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भारत हेवी इलेक्ट्रिकल्स लिमिटेड

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Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division

CE: PR: 003- Rev 01

PB 2606 , Mysore Road Bangalore , 560026 INDIA

SPECIAL COMMERCIAL CONDITIONS OF CONTRACT

Reference is brought to BHEL's Instructions to Bidders (Document Ref: CE: PR: 001- Rev 01) and General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 01).

These two documents along with Special Conditions of Contract annexed to this RFQ will form an integral part of the contract as and when the RFQ culminates into a Purchase Order / Contract.

RFQ No: **SAM0000226**

RFQ Date: **18/06/18** Due Date: **18/07/18**

Customer/Project: **UPPUR STPP, 2x800MW**

Item Description: **ELECTRICAL C & I, Lab Items**

TYPE OF BID: **SINGLE PART BID- / TWO PART BID- / THREE PART BID**

Purchase Executives: Clarifications with regard to the tender shall be addressed to purchase officers whose e-mail IDs are given below: umapathi@bhel.in or sapna@bhel.in

Splitting of tendered quantity to MSE vendors: The tendered quantity will /will not be split to MSE vendor/s subject to submission of relevant documents by vendors. Refer clause I of Instructions to Bidders for conditions applicable and for information on documents to be submitted.

Destination: Items are to be directly despatched to BHEL's Site Office or Stores located in **UPPUR STPP 2x800MW, RAMANATHAPURAM DIST, TAMIL NADU**. Consignee details and Road Permit, if applicable, will be issued by BHEL along with Despatch Clearance.

Project Benefits:

Imported scope of supply:

- ~~DEEC / SEZ/EPCG/DFIA/ Physical Export contract: Eligible for "NIL" Basic Customs Duty.~~
- ~~Project Imports: Supply of Main analysers for both projects are eligible for Concessional Basic Customs Duty. Merit Duty is applicable on Spares of both projects.~~
- ~~Basic Custom duty and Cess on Basic Custom duty are reimbursable by customer.~~

Terms of Delivery:

• **Indigenous scope of supply:**

Ex-works < station of dispatch > (including Packing & Forwarding charges but excluding Taxes & Duties).

• ~~Imported scope of supply:~~

~~F.C.A. (for air consignments) < indicate international port of dispatch > / C.I.F. (for sea consignments) < ICD, Bangalore > (including Packing, Forwarding, Handling, Ancillary charges like processing of Sight Draft/ Letter of Credit, negotiation of bank documents, Export declaration, Country of Origin etc.)~~

Kindly indicate the approximate weight of the total imported consignment, which is required for calculating air freight charges:

Under-mentioned details shall be provided against indigenous supplies and services:

a. GSTIN (no.) of place of supply: _____

b. HSN (Harmonized System of Nomenclature) code: _____

Applicable tax and Rate: _____ & _____

c. SAC (Service Accounting Code) no.: _____

Applicable tax and Rate: _____ & _____

d. GSTIN (no.) of place of supply of service: _____

I. Bidders to mandatorily provide confirmation/compliance for the under-mentioned terms:

SL NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	REMARKS,if any
01	Reverse Auction	BHEL's decision for opting Reverse Auction or price-bid opening, will be intimated separately to qualified bidders after finalization of techno-commercial evaluation. In case BHEL does not resort to Reverse Auction, the price bids and price impacts (if any) shall be opened as per BHEL's standard practice. Note: Non-acceptance to participate in RA may result in non-consideration of the bid, in case BHEL decides to go for RA.	AGREE	
02	Parting of license for imported raw materials	In case of projects where Basic Custom Duty is NIL and vendor is importing any raw materials / components for the enquired item, same are eligible for Zero Customs duty. As per EXIM policy, BHEL will part the import licence with the vendors to obtain import licence by themselves and custom clear the raw materials/ components by availing zero customs duty. Hence, please furnish list of raw materials / components to be imported by you with Quantity and CIF value (for which BHEL has to share import licence). The benefit due to the above shall be passed on to BHEL and confirmed in the quotation. If there are no imported raw materials/components, same shall be confirmed in the offer.	AGREE CIF value Yes, benefit passed on to BHEL in the priced quotation. (or) We confirm that there are no imported components	
03	Delivery Period	Delivery for all items shall be within 10 weeks from the date of issue of approved documents or manufacturing clearance by BHEL, whichever is later. Delay in contractual delivery will attract Penalty as per GCC Clause no.:04.b.	AGREE weeks	
04	Terms of Payment at the time of material supply	Refer Clause "F" of Instructions to Bidder for BHEL standard Payment terms and loading factors applicable for non-compliance against payment terms: Indigenous Scope : a)Supply with Erection & Commissioning b)Supply with Erection Supervision & Commissioning c) Supply only Imported Scope : d)Supply with Erection & Commissioning e)Supply with Erection Supervision & Commissioning f) Supply only High Sea sales : g)Supply with Erection & Commissioning h) Supply with Erection Supervision & Commissioning i) Supply only Spares & Consumables: e) and/or f)/i) depending upon the scope	AGREE	

II. Bidder to note that Deviations shall not be permitted for the below mentioned terms and are deemed to be complied. In case of non-compliance/deviation, offer shall be liable for rejection:

- (1) **Submission of documents post PO viz., drawings /data sheet etc. as indicated in Cl: 04 of GCC:** Within 03 weeks from the date of receipt of Purchase Order. Delay in submission of complete set of specified documents in NIT, will attract Penalty as per GCC Clause no.:04.a.
- (2) **Validity:** The offer will be valid for a period of **120** days from the date of part-I bid opening and in case of Negotiation/ Counter-offer/Reverse Auction, price validity will apply afresh for a period of **60** days from the date of according final price by bidder (or) up to original validity period, whichever is later.
- (3) **Warranty:** **36** months from the date of dispatch of goods or 30 months from the date of commissioning of goods, whichever is earlier.
- (4) **Performance Bank Guarantee (PBG):** PBG will be applicable for a period of **36** months from the date of dispatch of goods + claim period of 03 months, for a value equal to 10% of the basic value of the purchase order.
Refer Clause "H" of Instructions to Bidders. Also note that PBG should be in the format specified in Annexure VII of ITB and no deviation to this format will be allowed.
Note: In case PBG is not furnished, the 10% basic amount will be withheld from the supply invoice. This withheld amount will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.
- (5) **Despatch Documents:** Complete set of despatch documents (original + 1 photocopy set) as per Purchase Order shall be forwarded to Purchase Executive/BHEL directly. Depending upon the project/customer demands, despatch documents may include one or more documents from the following: Invoice (02 sets of original), Original Lorry Receipt (L/R), Packing List, ~~Air Way Bill (AWB)/Bill Of Lading (BOL), Copy of High Sea Sales (HSS) agreement, Country of origin certificate,~~ Warranty Certificate, NIL Short Shipment Certificate, Original Performance Bank Guarantee (directly from issuing bank to BHEL), insurance intimation letter, POD (Proof of Delivery) on L/R.
The precise list of despatch documents needed for the project will be specified in the Purchase Order.
One set of Invoice, Packing List and L/R or AWB shall be e-mailed/faxed immediately to BHEL-EDN after despatch.
- (6) **Freight Charges (for indigenous scope of supply):** Freight charges shall be to vendor's account. Against each project, vendor to quote lump sum reasonable Freight charges along with applicable tax, in priced offer.
- (7) **Evaluation criteria for tendered item/s:**
 - (a) ~~Item wise evaluation of tendered item.~~
 - (or)
 - (b) **Evaluation of the lowest bidder will be done on complete package basis.**
- (8) ~~**Integrity Pact:** Execution of Integrity Pact is applicable for this tender (Refer clause "K" of Instructions to Bidders)~~

~~Details of IEM for this tender are mentioned below:~~

Name: _____ Address: _____ Email: _____

With this, we hereby confirm that all the terms & conditions as indicated in Instructions to Bidders (Document Ref: CE: PR: 001- Rev 01) & General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 01) are accepted without any deviation.

Vendor's Signature with Seal

Note B:

The above filled-in document shall be furnished as part of Techno-commercial Bid without fail.

REQUEST FOR QUOTATION

 MMI:PU:RF:003	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: SAM0000226 RFQ DATE : 18.JUN.2018	Due Date 12.JUL.2018 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
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PURCHASE FILE COPY	(for all correspondence) Purchase Executive : Sarita Phone : 080 26998239 Fax : E-mail: sarita@bheledn.co.in
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Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by **13 . 00** hours IST and will be opened on the same day at **13 . 30** hours at the venue mentioned above. **PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.**

Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	EC-001 ERECTIONING AND COMMISSIONING	1	AU	1	28.JUL.2018
2	PR0900005351 ELECTRICAL LAB ITEMS - BOP ELECTRICAL LAB ITEMS UNDER C AND I - BOP PACKAGE	1	ST	1	30.AUG.2018

Total Number of Items - 2

Please note that the tender will be opened in the presence of the bidders or his authorised representatives (maximum two per organisation) who choose to be present with authorisation letters. Refer annexure for the terms and conditions.

Preference will be given to vendors who accepts our standard payment terms i.e.100% payment - 30 days after receipt of material at our works subject to acceptance.

Please specify Terms of delivery, Excise duty, sales tax, Ex-BHEL, Ex-works surcharge, Insurance,P&F, Freight and other taxes very clearly .

For evaluation,exchange rate(TT selling rate of SBI) as on scheduled date of tender opening (Part-I bid incase of two part bid) shall be considered. .

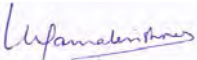
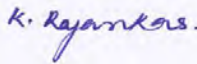
The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected.The list of banned firms is available on BHEL web site www.bhel.com

- i). This is only RFQ not an order.
- ii). In all correspondence quote RFQ No. & due date.
- iii). In Quotation BHEL material code / RFQ Sl. No. should be mentioned clearly.
- iv). Quotation Envelope / Fax not superscribed with RFQ No.and due date is liable for rejection.
- v). Quotation should remain valid for a minimum peiod of 90 days from due date.
- vi). In case of non-receipt of Quotation or regret letter for 3 consecutive RFQs you are liable to be removed from our vendors list.
- vii). All Prices should be written in words and numbers.
- viii). Excise Chapter Heading should be mentioned for all items where VAT is applicable .

For and On behalf of BHEL.

SPECIAL TERM(S):

- a) Please indicate current rate of GST, HSN Number of the quoted goods and GSTIN Number of the billing location.
- b) Please note that, the reimbursement of GST however, shall be at actuals against proof of Tax Invoice only. (Within contractual delivery).
- c) Evaluation will be done as a package for Supply portion, Supervision of Erection & Commissioning together and ranking will be done based on overall package for the complete project.
- d) Please fill the terms & conditions attached as Special Commercial Conditions of contract. In this connection, GCC & ITB shall also be referred for needful.
- e) As per the clause 171 has been inserted in the GST bill which provides that it is mandatory to pass on the benefit due to reduction in rate of tax or from input tax credit to the consumer by way of commensurate reduction in prices. In view of this clause, kindly pass on the benefit to BHEL.
Any claim is against the proof of document.
- f) Splitting of tendered quantity to MSE vendors: The tendered quantity ~~will~~ /will not be split to MSE vendors subject to submission of relevant documents by vendors. Refer clause H of Instructions to Bidders for conditions applicable and for information on documents to be submitted.
- g) Inspection agency: Material will be inspected by BHEL/Customer/Consultant/ BHEL nominated Third Party Inspection Agency(TPIA)

		बि एच डी एल  A4-10	CE/416/GLAB(E)/PQC REV 00	
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED . IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		PQR REQUIREMENTS FOR LAB ITEMS (ELECTRICAL)		
		REVISION:00	APPROVED  K.C.RAMAKRISHNAN	
			PREPARED  K.RAJASEKAR	ISSUED 416



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SL.NO	PROJECT	CUSTOMER
1	2 x 800 MW Supercritical Coal Based Uppur Thermal Power Project	M/S TANGEDCO

SECTION-A
GENERAL INSTRUCTION TO BIDDERS

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		 A4-11		CE/416/GLAB(E)/PQC REV 00 PAGE 02 OF 02
		Introduction: Bidders are required to offer Laboratory Instruments (C&I Pacakge) as per BHEL Technical Specifications (Ref :)		
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		1.0 ALL REQUIRED DOCUMENTS AGAINST THIS TENDER/SPECIFICATION SHALL BE SUBMITTED IN ENGLISH ONLY. 2.0 In order to accept the Technical offers/ proposals from Bidders mentioned in BHEL Technical Specification, certain Pre-qualification criteria Requirements are to be met by Bidder. 3.0 Pre – qualification requirements (PQR) are clearly mentioned in Section-B of this Specification. Bidder to read the same carefully and submit the details required for BHEL’s acceptance. 4.0 If a Bidder does not submit Complete PQR Documents or the Documents submitted by vendor does not meet the PQR Criteria mentioned , offer of such bidders will be summarily rejected and will not be considered for Further evaluation in the tender. 5.0 Technical Bid’s of those bidders who meet the PQR Criteria shall be opened for Review and further consideration by BHEL. 6.0 i) BHEL has Provided Approved makes against each item, to be followed for the BOM items .However If a vendor in his technical bid , offers makes different from approved makes and if found technically acceptable by BHEL , such <i>makes</i> only will be forwarded to customer for approval , along with credentials (Po copies of Past supplies/ commissioning Reports(MoM)/Satisfactory performance reports) <i>all the mentioned credentials as requested by bhel has</i> to be submitted by vendor ii) If the customer does not approve the makes submitted for approval or If BHEL finds that the credentials are not submitted/not satisfactory , the item will not be acceptable and supplier has to offer any other suitable make /model from approved makes ,without any financial implication to BHEL Else the vendor’s offer will be Rejected technically . 7.0 Changes in technical specification scope/BOM , If any shall be informed to participating bidders only. 8.0 If a vendor does not quote for all the listed items, then his complete offer will be technically rejected. Please note that essence of this tender is packaging and hence all items within this project are to be offered so as to have one packaged vendor for this project/Projects.		

