

**TSGENCO
1 X 800 MW KOTHAGUDEM TPS**


VOLUME II B

**TECHNICAL SPECIFICATION
FOR
ELECTRICAL LAB EQUIPMENT**

SPECIFICATION NO. : PE-TS-410-556-E002, REV. 0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA, 201301**


	1X800 MW KOTHAGUDEM TPS	Doc. No. PE-TS-410-556-E002	
		Volume	Section
	TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS	IIB	
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TOTAL NO. OF SHEETS		= 36
(INCLUDING COVER/ SEPARATOR SHEETS)		

IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.

 BIDDER'S STAMP & SIGNATURE
 (REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')

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INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer :
 - a) Unpriced Price Schedule (Annexure-A as enclosed with the specification) with bidder's signature and company stamp.
 - b) Datasheet-B filled with required details along with bidder's signature and company stamp.
 - c) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" with bidder's signature and company stamp.
 - d) A copy of sheet "List of Contents" with bidder's signature and company stamp.
 - e) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
 - f) Technical leaflets/ Catalogues on following
 - i) Testing of equipment
 - i) Instruments
 - ii) Misc. Equipment
2. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
3. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
4. Any changes made by the bidder in the price schedule with respect to the item description/ quantities, notes etc. from those given in Annexure-A to Section-C of specification [Bill Of Quantities] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
5. Bidder to furnish "No deviation" against each item quoted by them unless specifically indicated in Deviation Schedule sheet.

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF ABOVE)



TITLE

PREAMBLE

SPECIFICATION NO. PE-TS-410-556-E002

VOLUME IIB & III

SECTION -

REV. NO. 00

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SHEET 1 OF 1

1.0 The Tender document contains three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I** **CONDITIONS OF CONTRACT**

This consists of four parts as below:-

Volume – IA This part contains Instructions to bidders for making bids to BHEL.

Volume – IB This part contains General Commercial Conditions of the Tender & includes provision that vender shall be responsible for the quality of item supplied by their sub-vendors.

Volume – IC This part contains Special Conditions of Contract.

Volume – ID This part contains Commercial conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** **TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume – II, which comprises of:-

Volume – IIA General Technical Conditions.

Volume – IIB Technical Specification including Drawings, if any.

1.2.1 **VOLUME – IIB**

This volume is sub-divided in to following sections:-

Section – A This section outlines the Intent of Specification

Section – B This section provides “Projection Information”.

Section – C This section indicates Technical Requirements specific to Contract, not covered in Section - D


Section – D This section comprises of Technical Specifications of Equipments Complete with Data Sheets A, B, C.

Data sheet - A :- Specific data and other requirements pertaining to the equipments.

Data sheet - B : Specific Data to be filled by bidder (Data Sheet - B is Contained in Volume - III).

Data sheet – C :- Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable).

2.0 This requirements mentioned in Section – C / Data Sheet – A of Section – D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section – D.

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SECTION- A
SCOPE OF ENQUIRY

1. This specification covers the design, manufacture, inspection and testing at manufacturer's work, proper packing and delivery to site of **ELECTRICAL LABORATORY EQUIPMENTS** as mentioned in different sections of this specification for **1X800 MW KOTHAGUDEM TPS**.
2. It is not intent to specify herein all the details of design and manufacture. However the equipment shall confirm in all respect to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to vendors guarantee.
3. The general terms and condition, instruction to tenderer and other attachment referred to elsewhere are hereby made part of the tender specification.
4. The tenderer shall be responsible for and governed by all requirements stipulated herein after.
5. The offer should be complete with technical data, catalogue, brochures and drawings, as applicable.
6. The bid shall be in English language and MKS system of unit.
7. Deviation, if any should be brought out very clearly on deviation sheet enclosed with specification only. Otherwise it is presumed that the tender offer is in line with what has been stated/asked for in this specification.
8. Qualification data: in order to be able to present to the client the provision of the equipment offered, the bidder is requested to elaborate details of experience, capabilities reference list etc. in this offer.



TECHNICAL SPECIFICATION FOR
ELECTRICAL LABORATORY
EQUIPMENTS
1 X 800 MW KOTHAGUDEM TPS

SPECIFICATION NO. PE-TS- 410-556-E002

VOLUME II B

SECTION B

REVISION 0

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SHEET 1 OF 3

SECTION – B

PROJECT INFORMATION

SECTION - B

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 would be set up by Telangana State Power Corporation Ltd. (TSGENCO) at Kothagudem, Telangana. The proposed Power Plant will be installed adjacent to the existing D colony of Kothagudem Thermal Power Station, at Kothagudem.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

2.00.00 APPROACH TO SITE

Site is located in the existing D Colony of Kothagudem Thermal Power Station, which is at a distance 30 km from temple town of Bhadrachalam and 300 km from Hyderabad by road. The Nearest railway station is Bhadrachalam Road (Known as Kothagudem) at a distance of 12 km. Kothagudem- Bhadrachalam National Highway branches off to the power station site near village Paloncha.

3.00.00 LAND

Land is primarily required for the main plant & auxiliaries (BTG) and balance of plant (BOP) like ash handling, coal storage, cooling tower, switchyard etc., which is available within the existing plant boundary.

The existing colony is to be dismantled, and the land of about 137 acres will be used for the main plant building, water facilities, switchyard, coal handling etc. The raw water reservoir will be located adjacent to the existing raw water reservoirs.

230 acres of land required for Ash Dyke will be procured. Land is available for staff colony, which is to be constructed by the EPC contractor.

4.00.00 SOURCE OF COAL

100% Imported and Blended coal (50% imported + 50% indigenous) will be used. Indigenous coal shall be sourced from Suliyari coal mines, Madhya Pradesh.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

5.00.00 **SOURCE OF WATER**

Source of water (total quantity of water is 2192 m³/hr) is Godavari River near Burgampahad & water will be pumped through existing GRP pipe line (of length approx. 26 km).

6.00.00 **ASH DISPOSAL AREA**


Ash shall be dumped in the ash dump area which will be about 9 km from plant. The ash dyke area of 230 acres is adequate for 1x800 MW unit as per MOEF norms.

