 mA)
: 0.018 % at $\cos \phi =1$ or $\sin \phi =1$ (1 mA to 10 mA)

The Accuracy shall be same for Active and reactive measurement

- Phase Angle Accuracy < 0.005°

A common modular cabinet with door on front and rear shall be used for housing source and reference standard.

f) Measurement Drift :

Voltage : 15 PPM/Year
Current : 25 PPM/Year
Power / Energy : 30 PPM/Year

g) Temperature Drift :

Voltage & Current : 0.5 PPM/K
Power / Energy : 1 PPM/K

Temperature drift for DC reference input shall be 1 PPM / K.

h) Display :

The RSM shall have following display parameters.

- True RMS value of each voltage & current input and their DC component.
- Phase angle between voltage / current and defined reference.
- Power factor of each phase
- Active, reactive & apparent power of each phase
- Total active, reactive & apparent power
- Wave form of voltage & current and wave form and vector diagram display
- Phase Sequence
- Frequency
- Integration time

The selection facility shall be provided to select any parameters. The RSM shall have facility to maintain last setting when it is switched off.

i) Integration time

Facility to select integration time between 1 to 99 second shall be provided in the RSM. Integration time should be configurable from front panel button as well as through PC.

j) Operation

Membrane key board with membranes push button / touch screen to operate the RSM shall be provided in the front of the RSM

k) Reference Channel

The RSM shall have facility to select reference for phase angle measurement. Selection of reference shall be provided automatically. RSM shall also have facility to check quartz time base. The RSM shall have facility to measure DC reference voltage with an accuracy of 0.002 %. This facility will be used to verify the accuracy of RSM for intermediate check.

l) Frequency output :

This shall provide frequency output proportional to power to calibrate the reference standard against high precision reference standard. This output shall be in commonly used

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| | <p>BNC type socket.</p> <p>m) Frequency Input for calibration of substandard meters :</p> <p>The frequency input connections shall be provided with BNC socket to receive electrical pulses from substandard meters. It shall be possible to calibrate/ test ten substandard meter.</p> <p>n) Calibration:</p> <p>The reference meter shall be provided along with calibration certificate from national/international accredited laboratory. The bidder shall also arrange periodical calibration (once in a year) of reference standard meter from national/internationally accredited laboratory for the tenure of 5 years from the date of satisfactory commissioning.</p> | |
| 13 | <p>SCANNING HEAD:</p> <p>a) One photoelectric scanning head for each position suitable for reading the LED& LCD pulse output of the meters-under-test shall be provided.</p> <p>b) Scanning head shall have mechanical type fixing arrangement so that same can be fixed directly on the meter body. Each scanning head should be designed in such a way that the scanning head can be fixed easily in a position which would facilitate accurate and proper testing of the meter-under-test.</p> <p>c) The scanning head should be insensitive to ambient light. It should give optical indication of pulses by LED.</p> <p>d) The scanning head must be able to measure LED pulse output (as per IEC 62052-11, clause 5.11) of frequency up to 1 kHz.</p> | |
| 14 | <p>METER MOUNTING RACK:</p> <p>a) Four Nos. Separate Single Sided Meter Mounting Racks shall consist of a lightweight aluminum frame for mounting of sensor heads, display devices and meters-under-test.</p> <p>b) Meters-under-test shall get connected to the voltage and current circuits by means of connecting leads.</p> <p>c) Design of each frame should be such that 40 Nos. energy meters of any type, single or three phase, 3 wire or 4 wire, whole-current or CT-VT operated can be safety and easily accommodated on it. Each rack shall</p> | |

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| | <p>have capacity to mount 10 meters on Front side only shall be supplied along with test bench.</p> <p>d) Necessary BNC type socket to test the ERSS against a precision standard of higher accuracy and BNC socket or any suitable socket shall be provided for testing ERSS of other make shall be provided on Meter Mounting Racks. BNC socket should be provided with additional equipment to change to output voltage from SSM for testing ERSS of other make.</p> <p>e) Necessary BNC type socket or any other suitable arrangement shall be provided on the either of Meter Mounting Racks to test the inbuilt ERSS against a precision standard of higher accuracy without removing the inbuilt ERSS from the source cabinet.</p> <p>f) The Meter Mounting Racks shall be provided with minimum 40Nos. BNC type sockets for the simultaneous testing of ERSS of lower accuracy. The offered software shall have facility to test these ERSS in automatic mode by using these BNC type sockets.</p> <p>g) Necessary cables shall be provided along with equipment to test ERSS having frequency output on BNC type socket.</p> <p>h) There should be a warning lamp and two emergency push-buttons fitted on the Meter Mounting Racks.</p> <p>i) Each meter test position should have communication facility to communicate with meter under test using DLMS communication.</p> | |
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15 **ISOLATION CURRENT TRANSFORMER (ICT) & MSVT**

The meter- testing system shall have isolating current transformer (ICT) to test **three phase as well as single phase** closed link whole current meters. Technical details of ICTs shall be as follows.