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		9.0 Evaluation methodology: BHEL shall initially open Bidder's Part1 (PQR documents) only as per Section B (Pre-qualification Requirements) of this specification for review acceptance. Only after acceptance of PQR evaluation, BHEL shall open Bidder's Technical offer(Part2) for evaluation. 10.0 Bidders are required to submit offers as detailed below: aa. Documents pertaining to Pre-Qualification requirement shall be submitted/Uploaded in E-procurement system under attachment titled "PQR Documents " (Part1) bb. Technical offers/proposals (Part2) for requirements mentioned in BHEL Technical Specifications shall be submitted /uploaded in E-procurement system as attachments 11.0 If Bidder is not Registered in BHEL-EDN or any other unit of BHEL For supply of Lab equipment package ,Submit duly- filled Source Request form (SRF), which shall be downloaded by Bidder from bhel website .http://supplier.bhel.in/ and to be submitted along with offer. 12.0 Name & registered address of The Bidder with Organization chart, service team and contact details shall be submitted 13.0 Bidder shall be responsible for complete package supply, installation/commissioning and satisfactory demonstration to customer. Wherever OEM Representative to be deputed for commissioning bidder shall coordinate at his own cost and complete the work. Qualified technical persons shall only be deputed by the bidder for commissioning of the items in the package. 14.0 Whenever required during evaluation of PQR and Technical offers/bids, vendor is required to be present at BHEL Electronic Division, Bangalore, for discussions. Further in the event of order, during approval of the Vendor documents by End-users/Customers, Vendor shall accompany BHEL representative for discussions(If Required).		
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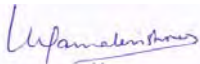


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PRE-QUALIFICATION REQUIREMENTS

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		AA.Pre-Qualification Requirements (PQR) bidders for Lab instruments(Electrical) (C& I Package) as Part of offer	
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.			1.0 Vendor should have supplied Lab instruments(Electrical) equipments to process plant/ refinery/ power plant/ nuclear plant / testing Lab. 2.0 Vendor should be in business of supplying Lab instruments(Electrical) equipments for at least last two (2) years from the date bid opening . 3.0 Minimum One no. purchase order for Lab instruments(Electrical) equipment shall be submitted which should not be more than 5 years old from date of bid opening for establishing continuity in business. 4.0 Bidder has to submit letter of undertaking stating that they will take care of service Requirements till guarantee /warranty period/ commissioning & Demonstration and handing over whichever is later 5.0 The Bidder's Average Annual financial turnover during the last 3 financial year, ending 31st March 2018 should be at least 75 Lakhs INR per year. Certificate from bankers/chartered accountant/IT return in this regard should be submitted along with the offer 5.0 Bidder should have a Clean track Record , i.e the Bidder should not be under Hold or blacklist by any of the BHEL units/any Govt of india PSU/Govt of india as on bid submission date.To this effect a declaration should be given by the bidder. Note : Proof for Points 1,2,3,4 should be submitted. 6.0 Important note: - In case Bidder does not submit clause wise details mentioned in above clauses or meet the requirements of Pre-qualification requirements, Offers will be summarily Rejected and Bidder's Technical offers/proposals will not be Evaluated. Please read carefully the General instructions in Section A of this specification.

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COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED . IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		<table><tr><th>SL.NO</th><th>PROJECT</th><th colspan="2">CUSTOMER</th></tr><tr><td>1</td><td>2 x 800 MW Supercritical Coal Based Uppur Thermal Power Project</td><td colspan="2">M/S TANGEDCO</td></tr></table> LABORATORY INSTRUMENTS ELECTRICAL (C&I PACKAGE)			SL.NO	PROJECT	CUSTOMER		1	2 x 800 MW Supercritical Coal Based Uppur Thermal Power Project	M/S TANGEDCO	
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		REVISION:00	APPROVED  K.C.RAMAKRISHNAN									
			PREPARED  K.RAJASEKAR	ISSUED 416	29.05.2018							

		बि एच ई एल  A4-10		CE/416/GUP/LABI REV 00 PAGE 02 OF 04									
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED . IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		INDEX <table><tr><th>S.No</th><th>Description</th><th>Reference</th></tr><tr><td>1.</td><td>SCOPE OF SUPPLY</td><td>CE/416/GUP/LABI/SOS Rev 00, Pages 04</td></tr><tr><td>2.</td><td>TECHNICAL SPECIFICATIONS</td><td>CE/416/ GUP /LABI/TS Rev 00, Pages 12</td></tr></table>			S.No	Description	Reference	1.	SCOPE OF SUPPLY	CE/416/GUP/LABI/SOS Rev 00, Pages 04	2.	TECHNICAL SPECIFICATIONS	CE/416/ GUP /LABI/TS Rev 00, Pages 12
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COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED . IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		<u>SCOPE OF SUPPLY</u> The scope of supply consists of LABORATORY INSTRUMENTS (C&I) Package for the project mentioned Although immense care has been taken to cover all the items applicable for the project, it is possible that some items may have been missed (which needs to be added) or some items have been already supplied which are not to be supplied now for these projects. Then in either case, unpriced impact (technical) and price impact will be taken from participating vendors. But please note that if a vendor has not participated in this RFQ and if the impact is applicable due to change in quantities or due to acceptance of deviations, non-participating vendor will not be sent intimation (under this RFQ) as the changes are very, very minimal keeping the non-participating vendor still debarred under this packaged RFQ. Hence, all vendors should actively participate offering all the items. If a vendor does not quote for all the listed items, then his complete offer will be technically rejected. Please note that essence of this tender is packaging and hence all items within this project are to be offered so as to have one packaged vendor for this project. Please note that if any item requires battery, same should be rechargeable type of same item make or equivalent good make. Then the corresponding charger is also to be provided. Also, please note that computer interface is to be provided with relevant pre-fabricated cable of 2 or 3 meters length for connectivity to computer, Current Probe and High Voltage Probe as and where applicable for the individual instrument. If any application software is required due to this, same is also to be provided as and where applicable for that particular instrument. If any deviations are accepted by bhel During evaluation stage and subsequently not accepted by end customer during datasheet submission stage ,then vendor has to replace the model without any financial implication to BHEL. Project wise unit rates are to be offered taking care of applicable BOM for individual project since the items are being enquired as a package for individual project. Subsequently, after ordering, unit rates of each and every BOM item of project is to be provided to take care of any addition/deletion during detailed engineering stage. Erection supervision and commissioning is also to be offered with lump sum rates each project wise. Please note that for any item offered by vendor BHEL reserves the Right to ask the vendor, any or all of these credentials (Po copies of Past supplies/ commissioning Reports(MoM)).If the credentials are not submitted/not satisfactory , the item will not be acceptable and supplier has to offer any other suitable make /model without any impact to BHEL. All the electronic M&C items shall be microprocessor based and shall have the data logging facility for keeping calibration/maintenance records with proper communication facility for downloading these data on the Lab PC. Wherever such facility is available in the Equipment offered The vendor if required has to visit BHEL-EDN for technical clarifications during technical evaluation After order and datasheet submission to customer/consultant vendor has to visit Customer /consultant (if required) with BHEL for resolving any technical clarifications required by them. The calibration standards of all M&C equipments furnished under this sub-section shall be traceable to National Bureau of Standards, USA or NPL, India or to the applicable standards existing in the country where the equipment is manufactured.Dust proof carrying case and Rechargeable battery along with external charger shall be provided For the project site under this RFQ vendor has to offer following option:- 1.) Despatch of items as per standard package as done normally. ERECTION SUPERVISION & COMMISSIONING: Please note that Erection Supervision & Commissioning is to be offered each project wise and same will be considered while evaluating lowest commercial tender. The commissioning will involve demonstrating the healthiness and working of all the items within the project to the satisfaction of BHEL site office/end-user. This will necessitate maximum of 3-5 days stay at project site.		



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TECHNICAL DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER(MANDATORY):

- 1.) Technical bid should be having Desc, Qty, make, Model, Strictly as per the Template format given below (In Pdf and excel)
- 2.) Catalogues of all the items in soft copy

DOCUMENTS TO BE SUBMITTED AFTER PLACEMENT OF ORDER:

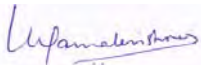
- a. Datasheets along with catalogs for each and every item properly indexed.
- b. Mounting details including necessary accessories (If applicable)
- c. Recommendations (if any) for installation/ storage etc
- d. Spare part list
- e. Consumable list
- f. Training details
- g. O&M Manual (*After datasheet approval*)
- h. Any other scheme, data, drawing, document, etc required to establish product quality and completeness of supply.

The above documentation shall be each project wise with around 8 copies or On as required for each project on an average. Apart from hard copies, soft copy in the form of CD/Pen drive should also be provided for each project.

TEMPLATE To be followed for technical bid (Example) :

Sino	Desc	Qty	make	model
1	Soldering Station	2	HAKKO	FR-810 Accessories : handpiece holder, FP pick-up (with pick-up wire SS), heat resistant pad, power cord,

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1	2 x 800 MW Supercritical Coal Based Uppur Thermal Power Project	M/S TANGEDCO								
	TECHNICAL SPECIFICATIONS FOR LABORATORY INSTRUMENTS ELECTRICAL (C&I PACKAGE) Note : Package is Common for total plant									
	REVISION:00	APPROVED  K.C.RAMAKRISHNAN								
		PREPARED  K.RAJASEKAR	ISSUED 416	DATE 29.05.2018						



A4-10

CE/416/GEN/LABI/TS

REV 00

BILL OF MATERIALS

SLNO	Description	Unit	Qty
1.	Electronic Test Bench	No	1
2.	Computer aided Callibration system with one no. OWS, Printer and Complete Software	Set	1
3.	Portable Digital Multimeter (4 ½ digit)	No	15
4.	(Digital Multimeter (Table Mounting Type) (5-1/2 Digit -1 No and 7 1/2 Digit-1 No)		
	a) 5 1/2 digit	No	2
	b) 7 1/2 digit	No	2
5.	RCL Bridge/Analyser	No	1
6.	In Circuit Tester	No	1
7.	Function Generator	No	1
8.	Digital Oscilloscope	No	1
9.	Tachometer	No	2
10.	Soldering iron (1 No of each type) 10 Watts25 Watts40 Watts	No	3
11.	Solder Sucker	No	2
12.	Soldering Desoldering station	No	2
13.	Potentiometer/Rheostat 2A : 2Nos (5000Ω) 5A : 2 No (47Ω) 2A : 2 No (470 Ω) 10A : 2 No(470 Ω) 2A : 2 No(2200 Ω)	set	1
14.	AC Thermometry Bridge	No	1
15.	Stop Watch	No	2
16.	mV Calibrator (3 No portable , 1 No Table mounted)		
	a.Portable	No	3
	b.table mounted	No	1
17.	mA Calibrator (6 No Portable , 2 No table mounted)		
	a) Portable	No	6
	b) table mounted	No	2
18.	Thermocouple calibrator (2 No-Portable), (2 No Table mounted)		
	a) Portable	No	2
	b) table mounted	No	2
19.	RTD Calibrator (1 No portable , 1 No Table mounted)		
	a) Portable	No	1
	b) table mounted	No	1
20.	Multi Function Calibrator	No	1

Note : Only Customer approved makes as per attached list is acceptable. Refer Bom with aproved makes appearing in the specification

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		बि एच ई एल  A4-10	CE/416/GEN/LABI/TS		
			REV 00		
		BILL OF MATERIALS			
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED . IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.	21.	Digital Insulation Tester	No	2	
	22.	Sound Level Monitor	No	2	
	23.	Portable Digital/Analogue Vibration Meter (Digital type-2 , Analog type-1 No)			
		a)Digital type	No	3	
		b)Analog type	No	2	
	24.	VIBRATION/ SHOCK PULSE ANALYSER cum Data Collector cum Balancer	No	1	
	25.	Decade Resistance Box (3 Nos-Analog type, 3 Nos Digital type)			
		a) Analog type	No	3	
		b) Digital Type	No	3	
	26.	LAN/ Coaxial Cable Meter/ Tester	No	2	
	27.	EARTH/GROUND RESISTANCE TESTER	No	2	
	28.	Fiber Optic Testing Tool Set	No	2	
	29.	Tong Tester	No	2	
	30.	Stroboscope	No	1	
	31.	Auto Transformer (Single Phase-2 No, Three phase-2 No)			
		a.single phase	No	2	
		b.polyphase	No	2	
	32.	Test Temp Dedector – Test RTD	No	2	
	33.	Overhead projection Board (Interactive White Board)	No	2	
	34.	Projector with white board.	No	1	
	35.	Portable Ph Calibrator/Simulator	No	1	
	36.	Logic Probe	set	1	
	37.	Marker Printers (1 No of each type)	No	1	
	38.	DC Regulated Power supply	No	4	
	39.	Portable multifunction counter	No	1	
	40.	Portable conductivity Meter	No	1	
	41.	Vibration Pick Up tester	No	1	
	42.	stabilised power supply	No	3	
	43.	Continuity Tester	No	9	
	44.	Optical time Domain reflectometer	Set	2	
	45.	Resistance Thermometer Bridge	No	1	
	46.	Decade capacitance Box	No	1	
	47.	Decade Inductance Box	No	1	
	48.	Clip on AC power Meter	No	1	
	49.	Portable High speed Trend recorder	No	1	
	50.	LAB WORKSTATION , A3/A4 B/W DIGITAL LASER PRINER CUM COPIER AND LAPTOP -1 NO Each	set	1	
	Note : Only Customer approved makes as per attached list is acceptable. Refer Bom with aproved makes appearing in the specification				

Chapter-12**CONTROL INSTRUMENTATION LABORATORY & TESTING EQUIPMENT****12.01.00 GENERAL REQUIREMENTS**

This section sets forth the technical information required for the design, furnishing and construction of an instrumentation Lab shop, complete with tools and test equipment required to maintain the instruments and control devices for the unit power plant.

12.01.01 Equipments, tools and instruments

Testing instrument/devices offered shall be proven type and shall incorporate latest design.