7.00.00 **SALIENT DESIGN DATA**


7.01.00 Meteorological data of site is given below:-

Elevation above MSL	:	89 m
Monthly highest temperature	:	44.9 °C
Monthly lowest temperature.	:	12.9 °C
Rainfall		
	Average.:	1031 mm
	Max. :	100 mm/ hr
Mean Wind speed	:	5.8 kmph
Relative Humidity		
	Max :	82%
	Min :	35%
Seismic Zone	:	Zone-III as per IS- 1893 (Part-IV)

[Climatological data of Khammam is attached for reference].

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SECTION-C
SPECIFIC REQUIREMENTS

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1.0 SCOPE OF SUPPLY

Electrical Laboratory Equipment mentioned in this section along with all essential accessories required for the successful operation of the equipment.

The bill of quantities shall be as per enclosed Annexure – A with technical specification.

Technical requirements of Electrical Laboratory Equipment shall be as per Annexure – II of Section-C with technical specification.

2.0 CODES AND STANDARDS

Some of the standards, which shall generally be followed, are listed below. Other applicable Indian standards for any component part, even if not covered in listed standards shall be followed.


- i) IS – 6103 Method of test for specific resistance (resistivity) of electrical insulating fluid.
- ii) IS – 6700 Requirements of general purpose Cathode Ray Oscilloscope.
- iii) IS – 722 Specification for AC electricity meters.
- iv) IS – 8143 Specification for plugs & keys for resistance boxes.
- v) IS – 6104 Method of test for interfacial tension of oil against water.
- vi) IEC-51 Direct acting indicating analogue electrical measuring instruments and their accessories.
- vii) Any other relevant National/ International standards as mentioned in the Annexure – II of Section-C with technical specification.

3.0 DESIGN CRITERIA:

- 3.1 Electrical Laboratory Equipment shall be used for testing various electrical equipment/ devices during Commissioning, Operation and Maintenance of power plant.
- 3.2 The Equipment will be kept in a clean but hot, humid and tropical atmosphere when not in use. Equipment will be placed in dust laden, hot, humid atmosphere during its use.
- 3.3 For continuous operation at specified rating, temperature rise of various equipment/ components shall be limited to the permissible value stipulated in the relevant standards and this specification.

4.0 SPECIFIC REQUIREMENTS & RATINGS:

- 4.1 The Bidder may note that the equipment range, rating, quantities as detailed herein, are the minimum requirement only. All accessories for the equipment not covered here, if necessary for satisfactory and trouble free operation of the equipment, shall be quoted by the Bidder.
- 4.2 Equipment's shall be complete with applicable accessories like power supply, mains leads, screened guard test leads, screened line test leads, earth leads, connectors and clips leather carrying case, input card, clip on current transformers with measurement leads and connectors, suitable hand spikes, main adopter, spare fuses, range extending devices, acoustic calibrator, extension cable input lead, microphones of suitable capacities, vibration pickup, probe pick up cable, camera, external hull detector, hammer, test cell with spherical and mush room type electrodes, spacing gauges, stirrers, inductive sensing heads suitable for different cable sizes etc.
- 4.3 The instrument shall be suitable for satisfactory operation at an ambient temp. from 0°C to 50°C.
- 4.4 The Analog instruments shall be provided with knife-edge pointer and anti – parallax mirror.

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- 4.5 Instrument/ meters suitable for DC supply should be provided with re-chargeable batteries, chargers and low battery charge indication.
- 4.6 All bidders to be advised to quote only 'one' make/model against each equipment best to suit specification requirement.
- 4.7 The instrument shall be suitable for hand held operation, rugged in construction and suitable for field use.
- 4.8 Power supply for AC operating instruments shall be 240V AC, 50Hz, single phase.
- 4.9 **Bidder to note that "In case any recommended make / model become obsolete or is stopped manufacturing by manufacturer, next higher make / model of the same company may be considered for ordering / supply at contract stage and no additional cost shall be paid by BHEL to supplier. Bidder is required to furnish confirmation that "next higher make / model is technical equivalent or better" in case of above condition.**

5.0 TESTS:

- 5.1 All acceptance and routine tests as per relevant standards and specification shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the material shall be deemed to be included in the bid price.
- 5.2 Equipment shall be completely assembled, wired, adjusted and tested in factory as per the latest edition of relevant standards.
- 5.3 Bidder shall follow his standard procedure for quality control. However the said procedure/ quality checks shall be submitted for purchaser's approval.
- 5.4 For Inspection and Testing refer Annexure-III & Annexure-IV.

6.0 DRAWING DATA & MANUAL:

- 6.1 To be submitted with the bid
- a) Compliance to Technical requirement of various equipments as specified in technical specification. Also, bidder to furnish Data Sheet – B.
 - b) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
 - c) Technical leaflets/ Catalogues on following
 - i) Testing of equipment
 - i) Instruments
 - ii) Misc. Equipment
 - d) Deviation sheet (if any)
- The Bidder may note that the drawing, data and manual listed herein are minimum requirement only. The Bidder shall ensure that the other necessary write-ups, curves and information required to fully describe the equipment are submitted with the bid.
- 6.2 To be submitted after award of contract for BHEL/customer approval:
- a) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
 - b) Detail instructions for application, assembly & testing of equipments.
 - c) Wiring and schematic diagrams.
 - d) Tests Reports and calibration curve
 - e) Technical Catalogues & leaflets.
 - f) Instruction manual of individual equipment
 - g) Data sheet-C soft copy in excel format and hard copy.

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Technical documentation such as Technical Particulars, GA sectional drawings, Technical leaflets, Catalogues etc. are required to be submitted within 2 weeks of LOI by the successful bidder for BHEL approval.

6.3 Instruction manual of individual equipment

The manual shall clearly indicate in English the installation and connection method, check list of the tests to be carried out before commissioning of equipment. Maintenance and Calibration method shall also be provided in the manual.