Nominal Primary current 100A
Maximum Primary current 120A
Nominal Secondary current 100A
Maximum Secondary current 120A
VA rating Minimum 50VA @ Nominal Current (100 Amp)with single turn in operation

Accuracy ratio error $\pm 0.01\%$ (1 A to 120 A)
 $\pm 0.03\%$ (0.15 A to <1 A)
 $\pm 0.15\%$ (0.02A to <0.15 A)
 $\pm 0.3\%$ (0.01 A to <0.02 A)
Phase angle error ± 1 minutes (1 A to 120 A)
 ± 3 minutes (0.15 A to <1 A)
 ± 10 minutes (0.02 A to <0.15 A)
 ± 20 minutes (0.01 A to <0.02 A)

Operating burden 3 m Ω
Max. Burden 5 m Ω

- There shall be provision to bypass the individual ICT automatically when secondary of ICT is kept open. Sufficient protection shall be provided to protect the ICT in case if secondary of ICT remain open while full load is running in primary.
- Secondary of ICT shall be designed in such a way that its secondary leads can be connected directly to Meter under Test. Ring type of design, which needed in operation to put multiple turns for actual connection to reach desired VA rating with loose primary/secondary type of connection won't be acceptable.
- Primary connection of ICT should be fixed type and all primary connection on each ICT terminal shall be connected permanently. Primary & Secondary leads of ICT should be designed in such a way that it can carry its maximum Current i.e. 120A for 2 hours continuously without any malfunction in ICT.
- LED indication shall be provided on ICT to indicate healthiness of ICT.
- Associate Software shall have facility to indicate fault in ICT like open circuit and over load on PC. It should have facility to display message on computer screen about any fault in ICT during testing of meters.

If MSVT is required for isolation in voltage circuit for testing single phase whole current meter dual channel with IP link short. The following provision will be required:-

2 Nos. MSVT shall provide isolation in voltage circuit for testing of single phase meters with IP link short. The each MSVT shall have single Primary and 22 nos. of secondary. Individual MSVT for each location will not be acceptable.

Each MSVT shall have accuracy as below:

| Parameter | Value |
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| No. of windings | 22 |
| Primary Voltage | 165-300V, 45-65 Hz |
| Secondary Voltage | 165-300V |
| Range of secondary burden | 4...15 VA |
| Error between primary and secondary | $\leq \pm 0.1\%$, $\leq \pm 2$ minutes |
| Error between the secondary windings, concerning the above mentioned range of secondary burden | $\leq \pm 0.05\%$, $\leq \pm 1$ minutes |

One sample certificate of ICT and MSVT shall be submitted along with offer.

Detailed catalogue of offered ICT & MSVT and its working principle of these both parts i.e. MSVT and ICT's shall be submitted along with offer (own make)