The workmanship and design shall be in accordance with the best engineering practice and shall be such, as have proved to be suitable for the intended purpose and shall offer satisfactory performance even in the worst environmental conditions.

Testing instruments/devices shall be furnished with all necessary accessories whether specifically indicated herein or not.

- 12.01.02 i) All instruments offered, shall conform to the relevant IS or international standards.

Accuracy of the calibration instruments should be traceable to National or international standards indicating date of calibration and due date of calibration. Calibration and trace ability certificate shall be provided with the Lab instruments.

- ii) The various instruments/devices, small tools, accessories etc shall be furnished (in applicable cases) with suitable and durable boxes of convenient size, complete with necessary packing etc in order to have safe storage when not in use.

- 12.01.03 Measuring/testing instruments, along with allied accessories shall be suitable for continuous operation (both indoor and outdoor installations as applicable).

- 12.01.04 The various equipments / devices, tools, accessories etc., shall be furnished (in applicable cases) with suitable and durable boxes of convenient size, complete with necessary packing etc. in order to have safe storage when not in use.

- 12.01.05 The Bidder shall supply testing instruments/ devices, specified hereinafter, for meeting the requirement of the power plant. The Bidder shall be responsible for proper functioning of supplied items, to check and make any necessary additions/tools as required for proper maintenance and testing of the installed instruments and controls. The Bidder shall also be responsible for erection and commissioning the test equipment where applicable.



- 12.01.06 It is obligatory to the Bidder to furnish a complete list of spare parts for these testing/calibrating, instruments/devices. The Bidder shall render guarantee for easy availability of all the spare parts required, especially for the components, which are prone to failure.
- 12.01.07 The Bidder shall repair the defective instruments/devices free of cost within the guaranteed period or replace the same if required.
- 12.01.08 A full description and detailed specification of the items offered shall also be submitted by the Bidder for owners approval prior to purchase. Photographs, catalogues, drawings as required shall be submitted with the proposal to provide necessary information pertaining to the items offered. Information for the items offered shall include(as applicable) but not limited to the following :
- a) Working Principle
 - b) Power supply and other utility details
 - c) Dimensional details
 - d) Mounting details including necessary accessories
 - e) Recommendations (if any) for installation, storage, etc.
 - a) Accuracy (wherever applicable).
 - g) Calibration Certificates for each equipment having National/International Trace ability.
 - h) Make & Model
- 12.01.09 The maintenance and calibration equipment specified in this section shall be in addition to similar portable equipment required by the Bidder for installation and initial calibration of instrumentation and control equipment furnished by these specifications. The Bidder shall hand over to the Owner all equipment specified in this sub- section immediately after receiving the equipment at the job site. Use of these equipments by the Bidder shall not be permitted without the Owner's consent. Owner has the rights to choose/select/decide the model.
The equipment specified in this section shall be in addition to any special simulator test stands which shall be recommended and supplied by the Bidder for use in calibrating electronic components of the instrumentation and control systems to be furnished.
- 12.01.10 **Calibration Standards**
- The calibration standards shall be traceable to the National Bureau of Standards of the United States of America, comparable Indian Standards, or to applicable standards existing in the country where the equipment is manufactured and tested. The Bidder shall elaborate in the proposal the standards followed for the equipment manufacturing and testing.
- ~~12.01.11 Five (3) nos. teak wooden work tables with thick laminated top of size 1x2 meters, Eight (8) nos. high adjustable wheeled swivel chairs, Five (4) nos. vertical cabinets 1000 x 480 x 2000 mm made of sheet steel (Sheet thickness of 18 gauge) and equipped with safety locks, Five (4) nos. open shelf 1000x200x2000 with partitions made of steel shall be provided in addition to Electronic & Pneumatic Lab test bench.~~



- 12.01.13. Microprocessor based lab instruments shall be offered wherever applicable. All the microprocessor based maintenance and calibration units should also have provision for data logging facility for keeping calibration/maintenance record with proper communication facility to down load these data on the lab WORK STATIONS.

The Bidder shall supply testing instruments/ devices, specified hereinafter, for meeting the requirement of the power plant. The Bidder shall be responsible for proper functioning of supplied items, to check and make any necessary additions/tools as required for proper maintenance and testing of the installed instruments and controls. The Bidder shall also be responsible for erection and commissioning the test equipment where applicable.



It is obligatory to the Bidder to provide mandatory spare parts for these testing/calibrating, instruments/devices as approved by Owner. The Bidder shall render guarantee for easy availability of all the spare parts required,

- 12.01.14. All the calibration instruments shall have a common LAB WORK STATIONS along with A3/A4 sized B/W Digital Laser jet printer cum scanner cum Copier for calibration and report generation. One no. lab laptop shall also be provided by bidder. Specification for WORK STATIONS, Laptop and Printer shall be same as specified elsewhere in the specification. The Bidder shall provide dual redundant interfacing for monitoring on OPC Protocol with DDCMIS.

All the calibration instruments shall be provided with RS232C port for Lab WORK STATIONS & laptop interface with their own interfacing cables & software.

All the portable type lab instruments shall be provided with own rechargeable battery & charger.

~~12.01.15~~ **~~Instrument Work Shop~~**

~~The scope shall include the arrangement and installation of instrument workshop equipment supply and connection of all electric power supply including air distribution system.~~

~~12.01.15.01~~ **Electronic Test Bench**

- SLNO:1 Self-contained test bench made of anodised aluminum for testing and repair of electronic instruments and gadgets shall be furnished. The test bench shall be of modular design, enabling easy change of arrangement/ layout as and when required. This shall include necessary isolating switches, power supply switches, holding brackets, etc. Test bench shall be furnished with thick laminated top. Desk with drawers shall be included.

The test bench shall include necessary power modules from reputed manufacturers to feed the following sockets mounted on the test bench (Voltage rating is tentative and shall be matched to supply requirements of Bidder's range of products):

Sno.	Items	Qty
i.	3 pin socket, 240VAC, 4A low-voltage output, earth leakage circuit breaker etc. for whole workstation	1
ii.	240V AC $\pm 0.5\%$, 1 phase, 50 Hz, 3 kVA supply socket, circuit breaker, as an Isolated supply module	6
iii.	110 V AC, 10 Amp. 50Hz supply socket & 0-260V AC, 1ph, 50Hz (Variat), 10amps with Digital meter for current (resolution 0.01 A) and voltage (Resolution 0.1 V).	1 no. each
iv.	Voltage stabilizer 240(+/-0.5%) VAC, 1ph, 50Hz, 3KVA	4
v.	+/-48V DC, 3A with Digital meter for current and voltage	2



Sno.	Items	Qty
vi.	+/-24V DC, 6A with Digital meter for current and voltage	2
vii.	+/-12V DC, 10A with Digital meter for current and voltage	2
viii.	+/- 5V DC, 20A with Digital meter for current and voltage	2
ix.	0-220V DC (variable) stabilized output 1 Amp No load to full load regulation shall be +/-0.2% or better with Digital meter for current and voltage	1
x.	Plant UPS power point/sockets.	2

The test bench shall include socket holders where the electronic gadgets under test may be plugged. The front equipment shall include multipoint connectors and test jacks for interconnection. There shall be connection between the connector and holder in which device under test shall be plugged in. All power points must be labeled. Electronic test bench should have instrument earth tapping points. 2 nos. Air guns shall be provided for cleaning the instrument in test bench tools.

~~Power cable with necessary sizing shall be supplied & laid by bidder from UPS ACDB1 and UPS ACDB2 to C&I lab at a centralized location in C&I lab and from there the required distribution board with UPS feeders including 20 % spare feeders shall be provided for distribution purpose inside the laboratory. Required MCB's & fuses shall be provided at distribution board.~~

3 phase, 415 VAC power supply with proper distribution board for electric actuator motor testing should be available in the lab by bidder. Also three (3) nos. of tables shall be offered by bidder with required regulated 24 VDC power supply socket for testing of transmitters on these tables.

~~Complete cables required for power supply in lab shall be in bidder scope of supply.~~

~~All external power supply points shall be located at a centralised location in lab room.~~

The standard high accuracy resistors shall be included to load and measure the current output of devices. Necessary control devices for voltage and current adjustments/ control switches for power supplies to feeders, isolation etc., shall be included. All electric circuits shall be protected against overload by fuses, whose holders are located on front of the panel. All electrical circuits and metal structures shall be properly grounded.

The following facilities shall also be provided on the electronic test bench:

- | | | | |
|----|--|---|--|
| a) | One DC voltage stabilizer (0 to 220V, 1 Amp) | - | Regulation +/-0.02% for 0-100% load variation. |
| b) | One AC voltage stabilizer (input 240V AC nominal, output 240V AC +/-0.5%) | - | Regulation +/-0.5% for 0- 100% load variation |
| c) | One no. 4 1/2 digits digital Multimeter for display of voltage, current, resistance <i>and</i> | - | Accuracy 0.1 +/- 1 digit |



having at least 24 measuring ranges

d) Standard Current Source (0-55mA)

12.01.15.03 Each workbench suitable for Electronic Work and pneumatic work with wood top approximate size 75 x 300 cms. with side drawers (fitted with lock) and board on back of the bench top with electric fittings. Each workbench shall be fitted with all essential tools as described under for electronic workbench and for pneumatic work bench. Each bench shall also be fitted with electrical fittings - sockets and colour coded banana jacks for each kind of voltage used in the power station control system and one 20-watt fluorescent lamp at each table

One no. 2 sided Folding Aluminium ladder (height 180 cm or better) for maintenance and mounting bracket for ladder shall be provided by bidder in each C&I lab room.

12.01.17 **The bidder shall ensure with appropriate documentation that direct service/support from the lab instruments/equipments supplier/manufacturers shall be available to the owner for all type of lab instruments/equipments/items for a minimum period of five (5) years after the expiry of defect liability period.**

SLNO:2

Computer aided Calibration system with one no. OWS, Printer and Complete Software

Computer Aided Calibration system offered, shall meet the demands of high precision transfer / secondary standards for automatic testing & calibration of temperature, pressure & electrical parameters in quick time and for issuance of simple, error free, reliable, fully traceable calibration certificates conforming to ISO standards / Protocol. Complete lab softwares with life time validity shall be provided by bidder, which shall be loaded on Lab operating station and Lab laptop parallelly. Any lab software mentioned or not shall be provided by bidder. Any software required for any lab instrument/equipment shall also be provided by bidder.

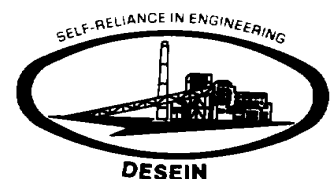
12.01.12.01 Computer Aided Calibration system shall have also the following facilities: -

1. Automatic Testing and Calibration:
 - i) Pressure instruments like pneumatic/hydraulic pressure/ differential pressure vacuum gauges/ indicators / transmitters/ switches/controllers, electro-pneumatic instruments P/I, I/P converters.
 - ii) Pressure/differential/temperature/flow transmitters current/pH converters.
 - iii) Analog instruments, such as indicators for pressure, current, voltage etc.
 - iv) Digital panel indicators with additional port for DC current measurement.
2. Automatic testing and calibration of all types of temperature measuring instruments including temperature indicators/ recorders/controllers, thermo switches, RTD and Thermocouples of all international standards (range from -20 Deg.C to 1200 Deg.C).
3. An automatic temperature calibration system for simultaneous calibration of multiple temperature sensors.
4. Automatic calibration and system documentation through Lab Operating station and Laptop offered with compatible calibration software.

Measuring/testing instruments, along with allied accessories shall be suitable for continuous operation (both indoor and outdoor installations as applicable).



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SLNO:3

Portable Digital Multimeter

Portable digital multimeters, with high voltage grade leads/probes and suitable casing including carrying strap are envisaged. Digital multimeter shall have 4 1/2 digits read out indicator with automatic decimal point and polarity indicator. Indication shall be in seven segment LCD display. Meters shall be complete with accessories for high voltage, DC current, temperature, Capacitance and frequency measurements.

Instruments offered, shall have built in overload protection feature. These shall have high resolution and low response time. For AC signals (True RMS) digital multimeter shall have good fidelity over a large range of frequencies. Signals and ranges required to be measured by the meter are furnished in a tabular form below :-



Sl.No.	Signal type	Range	Accuracy
i.	DC voltage	100 mV	+/- 0.3% +1 digit or better
		1 V	-do-
		10 V	-do-
		100 V	-do-
		500 V	-do-
		1000V	-do-
ii.	AC voltage	Same as DC voltage	+/-0.5% of reading + 2 Digits or better
iii.	Direct Current	200 micro amp.	+/-0.75 % of reading + 2 Digits or better
		1 mA	-do-
		10 mA	-do-
		100 mA	-do-
		1 A	-do-
		10A	-do-
iv.	Alternating Current	Same as Direct Current	+/-1.0% of reading or better
v.	Resistance	0.1 K ohm	+/- 0.5% of reading + 2 digit
		1 K ohm	-do-
		10 K ohm	-do-
		100 K ohm	-do-
		1 M ohm	-do-
		10 M ohm	-do-

- vi. Input resistance : 10 Meg ohms
- vii. Ambient temp. : 0-50 deg.C
- viii. Ambient Temp. : $\pm 0.1\%$ of reading error from 0-50 deg.C
- ix. One red indication lamp shall indicate the overload.
- x. Handheld
- xi. IEC CAT III 600V Safety rating.
- xii. Drop protected to 1 meter
- xiii. Easy access battery door to change the battery without breaking the calibration seal.
- xiv. Accessories : Test leads per mutimeter

One set of spare test leads per mutimeter
 Rechargeable Alkaline battery per mutimeter
 Software & hardware for interfacing per multimeter.



SLNO:4

Digital Multimeter (Table Mounting Type)

High standard multimeters are envisaged for the instrument shop. The multimeters shall offer simplicity in operation. The multimeters shall have a built in automatic overload protection. The meter shall offer ease and simplicity in operation to render the instrument in use after overload protection being operated. The instrument shall offer a good fidelity over a large range of frequency. Temperature compensation shall be built in.

The components inside the instrument shall be impervious to moisture. The multimeters shall be complete with suitable cover.