6.4 Number of copies of document/data to be submitted by the successful bidder shall be as per enclosed ANNEXURE – I.

6.5 Bidder to furnish all user instruction manuals, maintenance, handling, installation manuals & all test reports complete in all respect in bound volumes & soft copies to BHEL / BHEL’s customer at the time of handing over the same to BHEL / BHEL’s Customer.

6.6 Bidder to note that quoted item cost shall include cost of main item, cost of all accessories required for successful operation of equipment and testing cost of all acceptance & routine test as per relevant standard. Test certificates/ Test reports shall be furnished by bidder to BHEL at contract stage for review/acceptance. No additional cost for the same shall be payable by BHEL.

7.0 PACKING:

The equipment shall be properly packed in Galvanized sheet steel trunk/box with proper lock & key arrangement.

8.0 DELIVERY:

The delivery of Equipment shall be completed as per NIT (Notice Inviting Tender)

9.0 Bidder shall furnish unit rate for each item in the “Schedule of prices for Electrical Lab Equipment” enclosed in Technical Specification as Annexure –A. Purchaser reserves the right to add/ delete any item during detailed engineering as finally required for the project. Unit rate quoted shall be applicable for price adjustment in such cases.

10.0 All the equipment components shall be procured from reputed manufacturers and make of equipment shall be subject to the approval of BHEL/ BHEL’s Customer.

11.0 The modality of approval of technical documentation & priority of supply shall be mutually discussed & agreed upon with successful bidder in kick – off meeting after placement of LOI.

12.0 Demonstration & Handing over to BHEL / BHEL’s Customer


The bidder shall be responsible for demonstration of the supplied equipment at site to BHEL / BHEL’s customer and ensure handing over the same to the satisfaction of BHEL / BHEL’s Customer.

Bidders to identify the equipment requiring commissioning by expert(s) from vendor.

The lump sum charges for the same shall be indicated in the price schedule separately, enclosed as “Annexure- B”.

13.0 Performance Guarantee

The bidder shall guarantee that the equipment offered shall meet the requirement as stipulated in this specification and as confirmed by them in Technical Data Sheet. In case the performance of equipment is not as per performance guarantee, the bidder will have to replace the equipment at site free of cost.

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ANNEXURE - I

(VENDOR DRAWING/DOCUMENT SCHEDULE)

S. NO.	DESCRIPTION	THROUGH DMS	HARD PRINTS	CD-ROMs
1	Docs. /drgs. for approval (First submission)	YES	-	-
2	Docs. / drgs. for approval (Second & subsequent submission till approval)	YES	-	-
3	Final approved docs. / drgs. for Distribution	YES	As per NIT	As per NIT



DOCUMENT TITLE
DESIGN MEMORANDUM FOR
ELECTRICAL LAB EQUIPMENT (ANNEXURE-II)

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Annexure-II of SECTION-C
TECHNICAL REQUIREMENTS



DOCUMENT TITLE
**DESIGN MEMORANDUM FOR
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Item No.	Description/Specification	Qty.
1.0	Portable 10KV Digital Automatic Insulation Tester: Complete with test leads, mains lead, carrying case, PC down load software, instruction manual, test/ calibration certificate etc. Measuring Ranges : Resistance : <100 Kilo ohm - > 1 Terra Ohm Current : <100 pico A - > 5 mA Test Voltages : 0 to 10000V Accuracy : Better than 2% Test Time : Adjustable <15 Sec. -> 10 min. Display : LCD 3½ digit with analog bar graph for resistance, test voltage, current, PI Data Storage : >75 Values Capacity : Power Supply : 240V, 50 Hz and rechargeable dc battery MMI : Via RS232 Printer/PC interface : Via RS232C Safety Standard : IEC 1010-1 EMC Standard : EN50081-1 & EN 50082-1	One (1)
2.0	Portable HV Decade Resistance Box in Polystyrene case with lid and carrying handle Overall range : 1 K ohms to 1 Terra Ohms Resolution : 1K Ohms Accuracy : 0.1% - 2% Connection : Shielded Plugs with 1 Metre Cable	One (1)
3.0	Portable HV AC Test Set comprising	One (1)
a)	An epoxy cast, single phase, 50-200KV/240V, 5KVA (continuous) and 10KVA (5 minute) rated low discharge transformer with maximum discharge level of 1 PC mounted in a steel tank fitted with swivel cast or wheels, HV bushing.	



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Item No.	Description/Specification	Qty.
b)	A control unit with microprocessor based automatic control, programming key pad LCD display analog ammeter & voltmeter with $\pm 2\%$ accuracy trip push button, safety protections etc.	
c)	A zero interlock circuit shall be provided to prevent energization of HV output on less voltage control is set to zero. Necessary power & metering cables, removable earth link fuses etc. shall be provided.	
4.0	Automatic Capacitance and Tan-Delta Test Set (Schering Bridge) with oil resistivity test cell. Fully automatic, microprocessor-based, accurate ac voltage bridge.	One (1)
	Input : 120/240V, 50 Hz Output : 0-12KV, 100 mA (Cont.), 200mA (15 min)Extendible to 4A with resonating inductor Capacitance : 1.6 pF to 8 μ F (with 100pF Std. Capacitor) Measurement with $\pm 0.02\%$ to $\pm 0.05\%$ accuracy and 0.0001 pF resolution Tan-delta : 1×10^{-6} to 9.999 with acc. $\pm 0.5\%$ and 1×10^{-6} resolution Capacitive current : 0-5A Measurement Oil Test Cell : 2.5 KV(RMS), 150°C, 100 cm ³ , 100 pF Display: Large graphic TFT (4-5 digit) Test voltage, frequency, capacitance, Tan-delta Interface : RS232 for Printer 1 PC	
5.0	Portable Transformer Oil Breakdown Test Set : Fully automatic, microprocessor. Complete with transportation trolley oil test vessel with electrodes, PTFE agitator/lift-off sticks, gap-gauges, mains cable, operation manual calibration certificate, warranty certificate etc.	One (1)