| 16 | <p>CONNECTION CABLES: supplier shall provide the following set of connection cable for meter under test:</p> <table border="1" data-bbox="165 389 989 1666"> <thead> <tr> <th data-bbox="165 389 815 465">Requirement / Meter Type</th> <th data-bbox="815 389 989 465">Qty. (min)</th> </tr> </thead> <tbody> <tr> <td data-bbox="165 465 815 607">Voltage connection cables for phase (one side with omega pin and other side with 4 mm safety plug)</td> <td data-bbox="815 465 989 607">120 nos.+ 10% extra for spare</td> </tr> <tr> <td data-bbox="165 607 815 719">Voltage connection cables for neutral (one side with straight pin and other side with 4 mm safety plug)</td> <td data-bbox="815 607 989 719">40 nos.</td> </tr> <tr> <td data-bbox="165 719 815 898">Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) both side pin type lug to test without ICT</td> <td data-bbox="815 719 989 898">108 nos. + 10% extra for spare</td> </tr> <tr> <td data-bbox="165 898 815 1039">Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) one side pin type lug and other side connection to test bench to test without ICT</td> <td data-bbox="815 898 989 1039">24nos.</td> </tr> <tr> <td data-bbox="165 1039 815 1173">Current connection cables for testing of 1 phase 2 wire Energy meter (for 40 Nos. meter) both side pin type lug and one side along with voltage cable to test with MSVT</td> <td data-bbox="815 1039 989 1173">36 Nos.</td> </tr> <tr> <td data-bbox="165 1173 815 1308">Current connection cables for testing of 1 phase 2 wire Energy meter(for 40 Nos. meter) one side pin type lug and other side connection to test bench to test with MSVT.</td> <td data-bbox="815 1173 989 1308">8 Nos.</td> </tr> <tr> <td data-bbox="165 1308 815 1449">Looping colored current cables (for R, Y & B phase) of 2.5 sq. mm dia. with spade type lugs for testing of 40 nos. of ABT rack mounted type meters.</td> <td data-bbox="815 1308 989 1449">1 set</td> </tr> <tr> <td data-bbox="165 1449 815 1666">Voltage and Current Connection cables for testing 10 nos. ERSS at one time.</td> <td data-bbox="815 1449 989 1666">40 nos. for voltage and 60 nos. for current</td> </tr> </tbody> </table> <p>Note: Closed link Direct Connected meters shall be directly connected to the secondary connection of ICTs.</p> | Requirement / Meter Type | Qty. (min) | Voltage connection cables for phase (one side with omega pin and other side with 4 mm safety plug) | 120 nos.+ 10% extra for spare | Voltage connection cables for neutral (one side with straight pin and other side with 4 mm safety plug) | 40 nos. | Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) both side pin type lug to test without ICT | 108 nos. + 10% extra for spare | Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) one side pin type lug and other side connection to test bench to test without ICT | 24nos. | Current connection cables for testing of 1 phase 2 wire Energy meter (for 40 Nos. meter) both side pin type lug and one side along with voltage cable to test with MSVT | 36 Nos. | Current connection cables for testing of 1 phase 2 wire Energy meter(for 40 Nos. meter) one side pin type lug and other side connection to test bench to test with MSVT. | 8 Nos. | Looping colored current cables (for R, Y & B phase) of 2.5 sq. mm dia. with spade type lugs for testing of 40 nos. of ABT rack mounted type meters. | 1 set | Voltage and Current Connection cables for testing 10 nos. ERSS at one time. | 40 nos. for voltage and 60 nos. for current | |
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| Requirement / Meter Type | Qty. (min) | | | | | | | | | | | | | | | | | | | |
| Voltage connection cables for phase (one side with omega pin and other side with 4 mm safety plug) | 120 nos.+ 10% extra for spare | | | | | | | | | | | | | | | | | | | |
| Voltage connection cables for neutral (one side with straight pin and other side with 4 mm safety plug) | 40 nos. | | | | | | | | | | | | | | | | | | | |
| Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) both side pin type lug to test without ICT | 108 nos. + 10% extra for spare | | | | | | | | | | | | | | | | | | | |
| Current connection cables for testing of 3 phase 4 wire CT-VT operated meters (40 nos.) one side pin type lug and other side connection to test bench to test without ICT | 24nos. | | | | | | | | | | | | | | | | | | | |
| Current connection cables for testing of 1 phase 2 wire Energy meter (for 40 Nos. meter) both side pin type lug and one side along with voltage cable to test with MSVT | 36 Nos. | | | | | | | | | | | | | | | | | | | |
| Current connection cables for testing of 1 phase 2 wire Energy meter(for 40 Nos. meter) one side pin type lug and other side connection to test bench to test with MSVT. | 8 Nos. | | | | | | | | | | | | | | | | | | | |
| Looping colored current cables (for R, Y & B phase) of 2.5 sq. mm dia. with spade type lugs for testing of 40 nos. of ABT rack mounted type meters. | 1 set | | | | | | | | | | | | | | | | | | | |
| Voltage and Current Connection cables for testing 10 nos. ERSS at one time. | 40 nos. for voltage and 60 nos. for current | | | | | | | | | | | | | | | | | | | |
| 17 | <p>SOFTWARE: The operating of the test equipment, the display of the actual values, the processing and display of the test results and the print out of the test results, reports etc. should be</p> | | | | | | | | | | | | | | | | | | | |