Each multimeter shall include two (2) high voltage grade loads which shall be interchangeable. Spare loads/probes with clips shall be supplied with multimeter. Voltage multiplier, high and low resistance range extension unit with suitable replaceable battery may be offered. Ranges and accuracy of the multimeters shall be as per the table below: -

i. For 7 1/2 digit multimeter

SI No.	Signal type	Ranges	Accuracy
1.	DC voltage	3 mV to 10KV	+/- 0.002%
	AC voltage	3 mV to 3 KV	+/- 0.08%
2.	Alternating current	3 Micro amps to 30 Amps	+/-0.2%
3.	Direct current	-do-	+/-0.01%
4.	Resistance	30 mOhms to 1 G ohms	+/-0.003%

ii. For 5 1/2 digit multimeter

SI No.	Signal type	Ranges	Accuracy
1.	DC voltage	100mV to 1000V	+/- 0.025%
	AC voltage	100 mV to 750 V	+/- 0.025%
2.	Alternating current	1 mA to 10 A	+/-0.2%
3.	Direct current	-do-	+/-0.01%
4.	Resistance	100 Ohms to 100 Mohms	+/-0.003%

iii. Other functions:

Power supply : 240V single phase
 Display : 5 ½ digit, 7 ½ digit
 Resolution : 100 micro Volts for 0-1 KV DC
 Auto/Manual ranging facility.

Meters shall be complete with accessories for high voltage, DC current, temperature, Capacitance and frequency measurements.

iv. SPECIAL FEATURES:

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Self test Mode
Diode/Zener Test
Max/Min functions
Continuity Testing
A.C./D.C. Coupled facility
Countdown and sample beep on long filter periods
Oxygen free copper input terminals

- v. Accessories : Test leads per mutimeter
One set of spare test leads per mutimeter
Rechargeable Alkaline battery per multimeter
Software & hardware for interfacing per
multimeter.



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SLNO:5 ~~10.~~ **Precision RCL Bridge/Analyser**

The unit should be a Precision analyzer suited for accurate testing of any passive component or for various other applications to a high resolution and accuracy.

FEATURES:-

- $\pm 0.02\%$ basic measurement accuracy
- High measurement accuracy on dissipation factor
- Characterize to 3 MHz
- Fast automatic testing
- Fast measurement speed
- Large LCD display and intuitive user interface
- Comprehensive measurement functions, Graphical sweep on all measurement functions

Measured parameters :

- DC Resistance (R_{dc})
- AC Resistance (R_{ac})
- Impedance (Z)
- Phase Angle ($\emptyset$)
- Inductance (L)
- Capacitance (C)
- Quality Factor (Q)
- Dissipation Factor (D)



- Admittance (Y)
 - Conductance (G)
 - Reactance (X)
 - Susceptance (B)
- Series or Parallel Equivalent Circuit
Series equivalent circuit only
Parallel equivalent circuit only
Polar Form

Graphical sweep should be available for all measurement functions up to 3 MHz and should be selectable – linear or logarithmic

The unit should be able to characterize / analyse and create a graph of the parameter value against frequency or AC drive level.

Marker facility should be there on graph which can be positioned at any point on the graph using the navigation keys. The MAX (maximum) and MIN (minimum) keys should be able to position the marker at the peak or trough of the graph.

Unit should be user friendly allowing the user to toggle between major and minor terms.

Frequency range : 20 Hz to 3 MHz > 1800 steps, Accuracy of set frequency $\pm 0.005\%$

DC bias voltage (internal) : 2 V with rapid charge capacitor bias

Basic measurement accuracies : $R \pm 0.02\%$, $R_{dc} \pm 0.1\%$, $L/C \pm 0.05\%$, $Q \pm 0.05\%$ ($Q + 1/Q$), $D \pm 0.0002(1 + D^2)$

Mains operation : 230 V AC $\pm 10\%$, 150VA max., 50 Hz

Display : High contrast monochrome LCD, 320 x 240, backlit, viewable area 115 x 86 mm with a viewing angle of 45°

Interfaces : The unit should have a printer connectivity port so as to send a single parameter, table of results or a logarithmic graph to the printer – Centronics / Parallel printer port (if connected).
GPIB interface port should be also available.

Protection : The unit should have the necessary protection features built-in specially against charged capacitors from up to 25 Joules of charged energy.

Accessories : **Manual, conformity certificate**, Kelvin Lead (large jaw), 4 terminal lead set, BNC-4 Terminal Component Fixture,

The instrument shall be microprocessor based and programmable with front keyboard operation. Test frequency shall be 3 M Hz. Accuracy shall be of 0.05%. The instrument shall have a digital indication of inductance. Capacitance, resistance, impedance, phase angle, Q factor, admittance and Reactance etc. value with auto ranging facility.



11. In Circuit Tester

SLNO:6 This shall be provided for functional testing & various types of ICS used in different electronic modules. It shall also be possible to functionally test various industry standard ICs. Proven test methods, like signature *I V-I* trace methods shall be used. Suitable PC (as per latest trends) with SVGA colour monitor 19" LED monitor shall be provided along with the necessary software for achieving the same. The testing shall be possible both in In circuit and Out circuit modes The system shall be complete including all necessary hardware, Software, Cabling, Power packs etc.

12. Function Generator

SLNO:7

Operational Mode	: Continuous, Triggered, Gated, Burst mode
Frequency range	: 0.002 Hz – 80 M Hz
Waveforms	: Sine, Triangle, square, Negative square.
Amplitude	: 100 mV to 20 V p-p (into open circuit) 50 mV to 10 V p-p (into 50 ohms)
Frequency accuracy	: ± 1 %
Sine wave distortion	: less than 0.5%
Frequency stability	: $\leq 0.05\%$ for 10 min. $\leq 0.1\%$ for 1 hr. $\leq 0.5\%$ for 24 hrs.
Power	: 110V AC / 240V AC / 24V DC

13. Dual Beam storage type Digital Oscilloscope

SLNO:8 Dual beam storage type oscilloscopes with color LCD display shall be supplied for the instrument shop. It shall incorporate latest state of art in design. Low watt dissipation and light weight shall be preferred. Simple direct reading controls arranged functionally shall be there in the front of the cabinet. Positive and negative triggering circuit selection shall be done easily by a selector switch. Auto range, auto set menu, automatic wave form measurement, shall be inbuilt features. Intensity/brightness shall be controlled from the front. Oscilloscope shall have a bandwidth from DC to 200 MHz (minimum). The oscilloscope shall have a minimum sensitivity of 2 mV/div.

Time Base

Sweep rate	: 5 nano seconds/div.
Raise time	: 3.5 nano seconds
Accuracy	: $\pm 5\%$ or better
Power supply	: 240V, 1 pH, 50 Hz

Horizontal Amplifier

Input impedance	: 1 M ohms (min.)
Band width	: DC to 200 MHz



Operating Station	: 8 x 10 cm, P31 phosphor operating station with 0.45 cm/division
Display modes	: Coloured display with Nonstore, bistable, variable persistence, fast bistable, Fast variable persistence
Calibration	: Rectangular wave for calibration and probe adjustment
Accessories	: a. One trolley with one lower rack is envisaged for Carrying the OPERATING STATION from one point to other. b. High voltage grade, probe with suitable screening etc. Software & hardware for interfacing.

14. Tachometer

SLNO:9

Digital Tachometer with contact and optical measurement facility in single instrument shall be supplied. Tachometer shall have measurement unit selection facility for rotational and linear velocity measurement and the same shall also be displayed. This instrument shall be offered with contact and non-contact pickup tips.

Following requirements as a minimum shall be fulfilled:

a)	Range:	
	i) Optical mode	: 10 to 99,999 rpm
	ii) Contact mode	: 10 to 20,000 rpm
	iii) Linear mode	: 1 cm/sec. to 1000 m/min.
b)	Accuracy	: $\pm 0.01\%$ of indicated reading for optical mode & $\pm 0.05\%$ of indicated reading for contact & linear mode
c)	Display	: 5 digit LCD for measurement+ Measuring unit
d)	Sampling rate	: 0.5/1.0 second
e)	Operational Mode	: Sample
	- Hold	
	- Lock	
f)	Operating temp.	: 0-50°C range
g)	Power supply	: Built in 9.0 volts Rechargeable battery
h)	Accessories	: Carrying case One set of spare battery with Chargers Tripod & adopter Contact adapter, surface-speed



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wheel, convex and concave tips, reflective tapes, battery carrying case, etc.

~~15.~~ **Soldering iron**

SLNO:10	Use & performance	:	Electronic soldering iron specially engineered for long Lasting heavy duty and production line use fast heat up and quick recovery timing efficient heat transfer assure steady tip temperature and superior performance. All micro-electronics soldering application. Low current leakage and infinite heat insulation of element eliminates risk and damage to transistor integrated ckt and other electronic components and assure the safety of the operator.
	Wattage & Qty.	:	10 Watts - 1 25 Watts - 1 40 Watts - 1
	Supply voltage	:	230V, 50 Hz
	Accessory	:	Soldering iron stand

~~16.~~ **Solder Sucker**

SLNO:11

Solder sucker shall be provided for removal of molten solder from terminal connections.

~~17.~~ **Soldering Desoldering station**

SLNO:12

The soldering! desoldering station shall have the following features:

Two adjustable temperature controllers with maximum setting of 430 deg C (for soldering purpose) and maximum setting of 385 deg C (for desoldering cum sucking purpose)

Digital displays for the temperature settings and actual temperatures (A common display unit with provision for selection of settings or actual temperature may be provided.)

Vacuum pump with analog gauge meter having range of -1 bar to 0 bar.

All required accessories like soldering! Desoldering attachments. Soldering bits of various sizes, magnifying glass etc. shall be provided.



~~18.~~ **Potentiometer/Rheostat**

SLNO:13

Wire wound continuously variable rheostat/potentiometer shall be provided. Sliding part & brush shall be rated to withstand the current flowing. Insulation resistance shall be more than 5 M ohms at 500 V DC between the terminal and case.

Quantity : 2A : 2 Nos. (5000 Ω)
5A : 2 No. (47 Ω)
2A : 2 No.. (470 Ω)
10A: 2 No. (470 Ω)
2A : 2 No. (2200 Ω)

SLNO:14

~~19.~~ **AC Thermometry Bridge**

This instrument shall be based on bridge technology and shall have three input channels to support : PRT, Thermistor and Thermocouple. Instrument shall have feature like Touch Screen, Zero Drift and Data Logging facility.

Parameter	
Accuracy (25 Ω SPRT)	0.5 ppm
Accuracy – RATIO 0.95 to 1.05 ratio	0.125ppm
Probes Supported	PRTs, Thermistors & Thermocouples
Channels	3
Resolution – milliK, nV	0.01millik, 10nanoV
Stability – ppm / yr.	0
TC (resistance ratio) – ppm/degC	0
Resistance Range - kohm	0 – 500kohm
Voltage range	+/- 125mV
Current Accuracy - %	$\pm 0.4\%$
Keep-Warm Current	Adjustable 0-10mA each channel,
Internal Resistance Standards – ohm	1, 10 ohm (TCR 0.6ppm/degC and 5ppm/year stability) 25, 100, 400 ohm (TCR 0.3ppm/degC and 5ppm/year stability)
Measurement Time – sec	1
Units	Ratio, V, Ω , $^{\circ}\text{C}$, $^{\circ}\text{F}$, K
Switching Technology	Solid-state
Other features	Temperature conversions : PRT's (ITS 90, Callendar-Van Dusen), Thermocouples (IEC584-1 1995), Thermistors (Steinhart-HART) Ratio range : Unlimited Interfaces : RS232, GPIB, USB Data storage – Internal Display Large 163mm/6.4 colour TFT LCD.



SLNO:15	<u>22.</u> Stop Watch	
	Type	: Handheld, non- magnetic bevelled movement with two hands
	Resolution	: 1/5 seconds
	Range	: 30 minutes
	Display	: Analog & Digital both



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~~27.~~ **mV Calibrator**

SLNO:16 This instrument shall provide an accurate and reliable measure of millivolt thermocouple signals and shall generate millivolt signals for calibration of receiver type instrumentation. The instrument will contain built in electronic null detector and standard cell. Manual/automatic reference junction compensation shall be provided for thermocouple measurements. The instruments shall meet or exceed the following requirements:

Input range – selectable : 0 – 10 mV DC
0 – 200 mV DC
Output range – selectable : 0 – 10 mV DC
0 – 200 mV DC
Protection : 0 – 200 mV DC
Accuracy : 0.05% for 100% range
Ambient temperature : 0 – 50°C
Ambient temperature error : 0.02% of span from 0 – 50°C

~~28.~~ **mA Calibrator**

SLNO:17 This instrument shall provide an accurate and reliable measure of milliamp signals for use in calibrating receiver type instrumentation. The instrument shall be powered by a self-contained rechargeable battery pack and shall include a battery charging circuit which operates automatically when the instrument is connected to a 240V AC supply. The instrument shall be designed to operate from a 240V AC, 50 Hz supply with the battery pack removed. The instrument shall meet or exceed the following requirements

Input range – selectable : 0 – 10 mA
0 – 100 mA
Output Range – selectable : 0 – 10 mA
0 – 100 mA
Protection : 100% range
Accuracy : 0.02% of selected span
Ambient temperature : 0 – 50°C
Ambient temp. error : 0.05% of span

~~29.~~ **Thermocouple Calibrator**

SLNO:18 Thermocouple calibrator shall be capable to accept all types of thermocouples (type J,K,T,E,R&S). Calibrator shall have digital LCD display and shall operate from built in battery source. This shall be capable of both measurement and calibration mode of operation. Cold junction compensation shall be built in

Accuracy : Measure : 0.5deg C for K Type T/C
between (-)150 to 750 deg C; 1.0deg C for
R/S Type T/C between 400 to 1750 deg C;



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Simulation	:	0.4deg C for T Type T/C between 0 to 400 deg C; 0.4deg C for K Type T/C between 190 to 1250 deg C; 0.4deg C for R/S Type T/C between (-)50 to 800 deg C; 0.5deg C for T Type T/C between 150 to 400 deg C;
Ambient temperature	:	50°C (max.)
Temperature effect	:	0.01% per degree C or better
Power supply	:	240V AC 50Hz with built in Rechargeable battery for field operation
Voltage protection	:	Equipment shall be protected against external voltage upto $\pm 110V$ DC
Accessories	:	i. Carrying case ii. Connector leads iii. Extension cable iv. calibration certificate v. Battery with charger vi. Instruction manual

30. RTD Calibrator

SLNO:19

RTD calibrator shall be capable to accept 2, 3 & 4 wire platinum resistance thermometers of 100 ohms and copper resistance thermometer of 53 ohms. Calibrator shall be digital LCD display and shall operate from built in battery source. This shall be capable of both measurement and calibration mode of operation.