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Item No.	Description/Specification	Qty.
	Test Voltage : 0-100KV (RMS) Accuracy : $\pm 2\%$ of reading Switch-off response Current : <4 mA Switch-off response Time : <6 mS Rate of rise of : 0.5/1/2/3/5KV per sec. Test voltage : Manual/Auto adjustable Display : Alpha numeric LCD Interface : RS 232, RS232C Applicable Stds : IEC 156, ASTM D877, ASTM D1816, BS 5874, IEC 1010-1	
6.0	Portable Karl-Fischer Test Set : Coulometric test set for oils with specific gravity ranging from 0.6 to 1.4, with a built-in printer Titration Method : Coulometric, Karl-Fischer Display : 40 character alpha numeric backlit LCD Sample Volume : 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0 ml Sp. Gr. Range : 0.6 to 1.4 in 0.01 steps Moisture range : 1 ppm – 100% Measuring range : 1 μ g – 10 mg water End point detection : ac polarization End point indication : Visual display/ printout/ acoustic beep Titration speed : 2 mg/min maxm. Maximum current : 400 mA Drift compensation : Automatically controlled Start delay : 10 Sec. Stirrer speed : Microprocessor-controlled Accuracy : $\pm 3 \mu$ g to $\pm 0.5\%$ Calculation mode : Volume/density or weight/weight Printer : High Speed Thermal Power supply : 90-264V ac, 12V dc rechargeable Battery	One (1)
7.0	3-phase Portable Transformer Turns Ratio & Vector Group Meter : Fully automatic, microprocessor based having automatic tap changer control with internal chip card reader and built-in keyboard. In a robust mobile case having following features :	One (1)



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Item No.	Description/Specification	Qty.														
	Ratio Range : 0.75 to 10000 Ratio accuracy : $\pm 0.1\%$ to $\pm 0.3\%$ ± 1 digit Measuring voltage : 63.5V to 240V Frequency range : 45-55 Hz Phase angle range : ± 90 deg. Phase angle accuracy: ± 0.1 deg. ± 2 digit Magnetising current : <1 mA - >500mA Magnetising Current Accuracy : Better than $\pm 2\%$ Measuring time : 5-20 sec. Data Storage : >200 sets of measurement Display : Backlit LCD 256 x 128 pixels Data displayed : Vector group, phase, tap position, ratio, Ratio deviation, phase angle, phase angle Deviation, mag. Current, pass-fail result Interface : RS232C, printer port Accessories : Windows compatible software for control Via PC HV/LV cables, mains lead, clamps, Operating manual, guarantee certificate Tested for : EMI & EMC in EHV Switchyard up to 220KV															
8.0	Portable Digital DC Resistance Meter : Dual channel, direct-reading ohm meter; having a safe discharge circuitry and in-built printer with date & time stamping, software for remote PC control heavy duty connecting cables, clamps, operating manual, test/calibration certificate and transportable case. Having following features :	One (1)														
	Measuring ranges : <table border="0"> <tr> <td>Nom. Range</td> <td>Resolution</td> </tr> <tr> <td>0-2 m Ohm</td> <td>0.1 micro Ohm</td> </tr> <tr> <td>0-20 m Ohm</td> <td>1 micro Ohm</td> </tr> <tr> <td>0-200 m Ohm</td> <td>10 micro Ohm</td> </tr> <tr> <td>0-2 Ohm</td> <td>0.1 milli Ohm</td> </tr> <tr> <td>0-20 Ohm</td> <td>1 milli Ohm</td> </tr> <tr> <td>0-200 Ohm</td> <td>10 micro Ohm</td> </tr> </table> Accuracy : 0.1% of reading over entire range Exctn. Current : 0.1-25A with compliance open circuit voltage of 100V Display : 4½ digit backlit LCD Data Storage : Upto 700 measurements Interface for remote Control : RS232	Nom. Range	Resolution	0-2 m Ohm	0.1 micro Ohm	0-20 m Ohm	1 micro Ohm	0-200 m Ohm	10 micro Ohm	0-2 Ohm	0.1 milli Ohm	0-20 Ohm	1 milli Ohm	0-200 Ohm	10 micro Ohm	
Nom. Range	Resolution															
0-2 m Ohm	0.1 micro Ohm															
0-20 m Ohm	1 micro Ohm															
0-200 m Ohm	10 micro Ohm															
0-2 Ohm	0.1 milli Ohm															
0-20 Ohm	1 milli Ohm															
0-200 Ohm	10 micro Ohm															



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Item No.	Description/Specification	Qty.
9.0	<p>Portable High Current Digital Micro Ohm Meter : Suitable for carrying out measurements in charged EHV (>245KV). Supplied with built-in charger, mains lead, operating manual, test/calibration certificate, mounted in a light weight portable case with clip-on clamps and voltage leads for 4-wire measurement system. Having following features :</p> <p>Measurement ranges : 0.01 - 100 micro ohm 0.1 - 600 micro ohm 1.0 - 6000 micro ohm 10.0 – 60000 micro ohm 0.1 - 600 m ohm 0.02 - 6000 m ohm</p> <p>Resolution : 0.01 micro ohm to 1.0 m Ohm Accuracy : ±0.2% - ±0.5% Display : with 4 digit LED or LCD (backlit) Data Storage : > 300 readings Interface : RS232 Test Current : Up to 200A</p>	One (1)
10.0	<p>Portable Primary & Secondary Current Injection Test Kit with Separate Control & Loading Units</p> <p>Control Unit Current Output : 0-25A/0-50A (cont.) : 0-50A/0-100A (up to 5 min) Voltage Output : 0-230V Current & Voltage Measurement : By true RMS, 4 digit digital meters with±0.6% accuracy (+6 digit) Timing Units : For ON & OFF Range : 0 – 1000 Sec. Resolution : 1m sec. Accuracy : ±0.1% + 2 digits Power supply : 230V ±10%, 45-551/2, 1-Phase Display : LCD/LED</p> <p>Loading Unit Ranges : 0-500A/0-1000A/0-2000A/0-3000A @ 5 Volts</p>	One (1)
11.0	<p>Portable Automatic Earth Tester : Microprocessor-controlled, user-friendly, with self-diagnostic features and alphanumeric display, rechargeable battery. Mounted in a robust case and provided with hammer & 4 GI spikes and 50M long cable on a cable winder. Having following features</p>	One (1)