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| <p>effected by the associated Desktop PC (Personal Computer) system complete with licensed Windows based operating system, licensed proprietary software of the meter-testing equipment and a LaserJet printer having minimum specifications as given below to be supplied along with the meter testing system.</p> <p>The licensed proprietary software of the meter-testing equipment shall be supplied installed on the PC. This software should be Windows based, user- friendly and menu driven, operated with the help of a mouse and keyboard in manual or automatic mode.</p> <p>The licensed proprietary software of the meter-testing equipment shall allow, at least, performance of the following tasks:</p> <ul style="list-style-type: none"> • User interface to operate the system • Easy to prepare test-tables by using “ drag& drop “ concept. • Supervision and control of the test procedure • Supervision and display of the test current and voltage • Indication of the errors of the meters- under- test • Evaluation of the test results and generation of test reports • Manual testing and automatic testing facility • Facility to define test parameters in terms of percentage and absolute terms • Facility to define error limit in two levels • Facility to protect the system from over voltage in manual mode and automatic mode • Facility to check meters for short circuit and open circuit conditions prior to starting of the testing in fully automatic mode for each sequence • Facility to interrupt the testing and restart it again • Password facility for administrator and operator with different levels • Print out facility of test-reports with desired header • Facility to take back-up of data • Absolute measurement with higher precision / more accurate standard in fully automatic mode using BNC type socket provided on Meter Mounting Rack • Testing facility of at-least 40 different meters with 40 different constants. • Software shall have facility for display of different output voltages and currents. • Facility to display the curve of test voltage and current in presence of harmonics. | |
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| | <ul style="list-style-type: none"> • Protection of meters- under- test from high voltage and current • Indications of fault like open circuit and overload in ICT's during testing. <p>The licensed proprietary software of the meter-testing equipment shall have facility to display following parameters:</p> <ul style="list-style-type: none"> • Individual phase voltage • Individual phase current • Phase angle and power factor of symmetrical or asymmetrical star system • Total Power Factor • Individual phase power (Active , Reactive and Apparent) • Total Power (Active , Reactive and Apparent) • Frequency • Phase Sequence • Measurement mode • Vectorial display • Firm should have to arrange upgradation in software at least once in a year upto five years from date of satisfactory successful installation of testing bench failing which firms PBG may be invoked. | |
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|------------------------|---|-----------|-----------------------------------|-----|-----------------|-----|--------------|---------------|---|------------------|---|-----------|---|------------|--|------------------------|-----------------|------------------|---|--|
| 18 | <p>TECHNICAL DATA FOR PC:</p> <table border="1"> <tr> <td>Processor</td> <td>Pentium i7 or equivalent / better</td> </tr> <tr> <td>RAM</td> <td>Minimum 8GB DDR</td> </tr> <tr> <td>HDD</td> <td>1 TB minimum</td> </tr> <tr> <td>Optical Drive</td> <td>48X / 32X DVD / CD RW Combo Drive or better</td> </tr> <tr> <td>Keyboard & Mouse</td> <td>PS2/USB Multimedia / 107 keys Keyboard or better.</td> </tr> <tr> <td>I/O ports</td> <td>Minimum 4 high-speed USB 2.0 (2 front) , Mic-In, Headphone-Out, Line-In, 1 serial, 1 parallel, 2 PS2, One RJ-11, One RJ-45 minimum or better.</td> </tr> <tr> <td>Networking</td> <td>Onboard 10/100/ 1000 Mbps / Gigabit LAN with Slot available for adding wireless networking card.</td> </tr> <tr> <td>Modem & Communications</td> <td>Broadband ready</td> </tr> <tr> <td>Operation System</td> <td>PC shall be supplied with licensed operating system installed windows 10 or better.</td> </tr> </table> | Processor | Pentium i7 or equivalent / better | RAM | Minimum 8GB DDR | HDD | 1 TB minimum | Optical Drive | 48X / 32X DVD / CD RW Combo Drive or better | Keyboard & Mouse | PS2/USB Multimedia / 107 keys Keyboard or better. | I/O ports | Minimum 4 high-speed USB 2.0 (2 front) , Mic-In, Headphone-Out, Line-In, 1 serial, 1 parallel, 2 PS2, One RJ-11, One RJ-45 minimum or better. | Networking | Onboard 10/100/ 1000 Mbps / Gigabit LAN with Slot available for adding wireless networking card. | Modem & Communications | Broadband ready | Operation System | PC shall be supplied with licensed operating system installed windows 10 or better. | |
| Processor | Pentium i7 or equivalent / better | | | | | | | | | | | | | | | | | | | |
| RAM | Minimum 8GB DDR | | | | | | | | | | | | | | | | | | | |
| HDD | 1 TB minimum | | | | | | | | | | | | | | | | | | | |
| Optical Drive | 48X / 32X DVD / CD RW Combo Drive or better | | | | | | | | | | | | | | | | | | | |
| Keyboard & Mouse | PS2/USB Multimedia / 107 keys Keyboard or better. | | | | | | | | | | | | | | | | | | | |
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