Accuracy	:	$\pm 0.25\%$ of full scale $\pm 0.05^\circ\text{C}$ or better
Ambient temperature	:	50°C (max.)
Temperature effect	:	0.01% per degree C or better
Power supply	:	240V AC 50Hz with built in chargeable battery for field Operation
Voltage protection	:	Equipment shall be protected against external voltage upto $\pm 110V$ DC
Accessories	:	i. Carrying case ii. Connector leads iii. Extension cable iv. calibration certificate v. Battery vi. Instruction manual



~~33.~~ **Multi Function Calibrator**

SLNO:20

The portable unit is intent to measure electronic transmitters, RTD's, Thermocouples and act as a source for calibration of secondary instruments and system inputs. The instrument shall be digital LCD display and shall display simultaneously both input measured value and output signal. Multi meter shall be small stream lined shape, MAKES IT EASY TO CARRY. It shall be rugged, reliable design stand up to field use. It will be easy to read measure/source screen and view input and output simultaneously.



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Data entry shall be through numeric entry function keys. Instrument shall have built in diagnostic and auto calibration facilities & shall also be capable of measuring voltage, current, thermocouples, RTD's & frequency and stimulation of corresponding primaries including two wire transmitters.

Accuracy	: $\pm 0.025\%$ typical
Thermocouple	: Type J,K,T,E,R&S
RTD	: Pt-100 Ohms
Volts	: 0-10V, Resolution 0.2 mV
Millivolts	: -10-120 mV, Resolution 2 Microvolts
Current	: -5-60m Amp Resolution 1 micro amp.
Ohms	: 0-4000 Ohms
Frequency	: 120-50 KHZ
Power supply	: 240V, AC 50 Hz
Common Mode rejection	: 80 db at 60 Hz or better
Normal mode rejection	: 40 db at 60 Hz or better
Linearity	: ± 0.005 percent of span
Repeatability	: ± 0.005 percent of span
Ambient temp.effect	: ± 0.005 percent/deg.C
Long term stability	: ± 0.00025 percent/100 hr non-cumulative
Ambient temperature	: 50 deg.C
Input protection	: Upto 140V DC
Input/output isolation	: 300V DC, 50 M Ohm

Calibrator shall be furnished with RTD simulation facility, external charged battery pack, test leads, set of fuses, instruction manual. In addition one set of spare battery pack as well as charger for spare battery pack shall be supplied with each instrument. Unit should also perform calibration automatically on HART protocol transmitters.



SLNO:21 ~~35.~~ **Digital Insulation Tester**

Measurement - up to 100 Mega ohm at 500 V
Accuracy - 0.5% of reading over the range

~~36.~~ **Sound Level Monitor (Type I)**

SLNO:22 Sound level range : 50-100 dB, 80 to 130 dB
Resolution : 0.01 inches/sec.
Frequency Range : 20 Hz – 8 KHz
Vibration Meter Range: 0.05 to 3.93 inches/sec. At 10 – 1000 Hz
Display : LCD Digital Type
Accessories : Rechargeable Batteries, Software,
interfacing cables & Ports



39. Portable Analogue & Digital Vibration Meter

SLNO:23

This instrument shall measure vibration of machinery in terms of displacement, velocity and acceleration. Power supply shall be by self contained replaceable /rechargeable batteries & chargers.

Displacement Range : 0 to 3000 microns peak to peak.
Velocity range : 0 to 3000 mm/sec.
Acceleration range : 0 to 100 g's.

The instrument shall be furnished complete with vibration pick-up, straight probe. Carrying case and one meter cord for connecting pick-up to meter. Vibration Meter shall be of digital and analogue type separately. One extra cable of 10 meter long connecting the sensor & Electronic unit to take vibration measurements of vertical pumps to be supplied.

Note: Analogue meter is used to find out any vibration due to electrical problem in the motor by measuring the transient vibration.

40. VIBRATION/ SHOCK PULSE ANALYSER cum Data Collector cum Balancer

SLNO:24

Type : Portable type dual channel.

Frequency Range : DC and 1 Hz to 50 KHz.

Acceleration Input : 21 to 1,500,000 cpm
120 to 1,500,000 cpm

Velocity Input : 21 to 1,500,000 cpm
120 to 1,500,000 cpm

Displacement Input : 21 to 1,500,000 cpm
1500 to 1,500,000 cpm
120 to 1,500,000 cpm

Voltage Input : 30 V DC (Aux. 2 I/P)
5 V DC (Aux. 1 I/P)

Power : 240 V AC and 6 volt, 2.4 A hr rechargeable battery
Min. operating time - 6.5 hrs.

Environment : Operating temp. Range -18°C to 60°C



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- Output : Relative Humidity : 0-95% non condensing
Splash: Resistant, sealed case
: RS 232 C port with HART for communication to OWS/Laptop.
- Accessories : As required with complete software. , carry case & each type of cables with one set of extra cables, Adaptor, rechargeable battery, chargers etc.
- Application : Analyzing bearing condition, measuring machine vibration & checking of rotational speed.
- Type of Measurement : Acceleration, Velocity, Displacement, Phase, FFT, CPB, HFD spectrum, Temperature, Thrust, Axial position etc. with auto ranging in RMS, peak to peak, bearing fault analysis feature, balancing kit for in situ dynamic balancing and required software for 1 plane, 2 plane balancing, route generation and maintenance facility with off route data collection and analysis.
- Averaging Type : Linear, Exponential, Peak Hold
- Memory : Internal & Flash Memory (Minimum 512 MB).
- The Analyser shall be able to perform easy condition monitoring of equipment with high resolution of 12,800 lines, high accuracy of 0.01% of measured value & high speed of processing of 16bit (96db) dynamic range using the latest technology.
 - The Analyser shall be provided with data collector as an integral part of the instrument, which is capable of collecting various user defined data.
 - The Analyser cum data collector shall also be provided with Predictive maintenance software which shall store and manipulate data. Also user defined upload communication and down loading data to condition monitoring software shall also be provided.
 - Frequency ranges shall cover all machinery speed and high frequency multiples 1 Hz to 50KHZ.
 - Units - Metric, English, db.
 - Test Signal - Internally generated test signal to operate on AC, or battery power to check complete circuit operation. Also routine calibration check facility shall be provided.
 - Temperature Range - 0-60°C on both AC power and on battery outputs
 - Outputs and signal processing
 - RMS, peak, peak to peak and DC meter type



- Linear, exponential, RMS and peak hold averaging.
- X axis scale - HZ, CPM
- Y axis scale - lin, log, DB
- Digital/Analog amplitude and frequency meter with digital display of measurement.
- Instrument should have facility for upgradation in future with any hardware change.
- **Software Specification**
 - (a) The software shall be compatible with Microsoft Windows latest software, support network & mouse operation.
 - (b) The software shall be menu driven and shall also provide specific help message for all menu items. It shall have popup windows and icons that guide the user throughout the modules.
 - (c) The software shall support fully the relational data base server and able to integrate any front end tool (which support open data base connectivity) with the database Also the software shall have full feature of Active-X object and analysis of harmonics over a range of speed of instrument.
 - (d) It shall be able to generate exception report, out of alarm report, Band exception report, trends and custom made reports.
 - (e) Software shall be able to perform the various type of data plotting & display like cascade spectra, frequency spectrum, time vs amplitude plot form, overall trend, spectral comparison, spectral alarm etc.

~~41.~~ **Decade Resistance Box**

SLNO:25

This should be three nos. analog type decade resistance box with resistance range of 1 ohm to 1.2M ohm, $\pm 1\%$ accuracy, all resistors rated to 0.75W, and shall use stable metal film resistors with complete electrostatic screening. This shall be supplied with certificate traceable to National /International Standards.

This shall be two nos. digital type decade resistance box with resistance range of 1 ohm to 1.2M ohm, $\pm 0.05\%$ accuracy.

One no. digital type variable Decade resistance Box, shall be provided as an accurate resistance source for calibration of RTD elements and receiver devices. The range shall be 0-100 ohm with increments of 0.001 ohm. Accuracy shall be $\pm 0.05\%$ or better.

SLNO:26

~~42.~~

LAN/ Coaxial Cable Meter/ Tester



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This portable unit is used to check the quality of cable and test and troubleshoot coaxial and twisted pair cable in Local Area Network (LAN) installations. It shall be powered by standard AA alkaline battery allowing minimum 8 hour of operation. The cable meter shall meet the following requirement as minimum.

- (a) Display : Backlit LCD Display for observing result in sheet dark environment and emit audible tone to assist in pass/fail indication.
- (b) Test Standard : IEEE-802 & EIA/TIA 568
- (c) Range : For unshielded twisted pair (UTP) - 6 to 600 m

For shielded twisted pair (STP) - 6 to 600 m
- (d) Accuracy : For Coaxial cable - 6 to 1200 m
6 m to 60 m - ± 0.6 m
60 m to 1200 mm - $\pm 1\%$
- (e) Resolution : 1 m
- (f) Storage : allows storage of 400 complete test results for printing
- (g) Near end cross talk : 0 to 50 db
(Next TP only)
- (h) Characteristics : TP Cable 75 W - 180 W
impedance range Coaxial - 40 W - 120 W
with accuracy of ± 10 W
- (i) Accessories : Carry case, printer cable, battery & instruction manual.



44. EARTH RESISTANCE TESTER

SLNO:27

The unit should meet safety requirements as per IEC61010-1:1990 and feature:-

- i. It shall be able to measure earth resistance of various earth installations and the resistance of low resistance conductor.
- ii. Suitable to test earth resistivity and earth voltage.
- iii. 3 1/2 LCD Digital Display
- iv. It shall be able to operate with the minimum influence from earth voltage.
- v. Low power consumption and powered by batteries.
- vi. Low batteries indication.
- vii. If the testing current has no return loop or the resistance value of auxiliary resistance exceeds the upper limitation, a display indication shall be available
- viii. Dust-proof and damp-proof construction suited for outdoor use.
- ix. The unit shall be supplied complete with test leads (red, yellow, green, black - each 1.5m), Two bars, Test wires (20m & 40m), Instruction Manual, Carry-case, Screw driver and other accessories as required.
- x. Earth Resistance Test
 - a. Measuring Ranges : 0.00 to 19.99 Ω , 20.0 to 199.9 Ω and 200~1999 Ω
 - b. Accuracy : Base Error $\pm$ (5% of reading $\pm$ 2d) Error from earth voltage $\pm$ 2% ACV 50Hz $\leq$ 5V
- xi. Earth Voltage Measurement



- a. Measuring Ranges : 0.00 to 19.99V
- b. Accuracy : $\pm$ (5% of reading + 2d)
- c. Insulation Resistance : $\geq 20\text{M}\Omega$ (500V)
- d. Withstand Voltage : AC 1.5kV 50Hz 1min
- e. Power Supply : 1.5V (R6 or AA) batteries/
rechargeable batteries.



SLNO:28

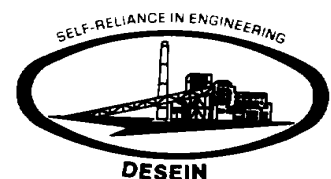
~~48~~**Fiber Optic Testing Tool Set**

- a. Source and Power Meter – Optical Loss Test set (OLTS)
- b. Reference Test Cables
- c. Fiber Tracer and Visual Fault Locator
- d. Optical Time Domain Reflectometer (OTDR)
- e. Cleaning material like Lint free Cleaning wipes.
- f. Optical Fibre Cable Joining Kit.

SLNO:29

~~50~~**Tong Tester**

Electronic type tong tester shall be suitable for measuring the current range of 0-5/10-15/30 Amps AC and DC. Auto ranging and 3 ½ LCD facility shall be available. It shall have swiveling joint between tongs and meter to facilitate easy reading.



51 Stroboscope

SLNO:30	Power Supply	:	240 V AC 50 Hz supply
	Display	:	4 ¹ / ₂ Digital LCD
	Accuracy	:	±0.1%
	Low range	:	100-1000 rpm.
	High range	:	100-10000 rpm.
	Sampling line	:	1 sec or better
	Flash tube	:	Xenon lamp with Flash color white 6500K. with automatic flash control
	Accessories	:	Adopter, Rechargeable Batteries, Charger, case etc.

52 Auto Transformer

SLNO:31	Max. input voltage	:	250V, AC 50Hz, Single phase
	Max. output voltage	:	0-112%, Single Phase
	Rated current	:	20 Amp., Single Phase
	Max. input voltage	:	415V, AC
	Max. output voltage	:	470 V AC, Three Phase
	Rated current :	:	10 Amp., Three Phase
	Insulation resistance	:	Greater than 5 M ohm at 500 VDC
	High voltage test	:	1.5 KV
	Feature	:	Voltage scale around the voltage varying knob of auto transformer shall have white lettering and graduation as black back ground.

53 Test Temperature Detector**TEST RTD**

SLNO:32	Sensor type	:	Platinum resistance element, Three/Four wire type
	Outer Sheath material	:	Ultra High Purity Quartz
	Minimum Diameter	-	6 - 7.5 mm
	Minimum Length	-	650 mm
	Accuracy/Stability	-	0.03 °C
	Temperature range	-	0-1000 °C
	Accessories	-	Connecting cable, carrying case.