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1X800 MW KOTHAGUDEM TPS

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Item No.	Description/Specification	Qty.
	Earth resistance : 0-20K Ohms (Auto ranging) Range : with 1 M resolution and $\pm 0.5\% \pm 2$ digit accuracy Test frequency : 100-160 Hz in 0.5 Hz steps Test current : 50 mA Maxm. output voltage : <50V (RMS) Maxm. Interference : 40V peak to peak (50 Hz) Display : 3½ digit Alpha numeric LCD Standards : IEC 1010-1, EN 50081-1, EN 50082-1	
12.0	Portable Three Phase Universal Protective Relay Test Set : Microprocessor-based user-friendly with digital signal processing. Having large LCD display with programmable menu. Having programmable output current & voltage waveforms and phase angles. Having following additional features and specifications :	One (1)
	Input Power : 90-250V, 1 Ph, 50 Hz Outputs : One ac Current 0-100A One ac Voltage 0-300V One ac Voltage/Current, 0-240V/0-2.5A Output Frequency : Selectable from 16.66 Hz – 300 Hz Output ac Voltage : 0-360 deg. independently controlled Phase shift Reading Accuracy : $\pm 1\%$ for AC/DC Volts, Current ± 0.5 deg. In phase angle $\pm 0.02\%$ in power factor $\pm 1.5\%$ in active/reactive Power $\pm 0.005\%$ in time Memory : Non volatile RAM Interface : RS port for PC and parallel printer port	
13.0	Precision Digital Multi-meter : 7½digit precision multi-meter, having a large 24-digit vacuum fluorescent display, a bar graph function allowing user programming of high and low pass/fail limits, audible & visual indication of component specification and Auto Dynamic Filter (ADF) to enable automatic selection of suitable filter.	One (1)



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1X800 MW KOTHAGUDEM TPS

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Item No.	Description/Specification	Qty.
	Input Power : 110/220/240V AC 50 Hz DC Voltage Measurement Range : 3 MV to 10 KV with resolution of 10 nV and accuracy of ± 12 ppm + 6 digits. DC Current Measurement Range : 3 μ A to 30A Resolution : 10pA Accuracy : ± 75 ppm + 10 digits Resistance Measurement : 30 meg ohm to 1 G ohms Resolution : 10 n Ohm Accuracy : ± 200 ppm + 6 digits Frequency Measurement : 1 Hz to 100 K Hz Resolution : 1Hz Accuracy : ± 10 ppm + 1 digit AC Voltage Measurement : 3m V to 3 KV Resolution : 100 nV Accuracy : $\pm 0.05\%$ + 40 digits AC Current Measurement : 3 Micro Amp to 30A Resolution : 100 pA Accuracy : $\pm 0.1\%$ + 80 digits Capacitance Measurement : 0-300 Microfarad Resolution : 1pF Accuracy : $\pm 0.2\%$ + 20 digits Special Features : Self Test, Diode/Zener Test, Max/Min functions, continuity testing AC/DC coupled facility count down and sample beep on long filter periods.	
14.0	Portable Digital Frequency Meter : Rugged, high accuracy portable frequency meter/calibrator in a dust-tight, water resistant case. Having LCD display complete with test leads, carrying case, 9V battery and instruction manual. Ranges : 0-100 KHZ / 0-1000 Hz Resol. 1 KHZ / 0.1 Hz Accuracy : $\pm 0.1\%$ FS ± 1 LSD Step Size : 10% of range Scroll Size : 0.1% of range Input : 1V to 100V p-p Output : 5V p-p Square Wave Maxm. Load : 5 mA	One (1)



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Item No.	Description/Specification	Qty.
15.0	Digital Sound Level Meter : Having condenser type microphone, frequency and time weighting functions, AC & DC outputs supplied with 9V battery and calibration screw driver.	One (1)
16.0	Digital Tachometer : Non-contact photoelectric optical type. Having features such as reading hold, memory recall & low battery indication. Range : 10-100,000 RPM Resolution : 0.1 RPM to 1 RPM Accuracy : $\pm 0.1\%$ ± 1 digit to $\pm 0.15\%$ ± 1 digit Display : 5 digit LCD Optical Range : Up to minimum 300 mm	One (1)
17.0	Cable Fault Locator (upto 11kV) Working on pulse reflection (echo) technique. Capable of discriminating between inter-core and core to earth fault with facility to detect high resistance faults (>10 ohms) complete with surge generator, acoustic receiver, input filters, head phones etc.	One (1)
	Input : 240V, 1 phase, 50 Hz Range : 10 nano sec. To 2000 ns Impedance range : 25 ohms to 100 ohms Surge Generator : 15KV, 100 mA, <512 joules, Capacity : 10-20 pulses per minute Display : Backlit LCD	
18.0	Portable Hand held SF6 Gas Leakage Detector : With audio-visual indication Sensitivity : 3 to 5 ppm	One (1)
19.0	Portable Hand held Hydrogen Gas Leakage Detector : With audio visual indication Sensitivity : 50 to 100 ppm	One (1)
20.0	Portable Vacuum Tester : For testing the condition of vacuum in medium voltage (6.6KV) switchgear with automatic discharging facility and high voltage screened cable and over load/overvoltage protection Display : Digital display of applied Voltage in KV and leakage Current in mA. Red & green Indications for defective & acceptable chambers Resolution : 0.1 KV and 0.01 mA Input : 240V AC, 50 Hz Output : 0-60 KV DC Adjustable 0-9.99 mA Adjustable Loading time : Up to 30 seconds	One (1)



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1X800 MW KOTHAGUDEM TPS

SHEET 9 OF 11

Item No.	Description/Specification	Qty.
21.0	Portable Light Intensity Meter : With selenium photocell, 2 metres lead and filters. Ranges:0-15/30/100/300/1000/3000 lux Accuracy : $\pm 4\%$ of full scale	One (1)
22.0	Portable Circuit Breaker Motion Analyser : For analyzing performance of SF6/Vacuum/air Circuit breakers. Microprocessor-based capable of measuring, recording and printing opening/closing times and velocity, coil currents, dynamic contact resistance of main/aux. & arcing contacts, pole discrepancy etc. The instrument shall have user-friendly menu driven software for easy operation and reduced set up time. It shall have communication ports for down loading of data from memory on to a PC. It should have a built-in DC battery and printer. Other specifications shall be as follows : Input Supply : 110-240V, 50Hz with built in DC battery backup with charger Current injection : up to 100A DC Timing Range : 0-9.99 S. with a resolution of 0.1 mS and accuracy of $\pm 0.01\%$ Number of channels : 12 analog 24 digital Display : 16 character alphanumeric LCD	One (1)
23.0	Portable, Hand-held Thermal Imaging Camera : Having voice recording & alarm facility, double ocular view finder and clear CCD lens, Multi-spot (Minimum 4) temperature measurement and High End image analysis software capable of generating wizard guided reports and trend analyses etc. Battery operated. Temp. Range : -10 Deg.C to 2000 Deg.C Detector Type : Uncooled Focal Plane Array Thermal Sensitivity : $0.08^{\circ}\text{C} @ 30^{\circ}\text{C}$ Frame Rate : 50 Hz Field of View : $20^{\circ} \times 20^{\circ}$ Spectral Response : 8 to 14 microns Battery Operation : For at least 2-hours	One (1)



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Item No.	Description/Specification	Qty.
24.0	Portable High Voltage/Live Line Detector : Electronic type, giving audio-visual indication for presence of voltage/charge. Having in-built self-diagnostic check feature. Insulating stick shall be class 'F' insulated Range : Up to 300 KV	One (1)
25.0	Tong Testers : Digital clamp-on volt-ammeters Ranges : i) 0-5/25A, 0-60/300/600V ii) 0-1/5A, 0-60/300/600V 0-10/30/300/1000A, 0-60/300/600V iii) 0-10/30/300/1000A, 0-60/300/600V	One (1)
26.0	Portable Phase Sequence/Continuity Indicators: To indicate phase continuity and phase rotation sequence of 3-phase power circuits. Complete with colour-coded & insulated 1 Metre long fused leads with boot-protected alligator clips and carrying case. Having an impact resistant plastic body with encapsulated circuitry incorporating neon indicators for phase continuity and phase sequence. Rated 100-600V, 40-60 Hz	Two (2)
27.0	Relay Tool Kit : Comprising following minimum tools : i) Spring setting tool ii) Inspection mirror and torch iii) Ring spanners iv) Box spanners v) Burnishing tool vi) Contact pressure gauge vii) Factor gauges viii) Test plugs with link plugs ix) Screw drivers x) Nose pliers xi) Scissors	Two (2)



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Item No.	Description/Specification	Qty.
28.0	HV Discharge Rod & Portable Earthing Equipment Class 'F' insulated. Having non-linear carbon film resistor with negative temperature coefficient. Non-hygroscopic Dimensions : ID 25 mm OD 31 mm Length : 1250 mm (Main rod & each extension) Total Length : 6 Metres Discharge Hook : 100 mm dia. on 12.5 mm dia. copper rod Earth lead : Flexible braided copper Voltage Rating : Up to 400 KV	Two (2)
29.0	Hot Sticks (Live/Dead Line Tester) : Class 'F' insulated, up to 400KV, extendible from 1.25 Metre to 6.0 Metres with inbuilt self-check feature. Contact or proximity type in a special carrying case.	Two (2)

Note: All Laboratory instruments shall be restricted to following make only:

1. Meggar (UK)
2. Tinsley (UK)
3. Vettiner (France)
4. Fluke (USA)
5. Omicron
6. Doble
7. Kusem Meco
8. Shivananda
9. Motwane
10. AE



DOCUMENT TITLE
DESIGN MEMORANDUM FOR
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1X800 MW KOTHAGUDEM TPS

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ANNEXURE-III INSPECTION & TESTING

The minimum quality assurance plan/test of various Electrical Laboratory Instruments and their accessories is listed below. However, Bidder shall conduct any other tests/inspection required at the manufacturer's works to ensure that the equipment being supplied shall conform to the requirement of this specification and other applicable standards and codes. The detail of checks to be carried out in various stages of manufacturing and erection of various items of the system shall be submitted to Owner's approval in the form of quality assurance plans, field quality plans and Test procedure as applicable.

The items covered under the scope of supply and erection shall be of Owner's approved makes. Bidder has to ensure that the proposed bought out makes have proven track record and meet the qualification criteria mentioned elsewhere in the specification. Bidder to submit the proposal of sub vendors of bought outs for Owner's approval along with their offer and no deviation with regard to approved sub vendors shall be acceptable.

The general quality assurance requirements as detailed in this technical specification (Annexure-IV) shall be necessarily complied with.

The testing and inspection requirements shall be in line with technical specifications and other related standards. And no deviation in this regard is acceptable.

Material tests like physical, chemical and functional test on various components being used shall be done as per relevant standards. Manufacturer's test certificates shall be submitted for all those tests for the review and approval of Owner.

All raw materials including the bought out shall be subjected to bidders inspection/ TC review as per their procedure / approved QAP for total compliance. The same shall not be limited to mechanical, physical, electrical, operational, aesthetic and functional checks but shall confirm to the best engineering practice and strict adherence to the specifications and standards. Bidders QAP shall indicate all such tests and procedures.

The in process checks for various components shall confirm to the bidders internal procedures which shall confirm to best manufacturing practices, national and international standards. QAP shall reflect all such tests/ standards and procedures in detail. Internal test records / test reports shall be produced to Owner as required.

Type test certificates for all items in – line with the relevant standards and technical specifications shall be submitted for Owner's review and approval.



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Flammability and explosion proof equipment shall be of type tested design. Necessary certificates demonstrating this for similar item/equipment shall be submitted during bid.

All the tests mentioned herein shall be applicable to spares also.