55. Overhead Interactive White Projection board

SLNO:33

Two Nos. of overhead projection board (Interactive White Board) with complete accessories, software i.e one for conference room at service building & one for training room shall be provided by bidder. These boards shall act as I/O device from/to the desktop computer or laptop computer.

These Interactive white boards shall be provided with following minimum features

- a. Two (2) nos. of USB port required for interfacing with PC/Laptop.
- b. Screen size 79" or better.
- c. Hand writing recognition with multi touch function
- d. Scroll down facility with wireless facility enabled.
- e. Remote conferencing enabled
- f. Should support OS: Windows, Mac and Linux
- g. Accessories as Stylus Pens & erasor including one spare set, VGA cable, wall mount brackets etc.
- h. Minimum 1 KVA industrial grade UPS with 60 minutes Ni Cd battery backup for each overhead projection board.

56. Projector with white marker board.

SLNO:34

One no. projector with white marker board size of 80" shall be provided by bidder for conference room at Administrative building. The projector will be have following minimum features

DLP/LCD based technology, Minimum 3000 lumens, minimum contrast ratio 400:1, uniformity of minimum 90%, with wireless adapter, USB port, with in-built speaker, able to provide Full HD view, motorized zoom & focusing, Optional lense in built for short & long throw, auto image feature depending upon input, with universal inputs like VGA, S video input, Composite video, IR, Audio, etc and Network capability.

57. Portable pH Calibrator/Simulator

SLNO:35

To Check & calibrate the pH analysers/measuring equipments, compact portable pH simulator/calibrator with LCD digital display shall be supplied by bidder.

Range	:	0-14 pH in steps of 1 pH
Accuracy/Resolution	:	+/- 0.01 pH
Temp. Coeff.	:	0.001 pH/Deg c
Power Source	:	Built in chargeable Nicd battery with battery



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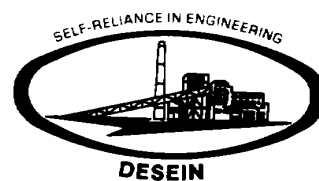


Accessories : Check switch and indicator.
Connector leads, Carrying case etc.

SLNO:36 **59** **Logic Probe**



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Logic probes shall be furnished to test the computer systems. It shall operate in pulse & normal mode. It must be capable of testing all digital logics such as CMOS, TTL; DTL etc. logic probes are envisaged to check the status of the binary logic modules. These shall be LED with current limiting resistor etc. with each of the logic probe. The LED shall glow whenever test point is touched by the probe and logic. 'I' shall be present at the test point. Logic probe shall be protected from overload and shall have pulse stretching facility. Pulse repetition frequency upto 80M Hz for TTL and 40M Hz for CMOS circuits. Types of logic probe necessary shall be guided by the types of binary logic supplied by the Bidder.

60 Marker Printers:-

SLNO:37

For Printing of silicon and halogen free labels of Polyamide, marker printers with high-speed UV hardening technology shall be provided by bidder. The printing method is based on a printhead with a LED UV Unit for hardening the fluid. The Labels printed with UV technology can with stand temperature from - 40°C to 120 °C. The Printers shall be capable of printing various types of printing suitable for Cable marking, terminal marking and equipment marking. The printer should come with software that supports all types of printing used of marking. All software shall be loaded in separate operating station.

Marker Printers with High-speed UV hardening printer shall comply standards like DIN EN ISO 1043-4, DIN EN ISO 4892-2 AND DIN EN ISO 60068, DIN EN ISO 175, DIN 50018, DIN EN ISO 2409, IEC 60947-7-1/2, IEC 60068-2-11/52 and EN 60464-2:-2001 etc.

Accessories:

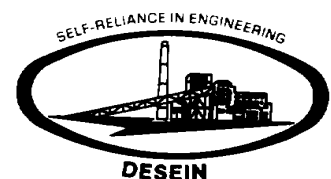
- i. Terminal marker card for 5mm, 6mm, 8mm & 10 mm Pitch (250 No. Each)
- ii. Wire Marker Card for wire diameter 1.9mm, 2.1mm, 2.9mm 3.1mm 3.6mm, 4.4mm, 4.9mm, 5.6 mm 7.5mm and more than 7.5mm. (250 No. Each)
- iii. Equipment Marking Card with carrier (200 No.).
- iv. Ink Cartridge for Printing above material (25 Nos.)"

61. D.C. Regulated Power Supply

SLNO:38

Bidder shall supply D.C. Regulated Power Supply designed with latest state of the art electronic and IC technology. D.C. Regulated power supply shall have the following features:

01. Voltage Range : 0 to +60V DC, 5 Amps. (Floating)
(Continuously adjustable)
02. Voltage/Current Range meters : 0-60V/0-10 A
03. Display : LCD
04. Meter Accuracy : +/- 2% FSD
05. Power Supply Connection : 240V AC, 50 Hz.
06. Output Impedance : 50 Ohm or less.



- 07. Load Regulation : 0.1% variation in voltage
0.2% variation in current
- 08. Drift in 8 Hours : 0.1% variation in voltage
0.2% variation in current
- 09. Ripple and Noise : Less than 1mV
- 10. Setting Resolution : 20mV / 20mA
- 11. Temperature Coefficient : 0.05% per Deg.c
- 12. Accessories : Test cords and clips are required.
- 13. Power supply shall be short circuit proof and crowbar protected.

64 Portable Multi-Function Counter

SLNO:39

64.1 The bidder shall furnish crystal-controlled oscillator based, dual channel multi-function counter to measure frequency, period, frequency ratio, time interval and unit count. The equipment shall be complete with test leads, spare fuses and all other accessories.

64.2 This instrument shall meet the following requirements as a minimum :

a) Ranges:

- i) Frequency : 5 Hz to 150 MHz
- ii) Period : 0.5 m sec. to 200 m sec.
- iii) Count : 0 to 99,999,999
- iv) Totalizer Function: 5 Hz to 10 m Hz sine wave



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- b) Accuracy for frequency/ : ± 1 count + time base error
period measurement
- c) Resolution:
- i) Frequency : 0.1 Hz at frequency below 10 MHZ
: 0.5 Hz at frequency above 10 MHZ
- ii) Period : 100 p sec. to 100 n sec. in decade steps
- d) Line Voltage Stability : $< \pm 1$ ppm with 10% line voltage variation
- e) Oscillator Temp. Stability: ± 10 ppm for 0-50°C
- f) Display : 8 digit
- g) Power Supply : 240 VAC, 50 Hz

65 Portable Conductivity Meter

SLNO:40

To Check & calibrate the conductivity analysers/measuring equipments, compact portable conductivity simulator/calibrator with LCD digital display shall be supplied by bidder.

- Range : 0.001 micro siemens/cm to 1000 mS/cm
- Accuracy : ± 0.01 micro Siemens/cm of reading
- Resolution : ± 0.01 micro Siemens/cm
- Temp. Coeff. : 0.00 to 10.00 %/Deg c
- Power Source : Built in chargeable Nicd battery with battery Check switch and indicator.
- Lab OWS connectivity: Yes
- Range Mode : Auto mode, Fixed mode. .
- Accessories : Connector leads, Carrying case etc.

66 VIBRATION PICK-UP TESTER

SLNO:41

Instrument shall be suitable for testing of both non contact and seismic probes supplied by the machine monitoring instrument supplier. Shaker table to simulate the required vibration levels so as to check and validate the vibration pickups is to be supplied.

67. STABILISED POWER SUPPLY

SLNO:42

Bidder shall supply stabilized power supply designed with latest electronics and IC technology. It shall have the following minimum features.

- Voltage Range : 0-230/240V AC, continuously adjustable.



Power supply consumption	:	240V AC, 50 Hz
Indication	:	Meters indicating voltage and current shall be integral with power supply
Load Regulation	:	0.25% variation in voltage

68. CONTINUITY TESTER

SLNO:43

Continuity tester shall be electronic and battery operated. A hooter shall be provided which will sound when continuity detected. Tester shall be supplied with battery charger, lead wires and probes. The tester shall be kept in a carrying case.

69. Optical time Domain reflectometer

SLNO:44

1. A recording optical time domain reflectometer (OTDR) will be utilized to test for end-to-end continuity and attenuation of each optical fiber. The OTDR shall be equipped with data storage (1 GB internal flash memory min.), printer, help feature, compare trace features and OTDR software. The data storage unit must include a built-in memory drive capable of storing a minimum of 100 test traces. Display shall be colored 6 inch TFT minimum. OTDR shall have built in power meter & visual fault locator.

Safety Class: - Class I FDA 21 CFR 1040.10 & 1040.11, IEC 60825-1:2007-03

Test Mode: - OTDR (Full auto, Expert Real Time), Auto test, OPM, OLS, VFL, DFS (Digital Fiber scope).

Application:-

- i. Automatic Pass/Fail Analysis (TIA/ISO/EN)
 - ii. Bi directionally measure loss and length of fiber links.
 - iii. Tier 1 & Tier 2 testing of networks.
2. Data traces saved to disk shall include the following labels.
 - a. Fiber Identification (ID) with a minimum of 10 characters.
 - b. Cable ID with a minimum of 10 characters
 - c. OTDR location with a minimum of 20 characters
 - d. Far End location with a minimum of 20 characters.
 - e. Test operator initials with a minimum of 3 characters.
 3. The printer shall preferably be internal. The printer shall be able to print data traces within 30 seconds or less. The machine setting used to repeat tests at a later time shall include index, range, wavelength, average time, pulse width and scale settings. The test results (on printout) shall provide information including: loss, distance, reflectance, data and time.
 4. The requirements for the compare trace feature include the ability to recall two historical traces from a diskette and display them simultaneously for analysis and printing. The compare trace must compute and display a



single graph representing any differences between two traces. The compare trace must be able to recall historical traces from a discrete and perform the same tests on connected live fibers. The compare trace shall perform a two point loss measurement test for any two particular fibers in a comparison analysis. The losses between the two points on the each fiber shall be displayed, and the differences between the two readings clearly shown.

5. The OTDR must be equipped with software to support all of the required functions. The software shall provide for printing of whole set of traces (batch print) with minimal commands eliminating the time spent for printing traces individually.
6. Bidder shall provide all mounting accessories, cables and connectors required to establish data communication.
7. Power supply – Rechargeable batteries for 7 hours operation as per Telcordia (Bellcore). Universal type AC/DC Adaptor.
8. Interfaceing - USB ports, RJ-45 LAN ports, Fiber inspection probe connector port, Built in Bluetooth & wifi.
9. Accessories – Fiber inspection probe, carrying case, USB mouse,

SLNO:45

71 Resistance Thermometer Bridge

RTD elements and receiver instrumentation. The instrument shall be powered by internal battery and shall be provided with a galvanometer. The instrument shall provide automatic lead wire compensation for measuring the resistance of typical 3- wire and 4 – wire RTDs. This shall include coarse and fine control knobs. Instruments shall include safety switch and all necessary accessories.

The instruments shall meet the following requirements as a minimum.

- | | | |
|----|------------------|--------------------|
| a) | Resistance Range | 0-500 ohms |
| b) | Resolutions | 0.0001 ohms |
| c) | Accuracy | ± 0.01% of reading |



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72 Decade Capacitance Box

SLNO:46

The variable capacitance device shall provide an accurate capacitance source for different purposes.

The equipment shall meet the following requirement as a minimum.

- | | | |
|-----|--------------------------|--|
| (a) | Range | 100 pF to 10 Micro F
in steps of 100 pF |
| (b) | Residual capacitance max | 20 Pf |
| (c) | Accuracy | $\pm 1\%$ |
| (d) | Operating voltage upto | 100V dc |

73 Decade Inductance Box

SLNO:47

The variable inductance device shall provide an accurate Inductance source for various purposes as a minimum. It shall meet the following requirement as a minimum.

- | | | |
|-----|---------------------|--------------|
| (a) | Range | 1 mH to 10 H |
| (b) | Accuracy | $\pm 2\%$ |
| (c) | Residual Inductance | < 0.5 mH |
| (d) | Operating Voltage | 240 V |

74. Clip-on AC Power Meter

SLNO:48

This instrument is envisaged to measure true rms voltage, current and power without shutting down or disturbing running devices. The instrument shall meet the following requirement as a minimum.

- | | | |
|----|----------------|---|
| a) | Range : | 20-600 V rms, 0.2-20 A rms, 0.2-20 KW |
| b) | Display : | 3.5 digit LCD |
| c) | Power Source : | Built in Batteries |
| d) | Accuracy : | (+1% of reading +0.5% of range) |
| e) | Accessories : | Test leads, carrying case and other necessary accessories |

Test leads, carrying case and other necessary accessories shall also be provided.

SLNO:49 75. Portable High Speed Trend Recorder

- 75.1 The portable high speed trend recorder shall be provided for recording purpose during commissioning and for optimisation of various automatic control loops.

The trend recorder shall be flat bed desk top type with the following features as a minimum:



- | | | | |
|----|-----------------------------|---|--|
| a) | Number of Channels | : | 6 independent channels for analog signals. |
| b) | Input Signal Type | : | 0/4 - 20 mA
0/1 - 5V dc
0/1 - 10V dc |
| c) | Recording | : | Continuous, different colour ink for each channel (Fiber tip recording shall be preferred). Facilities of digital & analog printout shall be provided. |
| d) | Accuracy | : | $\pm 0.5\%$ of span |
| e) | Temperature Drift | : | 0.05% of FS/Deg. C. |
| f) | Chart Speeds | : | 60 cm/min. to 1 cm/Hr. switch Selectable in minimum 12 steps. |
| g) | Recorder Electronics | : | Microprocessor based with plug in modules for easy maintenance. Built in electronic signal limiter to prevent damage to pens upon off scale signal. |
| h) | Power Supply | : | 240 V AC, 50 Hz, single phase |
| i) | Power Supply Cable | : | At least 30 meters |
| j) | Trolley with Wheels | : | To be provided |
| k) | No. of Chart Rolls | : | Minimum 100 to be provided |
| l) | Ink Capsules of Each Colour | : | Minimum 20 for each colour to be provided |
| m) | Transparent Enclosure | : | To be provided. |

75.2 If separate signal conditioning cards are employed for different input signal ranges, at least two numbers of each type to match input signal ranges shall be provided. If separate calibration cards are employed, one number of each type shall be provided.