The Bidder shall provide all test and maintenance equipment required at the site in duly calibrated condition.

The Bidder shall perform all the applicable tests in accordance with the latest revisions of pertinent codes.

For equipment not covered by these codes the Bidder shall apply his standard factory tests.

However Test procedures for these standard tests shall be prepared by the Bidder and shall be submitted for The Owner's review at least prior to the scheduled test. The tests shall be conducted, reported and certified by the Bidder.

All routine and acceptance tests shall be conducted on various components as applicable for the offered instruments. Acceptance and type tests shall be conducted as per applicable standards.

Bidder shall conduct Preliminary system testing and burn-in testing (where ever applicable) as per the approved test procedure.

Bidder shall obtain all statutory requirements required for the operation of the Instruments in a power plant.

The manufacturer, prior to system assembly shall functionally test all electronic modules and components, used within the system as per relevant standards and specific requirement clauses mentioned in this specification and approved test procedure.

Calibration certificates clearly establishing the calibrating instruments tractability to national / International standard acceptable to client shall be submitted along with. All Primary standard test instruments used for Calibration shall be Calibrated by instruments confirming to the above criteria and the same shall be demonstrated by the bidder to the complete satisfaction of Client.



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SHEET 3 OF 3

Initial checks like mechanical assembly checks harness connection checks shall be conducted by the bidder.

All painted surfaces shall be tested for shade, finish and DFT as per specifications.

TYPE TESTS

Bidder to submit the Type test certificates for the type tests (as per technical specifications and other applicable standards) conducted on similar equipment, which is not older than five years to the review and approval of Purchaser. However if these certificates are not acceptable to purchaser, bidder may have to repeat these type tests in presence of Purchaser. There shall be no delivery and cost implications to Purchaser on account of these type tests.

SITE TESTS

The performance tests and calibration tests shall be conducted at site to demonstrate guaranteed performance and rectification of all defects shall be done satisfactorily. If any equipment fails to meet the guaranteed performance, the performance test shall be repeated after rectifications / replacements are made till guaranteed performance is demonstrated satisfactorily by the Bidder. The Bidder in the presence of the Purchaser or his representative shall conduct the performance test.

All tests shall be carried out as per relevant codes and standards and as specified in the data sheet.

ANNEXURE-IV

QA - SPECIFIC REQUIREMENTS

Sl. No.	Item	Make	Model	Type	Range	Rating, accuracy & resolution	Functional checks	Calibration checks	Completeness with all accessories	Compliance to specification requirements
1	Portable 10KV Digital Automatic Insulation Tester	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Portable HV Decade Resistance Box	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Portable HV ac Test Set	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Automatic Capacitance and Tan-Delta Test Set (Schering Bridge) with oil resistivity test cell	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	Portable Transformer Oil Breakdown Test Set	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	Portable Karl-Fischer Test Set	Y	Y	Y	Y	Y	Y	Y	Y	Y

Sl. No.	Item	Make	Model	Type	Range	Rating, accuracy & resolution	Functional checks	Calibration checks	Completeness with all accessories	Compliance to specification requirements
7	3-phase Portable Transformer Turn Ratio & Vector Group Meter	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	Portable Digital dc Resistance Meter	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	Portable High Current Digital Micro Ohm Meter	Y	Y	Y	Y	Y	Y	Y	Y	Y
10	Portable Primary & Secondary Current Injection Test Kit	Y	Y	Y	Y	Y	Y	Y	Y	Y
11	Portable Automatic Earth Tester	Y	Y	Y	Y	Y	Y	Y	Y	Y
12	Portable Three Phase Universal Protective Relay Test Set	Y	Y	Y	Y	Y	Y	Y	Y	Y6
13	Precision Digital Multimeter	Y	Y	Y	Y	Y	Y	Y	Y	Y7
14	Portable Digital Frequency Meter	Y	Y	Y	Y	Y	Y	Y	Y	Y

Sl. No.	Item	Make	Model	Type	Range	Rating, accuracy & resolution	Functional checks	Calibration checks	Completeness with all accessories	Compliance to specification requirements
15	Digital Sound Level Meter	Y	Y	Y	Y	Y	Y	Y	Y	Y8
16	Digital Tachometer	Y	Y	Y	Y	Y	Y	Y	Y	Y
17	Cable Fault Locator	Y	Y	Y	Y	Y	Y	Y	Y	Y
18	Portable Hand held SF6 Gas Leakage Detector	Y	Y	Y	Y	Y	Y	Y	Y	Y
19	Portable Hand held Hydrogen Gas Leakage Detector	Y	Y	Y	Y	Y	Y	Y	Y	Y
20	Portable Vacuum Tester	Y	Y	Y	Y	Y	Y	Y	Y	Y
21	Portable Light Intensity Meter	Y	Y	Y	Y	Y	Y	Y	Y	Y
22	Portable Circuit Breaker Motion Analyser	Y	Y	Y	Y	Y	Y	Y	Y	Y
23	Portable, Hand-held Thermal Imaging Camera	Y	Y	Y	Y	Y	Y	Y	Y	Y
24	Portable High Voltage/Live Line Detector	Y	Y	Y	Y	Y	Y	Y	Y	Y

Sl. No.	Item	Make	Model	Type	Range	Rating, accuracy & resolution	Functional checks	Calibration checks	Completeness with all accessories	Compliance to specification requirements
25	Tong Testers	Y	Y	Y	Y	Y	Y	Y	Y	Y
26	Portable Phase Sequence/Continuity Indicators	Y	Y	Y	Y	Y	Y	Y	Y	Y
27	Relay Tool Kit	Y	Y	Y	Y	Y	Y	Y	Y	Y
28	HV Discharge Rod & Portable Earthing Equipment - Two (2)	Y	Y	Y	Y	Y	Y	Y	Y	Y
29	Hot Sticks (Live/Dead Line Tester)	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note:

All instruments shall be supplied with Guarantee and warrantee certificates, user manuals and applicable catalogues (English language).

Calibration certificates clearly establishing the calibrating instruments trace ability to national/ International standard acceptable to client shall be submitted along with.

Compliance to various standards as mentioned in the Technical specification shall be ensured in totality without any deviation.

All original software supporting the instruments shall be provided to the owner with user / upgrading rights.

1 X 800 MW KOTHAGUDEM TPS

PACKAGE- ELECTRICAL TESTING LAB EQUIPMENT

BOQ-CUM PRICE SCHEDULE (ANNEXURE-A)

S.NO.	ITEM DESCRIPTION	QTY	Unit	UNIT RATE (Rs.)	TOTAL PRICE (Rs.)
1	Portable 10KV Digital Automatic Insulation Tester	1	No.		
2	Portable HV Decade Resistance Box in Polystyrene case with lid and carrying handle	1	No.		
3	Portable HV AC Test Set	1	No.		
4	Automatic Capacitance and Tan-Delta Test Set	1	No.		
5	Portable Transformer Oil Breakdown Test Set	1	No.		
6	Portable Karl-Fischer Test Set	1	No.		
7	3-phase Portable Transformer Turns Ratio & Vector Group Meter	1	No.		
8	Portable Digital DC Resistance Meter	1	No.		
9	Portable High Current Digital Micro Ohm Meter	1	No.		
10	Portable Primary & Secondary Current Injection Test Kit with Separate Control & Loading Units	1	No.		
11	Portable Automatic Earth Tester	1	No.		
12	Portable Three Phase Universal Protective Relay Test Set	1	No.		
13	Precision Digital Multi-meter	1	No.		
14	Portable Digital Frequency Meter	1	No.		
15	Digital Sound Level Meter	1	No.		
16	Digital Tachometer	1	No.		
17	Cable Fault Locator (upto 11kV)	1	No.		
18	Portable Hand held SF6 Gas Leakage Detector	1	No.		
19	Portable Hand held Hydrogen Gas Leakage Detector	1	No.		
20	Portable Vacuum Tester	1	No.		
21	Portable Light Intensity Meter	1	No.		
22	Portable Circuit Breaker Motion Analyser	1	No.		
23	Portable, Hand-held Thermal Imaging Camera	1	No.		
24	Portable High Voltage/Live Line Detector	1	No.		
25	Tong Testers	1	No.		
26	Portable Phase Sequence/Continuity Indicators	2	No.		
27	Relay Tool Kit	2	No.		
28	HV Discharge Rod & Portable Earthing Equipment	2	No.		
29	Hot Sticks (Live/Dead Line Tester)	2	No.		

NOTE :-

1) EQUIPMENT TO BE SUPPLIED ALONG WITH ESSENTIAL ACCESSORIES FOR SUCCESSFUL OPERATION OF EQUIPMENT AT SITE .i.e. CLAMPS, CLIPS,LEADS ,CARRYING CASE etc.

2) ALL EQUIPMENTS SHALL BE SUPPLIED WITH VALID CALIBRATION CERTIFICATE, WHEREVER APPLICABLE.

3) IN ADDITION TO NORMAL PACKING OF THE EQUIPMENTS, THE EQUIPMENTS TO BE PROPERLY PACKED IN GALVANIZED SHEET STEEL TRUNK/BOX WITH PROPER LOCK & KEY ARRANGEMENT.

**1X800 MW KOTHAGUEM TPS**

Doc. No. PE-TS-410-556-E002

Volume: IIB


TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS

SECTION

Rev. : 00

DATA SHEET-B

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
1	Portable 10KV Digital Automatic Insulation Tester	1	No.						
2	Portable HV Decade Resistance Box in Polystyrene case with lid and carrying handle	1	No.						
3	Portable HV AC Test Set	1	No.						
4	Automatic Capacitance and Tan-Delta Test Set	1	No.						
5	Portable Transformer Oil Breakdown Test Set	1	No.						
6	Portable Karl-Fischer Test Set	1	No.						
7	3-phase Portable Transformer Turns Ratio & Vector Group Meter	1	No.						
8	Portable Digital DC Resistance Meter	1	No.						
9	Portable High Current Digital Micro Ohm Meter	1	No.						
10	Portable Primary & Secondary Current Injection Test Kit with Separate Control & Loading Units	1	No.						
11	Portable Automatic Earth Tester	1	No.						
12	Portable Three Phase Universal Protective Relay Test Set	1	No.						
13	Precision Digital Multi-meter	1	No.						
14	Portable Digital Frequency Meter	1	No.						
15	Digital Sound Level Meter	1	No.						
16	Digital Tachometer	1	No.						
17	Cable Fault Locator (upto 11kV)	1	No.						
18	Portable Hand held SF6 Gas Leakage Detector	1	No.						
19	Portable Hand held Hydrogen Gas Leakage Detector	1	No.						
20	Portable Vacuum Tester	1	No.						

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	TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS	SECTION
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DATA SHEET-B

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
21	Portable Light Intensity Meter	1	No.						
22	Portable Circuit Breaker Motion Analyser	1	No.						
23	Portable, Hand-held Thermal Imaging Camera	1	No.						
24	Portable High Voltage/Live Line Detector	1	No.						
25	Tong Testers	1	No.						
26	Portable Phase Sequence/Continuity Indicators	2	No.						
27	Relay Tool Kit	2	No.						
28	HV Discharge Rod & Portable Earthing Equipment	2	No.						
29	Hot Sticks (Live/Dead Line Tester)	2	No.						

NOTE :-

- 1) EQUIPMENT TO BE SUPPLIED ALONG WITH ESSENTIAL ACCESSORIES FOR SUCCESSFUL OPERATION OF EQUIPMENT AT SITE .i.e. CLAMPS, CLIPS,LEADS ,CARRYING CASE etc.
- 2) ALL EQUIPMENTS SHALL BE SUPPLIED WITH VALID CALIBRATION CERTIFICATE, WHEREVER APPLICABLE.
- 3) IN ADDITION TO NORMAL PACKING OF THE EQUIPMENTS, THE EQUIPMENTS TO BE PROPERLY PACKED IN GALVANIZED SHEET STEEL TRUNK/BOX WITH PROPER LOCK & KEY ARRANGEMENT.