50. LAB WORKSTATION , A3/A4 B/W DIGITAL LASER PRINTER CUM COPIER AND LAPTOP

All the calibration instruments shall have a common WORK STATIONS along with A3/A4 sized B/W Digital Laser jet printer cum Copier for calibration and report generation. One no. lab laptop shall also be provided by bidder. Specification for WORK STATIONS, Laptop and Printer shall be same as specified elsewhere in the specification.

(REFER SPECS GIVEN)



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4.03.03.04.01 Specifications for Operator Station, Engineering Work Stations

Each operating station & Engineering work stations and any other work stations/PC envisaged in the plant shall meet the following minimum requirements & as per latest trends at the time of supply:

- On board Intel – Xeon quad core, 3.46 GHz latest processor with 1066 MHz bus with Hyper threading or higher.
- 8 GB DDR3 RAM (min.)
- 1 x 1000 GB IDE Hard Disc Drive of 7200 RPM or higher
- 2048 MB Graphic Accelerator
- System chipset: Intel Express
- 2 x RS – 232 ports
- 1 x parallel port
- 4 nos. USB 3.0/2.0 or latest version ports. (2 nos. on front side)
- 1 x 52X DVD/CD Read Drive
- 16 X DVD R/W Drive
- 2 x Ethernet (10 / 100 / 1000MB) cards (Industrial Grade)
- UXGA graphics and monitor 1920 X 1080, 256 colours with MRPII compliant, viewing angle 178° vertical & Horizontal and fastest response time.
- 1 x windows 7/8/10 Professional or latest & proven version of Windows OS professional with Multimedia
- Ethernet adapter
- Third party operating system, graphical users interface and software, if required.
- 2 nos. graphic output crads minimum
- Optical mouse
- Sound card
- Internal speakers
- Wireless internet & Blue tooth Interface
- Redundant power supply (In built)
- General MS Windows latest, MS-Office Professional, Adobe Acrobat, anti-virus McAfee or equivalent, AutoCAD etc.
- Application engineering & HMI software - to suit project Specific requirement
- All OWS shall be interchangeable

Preferred makes of OWS/EWS/PC's are DELL, HPCOMPAQ, NEC & IBM.

4.03.03.04.02 Peripherals for Operator Station, Engineering Work Stations & Server System**4.03.03.04.03 Full flat Monitors with LED back lighting**

The bidder shall furnish OWS/EWS/Servers/PC with coloured Full flat Monitors with LED back lighting. OWS/EWS/Servers/PC with Monitors shall have a fast cursor control device like a track ball/optical mouse. All Monitors shall be of high



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resolution colour graphics type and with not less than 32 colours. The picture frequency shall not exceed 85 Hz. The resolution required is 1920 X 1080 pixel or better. The picture shall be stable and completely free of any flickering. The screen illumination shall be enough to give good readability. The screen dimensions shall not be less than 24" screen diagonal. The monitors shall be provided with USB and HDMI ports.

Antiglare hard coating shall be provided. High reliability and long life 24" (Industrial type) or better size monitors shall be supplied by the bidder. Monitors shall be equipped with all adjusting elements accessible on the front plate. Monitors with 3D capabilities for graphics shall be provided by bidder.

Monitors along with keyboard & optical mouse shall be mounted on supervisory control console specified elsewhere in the specification.

4.03.03.04.04 Key Board:

Functional key boards for plant operator station shall be of special type adopted to operation tasks and monitor functions. It shall contain all keys necessary for plant operation arranged in an ergonomically manner. Multi function keys shall be provided with automatic display for modified functions. Freely programmable keys (Minimum 101) shall be available for special user application.

Key Board shall be integrated into supervisors control consoles horizontal part.

Provision of functional keyboard shall be in addition to facility for operator control through mouse/track ball.

Membrane type keyboard shall be provided for operator interface with process for plant control and display functions to access plant data in conjunction with control OPERATING STATIONS. Membrane keypad shall be assignable with LED alarms, dedicated display selection keys with spare provision, hardware locking facility to set OPERATING STATION in engineer, supervisor or operator mode. The keyboard shall have a minimum of 101 configurable keys for assigning most frequently used displays. A minimum of forty of those keys shall have two independently lit LED's used for event-specific alarm annunciation.

Keyboard shall be provided to enable the shift supervisor to develop graphic displays, control system software and system configuration for the DDCMIS. It shall be possible to perform operating interface functions from engineering OPERATING STATION. Assignable function keys shall be provided for execution of command, program etc. Hardware facility shall be provided to set OPERATING STATION in engineer or operator mode. QWERTY type keyboard shall be provided for engineer's functions. QWERTY type Key Board may be offered alternatively for OWS.

4.03.03.04.05 PRINTERS



Line Impact Heavy Duty Dot Matrix Printers

All printers shall be low noise (less than 45dB at a distance of 1 meter from the printer) type with a minimum of 132/136 columns. Printing speed shall be a minimum of 300 characters per second. Since the control room printers are high-speed printers, the system shall output to these printers at the rate of 1000 lines of printout per minute as a minimum. This rate shall be independent of the number of printers in simultaneous operation. Style of printing available shall be indicated by the Bidder. The printers shall have graphic capability and any OPERATING STATION display may be printed on the printer. The printing shall be bi-directional and in two colours black and red for sequence of event recording. Paper input capacity shall be with continuous paper feed.

Printers shall accept and print all ASCII characters via an E.I.A. RS-232 C or twenty milliamp current loop interface. Parity checking shall be utilized.

All printers mounted shall be provided with a separate printer enclosure each if noise level exceeds 45 dB. The enclosures shall be designed to permit full enclosure of the printers at a convenient level. Plexiglas windows shall be used to provide visual inspection of the printers and ease of reading.

Printer enclosures shall be designed to protect the printers from accidental external contact and each should be removable from hinges at the back and shall be provided with a lock at the front.

If one of the printers fails to operate, it's functions shall automatically be transferred to the other printer. Failure of the printer shall be indicated on all OPERATING STATION's. Printer shall be offered and supplied from reputed manufacturer with latest proven technology. 5 rims of papers of highest size (A3/A4 of the respective printer) shall be provided by bidder for each printer provided with subject plant.

Coloured Laser Jet printer

Printing Speed	20 ppm (min.)
Resolution	1200 X 600 dpi
Memory	128 MB (min.)
External Port	1 no. USB 3.0/2.0 port, and TCP/IP 10/100 Ethernet, Blue tooth interface
Duty Cycle	40,000 pages per month
Pages size	A3, A4, and Transparency etc. with automatic duplex printing facility.
	Minimum 16 colours to be provided.

Laser Jet printer (B & W)

Printing Speed	30 ppm (min.)
Resolution	1200 X 1200 dpi
Memory	128 MB (min.)
External Port	1 no. USB 3.0/2.0 port, and TCP/IP 10/100



Duty Cycle
Pages size

Ethernet, Blue tooth interface
15,000 pages per month
A4, A3, and Transparency etc. with automatic
duplex printing facility. Paper tray - 2

Ink Jet Printers (Coloured)

Printing Speed 30 ppm (min.)
Resolution 1200 X 1200 dpi
Memory 64 MB (min.)
External Port 1 no. USB 3.0/2.0 port, and TCP/IP 10/100
Ethernet, Blue tooth interface
Duty Cycle 5,000 pages per month
Pages size A4, Transparency etc.
Duplex printing Automatic

Five sets of print cartridges and Five reams of papers shall be provided with each printer provided anywhere in the plant by bidder with each DDCMIS, DCS & PLC system and any other system specified elsewhere in specification.

Preferred makes of printers are HP, Canon, Fuji Xerox, & Epson.

4.03.03.04.06

External DVD/CD Drive

The external DVD/CD drive is a back-up device. The external DVD/CD drive shall have read/write capability and shall be provided with all required hardware interface including error detection and correction facilities.

Features:-

- i. Supported Formats: DVD+R, DVD+RW, DVD-R, DVD-RW, DVD-ROM, DVD-video, CD-R/RW, CD-ROM/XA, CD-ROM, Audio CD, VCD, CD-I(FMV), Photo CD, CD-EXTRA, CD-TEXT
- ii. Write Speed: 8x DVD+R, 4x DVD+RW, 24x CD-R, 16x CD-RW
- iii. Read Speed: 24x CD-ROM, 8x DVD-ROM
- iv. Compliant with USB 2.0 High-Speed (480Mbps)
- v. Bootable on OWSS/Laptops
- vi. Memory buffer size: 2MB minimum.
- vii. Powered by an additional USB power cable for best speed. (Requires one more USB port available)
- viii. Can be powerless (only connected by the USB data cable).
- ix. Plug & Play and hot pluggable.
- x. Portable Design.

Five nos. Boxes of DVD (Re-writeable) shall be provided with each external DVD/CD drive provided.

4.03.03.04.07

Hard Copy Facilities



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The system shall be capable of copying hard copy of OPERATING STATION graphics through a video colour copier switch able to any OPERATING STATION.

The printer/copier offered shall be capable of copying OPERATING STATION image in 20 seconds.

4.03.03.04.08 USB Port Pen Drive

Twenty Five (25) no. USB Port pen drive per unit having 32 GB memory with read/write facility shall be provided.

Preferred makes of USB pen Drive are HP, Sandisk, Kingston, Strontium.

4.03.03.04.09 Scanner, Copier cum Printer (A3 size)

Resolution	:	1200 x600 dpi (optical) (min) for Printer 600 x600 dpi (optical) (min) for Scanner
Colour Depth	:	48 bit
Scaling	:	10 to 2000% in 1% increments
USB interface	:	required.
Memory	:	1 GB
Printing Speed	:	30 ppm (min.) for A4 size 20 ppm (min) for A3 size
Duplex printing	:	Automatic

4.03.03.04.10 DVD Writer

The DVD writer should be capable to read and write any DVDs as well as CDs. and shall be provided with all required hardware interface including error detection and correction. The DVD writer shall meet following minimum requirements:

- DVD write speed - 16x
- CD write speed - 52x
- Cache / Buffer size - 2MB
- Buffer under protection technology

Five nos of DVD (Re-writeable) shall be provided with each OWS/server provided anywhere in the plant by bidder with each DDCMIS, DCS & PLC system and any other system specified elsewhere in specification.

4.03.03.04.11 Digital B/W Copier cum Printer (A3 size)

01.	Type	:	Laser, tabletop / latest
02.	Printer Memory	:	512 MB (min.)
03.	Speed	:	Monochrome 30 ppm - A4 20 ppm – A3
04.	Resolution	:	600 x 600 DPI
05.	No. of color (Basic)	:	Monochrome
06.	Duty cycle	:	Monochrome more than 75000 pages / month



- | | | | |
|-----|-----------------------|---|---|
| 07. | Power supply | : | 240 V, 50 Hz, 1 phase UPS |
| 08. | Ambient temperature | : | 0-50° C |
| 09. | Humidity | : | 95% non-condensing. |
| 10. | Size of paper | : | Paper weight of 45 to 165 g/M ² |
| 11. | Networking Capability | : | USB / Ethernet |
| 12. | Coping | : | Max Original Size – A3, Continuous Coping (1-999) |
| 13. | Accessories | : | i) Adapters
ii) Connector Cable
iii) Duplex Unit. Automatic
iv) Optional Paper feeder- 2 Nos |

4.03.03.05**Laptop**

All the Laptop will also be used as pluggable temporary Engineering/programmer's station and operator station functionalities of the Engineering/programming stations mentioned in the specifications shall be provided (including requisite license).

- a) Intel Centrino™ Mobile Technology.
- b) Intel Core – vpro latest generation Processor with 3.46 GHz, 4 MB L2 cache, 1066MHz FSB.
- c) 14" WXGA LED Screen with wide angle viewing.
- d) 1000 GB 7200 rpm HDD with shock absorber.
- e) 8 GB 800 MHz DDR3 SDRAM (slot for 1no. additional RAM slot should be provided)
- f) 1 x windows XP/7/8/10 Professional or latest & proven version of Windows OS with Multimedia
- g) Slim type DVD-RW/DVD ROM combo drive.
- h) Internal 10/100/1000Mbps Ethernet card
- i) IEEE 802.11B connectivity port
- j) IR port
- Optical mouse
- k) 2Nos. USB 3.0/2.0 or latest version ports & Wireless INTERNET & blue tooth Interface.
- l) External mouse connectivity and optical mouse
- m) Minimum 8 hrs battery backup.
- n) Recovery software tools.
- o) Sound cards
- p) Internal speakers
- General MS Windows latest, MS-Office Professional, Microsoft Visual Studio, Adobe Acrobat, anti-virus McAfee or equivalent, etc.
- q) Application engineering & HMI software - to suit project specific requirement.
- r) Carry Bag, Power Adapter.
- s) 1024 MB Graphic Accelerator



Preferred makes of Laptop are DELL, HPCOMPAQ, VAIO (Sony), Lenovo.

4.03.03.06 General Specification of the server:

Enclosure	:	6U Rack Mountable server / Tower type Sever
Processor	:	Intel Xeon Six (6) Core 64 bit Processor capable 3.6 GHz with 16MB L3 cache memory per processor, Dual independent 1333 MHz system bus (2 way SMF) or better.
Memory	:	64GB ECC DDR – 3, 800 SDRAM
Video	:	Integrated with 64MB SDRAM
Resolution	:	1920 x 1080
Drives	:	HDD – RAID 5 (1000 GB) Ultra 320 SCSI adaptors with internal storage capacity 3.6 TB DVD/CDROM – 24X CD – RW/DVD IDE combo USB – 4 ports of latest version. DAT – 36 / 72 GB 4096 MB Graphic Accelerator
Peripherals	:	PS/2 keyboard Optical Mouse
Operating system	:	Windows 2008/2012 server version standard / latest Enterprise Edition or latest & proven version of Windows Operating system
Backup & Disaster Recovery	:	VERITAS \ CA \ Tivoli \ any other approved by owner.
Environmental	:	Operating Temp range – 10degC to 35degC Humidity range – 8 to 80% (Non-Condensing) Vibration 0.25 G at 3 to 300 Hz for 15 Minutes.
Software	:	General MS Windows latest, MS-Office Professional, Adobe Acrobat, anti-virus McAfee or equivalent, etc. Application engineering & HMI software - to suit project Specific requirement.
Miscellaneous	:	i. 1 Parallel port ii. 1 Serial port iii. 4 – 10/100/1000 MB/1GB network ports



12.03.00 Bill of Material:

S no.	Lab Instrument	MAKE	Quantity (nos/set)
1.	Electronic Test Bench	Tinsley/ Scandura - Itlay/ BEAMEX/ Isothermal Technology Pvt Ltd (ITPL)/Isothermal Technology Ltd (ITL).	1
2	Computer aided Calibration system with one no. OWS, Printer, laptop and Complete Software	Scandura, Itlay/ BEAMEX/ITPL/Time Electronics (Note- Make & specification of OWS & printer and laptop shall be same as specified elsewherein the specification).	1 set
3.	Portable Calibrator for Vacuum	Tinsley/ BEAMEX/Scandura/Eurotron/Druck/ Time Electronics / ITPL	1
3.	Portable Digital Multimeter (4 ½ digit)	Tektronix / Extech / Tinsley / Eurotron / Yokogawa / Scandura/ Fluke/Agilent/ Time Electronics / ITPL	15
4.	Digital Multimeter (Table Mounting Type)	Tinsley/ Scandura/ BEAMEX/HP(Agilent) /Tektronix/ Time Electronics / ITPL	4 (2 each for 5 ½ & 7 ½ digit)
6.1	U-Tube Manometer	Dwyer/Meriam/Tinsley/Fitser/Yokogawa/ ITPL	2 no. of each type.
6.2	Inclined -Tube Manometer	Dwyer/Meriam/Tinsley/Fitser/Yokogawa/ ITPL	2 no. of each type.



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7.	Test Manometer	Dwyer/Meriam/Tinsley/Fitzer/Yokogawa/ITPL	2
8.	Digital Manometer	Meriam/Tinsley/Fitzer/Yokogawa/Cole Parmer/ Beamex/ Time Electronics /ITPL/AOIP	2
9.	a. Dead Weight Tester b. Vacuum Tester	Tinsley/ Scandura/ BEAMEX/Budenberg/ Time Electronics / ITPL	1 no. each
10.	Standard Pressure Gauges	Ametek/Budenberg/Tinsley /Scandura/ Time Electronics / ITPL	2 no. each type with Hydraulic pressure gauge tester.
11	i. Microprocessor based Fluidized Temperature Bath ii.Low, Medium & High temp Portable Dry block type Calibrator	Scandura/ Tinsley/ BEAMEX/Jofra/Isotech	2 nos. for Microprocessor based fluidized temperature bath & for dry block type calibrator, 1 no. of each type & range.
5	RCL Bridge/Analyser	Fluke/Philips/Scandura/Tinsley/Agilent/WayneKerr/ITPL	1
6	In Circuit Tester	HP/Teradyne/AicoSet/Alfa/Agilent/Philips/ITPL/QMax/Estec.	1
7	Function Generator	Tektronix/HP/Tinsley/Yokogawa / Scandura/ BEAMEX/ITPL	1
8	Digital Oscilloscope	Tektronix/HP/Tinsley/Yokogawa / Scandura/ BEAMEX/ITPL	1
9	Tachometer	Biddle/Ametek/Extech/Tinsley/B&K/ITPL	2
10	Soldering iron 10 Watts 25 Watts 40 Watts	Soldron/ Heko/Xytronicx	3 (1 no. of each type)
11	Solder Sucker	Soldron/ Heko/Xytronicx	2
12	Soldering Desoldering station	Soldron/ Heko/Xytronicx	2
13	Potentiometer/Rheostat	Tinsley/ Scandura/ BEAMEX/ITPL	2A: 2 Nos. (5000 Ω) 5A: 2 No. (47 Ω) 2A: 2 No. (470 Ω) 10A: 2 No. (470 Ω) 2A: 2 No. (2200 Ω)
14	AC Thermometry Bridge	Tinsley (ASL)/ Scandura/ BEAMEX/Isotech/MI Canada/ITL	1no.
22	Mercury Thermometers	Tinsley/ Scandura/Brooklyn/Amarrell/ITPL	2 no. for each range.



23	Flow meter Calibrator 0 – 1000 mmwcl 0 – 6000 mmwcl 0 – 30000 mmwcl	Tinsley/Odin/Ametek/E&H/Fuji/ITPL	3 (1 no. for each range)
15	Stop Watch	EHI Eric Armin/Gralab/Casio	2
25	Digital Thermograph/Hygrometer	Extech/Rosemount/Brooklyn/Tinsley/ITPL	1
26	Portable Flue gas Analyser	Endee/Land/Bacharach/Hitech/Eurotron	1
27	Aneroid Barometer	Wallace/Tiernan/Brooklyn Novalynix/Transcat	1
28	Miscellaneous Items		
	Tool maker clamp jaw	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker	50 mm wide 1 100 mm wide 1
	Hand operated wire wrap tool	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker	1
	Trimmer & Alignment Tool Kit	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker	1
	Magnetic screw driver	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker	3
	SS & copper tube cutter/blender	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker	4
	Standard tool box	ITPL / Beamex/Scandura/RS components/Hitachi/Black& Decker, Phoenix	9
	Coil winding machine single phase motor driven to wind wires of dia0.001" to 0.036"	ITPL / Beamex/Scandura/Taparia/RS components/BMP equipments/Hitachi/Black& Decker	1
	Electrically operated wire wrap (0.2 mm to 1 mm)	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker	2
	Panel wiring tool kit	Wago, Phoenix, Weidmuller, ITPL	5
16	mV Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL	3no. (Portable) 1 no.(Table mounted)
17	mA Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL	6no. (Portable) 2 no.(Table mounted)
18	Thermocouple Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL/AOIP	2no. (Portable) 2no.(Table mounted)
19	RTD Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL/AOIP	1no. (Portable) 1no.(Table mounted)
33	Pressure & Diff.	Scandura/Tinsley/Eurotron/Yokogawa/	2 no. (Portable)



	Pressure Calibrator	BEAMEX/Time Electronics / ITPL	2 no. (Table mounted) for each range & Type
34	Vacuum Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL	2 no. (Table mounted)
20	Multi Function Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL/AOIP	1
36	Pressure & Vacuum Air Pump	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL/AOIP	1
21	Digital Insulation Tester	Scandura/ Tinsley/ Eurotron/Kyaritsu/B&K/ITPL/Schuetz/Mess technik.	2
22	Sound Level Monitor	CIRRUS (UK)/ Tinsley/Baseline/B&K/ITPL	2
39	Air Set	Shavo-Norgen/ Placka/SMC Pneumatic	2
40	Portable Electro-Pneumatic Calibrator 0 - 2 bar 0-10 bar 0 - 40 bar 0- 200 bar	Tinsley/SMC Pneumatic/H&B (ABB)/MTL/P&F/Time Electronics / ITPL/AOIP.	4(1 no. each type)
23	Portable Digital/Analogue Vibration Meter	IRD(Rockwell)/Vibrometer/ Shinkawa/Bently/B&K/Provibtech/Benstone/Fluke.	Digital type - 3 Analogue type - 2
24	VIBRATION/ SHOCK PULSE ANALYSER cum Data Collector cum Balancer	IRD(Rockwell)/Vibrometer/ Shinkawa/Bently/Provibtech/ IMV/B&K/Benstone/Fluke.	1
25	Decade Resistance Box	Time Electronics / ITPL/Cropico/Eurotron Yokogawa/Siemens/ABB/Emerson	3 no. Analog type 3 nos. Digital type
26	LAN/ Coaxial Cable Meter/ Tester	ITPL/Scandura/Beamex/RS components	2
45	Portable Ultrasonic Flow meter	Fuji/ E&H/ITPL/Dynasonic/Micronics/Compuflow.	2
27	EARTH/Ground RESISTANCE TESTER	ITPL/Cropico/Scandura/Beamex/Cropico/S chuetz Messtechnik	2 nose
47	PORTABLE INFRARED RADIATION THERMOGRAPH (IR Imaging device & Camera)	ITPL/Exttech/RAYTEK(Fluke) / MIKRON/ COLE - PARMER/Impac/Nippon/Wuhan Guide.	1 no. of each type
48	Thermocouple Test Furnace	Isotech/Scandura/Beamex/Jofra	1 no. each type
49	Microprocessor based Portable H2 Gas Analyser	Hach Ultra/Ametek/Codel/e one/Eurotron	1



28	Fiber Optic Testing Tool Set	ITPL/Scandura/Beamex/RS components/Anritsu.	2
51	Industrial portable Vacuum Cleaner	LG, Electrolux, Godrej, Morphy Richards, Panasonic.	6
29.	Tong Tester	Scandura/ ITPL/ Eurotron/Kyaritsu/Weschler	2
53.	Portable Mercury Analyser	Nippon Instruments, Genesis, OhioLumex.	1 set
30	Stroboscope	Biddle/Ametek/Extech/ITPL/B&K/Rishikesh /GenRed.	1 no.
31.	Auto Transformer	AE / Meco /ITPL/ Beamex / Scandura	Single Phase – 2No Three Phase – 2 No
32.	Test Temp Dedector – Test RTD	Isotech/Scandura/Beamex/Jofra	2 No
33.	Overhead projection Board (Interactive White Board)	Hitachi, Smarttech, Polyvision.	2 nos.
34.	Projector with white board.	CASIO, SONY,BenQ, Panasonic, DELL	1 no.
35	Portable pH Calibrator/Simulator	Hanna Instruments/ABB/Hofmann/Eutech Instruments/Orion.	1 no.
60	Oil Condition Monitor	Eaton/Precision Filtration	1 no.
36	Logic Probe	HP/Aicoset/Alfa/Tektronix/Elenco	1 no.
37	Marker Printers	Inkcups, Laselec SA, Phoenix, Taymer.	1 nos. of each type
38	DC Regulated Power Supply	Siemens, Cosel, Phoenix, Weidmuller	4 nos.
65	Humidity Calibrator	Buck Research Instruments LLC/ Cole Parmer/Rotronic.	1 no.
66	Grinding Wheel	As approved by Owner.	1 no. of each type.
39	Portable multifunction counters	B&K Precision, Agilent, Fluke, Philips/eWaynekerr.	1 no.
40.	Portable Conductivity	Hanna Instruments/ABB/Hofmann/Eutech Instruments/Orion/Coleparmer.	1 no.



	Meter		
41.	Vibration Pick Up tester	IRD(Rockwell)/Vibrometer/Shinkawa/Bentl y/B&K/Provibtech/IMV/Fluke.	1 no.
42.	230/240 VAC Single phase stabilized supply unit	Aplab, KEPCO, Aiger.	3 nos.
43.	Continuity Tester	Scandura/ ITPL/ Eurotron/Kyaritsu/Weschler	9 nos.
44.	Optical time Domain reflectometer	Fluke Network, Exfo, JDSU, AFL, Anritsu, Yokogawa.	2 nos.
73.	Digital Thermometer	Extech/Rosemount/Brooklyn/Tinsley/ITPL	4 nos.
45.	Resistance Thermometer Bridge	Tinsley (ASL)/ Scandura/ BEAMEX/Isotech/MI Canada	1 no.
46	Decade Capacitance Box	Time Electronics / ITPL/Cropico/Eurotron Yokogawa/Siemens/ABB/Emerson	1 no.
47	Decade Inductance Box	Time Electronics / ITPL/Cropico/Eurotron Yokogawa/Siemens/ABB/Emerson	1 no.
48	Clip On AC Power Meter	Scandura/ ITPL/ Kyaritsu/Weschler/Yokogawa/Fluke/Meco.	1 no.
49	Portable High Sped Trend Recroder	Yokogawa, Omega, Astro-med, ABB, Daqscribe.	1 no.
79	Bench Magifier	Vision Engg, Optimax, Telesight Magnifier, RS Components.	2 nos.
80	Laser based Shaft Alignment System	SKF, Hamar Laser, Easy Laser, Pruftechnik.	1 no.

50. LAB WORKSTATION , A3/A4 B/W DIGITAL LASER PRINER CUM COPIER AND LAPTOP -1 NO Each



2 x 800 MW Supercritical Coal Based Uppur
Thermal Power Project
Spec. No. SE/E/T&H(P)/OT NO.01/2015-16
Vol. V



ADDITIONAL PROPOSED MAKES UNDER APPROVAL

S/no	Item S/no& Desc	Makes
1	#12 .Soldering Desoldering station	Weller
2	#13. Potentiometer / Rheostat	Toshniwal
3	#14. AC thermometry Bridge	AOIP France
4	#15 . Stop watch	Extech
5	#21. Digital Insulation Tester	Yokogawa
6	#23. Portable Digital /Analogue Vibration Meter	IRD Mechanalysis/ SKF
7	#24. vibration/shockpulse analyser cum Data Collector cum Balancer	SKF/ Bruel & Kjaer (B&K Germany)
8	#25 Decade Resistance Box	Toshniwal
9	#26 .LAN / Coaxial Cable Meter / Tester	Ideal
10	#27.Earth /Ground Resistance Tester	Fluke/Fluke amprobe
11	#28 .Fiber Optic Testing Tool Set	Fluke/Sumitomo
12	#29.Tong tester	Yokogawa/Agilent/keysight
13	#32 Test Temp Detector	Fluke/ Tempsens
14	#36 Logic Probe	B&K Precision
15	#38.DC Regulated Power Supply	Aplab/Tektronix/ Agilent/Keysight, Keithly /B&K Precision
16	#43 Continuity tester	Fluke/Fluke amprobe

Note : The above makes has been proposed for approval for this Project (UPPUR) , as they are already under approved makes in ENNORE LAB (Elec) project . Hence vendors can offer these makes subject to the approval of customer.

If any other make is approved, the same will be intimated to participating vendors during technical evaluation.